INTERNATIONAL JOURNAL FOR REGIONAL DEVELOPMENT

IJRD

International Journal for Regional Development (IJRD) is a scientific, academic review covering all fields of policies, administration and management of regional and logistics affairs, including, but not limited to, business ethics, business strategy, entrepreneurship, innovation, international projects, cross-cultural studies, as well as supply chain and operations management.

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EDITORIAL COMENTARY

Dear colleagues and readers,

Vol. III of the IJRD is presenting the latest thinking and research on topics such as logistics and supply chains, legal protection, sustainability, new technologies and modern management.

This time we divided the journal into two parts: in the first part we publish original scientific articles, and in the second professional articles. We are especially proud of the active participation of our students, who participated in the preparation of some research with the acquired knowledge.

And as we did it before, we still are cordially inviting professionals, academics, researchers and students to join us as international editorial members as well as researchers who would like to publish their original scientific research work and projects.

Looking forward to cooperate with you

Dr. Patricija Jankovič
Editor In-chief

SCIENTIFIC ARTICLES[1]

[1] original scientific articles; sicris / cobiss methodology 1.01

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LEGAL SECURITY OF INTRODUCTION AND USE OF INTELLIGENT SYSTEMS IN INDUSTRIAL AND OTHER LOGISTICS

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Abstract:
New technologies, modernization of production, introduction of robotics, autonomous and above all intelligent systems in industrial or other production represent many advantages, but also certain dangers that we must look at from the perspective of legal security. Logistics is a service activity that has had many victims through its development, which have occurred through the organization of transport, loading, reloading, lifting, lowering, pushing, warehousing and other logistics tasks that have been and still are very much tied to various forms technological advances. According to the industrial development period from industry 1.0 to industry 4.0, a number of legal, legal-economic and binding norms have emerged, which have changed through use, but have always been necessary to protect legal transactions, protect property and directly people, who are and who use technology in their field of work. Intelligent systems in logistics are logistics information and logistics management systems that create economic effects with the help of appropriate technology, autonomous devices, robots and programs, but are often subject to ignorance and even more legal gaps that would regulate their use. Through the review of the possible use of intelligent systems, especially various forms of robots, we sought a legal basis, which we expediently adapted to individual systems and helped to improve the entire system and legal security.

Many authors argue that intelligent systems and robots can increase the security and efficiency of logistics and logistics processes and ensure security in individual forms of work, while forgetting the basic security, which is basically provided by the Constitution and concretized sectoral legislation. We know that the main goal of intelligent systems, robots and autonomous devices is to improve and increase industrial, production or other productivity, increase mobility of raw materials and ensure security in internal or external supply of industry or other production or similar systems, but in this part we see only basic a function that the user or operator is trying to achieve. In all this, it is necessary to find a legal basis that will harmonize the coexistence of natural and artificial intelligence, ie robot and man, and lay the foundations for increasing use.

Key words*: intelligent systems, robots, devices, law and legal security*

1 INTRODUCTION TO THE RESEARCH

Researching and finding appropriate answers to safe use, especially the legal security of using intelligent systems, always raises the question of how much we know about new technology, how and on what basis we are educated for new professions, how far we will use autonomous devices, robots and intelligent systems. An inter-network has been developed in the international communication space, which enables the connection of countless users of personal computers, smartphones, tablets and other forms of communication products, which enable

interconnection, communication, transfer of data, images, sound and they enable the management of various systems remotely, encroachments on the integrity of legal entities (natural or legal persons), which presents many advantages, as well as certain dangers. These are transfers and data carriers that can be used through research for scientific, business, economic, administrative, military, civil and all other purposes, the use of which can also have various consequences. In general, these are multimodal communication systems that allow integration into several systems and subsystems and the transfer and use of data that may be questionable in terms of business security of the industry or the security of the state and the like. The systems are adapted to all forms of computer or other media communication equipment, which through a package of connectable TCP / IC communication allows access and use of the entire web, which allows advanced production, advanced logistics, advanced services, entertainment and the like. These systems are, in technological terms, the infrastructure or basis for the operation of many autonomous devices, robots and technical achievements that we use in industry, trade, household, which we will show below. So technologically it is an industrial development of a new generation, which the Japanese call Industry 5.0 or Industry "Z" generation of communication networks, which includes new forms of industry, communication systems and where there is a coexistence of natural and artificial intelligence. With their attractiveness, intelligent systems cause some users to gradually become addicted to technology, which is especially recognizable in children at an early age and in youth. The Internet is a software network that can be used for scientific, technological, economic, business and other purposes, and can also be used much more widely because it allows communication, remote commanding, data transfer, fast knowledge exchange, business transfer , industrial, economic, school and other data that enable international integration and communication. With it, it is possible to control, manage and control intelligent systems, which we consider in the form of robots in various fields. Whether we can talk about a secure form of legal, technological, business, sociological and much broader secure field of communication is quite unknown, because the use of autonomous systems, robots or other forms of intelligent systems is presented only in the form of instructions or recommendations. legal basis. While there are systems that are software in nature and protect businesses from misuse, data theft or unauthorized use, the question is whether this is enough. Numerous safeguards, firewalls and programs have been developed in this part of the program to prevent unauthorized use, abuse or damage, but this does not provide legal certainty for legal entities. In the general view of intelligent systems, the Internet is primarily a source of access to computers, software, management and administration of various operating systems that are agreed, paid, use is justified, protected and through these agreements and software agreed form and method of communication. How it is regarding the use of individual products in the form of robots in industry, production, tourism, domestic use, however, is a question for science, profession, industry, the state and everyone who encounters this field in any way.

If the question is "Use of intelligent systems", the answers should always be "Yes", as it concerns the development of science, business, technical and technologically advanced systems, education, technological progress, new culture, media literacy, organizational integration, inter-state connections and much more broadly, but adequate legal and software security of users must be ensured. When and if we mention business entities (natural or legal persons) in the research, we find that they are technologically provided with appropriate software and system equipment that ensures safe use and operation. They educate employees, introduce robots and autonomous systems, and try to be competitive in the marketplace with their products or services.

Through the research, the authors asked themselves what can be done to accelerate the use of intelligent systems, especially robots in industry, manufacturing, services, logistics and elsewhere. At the same time, authors sought a legal basis in the Croatian and Slovenian legal fields that would be recognized as an instrument of security for individual entities (natural or legal persons).

2 RESEARCH FIELD

The research area is represented by intelligent systems and their legal use in industry, manufacturing and other organizations, focusing on the use of robots and robotic systems, which are increasingly encountered in all areas of work, education and general life.

We focus on new forms of robots that have navigation, communication and accompanying intelligent systems, technologically advanced generations that allow them to use independently in different forms and different environments. Many authors recognize them as a new generation of intelligent systems (the Japanese call them G5), which in the beginning and through the connection of all digital systems create the upcoming smart industry 5.0, where screws communicate with assembly robots, self-propelled forklifts store goods on high shelves, intelligent machines independently coordinate production processes, robots mow the grass, clean and disinfect rooms, and perform many tasks that humans would otherwise have to do.

But what does the legal security of using intelligent systems, dedicated robots and internet to connect or communicate with individual robots mean? The appeal of intelligent systems leads us to admire its capabilities and usability, often forgetting about security, which we see only after identifying errors or unwanted situations. Could it be that the use of intelligent systems, robots, the Internet, online networks and systems has violated human rights or fundamental freedoms, caused damage? What can we do in this case, who can we turn to? In this case, we must first look at the legal possibilities found in the basic act of the Constitution of Slovenia and the Constitution of the Republic of Croatia, which in the chapter "Human Rights and Freedoms" opens up transparent possibilities where we can see whether the

constitutional basis list RS, No. 33/91-I, 42/97 - UZS68, 66/00 - UZ80, 24/03 - UZ3a, 47, 68, 69/04 - UZ14, 69/04 - UZ43, 69/04 - UZ50 , 68/06 - UZ121,140,143, 47/13 - UZ148, 47/13 - UZ90,97,99 and 75/16 - UZ70a) and the basis of the Republic of Croatia (Constitution of the Republic of Croatia, consolidated text, NN 56/90, 135 / 97, 08/98, 113/00, 124/00, 28/01, 41/01, 55/01, 76/10, 85/10, 05/14). Slovenia has adopted the Electronic Communications Act (Official Gazette of the Republic of Slovenia, nos. 109/12, 110/13, 40/14 - ZIN-B, 54/14 - US decisions, 81/15 and 40/17), where Article 203 states the neutrality of the Internet and requires access to the Internet for all users, while the said Act gives tasks to the Agency and operators on how to act. Similarly, the Republic of Croatia has the Electronic Media Act NN 111/21, in force since 22.10.2021), where, similarly to Slovenia, the field of the Internet and intelligent systems are discussed in connection with it. We find the European Parliament Resolution of 16 February 2017 with recommendations to the Commission on the rules of civil law on robotics (2015/2103 (INL)), which states that robots have made extraordinary technological advances and carry out activities that were distinctive and exclusively human. With the development of certain autonomic and cognitive characteristics, learning abilities and, based on experience and almost independent decision-making, robots have become more and more like agents that interact with their environment and can change it greatly, so they need to be regulated and The same resolution is used in the Republic of Croatia, so there is no direct law that would specifically regulate the field of robots, the field of the Internet and the use of intelligent systems, or there are no legal norms that would specifically define criminal conduct. or offenses committed in use or in connection with you using robots or intelligent systems. Therefore, we are looking for possibilities in the Criminal Code (Official Gazette of the Republic of Slovenia, No. 50/12 - official consolidated text, 6/16 - amended, 54/15, 38/16 and 27/17), where we can use 131, 137 - 148 Article and find the appropriate classification that will allow us to turn to law enforcement and the judiciary. A similar record can be found in the Criminal Code of the Republic of Croatia, consolidated text of the Act (OG 125/11, 144/12, 56/15, 61/15, 101/17, 118/18, 126/19, 84/21), in force since 31. 7. 2021 (for more read the law of the Republic of Croatia).

Many authors argue in their writings that with the introduction of intelligent systems, robots and autonomous devices, it is increasingly possible to identify the need for greater cooperation between production and services, which allows technological advancement of service activities. The research raises the question of the legal security of the operation of individual economic entities (natural and legal persons) involved in commercial transactions (Murtič, Uhernik, 2018), where the stakeholders are robots and intelligent systems. Also in the field of the use of robots in individual forms and environments, it is possible to find forms of use that are not legally regulated, which we will present below. Some forms of recognizing the use of modern technologies, which already border on the use of intelligent systems, can be detected in Zelenika (2001), where he seeks economic effects through transport systems, technology and organization. Its advantages are even more noticeable in

the economics of the transport industry, where there is an interest in the development and introduction of new technologies, especially the management of systems through programs and Internet connections (Zelenika, 2010).

3 RESEARCH THESES

Due to the breadth of the research field, it was impossible to cover all forms of robot use or the use of intelligent systems, although in the subject "Intelligent Systems" they are used and processed by individual fields. We are tied to curricula that are related to logistics and management in regional management, which is the starting point for research. We recognized the use of robots in industry, tourism, health, education, science, agriculture and beyond as a positive form of technological development of industry, production, trade, distribution, education ... We also recognized the use of intelligent systems as a way to coexist natural and artificial intelligence , which leads to an increasing transfer of heavier and hazardous work and tasks to technological systems, thus eliminating the waste of time, space and labor. We also recognized the role of information logistics and management logistics systems, which guided us in finding appropriate legal bases that would support the introduction of intelligent systems in logistics. As we did not find a specific legal basis in general legislation concerning the regulation of operation and use of robots, the use of autonomous and intelligent systems in program terms, we put forward the thesis "It is necessary to regulate the introduction, use and responsibility for work and activities «. The aim was to find at least an approximate legal basis that would at least indirectly protect users of robots and other intelligent systems, and even more the aim was to find objective and concrete responsibility for the damage that would result from the use of intelligent systems.

4 BACKGROUND TO THE RESEARCH

The starting point of the research was the many forms of using intelligent systems in all areas of work, education, and of particular importance many robots and robotic systems introduced into their production processes by industry, manufacturing and other organizations, educational institutions and other legal entities. The history of robotics eloquently testifies that the automation of demanding tasks without human intervention in industry began with machine tools, which with mechanically executed logic performed their function automatically in a sequence where it was a repetition of fairly reliable movements or functions that allowed production (analog systems). With the advent of electronics and later computers, automatic machines were transformed into modern computer-controlled (CNC) machine tools. It was similar in the field of assembly, where the originally mechanically controlled movement began to be replaced by pneumatics, electronics, and programmable logic controllers. In the newer automation of production, logistics, education, etc. various robots that are part of intelligent systems are also playing an increasing role. In industrial terms, they are mostly used

for welding, painting, assembling, packaging, grinding, optical inspection, etc. The data show that the development of robotics began in the automotive industry, and now we can hardly imagine an industry that would operate smoothly without robotic support.

Robotics is also increasingly evolving in non-industrial areas such as healthcare, research, military technology, the world of entertainment technology and also in the household. The education systems, institutes and research departments of individual industries see enormous potential for improvement in the field of robot control, artificial vision and intelligence, robotic dynamics and kinematics, which we took into account and tried to find a legal basis for these areas.

The answer to the question of why industry, manufacturing and other organizations use intelligent systems can be found in various areas of production, promotion, market and product integration. The reasons for automation and the introduction of robots industry, manufacturing and other organizations see in the elimination of waste of time, space and labor, or in other words in reducing costs, relieving workers and providing production capacity, with emphasis on quality. Research tells us that automation and the introduction of intelligent systems also have an impact on reduced production time and increased capacity, and one of the important reasons for the introduction of robotics is also harmful and monotonous work. A good two-fifths of robots are dedicated to machine assistance, about one-fifth to welding and one-sixth to assembly. This is followed by the use of robots for the application of adhesives and other varnishes. About five percent of robots perform operations such as grinding, polishing, cutting, dehumidification and the like (data obtained from TPV Novo mesto, 2021).

Where the industry sees the reasons for deploying intelligent systems depends on the form and type of industry. They are most often used by industry in production and are called industrial robots, which are present in all production processes. These are fixed robots that perform tasks, think and adapt quickly to the needs and systems of production. Increasingly, the industry uses mobile robots and robots with the ability to decide, which without the presence of natural intelligence can perform machining, assemble electronic components and circuits, weld (spot, arc, laser), process plastics, control quality and perform measurements, painting, application of protective coatings, research work, work with hazardous substances, agriculture, storage, work in medicine or in the army. If we focus our research on logistics and logistics processes, we find that logistics is the service activity that enables industrial or other production and as such it makes sense to modernize it. Therefore, there are more and more different forms of intelligent systems in logistics, which connect procurement, transport, warehousing, infrastructure, modernization of internal and external logistics and the introduction of various robots for transport, loading, unloading, pushing, lifting, blowing and the like. All areas are somehow legally regulated, at least when we mean contractual or contractual relationships (Murtič,

Jankovič, 2018), but there is no legal regulation that would define in detail the responsibility for the work of robots or intelligent systems.

Through the research we come to the conclusion that the main reasons for the introduction of robotics are technical, economic and sociological. Interestingly, these causes are always directly related to each other, and indirectly according to the needs of industry, the market or other legal entities. In all forms we come to the realization that these causes are economic or scientific in nature, we receive instructions for work, rules of management and preparation, and nowhere do we find a legal basis that would specifically determine the responsibility of the owner or anyone else for damage caused by the robot . The starting point of the research was focused on the identification of individual forms of robots, and on the basis of these we sought an official basis for legal certainty and responsibility for individual forms and tasks of robots. In this way, we wanted to justify, ie confirm or refute our thesis on the need for legal regulation of the responsibility for the introduction of intelligent systems in logistics.

5 THE COURSE OF THE RESEARCH

In order to start the research, we first looked for the main reasons for the introduction of robotics. As we have already mentioned, these are technical, economic and sociological causes, and we have found that they are always interconnected directly or indirectly. We find that the technical reasons for the introduction of robotics are greater reliability of systems, uniform speed, adaptability (rapid product change), higher product quality and accuracy, ergonomics (long work, heavy loads), greater satisfaction of technical requirements than humans. Economic causes include higher earnings or profits due to higher productivity, lower production costs, faster capital turnover, labor shortages, rationalization (success in the fight against competition), shorter depreciation periods and higher profitability. Sociological causes include unsuitable working environments, such as heat, toxins, dirt, increasing living standards by not having to perform monotonous work, increased safety measures and stricter legislation. In all of this, we connected web networks and used the Internet as the infrastructure of all systems for the implementation of logistics information and logistics management systems, which was the basis for recognizing the competencies of using individual forms of robots (fixed or mobile). Robots belong to the field of intelligent systems, so before using them, it is necessary to know certain competencies that will introduce the user to the usefulness of intelligent systems. Before the industry, production organizations or other legal entities (natural or legal persons) decide to purchase (purchase) and use a robot, they must examine the area or workplace in which they will place the operation of the robot. It is necessary to study the individual phases of work, usability and technological capabilities of intelligent systems that will give appropriate responses. Therefore, they must take into account at least the minimum competencies in the decision, namely:

- choosing the right and successful first application of intelligent system operation,
- selection and determination of the robot that will most effectively meet the requirements. The optimal type of robot must be selected, taking into account the required number of degrees of freedom, the shape and characteristics of the installed tool or gripper, the shape of the working space and the load capacity,
- identifying a parallel post that they are trying to keep operational. Any duplication of operations represents unnecessary costs, if they robotize a work operation located in the middle of a work process, then it makes sense to think about a parallel (manual) workplace,
- speed of operation or production, bearing in mind that robots generally work slower than humans, but are accurate and much more even. Preliminary analysis of times or determination of the robot cycle time as well as the entire robot cell or line is required,
- economic justification. With robotics, the industry or other user expects positive effects, which means higher productivity, lower emissions, higher quality products, etc. Sometimes it is wise to set up a test robot cell to teach technical staff before introducing more robots,
- the complexity of automation, as simple solutions also lead to easier management of the situation, which in turn leads to lower start-up and maintenance costs,
- the first installation of the robot or its start-up means to have adequate personnel for management, control and maintenance. Robots are controlled and operated by operators directly or from remote locations. A robot that does not perform its function is useless to industry or another user,
- the duration of the introduction of the robot into the work system. It is necessary to anticipate the service life of the robot, as it significantly affects the depreciation of invested funds,
- environmental preference within the industry or other organization. Often, people in environments where they are not used to working with robots complain about them and even sabotage them because they are afraid of losing their jobs. It is important to prepare employees psychologically well to work with them and
- support of the management, which must decide to introduce intelligent systems or robots in production processes or in logistics processes. The leading staff in the company must absolutely support the introduction of new technologies, otherwise it is all nonsense and just a waste of time.

Types of robots

The decision of which intelligent systems the industry, manufacturing or other organization or other legal entities (natural or legal persons) will introduce into their

production processes or logistics depends on the type of robot, its characteristics, operability and usability.

We are witnessing a large introduction of various forms of intelligent systems in industry, in production and other organizations, which is most recognizable in the motor, hybrid or electric vehicle industry. elsewhere. Thus, in the age of rapid development and new technologies, the field of robotics is gaining ground in addition to industrial robots in areas such as medicine, military, household and everywhere where there is a need to perform work that makes work easier, economical and eliminates waste of time and space. and the workforce, which is very important for the industry in particular. Basically, the robots we mention below are designed to perform their functions autonomously (without humans) in connection with humans and the environment.

They consist of mechanical construction, electric drive, control system and appropriate sensors that detect changes in physical quantities in the environment. Many of these systems come from the development environment of the military and similar bodies, where they are developing powerful systems for modern combat.

Industrial robots

The motor vehicle industry was among the first to use robots in its production. The robots worked analogously and performed a series of successive tasks, such as cutting, chopping, welding, make-up, etc. With the introduction of intelligent systems, new robots have started to think, they have systems for recognizing obstacles, they are involved in the general provision of safety at work and the people around them or working with them. They are installed and used in industrial applications where working conditions are poor for humans, that is, where gases, high temperatures, large masses and repetitive monotonous work occur. The main reason for the use of industrial robots is the relief of man, and an important factor is also the competitiveness, quality and revenue of the company. Industrial robots are used for serving and handling, palletizing, welding, painting, measuring and other automated applications. Well-known manufacturers in Europe include Kuka, ABB, Yaskawa Motoman, Fanuc, Mitsubishi, Reis, Staubli, Kawasaki, Otc, Denso, Nachi, Epson, Skilled, RRR, Hyundai and others.

Figure 1: Industrial robots in the motor vehicle production phase

Source: found online, free encyclopedia, 2022.

These are industrial fixed robots that have mobility in their circle of work, with the ability to rotate in a circle of demanding tasks. Their characteristic is also in the rapid adaptability to changes in frameworks and the performance of other work, which they themselves recognize through work processes. The industry also has mobile or mobile intelligent systems, ie robots that perform various functions in production, and most of them are in the field of logistics, where robots take care of the delivery of materials into production.

Mobile robots

In the case of mobile robots, their path, ie movement or mobility, is important, as they need a leading infrastructure and wireless busses that will guide the robot's path and ensure safety in production or logistics. In 2022, we know mobile robots that follow the black line on the base, move autonomously in the maze and are used to solve, deliver materials or perform certain tasks that are more time-consuming, repetitive, etc. In the transition period of Industry 4.0 to Industry 5.0, they are intended primarily for learning about robotics among pupils, students, for which schools, institutes, institutes, faculties and certain industries organize various local, regional and national competitions. It is about promoting the development and use of intelligent systems in different environments.

Figure 2: Mobile robot

Source: IntBas http://intbas.com ›robotics, 2022.

Among mobile robots in the industry, as autonomous automated trolleys and as stand-alone intelligent systems called autonomous devices, there are recognizable trolleys, which in logistics are called internal transport lorries. They are used in various industries, production and other organizations in the field of logistics, namely for the transport of material from one production set to another. A robot, autonomous device or intelligent system works completely automatically, thinks for itself, performs its movements and performs tasks completely independently. This is made possible by the control system and the corresponding sensors that detect obstacles in the surroundings and the sensors for guidance (magnetic stripe, WIFI, GPS, tracking the conductor in the base, tracking lines), which can be different. In previous research, we tested 8 systems (Murtič, Zorko, 2022) through the research at TPV Novo mesto for management, and we found that all systems work flawlessly. The models are used in TPV Novo mesto, similar examples are also in pharmacy, warehouses and preparation of goods for distribution in grocery stores and elsewhere.

Figure 3: Design of AGV for internal transport in logistics

Source: Izvozniki.si https://izvozniki.finance.si ›TPV-razvil-lastno-avtonomn.

These are forms of robots or autonomous devices or intelligent systems that, with the help of various forms of control, think for themselves, plan their own work, perform individual tasks themselves and continuously take care of the production supply. In this form, the question of liability for material damage that would be caused and especially for damage that could be caused to natural persons is often raised. In addition to the Constitution, the Penal Code and the EU resolution, we were looking for other forms of legal norms that would at least indirectly cover this area. We touched on the Employment Relationships Act of the Republic of Slovenia (Official Gazette of the Republic of Slovenia, nos. 21/13, 78/13 - amended, 47/15 - ZZSDT, 33/16 - PZ-F, 52/16, 15/17 - dec. US, 22/19 - ZPosS, 81/19, 203/20 - ZIUPOPDVE, 119/21 - ZČmIS-A, 202/21 - odl. US and 15/22), where we found only a minimum of rights or obligations of the employer and the employee, but it is not possible to concretize an individual norm that would directly interfere with the field of legal security of the introduction of intelligent systems in logistics. We also made the transition from lex lokalis to lex specialis and looked for possible levers to protect the rights of employees in various fields, but we did not find a tangible legal norm that would directly cover the safe implementation of intelligent systems in cooperation with natural intelligence or workers. The situation is similar in Croatia, where the Labor Act, consolidated text of the Act, NN 93/14, 127/17, 98/19, has been in force since 1 January 2020, similar to the Slovenian regulation of the field independently of intelligent systems or robots. Technological developments, the increasing introduction of intelligent systems in industry, the increasing use of intelligent systems in the home, medicine, tourism and elsewhere are slowly dictating the need to find legal solutions in a very short time that will clearly state who is responsible for damage or injury caused by artificial intelligence.

In addition to this form of useful intelligent robot systems, we also met home mobile robots that think for themselves, do the work themselves and take care of the energy needed for work. These are robot vacuum cleaners used in industry or household. It is a completely autonomous system, ie an intelligent device that performs the task of vacuuming dust in the form of a robot. It is an autonomous robot that moves in space and sucks dust and small debris. It consists of a mechanical construction, a robotic controller and contact and ultrasonic sensors that detect walls and obstacles. It enables autonomous movement in space, programming of work cycles and automatic charging of the battery unit. The robot has a memory that it writes at the sign or at the command of the operator (in the owner's house), who gives the command to operate, the vacuum cleaner inspects the premises, detects obstacles and remembers routes and in a certain system performs suction, activates itself, charges and operates without constant supervision.

Figure 4: Home robotic vacuum cleaner

Source: https://www.trgovina-jana.si/robotski/sesalci, 2022.

These are robots that act as intelligent systems in the home circle, have instructions for use, do not cause noise during operation, their shape and mode of operation do not endanger anyone, but it would still make sense to legally regulate such forms.

To satisfy other areas, scientists along with industry have tried to construct a mobile intelligent device in the form of a mower that could take care of mowing the lawn at a time when lawn owners are not at home or when the owner does not have time to mow himself. A robotic lawnmower is an intelligent device or autonomous system that is very similar to a robotic vacuum cleaner in terms of mode of operation. It moves autonomously on the lawn and mows the lawn grass. Normally, a special wire must be routed around the lawn, which the mower detects with the help of sensors

and thus determines its working area. They can also be limited in other ways such as WIFI, magnetic stripe, GPS and the like.

Figure 5: Honda robotic lawn mower

Source: https://www.honda-powerequipment.si, 2022.

Modern robotic lawnmowers also have a solar module for charging the battery unit, which is similar to a robot vacuum cleaner connected to electricity and charges the robot battery. It can be placed in different places and a connection is established all the time, where the intelligent system recognizes the need for charging and returns to the base.

Humanoid robots

For many years, there has been research and interest in making humanoid robots that would be similar to humans and would perform a range of tasks and duties that are otherwise performed by humans as natural intelligence. In their construction and appearance, robots are very similar to humans, which was the goal of the manufacturer and researchers. Interesting is the modern humanoid robot of the Honda Asimo industry, which is very sophisticated and is able to move similarly to a human, and can also run at a speed of 6 km / h. Guidelines for the development of robots are being developed in the direction of assisting humans in everyday tasks, not only in industry, but also at home, in the bar, in performing certain tasks and the like. This robot can move a food cart in front of it, can carry a tray, cans, cups and the like. In addition, it recognizes human speech and facial expressions. The construction of the robot is very complicated, as it is difficult to ensure the coordinated movement of the joints, walking on stairs is especially problematic. For this purpose, it is necessary to measure the inclination (gyroscope) and position in

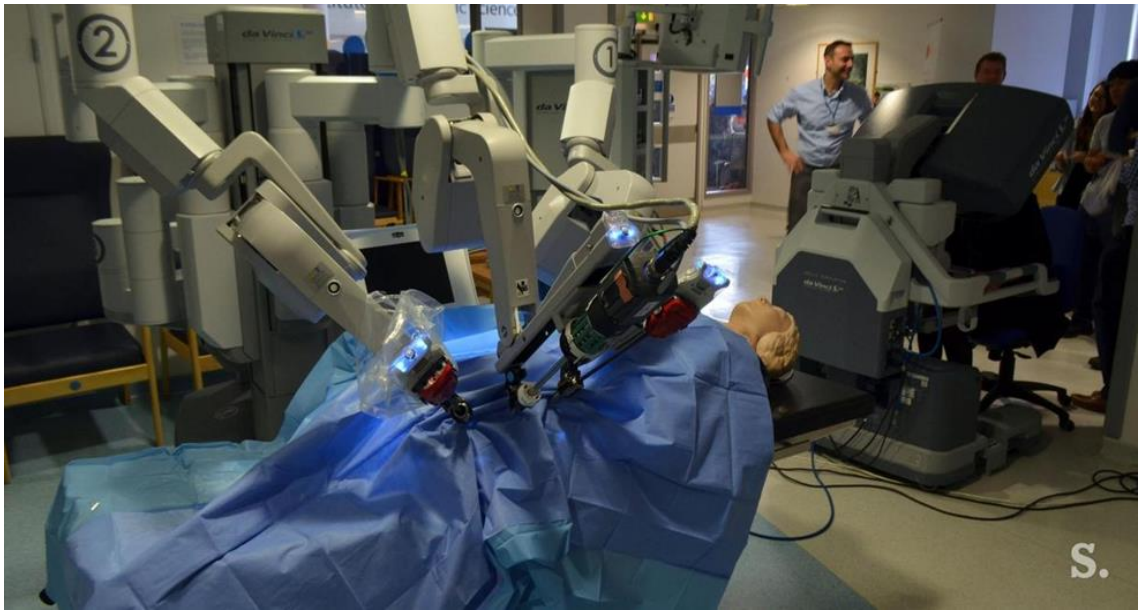
space (machine vision - cameras). The intelligent system works in such a way that it can hold a person by the hand, and we find that it has very precise hand mechanics and appropriate sensors. The whole system is controlled by a technologically sophisticated control computer, and above all, the goal is for the humanoid robot to learn, write and think.

In this form, movement, grips, repetition of functions and the like are very questionable, because due to the purpose or error in the system, it can cause bodily injuries or damage of greater value. This form of intelligent system is also nowhere covered in terms of legal certainty. As we have stated, the legal basis can only be sought in strict liability. This form of liability is not entirely clear, as we do not know who is the legal entity (natural or legal person) that will be liable for the damage caused by the robot.
We also know robot security guards who intend to protect facilities in major shopping centers. It moves autonomously in space and detects pre-programmed dangerous and unpredictable situations. In the event of theft, danger and similar circumstances, the robot security guard sends a security warning to the security center, where the events are monitored by security guards via a camera. They are also robotic dogs, which otherwise belong to the field of consumer electronics for children and adults. The Japanese in particular have taken the device very seriously, as it replaces live pets for some. The device detects the owner's facial expressions and responds to him and his voice. It is able to animate and entertain the owner with special tricks, and also has the function of night security of the apartment.

Medical surgical and medical nanorobots

Research has been under way in medicine for a long time on how to introduce robots into the field of surgery that will perform procedures on the human body. Medical surgical robots are robots for performing operations and are guided by a special haptic device operated by a surgeon, which guides individual axes and robotic tools. With the help of optical systems, the camera allows for appropriate magnification, making it possible to perform smaller interventions and achieve greater effects. The advantage of this system is faster recovery of the patient, because the operation is performed through special tubes into which robotic tools are inserted. As a result, there are far fewer cuts and wounds, and as a result, the patient recovers faster.

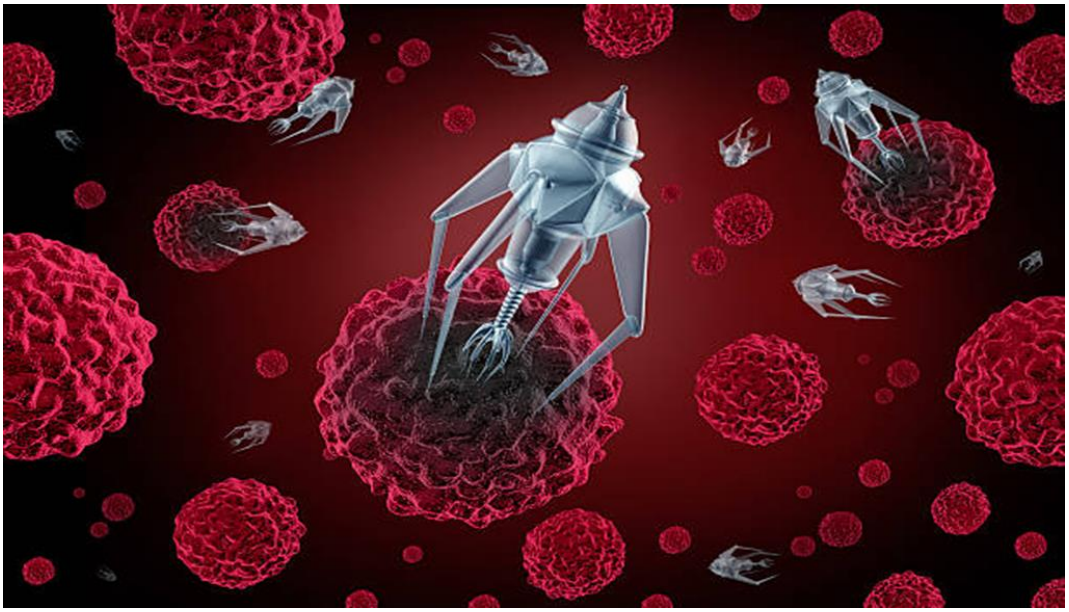
Figure 6: Medical surgical robot



Source: https://www.sb-celje.si › robotic-assisted-surgery.

The field of nano medical robotics is still under development, so it is time for the field to be regulated. The prevailing idea is to inject nano robots into the bloodstream, where they would repair a specific cell, unclog a vein, and so on. The nanorobot consists of nano mechanical assemblies, drive, sensors and power supply unit. The biggest problems are still caused by providing power to the robot. These are interventions in the human body, which are supposed to be legally regulated, but we can only find the Occupational Safety and Health Act of the Republic of Slovenia (Official Gazette of the Republic of Slovenia, No. 43/11), which generally regulates occupational health and the Occupational Health Act. Patients' Rights of the Republic of Slovenia (Official Gazette of the Republic of Slovenia, Nos. 15/08, 55/17 and 177/20), where they do not say anything about the interference of intelligent systems in the field of medicine and health. Also in the Infectious Diseases Act (Official Gazette of the Republic of Slovenia, No. 33/06 - official consolidated text, 49/20 - ZIUZEOP, 142/20, 175/20 - ZIUOPDVE, 15/21 - ZDUOP, 82/21 and 178/21 - ex. US), there are no legal norms that would mention legal certainty, much less the use of intelligent systems. A similar finding can be found in the Health Care Act of the Republic of Croatia, NN 100/18, 125/19, 147/20, in force since 31 December 2020, where, similarly to Slovenia, they list measures and do not mention intelligent systems.

Figure 7: Nanorobot in the body



Source: http://serious-science.org › nanorobots-i.

More about medical robots can be read in the research of Professor of Physical Chemistry Peer Fischer, who in his research presents the advantages and disadvantages of new intelligent systems.

Due to the intervention in the human body, intelligent systems are also interesting as robotic aids for missing parts of the human body, where it is a complete intervention in the human body. We show a robot bionic leg, which has its own power supply, mechanical construction, electric motor drive and appropriate control and sensors. On a healthy foot, there is a special sensor and transmitter in the foot that transmits to the robot foot the information needed to move it. The robotic leg moves in reverse mode like a healthy leg, but also allows active walking up stairs. There are also robotic walking aids developed for military purposes to increase the strength and capacity of soldiers in walking and running. In medicine, they try to use this form for the disabled, who are lame from the waist down. It is necessary to install special attachments on the legs that allow walking.

Figure 8: Shapes of bionic devices

Source: https://repozitorij.uni-lj.si.

We have found that many forms of bionic devices or intelligent systems in the form of robots that provide assistance to the disabled are already in science and in use, but we do not find a specific legal basis for this use that would allow, allow or order such use. we have less legal basis to give patients legal certainty unless we apply the general law on patients' rights.

6 DISCUSSION

Recognition of intelligent systems in logistics represents learning about procedures and technological achievements that are important for safe operation and monitoring sequential procedures that enable production and logistics services in coexistence. These are new technologies that enable the modernization of production, the introduction of robotics, autonomous and, above all, intelligent systems in industrial or other production, and represent many advantages. In all of this, we must be aware that intelligent systems pose certain dangers that we must look at from the perspective of legal certainty and the protection of human health and their general rights and fundamental freedoms. We realized that logistics is a service activity that has had many victims through its development processes, which happened through the organization of transport, loading, reloading, lifting, lowering, pushing, warehousing and other logistics tasks that were and still are very tied to different forms of technological achievement. Through the comparison of industrial development periods, we realized that during the industrial development period from industry 1.0 to industry 4.0, many legal, legal-economic and binding norms were formed, which changed and adapted through use, but were always necessary to insure legal transactions, insure property and directly people who are and who use technology in their field of work.
Intelligent systems in logistics are logistics information and logistics management systems that use appropriate technology, autonomous devices, robots and programs to create economic effects, but are often subject to ignorance and even more legal gaps that would regulate their use. Through the review of the possible use of

intelligent systems, especially various forms of robots, we sought a legal basis, which we expediently adapted to individual systems and helped to improve the entire system and legal security. We followed the legal search for a legal basis that would make sense for the protection of health at work and the use of intelligent systems as tools for work. We started with the basic act, the Constitution of the Republic of Slovenia and the Republic of Croatia, where in Article 26 we found the right to compensation, in Article 49 freedom of work, in Article 57 the right to education, in Article 66 safety at work and in Article 74 the right to entrepreneurship. The Constitution leaves the field of development, education, technology, innovation, intelligent systems, logistics information and management systems to sectoral legislation.

We then looked at the Occupational Safety and Health Act, where Article 7 deals with planning and occupational safety and health, Article 11 the right to occupational safety and health, Article 17 risk assessment and the safety statement. , in Article 27, information on serious, imminent and unavoidable danger, in Article 38, training of workers at the workplace. Other legislation also deals with contractual relations, rights and obligations, and industry and major production organizations have internal rules on the safety and safe use of individual tools, technology and intelligent systems, and nowhere can we find a specific legal norm that explicitly touches on legal security of the introduction of intelligent systems in production, logistics or elsewhere. Many authors gave their opinions on the Internet and online security, especially how web links affect science, education, industry, and especially how it affects generations of users. Typically, intelligent systems are the ones that transmit various information and enable communication around the world via the Internet, thus posing certain risks to the user, with companies being more secure to protect business secrets, confidential information and protect competition.

We also looked at the European Parliament resolution of 16 February 2017 with recommendations to the Commission on the rules of civil law on robotics (2015/2103 (INL)), which states that robots have made extraordinary technological progress, but there is no explicit legal protection for the introduction of intelligent systems in logistics, which means that it will be necessary to research and find an appropriate legal basis in this field. We found that there is a lack of legal norms that would ensure the security of stakeholders in industry, manufacturing and other organizations, as well as no legal norms that would protect the individual in the use of various forms of intelligent systems, in this case when using robots.

In the discussion, we note that the priority directions of research and development in the field of intelligent systems go for the needs of managing and directing various forms of production and service work and tasks in logistics. It is about introducing systems that enable better integration of the physical and digital world into the future of technological development, while industry, manufacturing and other organizations seek promotional and market advantages, while faster and more

secure systems enable the development of new systems. development. In this discussion, we confirmed the thesis that the legal regulation of the introduction of intelligent systems in logistics is necessary, and at the same time we pointed out how fragile this area is, which the state should take care of.

We are aware that our research is only part of the review of existing intelligent systems, so we will strive for more recent research and present our findings in the course Intelligent Systems in Logistics. Slovenia has prepared a proposal for the Act on the Promotion of Digital Inclusion, which is being considered by the National Assembly under an urgent procedure, but its proposals for the general public and its use are still unknown (https://www.gov.si ›Novice). From a legal point of view, the discussion was effective as it provided a broad overview of the current state of legal certainty in the deployment of intelligent systems in the wider field of their use. The authors, however, have at the same time triggered thought processes that will have legal learners to show up in the coming years.

7 CONCLUDING THOUGHT

In the field of law, we also believe that intelligent systems represent human progress, and at the same time they are a form of replacement that will perform many jobs and tasks in the future instead of employees in various industries. Systems of connecting artificial and natural intelligence are becoming more and more popular, so further development of systemic development is expected in the future. An overview of the use and importance of individual robots and autonomous devices that act as intelligent systems tells us that a future is guaranteed for the economy, industry, market and people, and that only better intelligent systems in our environment can be expected.

We can conclude that the use of intelligent systems, robots, autonomous devices and the Internet is necessary, sensible, as it leads us into the world of communications and information and the general visibility of world development. The use of intelligent systems also means a general outlook and knowledge of the past, present and future, so it makes sense to use the systems, research, seek solutions and give our opinions. We can do all this if we are educated enough, if we are aware of our responsibilities, and if we take systems as a useful means of achieving our goals, no matter what we set ourselves. Modern technologies, the development of industry, media and the Internet also demand our attention, and new professions, new titles and new skills are emerging accordingly, which will continue to change the world and our surroundings. Numerous articles, diploma, master's and other works have been written about intelligent systems, which can be found online at libraries of faculties, colleges and elsewhere, so we suggest that we read, research and generate new opinions.

The legal and legal field also follows and uses intelligent systems. Lawyers are trying to be in the trend of the digital world, in the role of users of the Internet cyber network, and we will use new and new achievements in law as well. At the same time, we will constantly strive to recognize the need for legal order through this use. We leave new findings, new regulations, new solutions to the legal regulation of the use of intelligent systems to new research, new researchers and new publications that we will read and study.

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Tilen Medeot[6]

IMPACT OF COVID-19 ON REMOTE WORK

Abstract:
Before the covid-19 pandemic typical work environment was usually a desk in an office surrounded by other team members. After countries went into lockdown employees and organizations were forced to adapt to the new reality. Technology (communication, software) has already been developed but never used on a full scale. The pandemic accelerated the usage of technology trends largely, which showed the advantages and disadvantages of this new way of working.

Keywords*: remote work; teleworking; pandemic; working environment; work process; collaboration; productivity;*

INTRODUCTION

Modern technology gives different solutions to support various organizational processes involving numerous people. Communication technologies (FTTH, 5G, Wifi…) have been developed to make instant commands that can result in different actions on a remote location. Additionally, software vendors developed applications that enable communication and collaboration between people using previously mentioned high capacity communication technologies. These modern solutions are the basis for the enablement of remote work.

WHAT IS REMOTE WORK

Remote work is in the modern world-well-known term and it describes a flexible employment arrangement from a remote location where employees don't need to commute to work. (Gartner, 2022). In the case of remote work employees can work from a different location other than the central office, which is operated by the

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Tilen Medeot received his master degrees in Information management in 2010. In last 15 years he has been working of various software development and IT consulting projects that include: Business Intelligence project, Artificial Intelligence project, Customer Relationship Management, Product Lifecycle Management, Business Process Management projects, development of various web portals. He has also consulted companies on business model improvement using different IT approaches and solutions. Additionally, he has been participating in various educational institutions, where he has lectured different IT related courses. Tilen is recipient of many certificates from different IT ares (TM Forum eTom Foundation Level; Reactive Architecture Foundations; Certified BPM Professional: DAT207x - Analyzing and Visualizing Data with Power BI; Google Digital Marketing…).

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employer: employee's home, co-working or shared space, private office or any place outside the typical corporate space (VMware, 2022).

Remote work is also identified under many different synonyms: distance working, teleworking, working from home (WFH), mobile work, remote job, and work from anywhere (WFA) etc. (US OPM, 2022).

The idea of remote work is not new: the terms telecommuting and teleworking were first introduced by Jack Niles in 1973 while performing research on the present and future impacts of information technology (Niles, 2018). The first known implementation of remote work began in 1979 when IBM allowed five of their employees to work from home as an experiment. This experiment has grown from five to 2.000 employees working from home by 1983 (Butler, 2022).

MODELS OF REMOTE WORK

Remote work can be implemented in many different models. Which model of remote work will be used within an organization depends on many different criteria (type of organization, size of organization, type of activities done within organization, employee profile etc.). Work model represents standards for the successful execution of operations in which work arrangements are prescribed for employees to follow and respect.

Considering remote work, we can talk about the full remote work model or hybrid remote work model. A full remote work model allows employees to work the entire time from a remote location (home or any other location not belonging to the corporation). A hybrid remote work model combines on-site and remote work to a different degree regarding organizations' needs (Vidojevic, 2022).

Today there are five most common hybrid and remote work models that are used by organizations (Hinds, 2021):

1. Office-centric hybrid: this model of remote work requires the employee to work from the office location majority of the time but are allowed to work from a remote location a smaller part of working time. Companies usually choose this type of model because they believe that working and meeting in person develop stronger connections, makes work coordination easier and more efficient and feel a stronger sense of belonging.
2. Fully flexible hybrid: in this case employees can choose when they would like to work from a remote location and when from a corporate office. This model is often regarded as most risky because it can create status tiers of employees and significant inequities that favor those who are office-bound more often. It is also logistically more intense because it is difficult to predict who will be working from an office location.

3. Remote-friendly hybrid defines limitations to the full flexible hybrid: it may involve limitations on which days employees may work from a remote location, it may define a minimum percentage of time that employees may work from a remote location or it may even define a percentage of the workforce that are allowed to work from a remote location on a particular day. This model is popular when organizations are hiring top nonlocal prospective employees.
4. Hybrid remote-office model offers the most options for employees to choose from: from a fully remote option to a flexible option (partial work from office and partial from remote location) or even to a "classical" in-office option. This model provides more predictability of who will be working from an office location compared to a fully flexible model. This model is also quite an attractive option from a recruiting standpoint as it offers more flexibility relative to classical on-site jobs.
5. Remote first is a model which presupposes working from a remote location by default. This model should not be confused with the remote-friendly model: the remote-friendly model only allows employees to work from a remote location as the remote-first model empowers employees to work from a remote location. There is also a significant difference in processes: remote-first companies build their processes, systems, and culture around remote workers. The remote first model faces the challenge of building a strong sense of belonging between employees as they do only communicate with work-related topics and do not have any other less formal meetings.

DIFFERENCE BETWEEN REMOTE AND DISTRIBUTED WORK

Next to remote work the term distributed work is often used. But those two terms are not to be interchanged. Remote work is referring to an arrangement between an organization and an employee, whereas the term distributed work is referring to the relation between a team (or any other organization parts) and an organization. Distributed work coordinates activities between different locations but it does not necessarily involve remote work. Organizations can have teams that are located in different locations but employees within those teams work on-site (Hinds, 2021).

STAGES OF REMOTE WORK

Working from a remote location can be a lasting journey for an organization to enable employees to be fully effective in a distributed fashion. Matt Mullenweg's five levels of distributed work (similar to the self-driving car levels of autonomy) (Mullengweg, 2020):

0. Level zero: at this level, we have jobs that cannot be done without the physical presence of employees. Jobs at this level are cooks, therapists, construction workers, drivers etc. A lot of organizations presume that they cannot move from this level but technology development, reorganization of work made it possible for the companies to progress to other levels.

1. Level one: when companies make no additional effort to evolve remote work, but employees are able to work from home – they have access to essential work-related resources but are excluded from most coordination related events (meetings, workshops…). This level is not a result of an organization's planning but more a result of an extraordinary event.
2. Level two: this level is the most common level at this time (mostly because of the Covid crisis). Organizations at this level have sorted their connectivity and basic collaboration tools. At this level employees and teams are recreating the same work processes from a remote location. Workplace culture stays unchanged (goal of organizations is to retain "business as usual˝): employees are working during normal working hours and should be available on-demand during this period. There is a lot of worries regarding productivity which causes a lot of organization to enforce additional supervision activities and tools (surveillance software).
3. Level three: Organizations at this level begin to benefit from remote work and adapt their processes, practices, and policies. Increasingly, companies are investing in the tools that will improve remote working for employees and make their interactions with customers and business partners more professional. By this point, meetings become more complex than simply sharing information (simple tasks): employees are engaged in enhanced teamwork activities (complex tasks).
4. Level four: this level is the tipping point where work becomes asynchronous – employees do not need to be working at the same time. Employees' work is evaluated through their work (quality) and not on when or how they produce results. A crucial component of this organization is trust – remote team leaders manage people on the basis of trust and outcomes instead of micromanagement and input. Asynchronous work and communication also benefit from a higher quality of work as it gives knowledge workers more time to think and create and make more thoughtful decisions.
5. Level five: the last level is the ideal goal, which is unlikely for most companies to achieve in near future. At this level organizations and workers produces better performance than they would work on-site – effortlessly effective. Benefits of this level make employees contribute high-quality results and still have time for ensuring wellness and mental health. This level is also known as Nirvana.

Picture 1:Distributed work's five levels of autonomy (Mullengweg, 2020)

WHY REMOTE WORK

The development of technology and change in the work process have encouraged people and organizations to start using remote work in different ways. In the last few years, many benefits of remote work have been identified:

1. Reduced commuting: average work-related commuting time in the EU is 25 minutes (Eurostat, 2020) which means that an average person loses about 50 minutes per day just to get to work. But time is not the only thing that is optimized for reducing commuting. Without commuting, there are fewer travel costs (either for employer or employee) and less commute-related stress. More than 30 minutes of time spent for daily commuting is associated with higher levels of stress and anxiety and also that commuting 10 miles or work daily is related to health issues (high level of cholesterol and blood sugar, increased risk of depression...) (Courtney, 2022).
2. Remote work and flexibility that it enables are very important in the modern employee. Some workers find it increasingly difficult to work in a "regular" timeframe and in offices. The ability to work anytime and anywhere is becoming a very important perk in different job profiles and is often recognized as a key factor when people are changing jobs or selecting certain organizations as their employers (Vick, 2020). Analysis shows that 54% of employees are inclined to jobs that offer more flexibility, which results in an average of 12% turnover reduction after a remote work option is offered (Farrer, 2020).

3. Many organizations and people reported that since practising remote work, their productivity has risen. Working from a remote location (usually) results in fewer interruptions, fewer meetings and a more pleasant environment (quieter noise levels, customized light setting …). All these factors add up to increased productivity and better performance result (Courtney, 2022). Studies show, that employees that are working from a remote location are on average 35-40% more productive compared to colleagues working from the office and have measured a 4,4% increase in their output (Farrer, 2020).
4. Cost saving is also an often advantage of remote work. Full-distributed teams can help companies reduce overhead costs by saving on rent, office costs and costs related to the equipment needed to achieve a business result (George, 2021). Financial benefits apply to both – employer and employee. Studies show (based on US data) that organizations can on average save up to $22.000 per remote working employee, on the other side employee can save from $2.000 up to $5.000 (Prossack, 2021).
5. Reducing work-related travel has a beneficial effect on the environment. Air pollution, greenhouse gas emissions, and carbon footprint are lowered by reducing or eliminating daily office commutes. Considering the current climate conditions, these changes would have a significant impact (Prossack, 2021).

Characteristic	USA	UK	Canada	Australia
Flexible scheduling	53%	50%	56%	50%
Lack of commute	32%	43%	50%	39%
Cost of savings	33%	33%	36%	43%
Able to care for family, pets, aging/sick relatives, etc.	36%	34%	33%	32%
Reduced anxiety/stress	34%	32%	28%	28%
Improved health (mental, physical, spiritual, etc.)	26%	25%	22%	30%
Freedom to travel/relocate	26%	18%	13%	21%
Able to live where you want to live	23%	15%	16%	21%
Reduced office politics	18%	19%	17%	22%

Picture 2: Benefits of working remote in 2020, by country (Statista, 2022)

It is clear that remote work brings many more benefits for different kinds of organizations in different processes and in different use cases. But we must be aware that remote work does not bring only benefits, it can also impose different challenges or even threats.

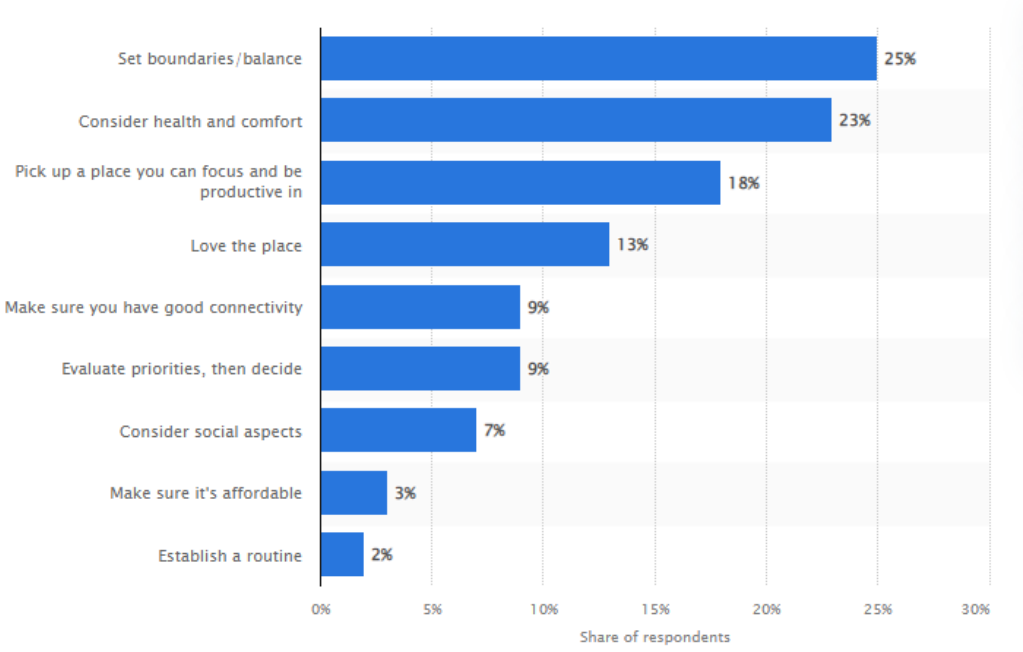
Every change in the work process needs some time to adapt to the organization's culture and environment. Employees need to gain new knowledge and competencies in order to efficiently communicate and collaborate. But not only do workers need new skills: managers also need to adapt as leading a remote team can be more challenging. Team members can struggle with maintaining team spirit and

belonging to the company. Managers often change the way employees are evaluated – transitioning from time-based to results-based leaders (Janža, 2020).

Working from a remote location (home) can reduce the social interaction of individuals regardless of being a worker or a manager. Isolation can lead to depression and lower levels of productivity. Managers and employees need to take care that team members do not feel isolated during remote work. To reduce the feeling of isolation organizations could combine different strategies: combining remote work with working in an office, usage of audio and video communication (not only written communication), organizing (virtual) events and other informal work interactions (Janža, 2020).

It was already mentioned that working from home can represent a pleasant environment that boosts individuals' productivity. But this is not always the case. Working from home can be the source of many other distractions: kids, pets, hobbies… Organizations could define policies, best practices and advice in order for workers to establish a working space without any distractions (Janža, 2020).

A crucial aspect of working from home is finding the right balance between professional and personal life. This problem has two sides: either working too much or working too little. Workaholics tend to be constantly working but in long term, this has negative consequences as work productivity declines when working long hours. On the other side some employees can have problems in focusing on work activities (Janža, 2020).



Picture 3: Advices for home working

IMPACT OF COVID-19 EPIDEMIC ON REMOTE WORK

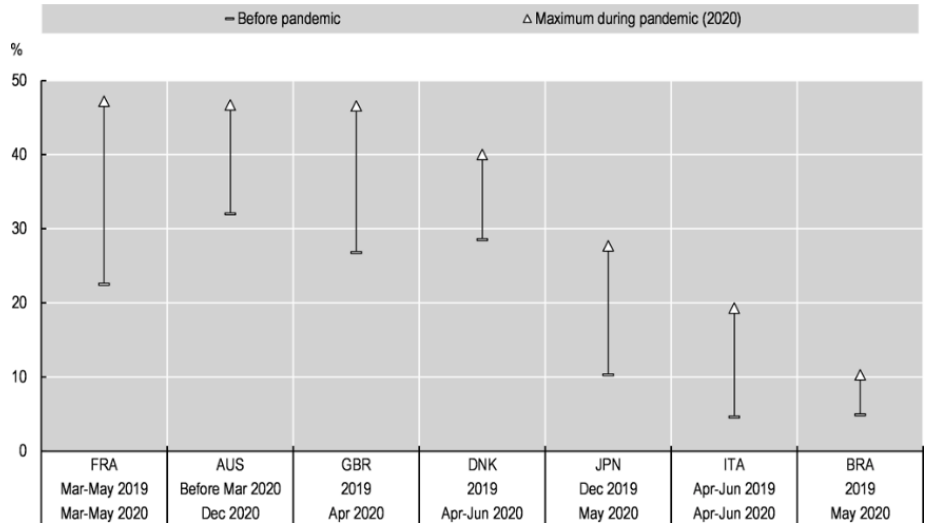
When the covid-19 pandemic hit the earth in 2020, everybody was trying to protect themselves and adapt to the new way of life. People reduced social interactions, shopping habits, the way they exercise and normally – the way they work. Before the beginning of the epidemic, many employees and organizations claimed that full-time remote work is not an option – only part-time as an alternative to established work processes.

Organizations have started using remote working as a means by which to maintain employment and ensure the continuity of economic activity during the covid-19 epidemic. Managers and employees got used to working from a remote location using digital communication and collaboration tools. Due to the fact that nobody knew if the pandemic is a short or long-term state, many organizations adopted to different levels: some organizations only supported their current processes while other organizations made greater changes and optimized working processes to fully embrace “a new normal”.

Practically everyone has been affected by the covid-19 epidemic in one way or another but it is impossible to accurately measure how big the impact was on different parts of life and work. Many different surveys and analysis have been made that represents this impact from different viewpoints.

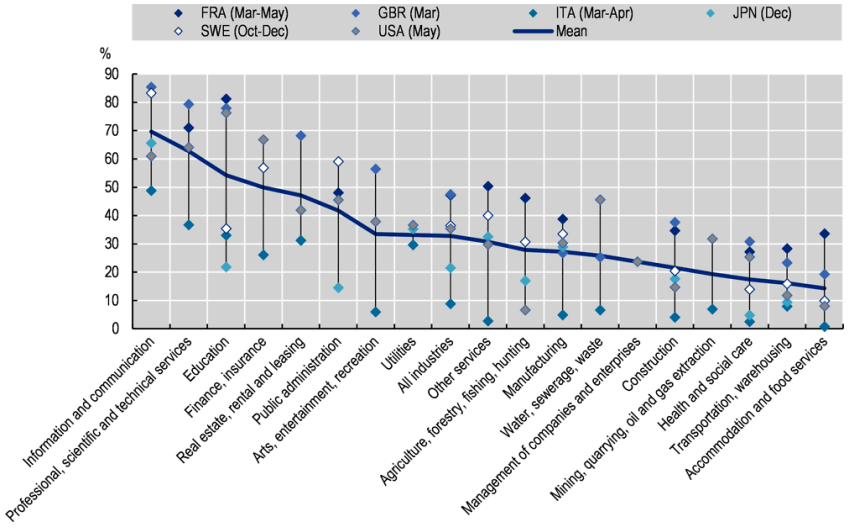
OECD performed an analysis where teleworking in the covid-19 pandemic was studied. The study reveals the following findings (OECD, 2021):

1. During 2020 lockdowns in Australia, France and the United Kingdom 46% of employees started working from a remote location (home). Even in Japan, where there was not a nationwide lockdown, remote work increased from 10% to 28% in 6 months (from December 2010 to May 2020).



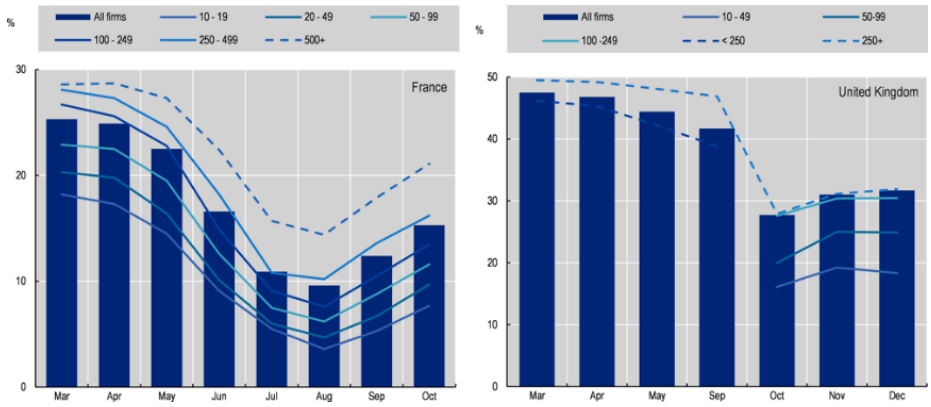
Picture 4: Difference in remote working rates between countries (OECD. 2021)

2. Rates of remote working varies between industries. Highly digitalized industries (financial services, information and communication services, scientific services…) achieved rates greater than 50%.



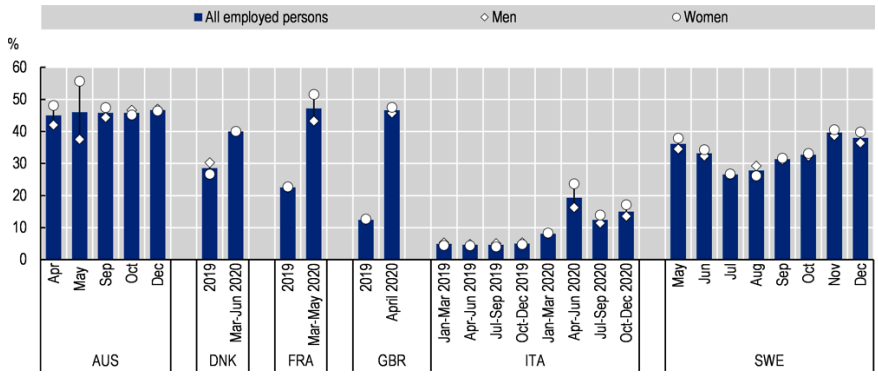
Picture 5: Percentage of employees remote working by industries (OECD, 2021)

3. More people from large organizations worked from a remote location, which shows lower digital uptake in smaller organizations.



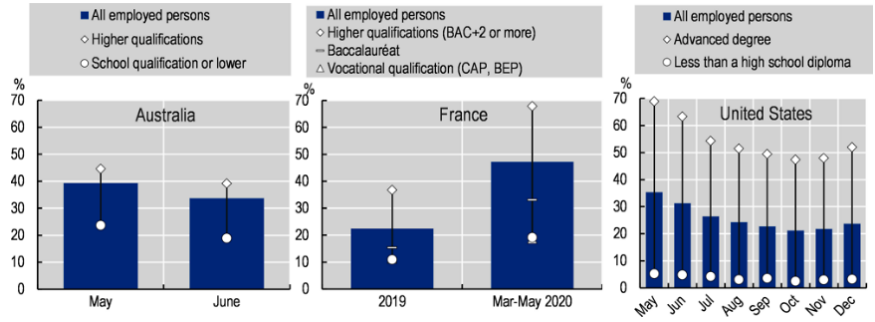
Picture 6: Percentage of employees working from a remote location in France and the United Kingdom in 2020, by firm size

4. Many countries reported differences in remote working based on gender, where women were keener to work from home.



Picture 7: Remote working during the pandemic by gender (OECD, 2021)

5. Highly educated employees (individuals with a Master's degree or a PhD) were 15 times more likely to work from home in the US compared to the least qualified employees.



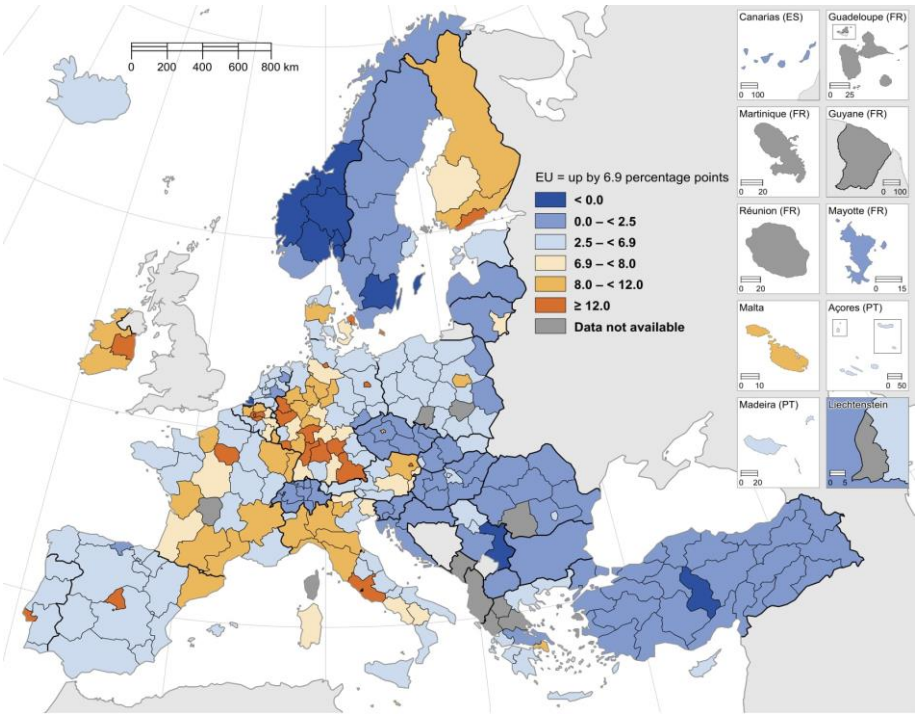
Picture 8: Remote work during the epidemic by educational attainment (OECD, 2022)

Eurostat also reported higher rates of remote working workers in their report: the percentage of workers doubled in 2020 when the pandemic hit Europe. In the last decade there was a stable 5-6% share of workers who worked from home, but during 2020 this number jumped to 12% (Eurostat, 2021)

The distribution of the percentage of employees working from home was not homogenous throughout Europe. The highest share of workers working from home was recorded in the Helsinki-Uusimaa region in Finland where 37% of workers worked from home. This region had a much greater share (10 percentage points) compared to the region that placed second – Belgian region Province du Brabant Wallon with 27% of people working from home. There were many European regions where the share of remote working employees was somewhere around one quarter: Région de Bruxelles-Capitale/Brussels Hoofdstedelijk Gewest with 26%.

Eastern and Midland in Ireland (25%), Wien (Austria) and Hovedstaden (Denmark) with 24% and with 23% Ile-de-France (France), Utrecht (the Netherlands), Luxembourg and Área Metropolitana de Lisboa in Portugal (all 23%). Interesting is the fact, that remote work was less common in southern and eastern regions of the European Union: in Croatia, less than 5% of the workforce was working from home, Cyprus, Latvia, Bulgaria and in the majority of regions in Hungary and Romain (except for the capital regions) (Eurostat, 2021).

The highest increase in the share of employees working from home was 19 percentage points. Regions with such increase were: Région de Bruxelles-Capitale (Belgium), Province du Brabant Wallon (Belgium), Helsinki-Uusimaa (Finland), Eastern and Midland (Ireland). We can see that 3 of 4 regions were capital regions of a country. These regions were followed by the capital regions of Denmark, Germany, Spain, France, Italy, Austria and Portugal (Eurostat, 2021).



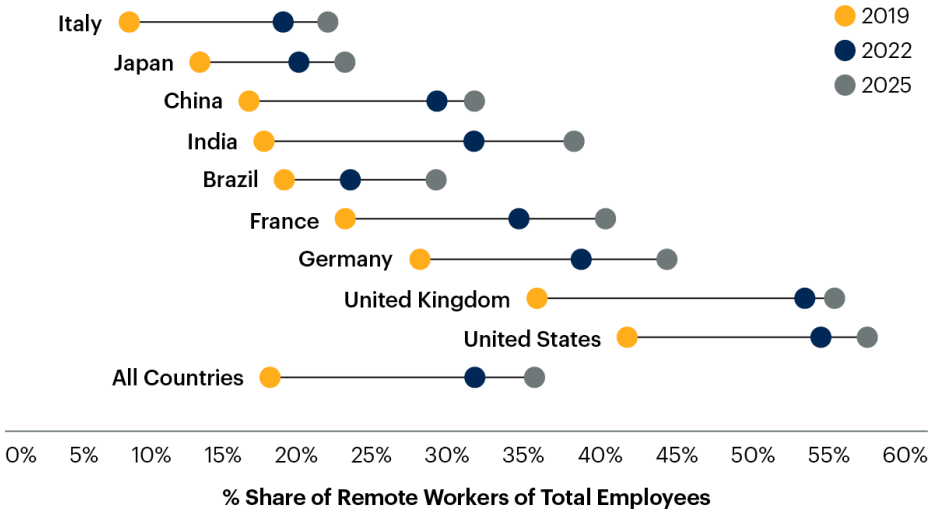
Picture 9: Change in share of employees working from home (Eurostat, 2021)

FUTURE OF REMOTE WORK

In the last pandemic, a lot of people and employees experienced working from a remote location. Everybody got familiar with the concept, we have seen the advantages and experienced disadvantages. The latest data shows us that the pandemic is in suppression which means that things can get back to normal soon. But is this the case with remote working?

Gartner predicted that in 2022 32% of the worldwide workforce will work from a remote location which is almost a 100% increase from 2019 (17%). Even when offices will go to "business as usual" 51% of employees will be working in a hybrid working environment: working from home at least once a week (Gartner, 2021).

Prediction of remote work varies globally and depend on different factors: ID adoption, culture and industries. Gartner predicts that in 2022 53% of the United States workforce will be working from a remote location, while in the UK 52% of the workers will be working remotely. On the other side, workers from China will represent 28% and workers from India 30% (Gartner, 2021).



Picture 10: Remote Worker Penetration of Total Employees by Country (Gartner, 2021)

CONCLUSION

The pandemic has disrupted the way we work. Due to health hazards, a lot of employees started working from home using modern communication and collaboration tools. After adjusting to the new way of working many organizations and workers noticed that work from home can be even more efficient than from the office.

Now that pandemic is in suppression a lot of organizations and even people ask themselves if they even want to work from the corporate office. Many benefits of remote work have been identified and confirmed which opens the different questions of meaningfulness of classical brick and mortar offices.

Many analyses and surveys have been done but only time will show us what people and organizations desire.

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Sašo Murtič[8]
Robert Mašera[9]
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DEVELOPMENT OF INTELLIGENT PORT SYSTEMS FOR MARITIME TRANSPORT GUIDANCE PURPOSES

Abstract:
Transport is a form of logistics process, which is the foundation of service activities. It is responsible for the transport of goods, raw materials, materials and transport of persons, securities, precious metals and other googs from one destination to another. For these reasons, transport is one of the most important industries fort he whole world economy, industry, production, market and supply of the population. In this industry, maritime transport is a fundamental part of

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transport water infrastructure, mainly due to the huge amount of transshipped goods, therefore represents one of the regular or occasional movement forms of goods included in the transport network, which is regularly or occasionally carried out at different destinations or transport routes. The final destinations or stations are ports or seaports, where they perform a lot of different operations that allow the ship to arrive safely at the berth, mooring, transshipment or loading and performing other tasks related to transport. In the implementation of many processes are already involved many of intelligent systems, which enable the combine of advanced technology and electronics, computing, communication systems, the Internet and cyber control and monitoring. Intelligent systems can increase the safety and efficiency of services and ensure traffic safety for all types of transport systems, helping us to access and manage the information provided at relevant times. At the same time, intelligent systems and appropriate technology, in and around the port, obtain data through sensors and equipment installed in the vehicle and on the infrastructure, thereby interconnecting the data and giving operator or user the necessary instructions for the efficient management and routing of individual systems in the port. The main goal of intelligent systems is to improve mobility and increase productivity, as well to ensure safety and cleaner waterways, which represent water infrastructure, at the same time, a good network of intelligent systems can eliminate the loss of time, space and labor in ports.

***Key words**: intelligent systems, ports, transport and networks*

INTRODUCTION TO THE RESEARCH

The characteristics of maritime transport are reflected in its scale, and at the same time it is a logistics process that takes the form of a service industry responsible for transporting goods, raw materials and transporting people, capital, securities from one place to another or from the point of departure to points of arrival. Due to the connection of individual continents and individual economic, industrial, production and other activities, is maritime transport one of the most important industries on which based the whole world economy, industrial, entrepreneurial or other production, market and population supply (Sepúlveda Whittle, 1987). According to the author of Sepúlveda, we would say that the definition is outdated, but it is still the same and other authors still use it, so we also used this source. The characteristic of maritime transport is also reflected in its water infrastructure, which is specific, determined and has its own characteristics. Maritime transport is a fundamental part of transport infrastructure mainly due to the huge amount of goods, raw materials, finished products, etc., which shipowners transported by sea, the quantities of goods transported reflect international trade and the number of performed transports (Dichirico, 2018; Arora, 2012). Maritime transport is the most important form of transport included in transport networks, which is regularly and

efficiently carried out by transport organizations on different continents, many destinations and along certain water transport routes. It is also characterized by a special form of cost, because the cheapest way to exchange goods from one continent to another, which allows the movement of goods, raw materials, materials over very long distances. due to movement, landing and arrivals at certain destinations, it is limited to coastal areas or areas that, due to their structure, enable safe maneuvering and landing (Dichirico, 2018).

Thus, according to the author Dichirico (Dichirico, 2018; Eurostat, 2015), we separate two main types of maritime transport, namely short sea shipping and deep-sea shipping. Short sea shipping is defined as short sea shipping, usually within the same continent or even within the same country. Characteristic elements of short sea shipping are, as stated by the author (Dichirico, 2018), high frequency of performed transports, reliability and punctuality of shipments, reduced transit time due to shorter routes and use of faster ships and lower costs.

Deep sea shipping represents a long-distance shipping, usually across the oceans, from one continent to another, and it should be understood that, due to distance, delivery times are longer, including the time of arrival and departure from each port (Dichirico, 2018). Modern development, the great exchange of products between continents, the need to supply the market and the population have contributed to the development of giant ships, and the procedures for loading and transporting goods have changed, for which shipowners most often use crates or international containers. Ships are increasingly well equipped with various navigation systems and systems for monitoring the movement of ships at sea, while with the help of intelligent systems and international communication, networks are constantly in contact with ports, shippers and consignees have the opportunity to monitor goods in transit and determine their condition on board.

Intelligent systems enable shipowners and shippers to combine advanced electronics, computing, communications systems and remote communications on land or in the air. Logistics and logistics processes with intelligent systems, increase the safety and efficiency of transport services and, at the same time, improve traffic safety for all types of transport means and systems, which gives priority to real-time access to and management of transmitted information (Krmac, 2019). There are intelligent systems used for the purpose of managing and communicating with the world and other vessels at sea, and systems that are integrated into common transport systems but allow for ship management and maneuvering. These systems enable data acquisition through sensors and equipment installed in the vessel and equipment installed on the infrastructure. These are intelligent systems that enable safe navigation, safe harbor in the port, mooring, loading and unloading, and departure of the ship from the port. The purpose of using intelligent systems in maritime transport is to improve maritime mobility, increase the logistical productivity of ports and ensure safety and a cleaner environment. With a good network of intelligent systems, it is possible to ensure fast movement of vessels,

eliminate losses of time, space and labor, and ensure safe navigation. In placing intelligent systems in the processes of safe work in ports and the part of the sea in front of the port, human resources play an important role (Friščić, 2009).

In this case, we studied some navigation and communication systems that allow interconnection of communication points at sea, on the coast and waterways and their connection with various intelligent systems that enable communication connectivity, which is the foundation of safe navigation.

RESEARCH AREA

The research area presents the maritime transport, in which we are studying the possibilities for the location of intelligent systems that enable navigation, monitoring and guidance of the ship. We focus on new forms of navigation, communication and accompanying intelligent systems, technologically advanced generation, which many authors recognize as a new generation of intelligent systems (the Japanese call them G5), which basically allows all digital systems to connect, which in the upcoming Smart Industry 5.0 as "screws communicate with assembly robots, self-propelled forklifts store goods on high shelves themselves, intelligent machines independently coordinate production processes, employees are connected to machines and products are directly connected to each other". Ongoing development and coordinated management of the new era has begun, which show the production flexibility and integration of production within the industry and between different industries. There is a growing interconnectedness and interdependence of the economy, industry, production systems, administration and countries, in the connection of digital networks, they are connected by the Internet, the international web, which allows fast and seamless communication. It represents the ongoing transition of Industry 4.0 to the new generation of Industry 5.0 or the "Z" generation or "G5", to which the representatives of the transport industry are also adapting. With the introduction of new intelligent systems, the need for greater cooperation between production and services is increasingly recognized, which enables technological progress in service activities, while ensuring legal security of individual economic entities (individuals and legal persons) involved in business transactions (Murtič, Uhernik, 2018). Also in the field of transport, especially in the field of maritime transport the development of the upcoming Industry 5.0 has identified intellectual systems that perform many tasks of employees, which can ensure greater security, accuracy, measurability and processing of data needed for transport control.

Due to the breadth and complexity of intelligent systems, which in the interconnection of industry and service activities represent a huge communication area, our research project focused on finding those intelligent systems that can safely control and control navigation in the seaport and at the same time with their systems allow safe movement, sailing, maneuvering, turning, mooring and stopping cargo or other ships in port. We did not pay special attention to the transport of

passengers by sea, we limited ourselves to intelligent systems that allow navigation, movement, sailing, which is the same for a cargo or passenger ship. The only difference is in appearance or technical changes, which does not affect our research and study of intelligent systems for maritime transport. It should be noted that our task, as a field of research, is only one of the central insights into intelligent systems, which can be extended to a much larger research, studied in countries with large maritime systems, large ports and a great need for digital governance systems.

RESEARCH THESIS

In our concrete case, we will present the results that represent research within a small port, where we sought answers about the efficiency of intelligent systems with the help of certain techniques and technologies and their interconnectedness. Therefore, in the thesis, we put forward that intelligent systems enable safe navigation and maneuvering of sailing ships and ships in port. We wanted to present known intelligent systems and their operation in the port environment, and on the basis of collected data or measurements, to find out how and which intelligent systems ensure safe navigation in port and departure of ships from port.

The range of useful intelligent systems is large and there are more on the market every day, but we decided to identify those that are suitable for smaller ports, including the port of Luka Koper. Intelligent port systems enable the combination of advanced technology, electronics connected to a computer network and remote communication, which, when interconnected, provide concrete data for navigation decisions. The author Krmac explains that intelligent port systems increase the security and efficiency of services in the port, while improving the flow of ship traffic, which enables them to be more productive (2019).

RESEARCH BACKGROUNG

If we were to talk about shipping and if we were to study the economic, transport and other efficiencies of maritime transport, we could easily find figures that show how much transport is carried out daily by sea, while we could get data on cargo, mode of transport, economic viability, the efficiency of individual transport companies and similary. However, this was not our goal, as in this case it would be necessary to make a brief analysis of the development of maritime transport, and we do not deal with this area in our research.

Also, our goal was not transports and their justification in terms of the amount of goods, time spent or energy that the ship needs for a particular transport. We identified intelligent systems that enable safe organization, implementation, and control of maritime transport. We were mainly interested in the intelligent systems that can control the safe entry of a ship into port, its movement, towing or pushing and departure on its way. The starting point of the research is in the intelligent

systems that enable guidance, navigation, management and monitoring of the ship during its sailing, before the berth and in the port itself.

In the research we have focused on the Galileo navigation system, which presents a form of development of the latest intelligent transport systems and is an important part of the strategic development of the European Union, its members and Europe as a whole. Collected data, according to the author Cvahte, is a system consisting of three satellites orbiting the planet Earth, 34 earth stations installed so that they can receive and transmit data smoothly and 4 control centers located around the world (Cvahte, 2010). As an intelligent system, the Galileo navigation system is useful in all phases of seafaring, from the initial sailing to maneuvering in ports, in all weather conditions. The features of the intelligent navigation system enable the tracking and identification of vessels, which is a condition for ensuring greater safety in maritime transport, while ensuring the information of all vessels at sea, thus reducing the possibility of collisions between different vessels. In conjunction, the use of distributed transmitters on the ground allows tracking of shipments and containers, as well as greater control over the cargo itself (Cvahte, 2010).

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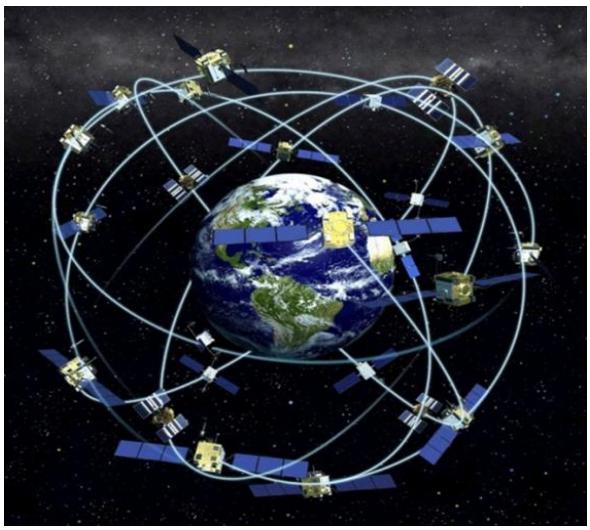

Figure 1: Galileo satellite constellation
Source: Cvahte, 2010

As we have already explained, the consignor, consignee or client can constantly monitor the course of the transport, also has information about the condition of the ship and the condition of its cargo and can organize production, sales or other activities related to the transported goods. The role and importance of the intelligent system can also be evaluated through measurable data, according to the number of operations performed, but this is the subject of another study, because in our study we wanted to present which programs and technically advanced intelligent systems are most useful in the central port. Already in its content, the research methodology is adapted to the technological development of intelligent systems for the organization of transport and the implementation of safe navigation at sea with

cargo and other ships. Therefore, we adapted the research to the research needs of intelligent systems and the research field (Wilamowvski, Irvwin, 2018).

RESEARCH COURSE

Intelligent transport systems in maritime transport have been divided into different systems or subsystems and presented as possible systems that operate and are interconnected, can also operate independently, and what they both have in common is that they can be used effectively in the process of ensuring safe navigation in ports. Such a presentation is scientifically acceptable and gives a greater overview of the knowledge of individual systems or intelligent subsystems, which represents the results of our work of research.

SafeSeaNet is a European Internet database for the exchange of nautical data between members of the European Union or the competent port authorities. The main purpose of SafeSeaNet is the exchange and acquisition and dissemination of maritime data for use by a wider number of users. It is a form of intelligent systems that enable communication both regionally and locally between the competent authorities, which helps to prevent maritime accidents, and at the same time allows us to see the exact location of the ship (Friščić, 2009).

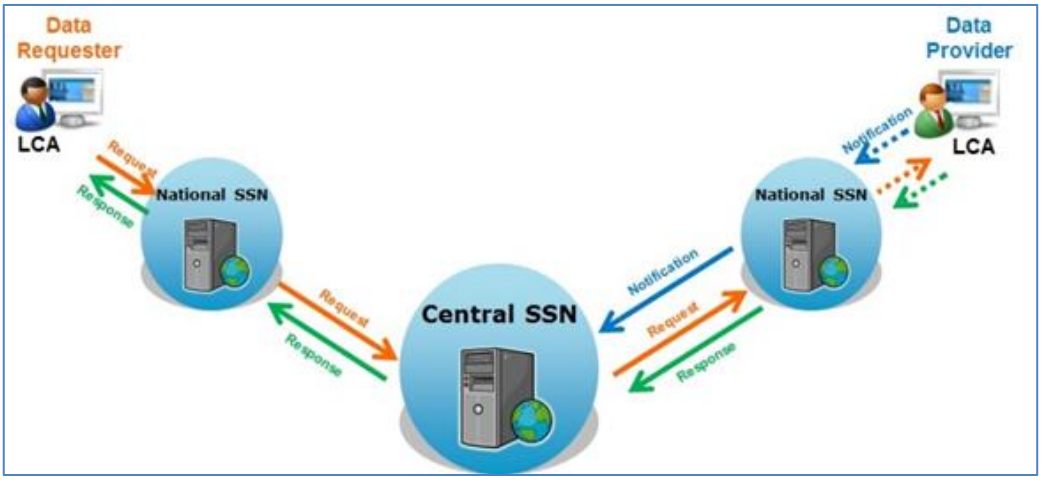

Figure 2: Data exchange in SafeSeaNet.
Source: Emsa, 2020 – (Available at: https://syr.us/DPk)

The program and the image can be found on the Internet and in the interconnection of companies involved in maritime transport, or in those companies engaged in the control and supervision of transport, using these intelligent systems. The system constantly monitors the movement of ships and, if necessary, communicates positions where the ship is located, which helps the organization in ports to prepare for the arrival and conduct of operations related to the transport ship, and for others means appropriate action to ensure safe entry or departure.

Figure 3: Display of the ship position.
Source: Emsa, 2020 – (Available at: https://syr.us/DPk)

CleaSeaNet is a system for satellite tracking of illicit discharges into the sea, which allows the user of intelligent systems to be able to detect illegal spills and pollution of the sea in real time based on a radar image. The aim of the system is to detect in time the locations of spills of fossil fuels, oils or other liquids and to identify the ship that accidentally or intentionally caused the spill at sea.

Figure 4: Display of detected oil spill.
Source: Emsa, 2018 – (Available at: https://syr.us/jcm)

VTS and VTMIS intelligent systems represent the VTMIS (Vessel Traffic Management Information System) system, which is a special information system for vessel traffic management, in our case for vessel management in front of and in the maneuvering space of the port. The purpose of the system is active control of ships entering and leaving the port and advising ships on navigation. The system has a connecting role and works in digital form on the interconnection of databases, from which useful data are obtained for the management and monitoring of shipping.

Everything is systematically connected and provides nautical data, coordinates, time and weather directions, and allows proper navigation of ships and other vessels. The system provides access to data on ships, through which it controls the technical characteristics, dimensions or size of the ship and its cargo, obtains information on the owners of the ship and scanned data and detects the flag under which the ship sails. The system also provides access to dynamic data in ships, from which it is possible to determine the previous destinations or stops of the ship, the direction of sailing and further destinations, and the type of cargo loaded on the ship and transported by the ship. The system then displays data on the ship's course and place and time of anchoring, records many events, loading and unloading times, detects types of cargo, allows security control and stability of the ship and cargo. The system can be accessed by ship agents, captaincies in ports, customs services and other competent services (Friščić, 2009).

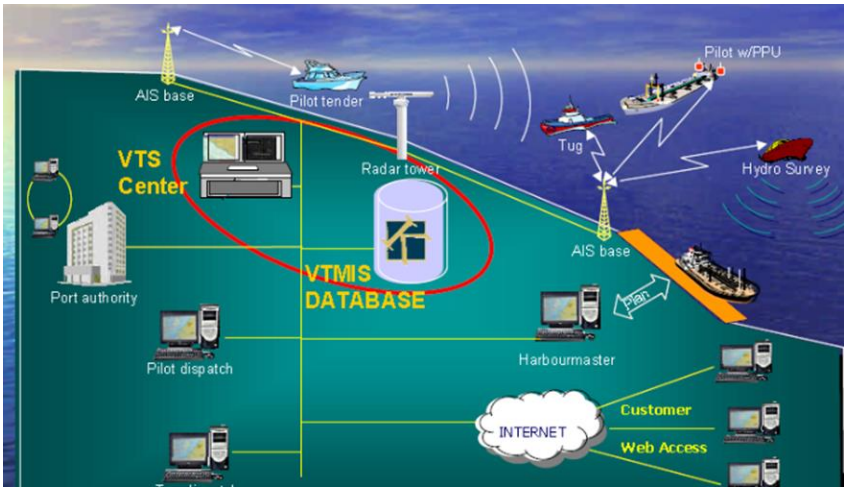

Figure 5: Demonstration of VTMIS operation.
Source : Shelter, 2022 – (Available at : https://syr.us/76X)

We also identified intelligent AIS - Automatic Identification Systems, which enable the acquisition of data on the position, speed and direction of navigation of ships, as well as identification data on the ship. These data are very important in maritime transport because they allow accurate graphical monitoring of maritime traffic in real time, at the same time the systems are connected to navigation control centers that monitor navigation coordinates and can help in case of need for rescue at sea. The system facilitates the management of the mandatory course of navigation and offers support in the identification in the event of marine pollution. The system enables the search of ships according to the criteria and the estimated time of arrival at the destination, while the built-in alarms warn in case of collision danger, approaching the forbidden area, poor transmission or cessation of signal transmission (Friščić, 2009).

LRIT identification involves tracking ships over long distances. These are intelligent systems that provide global identification and tracking of ships over long distances, which is typical of oceanic distances between continents. The system has enabled

progress in the field of maritime safety, security against terrorists and assistance in searching for crashed ships, and in this way enables rescue, as we can locate a ship at any location (Friščić, 2009).

Ships that must have this system are (IMO, 2019) all passenger ships, including high-speed passenger craft, cargo ships of 300 gross tonnage and up, and mobile oil rigs. The LRIT system consists of (IMO, 2019), marine LRIT transmitter, communication service provider, application provider, LRIT data center, maritime traffic control system, LRIT data distribution plan and the possibility of international exchange of LRIT data.

Intelligent ECDIS systems or the System of digitized raster charts or vectorized nautical charts, is an information system that serves to digitally display nautical charts of information that is important for navigation. The IMO interprets ECDIS as a system to assist seafarers in the planning and monitoring of the waterway itself with information displays and all position information from navigation sensors. The system is defined as a tool for seafarers, as in addition to the GPS system and electronic maps, it has the option of upgrading navigation sensors such as AIS system, radar and active sensors (Friščić, 2009). The study presents two types of ECDIS charts (Canada, 2021), namely Raster Map (RNC), which is a simple electronic image of a paper chart.

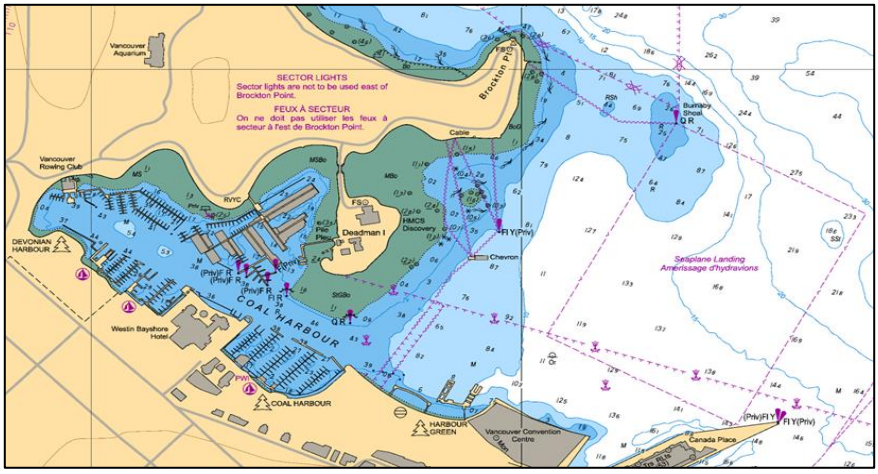

Figure 6: Example of a raster chart (RNC).
Source: Government of Canada, 2021 – (Available at: https://syr.us/Kp1)

Another form is the Vector Chart (ENC), where the system displays smart charts that serve as flexible navigation tools for navigation, where the user can set criteria and use various functions that help navigation. The purpose of the intelligent system is to obtain additional information that is not otherwise available on paper and raster charts, because ports and coastal signals systems are updated and the system enters and takes into account when detected on the next ship, etc. For example, the RNC subsystem can be used, which displays the berth only as an image, while the ENC displays the berth and attaches attribute data determining the berth and ship

height, berth and ship length, safety age, ship ownership, number of berths and operations etc.

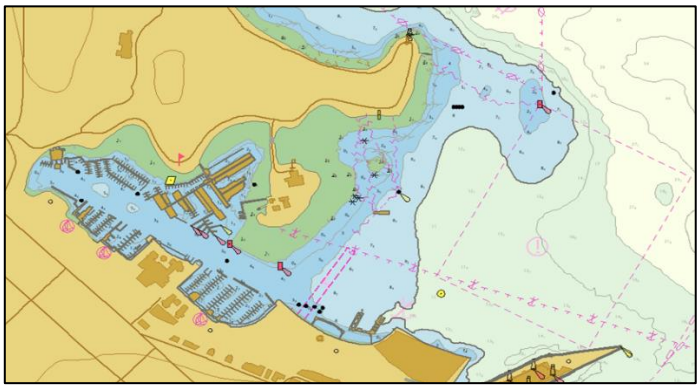

Figure 7: Example of an electronic navigation chart (ENC).
Source : Government of Canada, 2021 – (Available at: https://syr.us/Kp1)

DISCUSSION

The identification of intelligent systems in maritime transport represents the knowledge of procedures and technological achievements that are important for the safe navigation of cargo and other ships on sea routes. For many people, sea routes are routes that are not known, so they do not even imagine how congested these routes are, sequential or planned and safe entry or exit of ships from an individual port.

Figure 7: First discoveries and records of maritime routes.
Source: https://sl.wikipedia.org/wiki/Velika_geografska_odkritja

Through the study of intelligent systems in the field of maritime transport, we also touched on the field of maritime marks and marking, where systems include various visual and audible signals represented by buoys, lights, signs, sirens, and more recently electronic or technically advanced technological achievements that represent intelligent systems in maritime transport. Waterway marking began as early as the fourteenth and fifteenth centuries, and today they are mostly marked

and covered by electronic systems and digitally connected to the world wide web, recognized by the intelligent systems we described earlier. If we are talking about the Slovenian sea, we must state that the markings in the Slovenian sea are harmonized with the international maritime labeling system IALA. The system, in its current form, was adopted at the IALA conference in November 1980. It has five types of labels that can be used in various combinations. The four types of markings are the same for both valid zones A and B, only the lateral markings differ by zones. Maritime markings at sea can be materialized by anchored floating buoys or by masonry signals. All details about the system with a detailed explanation of the labels can be found in the brochure entitled IALA - Maritime Label System (https://www.hidrografija.si/osnove-navigacije/sistem-pomorskih-oznak-iala/).

The Maritime Code (Official Gazette of the Republic of Slovenia, No. 62/16 - official consolidated text, 41/17, 21/18 - ZNOrg, 31/18 - ZPVZRZECEP, 18/21 and 21/21 - corr.) regulates sovereignty in its provisions, sovereign rights, jurisdiction and control of the Republic of Slovenia at sea, safety of navigation in the territorial sea and inland waters, protection of the sea against pollution from vessels and the legal regime of ports. It determines the internal sea waters of the Republic of Slovenia, which include all ports, bays and anchorages of the Port of Koper, bounded by the meridian 13 ° 40 'east and the parallel 45 ° 35' north.

Figure 8: International water connections with Slovenia.
Source: Free Encyclopedia, found on the Internet 2022

Recognizable intelligent systems that can be used by both small and large ports are an example of good practice, which we identified as useful for our research. Just like the organization of air traffic for the needs of aircraft, all sea routes that enable safe navigation are precisely arranged. More and more economically developed countries are introducing intelligent systems into their territorial waters, and the international community for safe navigation in international waters, which, as we

have mentioned, represent safe navigation in terms of useful value. In the field of application of intelligent systems in transport and its management, forms of remote control are increasingly penetrating, which represents a challenge in the use of control technology in the context of what is already used in some advanced factories of the future. With the introduction of intelligent systems for the needs of safe transport and traffic in marine waters in addition to existing navigation systems, support information systems are increasingly used, which are defined as sensors, actuators, I / O interfaces, SCADA, MES, ERP systems that are interconnected connecting the various systems in favor of managing the newly developed systems needed to ensure security in ports or on the high seas. There are more and more attempts to build building blocks that will increase the safety and overall efficiency of maritime transport by integrating intelligent systems.

In the discussion, we note that the priority directions of research and development in the field of intelligent systems for the management and guidance of maritime navigation go in the direction of various building blocks that allow better integration of physical and digital worlds in the future of navigation, which in turn takes the company to a higher level of development. In our discussion, we confirmed the thesis that intelligent systems enable safe navigation and maneuvering of ships in front of and in port, thus confirming that today the development and use of navigation, guidance and management technology is one of the most important branches of ICT development and innovation trends in the world.

We are aware that our research is only part of the review of existing intelligent systems, so we will strive for more recent research and present our findings in the subject Intelligent Systems in Logistics.

CONCLUSION

Intelligent systems represent a human progress, and they are a form of replacement that will perform many jobs and tasks in the future instead of employees in this industry. Transport and shipping are the cornerstones of economic integration between different economic and non-economic entities, so its development, modernization and appropriate regulation are expected.

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WAYS OF SYSTEM MAINTENANCE IN THE INSULATION MATERIALS MANUFACTURING COMPANY

Abstract: *The development of logistics processes and especially the introduction of intelligent systems and new technologies in production processes always requires the maintenance of systems that are interconnected and which through this connection enable more modern production. According to its procedures, technology and logistics processes, the production of insulation materials is a specific economic branch, which is already quite unsuitable for the environment and human health in terms of content and substance or raw material, so handling and maintenance of systems is very important for this industry. Appropriate management of the logistics processes used is important, and the procedures necessary to maintain the systems and thus the entire production are important. It is a vision of the company, which the company's management sets and leads in the direction of changes and development of production systems that enable the improvement of products. In cases where the production company has a larger number of employees, the forms of system maintenance also require the involvement of a larger number of employees, management and intelligent systems in the processes of organization and implementation of maintenance. Effective maintenance means maintaining many operations in their operation, which prolongs the service life of equipment, improves availability and keeps machines in proper working order.*

Key words*: intelligent systems, management, maintenance, equipment*

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1 INTRODUCTION

For examples of good practice, we summarized the forms of maintenance of systems in the production company of insulation materials. The company is the largest manufacturer of insulation materials in Slovenia. From the collected data of the production company, we found that the company's vision is to actively change and update production systems, management systems, maintenance systems and the development of superior durability of insulation solutions. The company has developed a partnership and connection with development institutions, faculties and institutes that are constantly studying insulation systems, and is also connected with the state in the sustainable search for better solutions. Their advantage is the difference in thinking, organization, use of intelligent systems, which in fact represents the key factors that enable the company to enter the global business market. The fact that the company is a manufacturer of insulation materials in Slovenia and has more than 500 employees and in its production processes produces more than 100,000 tons of stone wool insulation with a turnover of 150 million euros in 2021, is telling enough to use the case for research purposes. The company is increasingly investing in its own innovative systems and uses the most modern intelligent systems for production, which can be used in the procurement, production and distribution of materials.

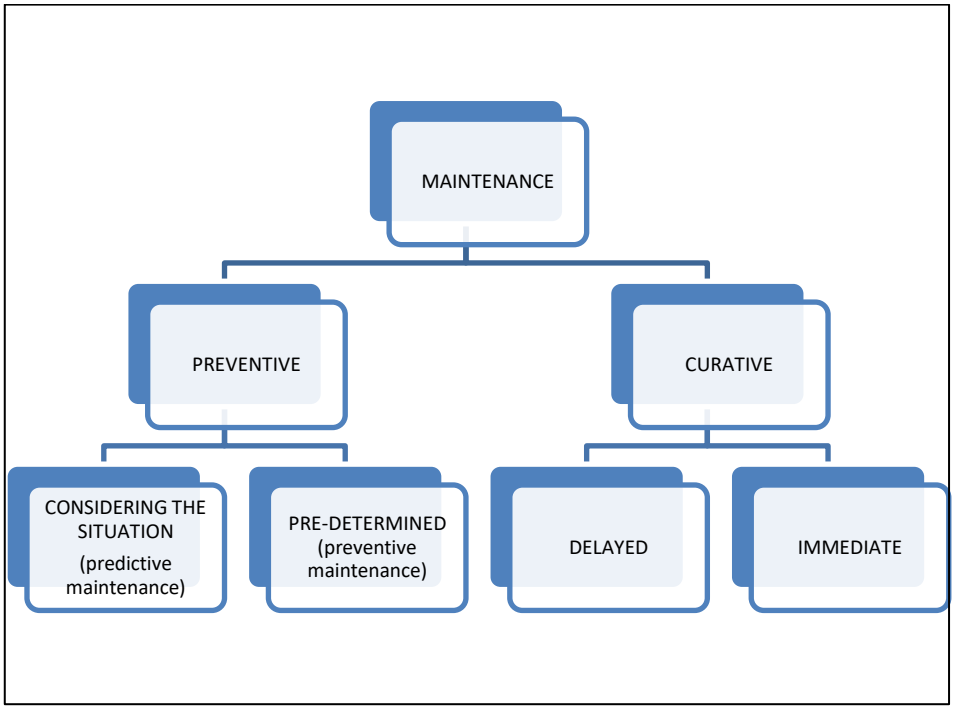
Forms of maintenance of systems in the production company of insulation materials are necessary and represent their own innovative potential, which the company presents as very efficient in the market. These are procedures and maintenance processes that are performed in the company in close connection with the production itself, which represents gradual activities that are related to the company's processes, but must be performed independently for the needs of production. Both in the company and in the organizations working with the company it is quite clear that their presence in the market depends on innovation to improve insulation materials. In order to achieve this, appropriate improvements must have the appropriate equipment and machinery to enable modern production. The company carries out maintenance and modernization partly through employees' development potentials, leaving more demanding work and development to an outsourcer, ie to institutes, schools, etc. They are aware that efficient maintenance of equipment and production systems is crucial for many production operations, while proper maintenance prolongs the usability of production systems and equipment, improves staff availability and keeps processes in good condition. Successful maintenance in production is ensured by the company's management, which evenly provides funds for production, transport, procurement, engineering and constructions. Within the systems, there are logistics information and logistics management systems that enable the real-time sending and management of information.

2 THEORETICAL VIEW OF ENTERPRISE MAINTENANCE AS A STARTING POINT OF RESEARCH

The production company systematically deals with the issue of internal regulation of individual processes, taking care of personnel policy and employment, the adequacy of the profession and professional activities, education and development of individual systems. The complexity of the market requires changes in supply and demand, which in turn requires the search for new solutions that are suitable for the operation of all processes in the company. The focus of our presentation is maintainance, which we will present and in the final part give suggestions for improvement.

The data show that during this time the company presents quite a few approaches to maintenance (Figure 1), showing the technological transition from one system to another, which is presented in the company as a transition from old to newer maintenance. In doing so, they emphasize the forms of planned maintenance, for which they explain that much depends on whether they plan it in advance before the failure or decide that they will perform maintenance after the identified failure.

Figure 1: Maintenance approaches



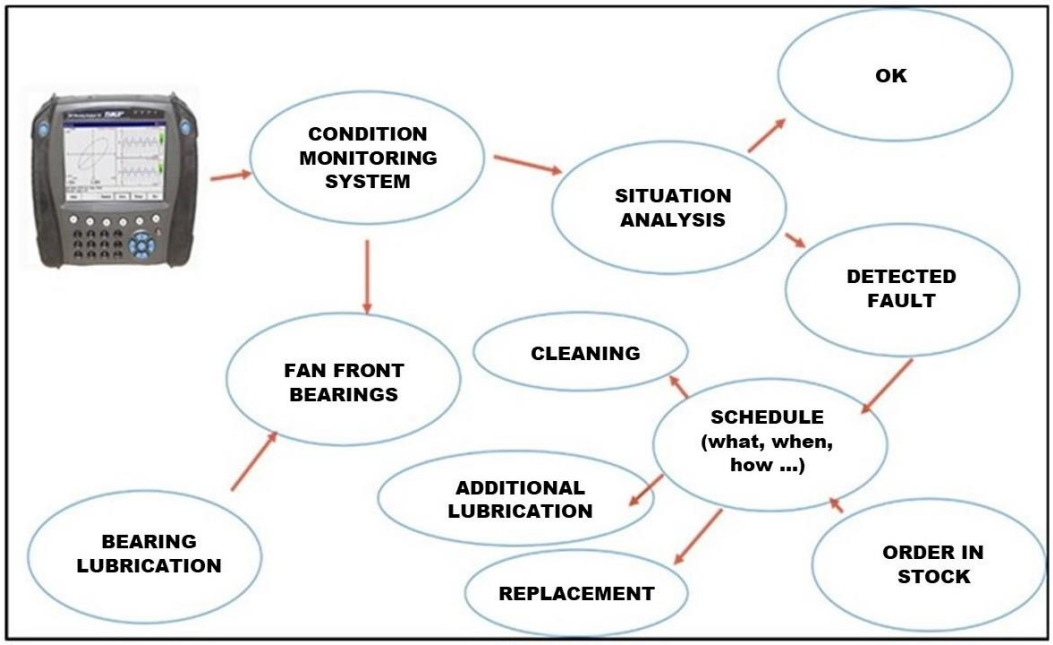
Source: Made by the authors, 2022.

As shown on Figure 1, the production company divides professional maintenance into preventive and curative, further dividing preventive maintenance into maintaince, considering the situation, and already planned maintenance (pre-determined maintainance), which both certainly represent a preventive form of maintenance. In the curative form of maintenance, they systematically provide for

delayed and immediate maintenance, which is understood as dependence on the production processes themselves. Thus, from the content of system maintenance, we find that preventive maintenance prevents unforeseen downtime. It is used in the company in areas of production where congestion means a great loss or can even have a dangerous impact on human lives. Therefore, we can understand that the company replaces the key (important) part of the hardware during the period of good operation of an individual machine or production device, for which it is estimated that it will not withstand certain functional changes or long-term operation. Since the assessment is preventive in this case, they still decide to replace it, using measurable data from past service life or experience from other sources (it is assumed that part of the equipment or machine will soon failed). To decide the time of failure or to estimate when a part will fail, they use changing measurements, where they record the chronological events of individual systems or devices. These are the measurement of vibrations (piezoelectric sensors), the noise or change of sound, the measurement with ultrasound, the measurement using thermography, the measurement according to the samples taken by the controller, etc.

For the case of preventive maintenance, the system according to Figure 2 can be used, which clearly shows how the measurements should be performed. The company uses portable systems to assess the condition of the bearing, specifically the SKF Microlog analyzer, which automatically collects dynamic and static measurements. After the division of jobs, the measurements are performed by a mechanical technologist, according to a detailed plan, and the collected data are analyzed with the help of programs and SKF experts. If the analysis shows a deviation or it is determined that a defect is detected on the bearings, they determine the cause of the defect and plan remediation. Maintenance examples show that in some cases suitable lubricants that prolong operation are sufficient, otherwise the bearing must be replaced.

Figure 2: Example of a preventive maintenance process



Source: Made by the authors according to data, 2022.

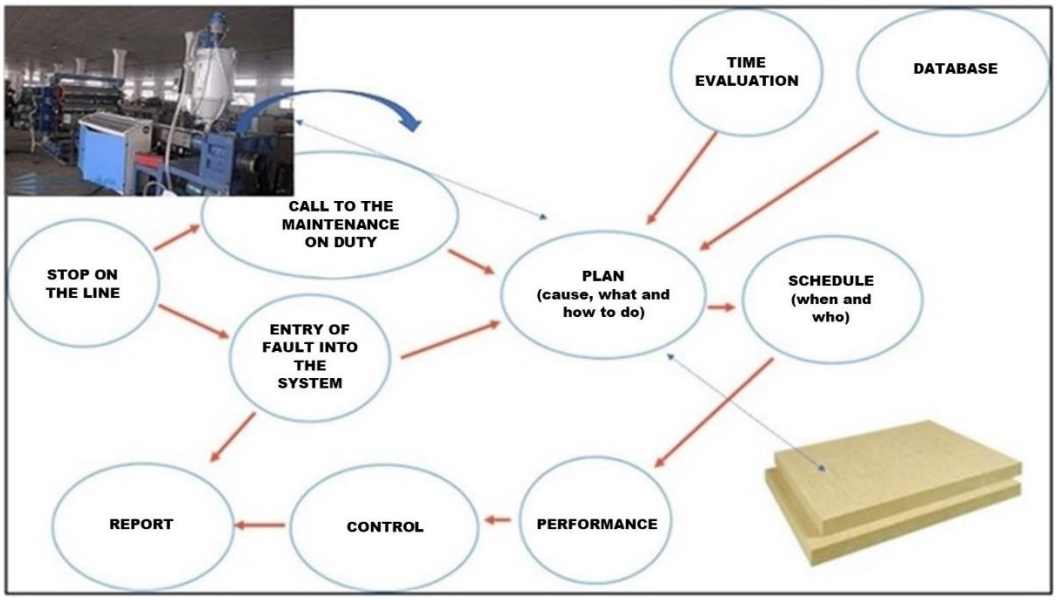
This form represents preventive maintenance, so it takes some knowledge and experience for the maintainer to decide to replace it before the final failure occurs. The management of the manufacturing company understand that there may be instances where the element or bearing did not need to be replaced, but the risk of congestion is greater than the cost of replacement, and therefore approves such maintenance.

Another form of system maintenance is curative maintenance, which is performed in the company when there is actually a concrete failure of the system or machine or device for production. So it is a concrete defect that has already caused a standstill in production or could have caused a standstill. In such cases, which are not known, but can be predicted, immediate maintenance or elimination of the defect or repair is required. In the process of organization, the importance of logistics processes is shown, especially the purchase and organization of transport for fast delivery of spare parts. The company has permanent on-duty teams that follow the production process and are ready to quickly and efficiently maintain and correct the error.

An example of curative maintenance can be identified in Figure 3 below, which shows the activities involved in maintenance processes. Systemic means that a troubleshooting call has been triggered by the manufacturer, for which the machine maintainer uses the knowledge and available technology to troubleshoot the system. The operator also enters an error into the system we have to monitor congestion and breakdowns on production lines.

This is a table in which we need to enter the time and date of the congestion, briefly describe what is wrong and who was called for repair. The called mechanic looks at the situation and assesses whether the machine can continue to operate without repair or whether intervention is required. If an intervention is required, the on-duty maintenance worker must be able to estimate the time of the repair, how many people will be needed to repair, what spare parts will be needed from the warehouse, and so on. Once the defect has been rectified or partially rectified to the extent that production can operate, it is his duty to write a report to the system that may include the workflow and the reason why the failure occurred and what he did to prevent it from happening next time.

Figure 3: Example of curative maintenance process



Source: Edited by the authors themselves, 2022.

It is an internal response of production processes and quick responses of maintainers, which the company must have at all times, otherwise there would be a stagnation of production, which would result in a waste of time, space and labor. It could also mean a stagnation of financial flows in the process of purchasing, production and sales, which a manufacturing company should not allow itself.

3 RESEARCH THESES

In the initial part of the research, it was immediately possible to detect various procedures for the purchase and entry of materials into a manufacturing company, which is in many ways different from some known systems of procurement and storage of raw materials, semi-finished products or products. We have identified the processes of procurement, input and flow of raw materials through production, storage and preparation of production, which is quite identical to the logistical forms or processes that are common to many forms of production. However, there are also cases of the need for smaller warehouses, which fragments the process and there

seems to be a departure from the uniform principle of usable systems of procurement and storage of raw materials or semi-finished products. This is the need for the purchase and storage or storage of individual spare parts for the maintenance of production processes, which differs from the production processes themselves and we had to consider them as such. Many intelligent systems and forms of work organization can be detected in the procurement processes, but there are also those that cannot be attributed anywhere or classified in the forms of storage, recording, fast delivery, fast installation, etc. It is precisely these deviations or the established situation that led us to the thesis "With an appropriate system of computer recording and storage of inventories, maintenance interventions would take much less time." We will try to find levers or technological achievements that would guide us in finding an appropriate solution and in clarifying the thesis, which we will confirm or refute as impossible.

4 FIELD OF RESEARCH

The field of research is quite complex because it was not possible to study the classic logistics processes, as we found ourselves in a logistics space intertwined with management, and at the same time it is a kind of parallel logistics with logistics. This prompted us to find solutions to these parallel logistics requirements, and it was a challenge to study logistics and logistics processes in slightly modified forms of production organization, which is certainly a good challenge in science, but can be considered examples of good practice, which can be transferred to similar systems.

5 DELIVERY PROCESS AND STORAGE OF SPARE PARTS IN THE COMPANY

It was interesting to study the forms of purchase and storage of spare parts, because according to the soft production system or "Just in Time" system, where the industry took over the supply systems at the right time in the right place, the company would have a convenient warehouse for fast delivery and import raw materials into production, which we also found in the production process, in the supply and entry of raw materials for production. With regard to spare parts and material for the maintenance of production systems, the organization is completely different, because it is impossible to organize it according to the production system of the logistics organization. As production is organized according to its processes, it covers systems for protection of workers (respiratory and other parts of the human body) and machinery (protection against penetration of raw materials into machinery systems) and environmental protection system, production processes are also separate, which requires that the company organizes smaller warehouses for individual systems or individual machines, where they always have spare parts for replacement or tools for troubleshooting. Therefore, in addition to warehouses with raw materials for production, the company has special smaller warehouses for spare parts, which it supplies with materials for quick troubleshooting and quick start of

production or operation of systems. The storage system also separates warehouses or compartments or premises that are classified according to electrical (spare parts for electrical systems), mechanical (machine elements) or other equipment or materials, as they call them. One of the processes was described by the author Zelenika (2005) in his scientific book on logistics systems in industry. The machine part is especially organized according to the plumbing, hydraulics, pneumatics and other arrangement of machine works in sequence. Individual usable shelves are organized in such a way that they have an overview of tools and parts, due to the quick search and intervention in case of production downtime. They try to ensure the rapid search and use of certain sets of the production line and related spare parts with a classic organization. Spare parts that arrive at the warehouse are assigned a bar code and a plan number, which allows a faster search for the composition or plan of a particular product in the computer database with plans. All spare parts storage systems for maintenance are, in principle, directing the worker to the spare part. In practice, this means that during the intervention you need a spare part, which you get from a maintenance site, which is organized as a mini spare parts warehouse, but if there is no spare part, you have to look for it at a central warehouse. They explain that each spare part is inverted into a database (computer program) with the current stock and in cases of intervention and use of an individual part, the storekeeper knows that the work in the warehouse must be written off, which is done by the maintainer with PDAs displayed by the maintenance manager. With such records in the main database and in the management of the company, they know that an intervention has been carried out, a new part of the system is installed, which must be procured for the next intervention. At the same time, data on the time spent replacing are shown, delays in the time and number of products are recorded, and a financial statement is made. In this way, the system stores what the maintenance staff repairs and in the future it is known exactly what they need for this repair, and in addition, the company's costs are divided according to the orders. To order spare parts, it is also necessary to monitor safety stocks prescribed by maintenance managers. Only ordering from the warehouse follows the following path: during the day, spare parts are entered on the order form, which must be ordered in stock, and twice in the morning shift is delivered for purchase, which then orders the desired parts. The system is about identifying certain logistics systems as described by the author Zelenika (2010).

The company also has spare parts in reserve, which are often not changed, but are in stock, because the company can not wait for delivery from abroad, as this would mean financial losses, market losses and customers dissatisfaction. Above all, there is a waste of time, space and manpower, which could mean major economic setbacks for them. Through these systems, the company develops innovations that serve as an orientation in business processes, which can be found in the comparison of the author Beganović (2016), who describes the innovation and strategic direction of small businesses in the development economy.

The company also has a larger warehouse that it uses to store many pieces or tiny systems, which are marked with a barcode and product plan number. In this part, there is often a deviation from the good organization of the work of systems in the company, but these cases are very rare and the system does not consider them inappropriate. There are also visible cases when it comes to special orders, spare parts that the industry needs less often, the task of ordering is performed by a maintenance technologist. Such purchases of spare parts are recorded under a special item and funds for payment are drawn from the investment fund. The company combines systems of other supply or purchase systems in its production, so cooperation between them is developed between organizational integration and compliance (Murtič, Jankovič, 2019).

The company tell us that there are cases when it is not possible to obtain a certain spare part due to congestion or repairs because suppliers do not have it in stock. In such cases, through organizational cooperation with other manufacturing companies and through their own innovation, they have established business relationships that allow other organizations to withdraw individual spare parts from their warehouses, which they buy or return after purchase. They explain that, in the case of ordinary machine parts that can be obtained from the surrounding suppliers, they have two options, with some concluding special contracts for these companies to provide them with the supply or delivery of spare parts that are less than 24 hours. Alternatively, they have to send a maintenance technologist to the provider and pick up the desired product there. When purchasing spare parts, they often use postal delivery systems via the Post of Slovenia, Slovenian railways, DHL, TNT, etc.

6 PROCEDURE OF THE RESEARCH

The course of the research was adjusted to the internal logistics maintenance systems in the company, thus studying the transport of spare parts from the warehouse to the repair location. We found that when organizing the supply of spare parts to the company, the purchase is not the most in line with the company's needs for maintaining the system in operation. The company told us that purchasing spare parts is a problem for them, because the provision of lighter and small spare parts is quite transparent, they have a system adapted to arrange smaller warehouses at a certain stage of production and are always ready to fix the problem quickly. They have problems with the purchase of more demanding parts, which are expensive, which means that the company cannot have them in stock or purchase them as needed. In addition to management, they also have financial difficulties in decision-making, because they cannot anticipate failures, so they have no basis for reserving financial resources for the purchase of more demanding maintenance parts. Even the internal organization is not the best for them, because they have problems with the transfer and installation or maintenance. Technologically heavier spare parts are brought in with the help of handcarts, occasionally using forklifts where this allows access, otherwise they have to do everything physically, which is a big problem.

Here, in addition to lack of organization, one can also see the technological imperfection of the systems. They say that spare parts of smaller dimensions and with a total weight of up to 80 kg are transported with the help of dedicated carts, for heavier parts they use forklifts, because heavier parts have to be raised to a height of 4 m. To get spare parts, the company also uses dedicated elevators to a certain height. Within the company, they have adapted elevators that are not standard but still correspond to certain maintenance work or logistical procedures that must be performed in the maintenance of systems.

The company has development services that adapt to needs, and there are more and more innovative systems and attempts to introduce tools that encourage the development of logistics processes in maintaining systems in operation. Through market research, development services have realized that the world is already full of tools that have established themselves in various forms of production, as very successful and efficient. The task of the maintenance staff are new systems in the company and world-renowned forms of modern tools, so they are constantly studying various innovative systems and looking for intelligent systems to eliminate unnecessary congestion. The goal and task of maintenance workers is to establish the safest possible system of operation, to prepare an appropriate system for providing spare parts, ensure timely procurement and agree on an appropriate financial fund to provide spare parts, which they recognize as sensible and innovative to quickly ensure the maintenance of production systems. The company started with the gradual introduction of the 5S model, the TPM method and some tools for analyzing the effects of system maintenance.

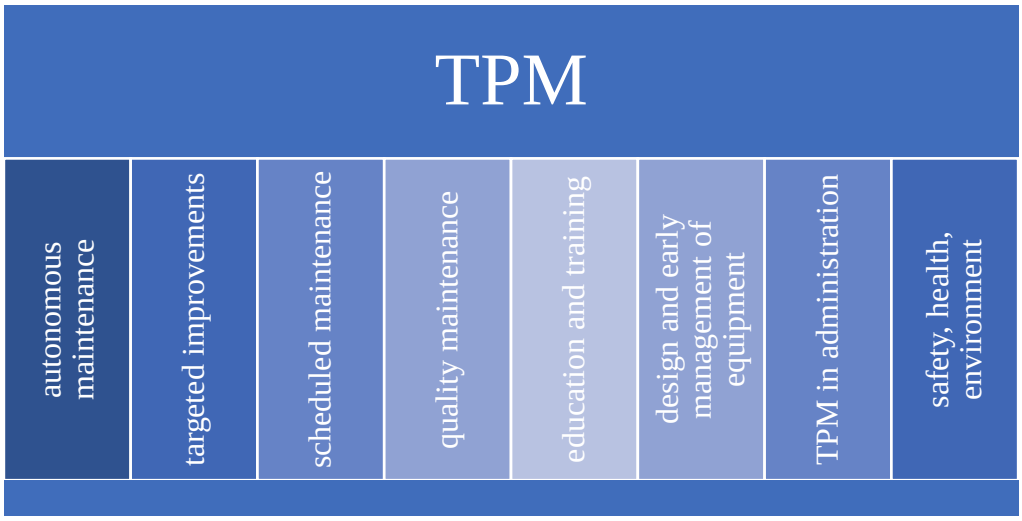
The TPM method is an acceptable method, because total production maintenance with the Total Productive Maintenance method requires that the quality of equipment maintenance be treated in the same way as the quality of products. It contains a broad maintenance program throughout the life of the equipment and requires autonomy of maintenance and participation of all participants in the production process (meaning that everyone is responsible for the maintenance of the equipment they work with). TPM has many objectives that do not differ between sectors of the economy, which makes the use systematic or different and basically equally useful [1, 2]. Among the goals of the Total Productive Maintenance method are:

- increase equipment flexibility,
- improve process capacity,
- prevent major repairs to the equipment,
- extend the service life of equipment,
- reduce variation in production,
- reduce throughput time at all sources,
- full management support,

- create a robust system of planned maintenance and a set of activities for improvement,
- achieve and maintain the most efficient use of equipment,
- bring together all the people involved in equipment and its planning, and
- create a robust system of planned maintenance and a set of activities for improvements [1, 2].

The main goal of the Total Productive Maintenance (TPM) method is to increase production while increasing work awareness, motivation and employee satisfaction. It defines maintenance as a necessary and important part of the business and not as a cost or unprofitable activity [1]. It is a model that is acceptable in various forms of production, is recognized as successful and must be defended in this form of production at Knauf. It is a Total Productive Maintenance model, which contains 8 pillars, which complement each other in sequence and enable the operation of the systems. The model is useful in various forms of production and also in other systems, so in our case we also consider it as an example of good practice.

Figure 4: 8 pillars of the TPM method



Source: Zwany, 2017.

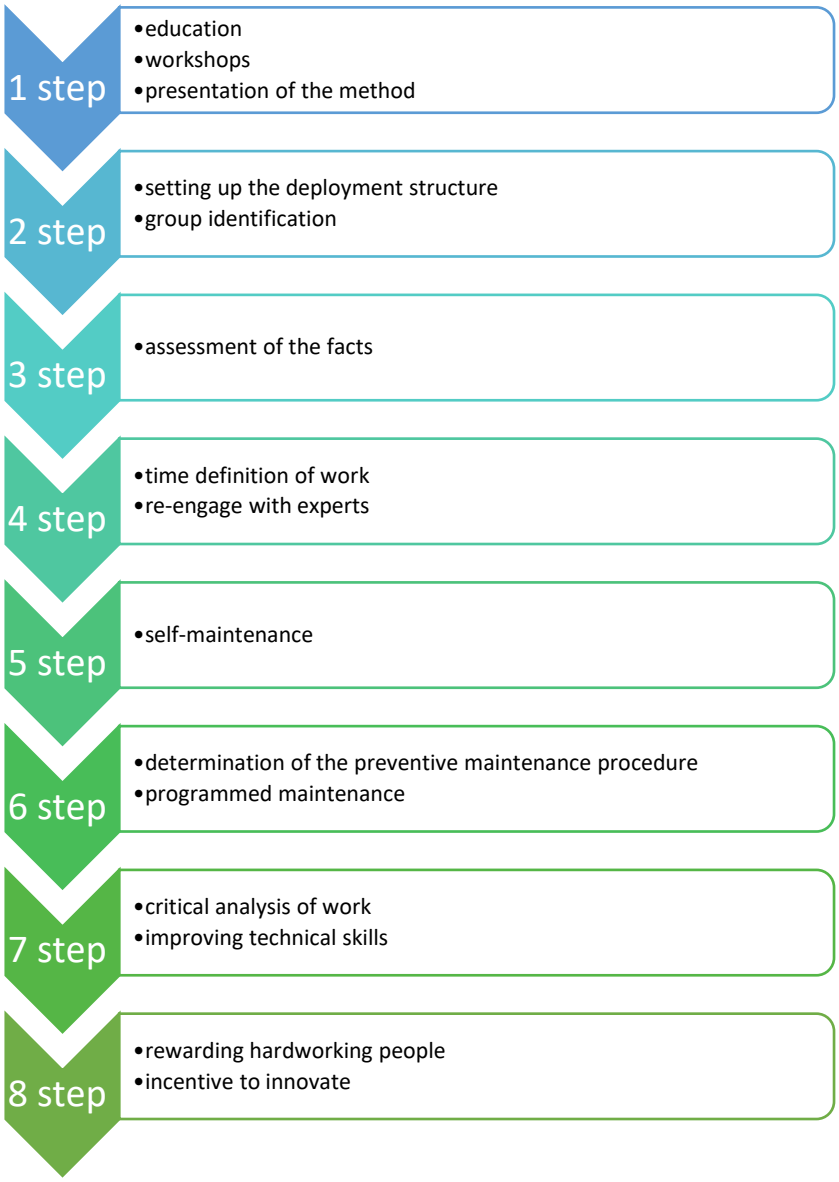
Maintainers have recognized the importance of the TPM model and want to incorporate it into the company's maintenance processes. In a conversation with the company's management and maintainers, we come to the conclusion that the TPM method has not yet been introduced in the company, but in the future the company's management wants to introduce the method. In the following, we can see the procedures for placing the TPM model with the help of the knowledge that students acquire in the subject matter of higher education.

In the first phase or step, the students started to identify the model and study the possibilities of using the model in maintenance. They tried to encourage the leaders

in the company to get to know the TPM model and talk about the experience of the TPM method, if anyone already has it. The indicative means for the introduction and implementation of the model need to be determined and the TPM method project manager appointed. In the future, it is necessary to find in the entire production (regardless of the current position or pay grade) those employees who have an education but have not yet progressed to the desired position or at least they want to prove themselves and those who are willing to learn and accept innovations and changes in the company. The management or those responsible for the implementation and the employees must get to know the introduction of this system, which they would do with the help of various workshops with external experts who know the TPM model. The objectives of the workshop or the content of the workshops should include some basic information on the TPM team board, criticality assessment, condition assessment, preparation of documents for autonomous maintenance (for better understanding of the case on the line) and handling spare parts lists. If there is a case of resistance to TPM due to the complexity or non-acceptance of the change, it is the task of the project manager to overcome such resistance.

The implementation of the Total Productive Maintenance model in the company would be divided into eight useful and very practical steps, which in turn enable the best maintenance effects, as shown in Figure 5 below.

Figure 5: Proposed steps for the introduction of the TPM method in the company



Source: adapted by maintenance staff as a form of maintenance, 2022.

The modernization of maintenance systems envisages first educational processes, workshops and presentation of the Total Productive Maintenance model, followed by setting up the structure of introducing the model and determining the group of maintainers. In the second step, those selected from the learned information begin to get to know the organization of production in detail and set up a management structure. In addition, they must review all existing rules and standards of conduct in the company, and rearrange them if necessary, because it is to be expected that some forms of maintenance will not leave the full implementation of the TPM model. The program envisages education and training by group, so it is expected that the first qualified group from the first step to master the TMP model would already be suitable for mentors to the following groups. In the following groups, all employees are systematically involved. It is an education that is passed on through

mentoring to new groups and new maintainers who get to know the model and can get involved in a new form of in-house maintenance systems. The model also allows the formation of several different groups, which will be specially trained only for certain forms of maintenance, thus ensuring greater training of the individual for a particular form of maintenance.

So it makes sense that in the third step, those responsible make an assessment of the state of success of the introduction of the TPM model in the company, and the assessment is the basis for the transfer of experience to new systems. An assessment of the infrastructure, premises, supply route of spare parts, time assessment of the purchase of materials and time assessment of the time of elimination of defects in the production system is performed. The model is followed by an assessment of the usability status of machines in the production system, wear and tear and process limits of processing are examined. Conveyors help them with the assessment or properties of means of transport. We would also need the condition of materials and raw materials and compliance with deadlines in order to assess our own efficiency. This is an important step where it is possible to predict in advance what needs to be changed, what the TPM model offers and what the benefits are. The assessment of the situation also shows in what way the model is useless, where are those elements that can be used in the measurability of data on the positive or negative operation of the model. The fourth step is a certain turning point, which through numerous reports and findings provides an assessment of the applicability of the model and the reasonableness of the use of the model to continue.

In the fifth step, they can test the model by having minor maintenance tasks taken over by line production workers. In this way, they get to know the system of operation and maintenance of the machine with which they produce and, in the case of large-scale and serious faults, it is easier to inform and define the fault and perhaps even advise how to correct the fault. The presence of other TPM production tools, such as the 5S method, KAIZEN and OEE, will already be very much felt in this step. It is concluded that the mindset required in step five is already present and it is clear that machines need to be regularly cleaned, monitored and debugged.

The sixth step will contain extensive knowledge and experience of mechanical maintenance, electrical maintenance, operators and installers. For each machine, a maintenance scenario must be created and written. If we do not yet have suitable documentation for the repair and ordering of spare parts for a machine, it will have to be made or drawn. It will also be necessary to determine the monitoring of individual parts of the machine on the lines and to analyze the parts such as bearings, chains, clutches with frequencies, vibrations and thermal analysis of the machine. So all production needs to be managed and the goal is to avoid any unforeseen congestion in order to increase production efficiency.

The seventh step requires reports, through which a critical analysis of the work of the set model is made and proposing improvements in the technical competence of systems, people and tools. In the last step, the model already predicted that it would never end. The model allows the introduction of more modern technology, innovative systems, intelligent systems and innovations, which show the efforts of qualified personnel in the company. It is about people and those who find additional solutions for improvements that the system must reward, encourage and enable them in every way to put their idea into practice.

Finally, a final report should be prepared, setting out all the starting points of the research, training, practical methods and final success. The report is the basis for continuing the model or the starting point for changing the model to something different and better.

The possible introduction of the 5S maintenance model represents the changes that the company introduced a year ago through individual departments (production, transport, electrical and mechanical maintenance, product control, warehousing...) and included all employees. The introduction of the 5S model by individual departments showed an effective response of the individual and the group of maintainers, as all employees in a particular department joined the group and built and improved their work habits according to the 5S method. Basic information on how to start with this method was presented to all employees by the heads of production, safety and innovation. In addition to the theoretical foundations, workshops were created to facilitate perception, where each individual could create a change in a case from their field and with the help of 5S thinking methods found online. Once all employees understood the basic concept of the 5S model, they began using it in five steps, which in turn tell **remove, organize, clean, standardize** and **maintain**. For the general identification of the 5S model, we have presented the individual steps, namely:

1. **Remove**: unnecessary items were first sorted and removed from the workplace, allowing tools for current activities to be in the workplace. A group of employees in an individual department identified objects that are located there for no real reason for their department or their jobs. Together, they created a list to determine what is needed in the workplace for a particular activity. In the workshops, they realized that visualization was crucial in this method, so they marked unnecessary items with red tape and slips and subsequently found a place to eat when they didn't need them. Table 1 (below) was followed for the classification of objects, equipment or materials.

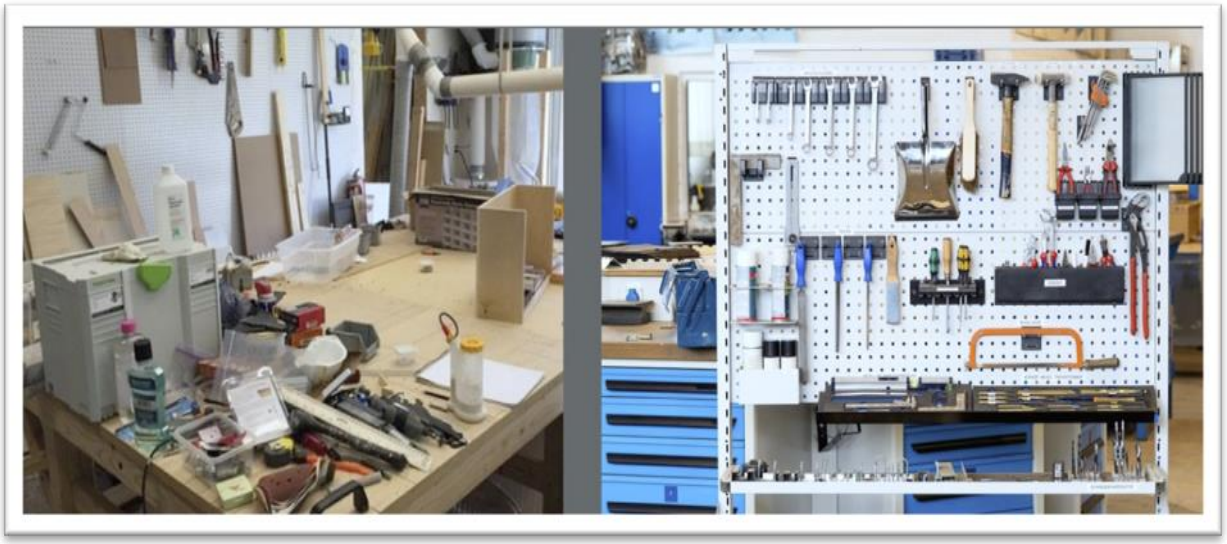
Table 1: Purpose classification

use of objects, materials, equipment	**location of storage or warehousing**
more than two hours each day	stays in the workplace
every day from one to two hours	near the workplace
once a week	quickly accessible work area
once a month	quickly available in the warehouse
very rarely throughout the year	warehouse, can be remote
we cannot define	specially marked, kept near the workplace for 4 months, keep records of use and then determine

They recognized the importance in this step of determining the workers responsible for overseeing each set of work area, storage cabinets, storage trolleys or racks. With the first step, they increased productivity in all departments, raised the quality of products, and used space more efficiently in all departments. By improving the first step, they have reduced the time to search for tools and materials. Also, there are no additional supplies and no waste of time or space.

2. **Organize** is a step where the main task is the use of space and processes. Thus, they optimally and logically arranged the places for storing objects for work. For work tasks in which the worker performs rapid movements, the tool stands had to be placed in such a way that the worker does not change direction or rotate around his axis. He sees tools and accessories from the place where he works. To realize the second step of the 5S model, groups of departments have identified places where work items will be stored or disposed of. The essence of the system is that every thing has its place in the work environment and that it is also there when not in use. With this step, the company reduced the waste of time searching for items. Figure 6 shows the unorganized and organized workplace of the maintenance worker, which shows how he was able to organize himself for quick intervention and troubleshooting.

Figure 6: Unorganized (left) and organized (right) workplace [3]



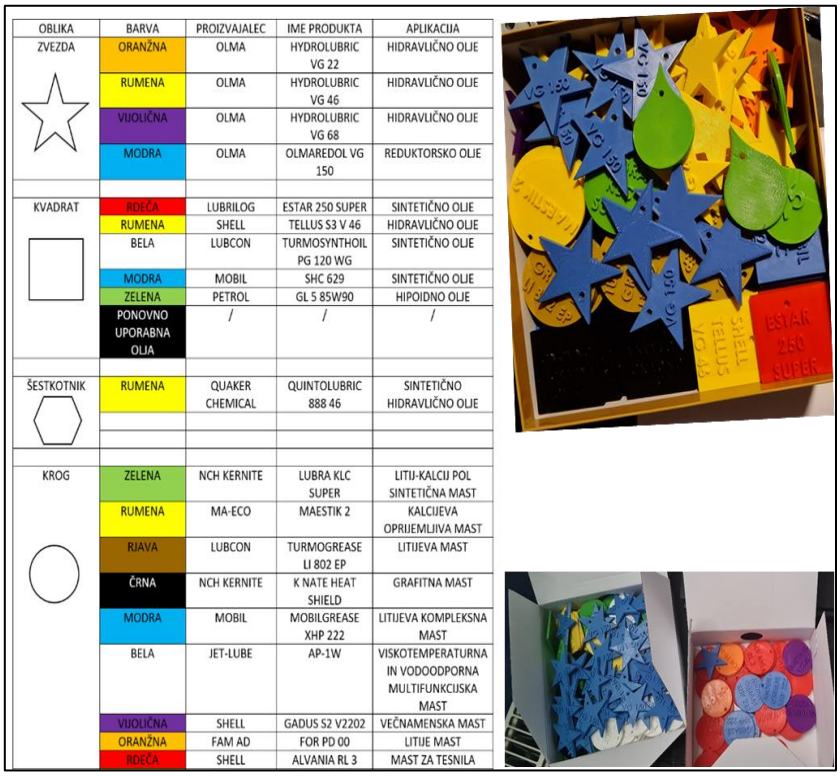
Source: authors' simulation, 2022.

Figure 6 shows that a system works when it employs several maintenance staff working in the same job or in different shifts. Also visually, the organized workplace is more attractive and thus employees are more satisfied and have less resistance to work.

3. **Clean** is a step to maintain a clean work environment, better transparency, faster use of tools and components. The model is not complete and is basically suitable for change and innovation, which explains that with good suggestions and innovations, the system will improve in the search for dust extraction, sawdust residues, gypsum dust, stone, fiber and the like. When setting up this step of the 5S, employees were given a schedule with the necessary instructions for cleaning the workplace, which is reviewed by the shift manager at the end of each shift. In addition, the so-called weekly cleaning is carried out, where all devices of a certain line are stopped and thoroughly washed or washed. The main advantage of this step in the company is that the time of repair and maintenance of devices along the line has been greatly reduced, as less time is required to clean the machine before repair, so that maintenance workers can start work. Error detection is also faster.
4. To **standardize** means to establish a new form of organization according to the standards offered by the model. With it, the company eliminates ambiguous systems, so that employees have a clear definition of the implementation of the 5S model. Most of the information is stored in logistics information systems (hereinafter: LIS) or logistics management systems (hereinafter: LUS) and in the computer information system SAP (Murtič, Uhernik, 2022). The color code of the lubricants introduced into the company and shown in Figure 7 is useful to show the company standard. Color coding is an essential part of the 5S method, which contributes to lean and

productive production. They realized that color coding makes it easier to find certain tools, critical areas, checkpoints, and reduce wasted time. It is about setting up LIS and LUS systems that explain that good communication is important in every manufacturing or non-manufacturing industry. The model shows that without visual communication it is impossible to communicate, which means a waste of time and space. Unclear orientations lead to non-communication, which disrupts production or maintenance productivity, so color coding was considered important by the model. They explain that color coding according to the 5S method allows communication without conversation. On the right side of the image we see colored plates for marking. Due to the way work, cleaning and maintenance of devices in production, it was necessary to consider different labeling procedures than we are used to in the automotive industry (only colored cards). In this way, they prove that regardless of the presence of dust, water and compressed air, they can still reach modern methods, but they must be technologically and systematically adapted to the form of production and maintenance of systems.

Figure 7: Color code of lubricants (left) and color plates for marking (right)



OBLIKA	BARVA	PROIZVAJALEC	IME PRODUKTA	APLIKACIJA
ZVEZDA	ORANŽNA	OLMA	HYDROLUBRIC VG 22	HIDRAVLIČNO OLJE
	RUMENA	OLMA	HYDROLUBRIC VG 46	HIDRAVLIČNO OLJE
	VIJOLIČNA	OLMA	HYDROLUBRIC VG 68	HIDRAVLIČNO OLJE
	MODRA	OLMA	OLMAREDOL VG 150	REDUKTORSKO OLJE
KVADRAT	RDEČA	LUBRILOG	ESTAR 250 SUPER	SINTETIČNO OLJE
	RUMENA	SHELL	TELLUS S3 V 46	HIDRAVLIČNO OLJE
	BELA	LUBCON	TURMOSYNTHOIL PG 120 WG	SINTETIČNO OLJE
	MODRA	MOBIL	SHC 629	SINTETIČNO OLJE
	ZELENA	PETROL	GL 5 85W90	HIPOIDNO OLJE
	PONOVNO UPORABNA OLJA	/	/	/
ŠESTKOTNIK	RUMENA	QUAKER CHEMICAL	QUINTOLUBRIC 888 46	SINTETIČNO HIDRAVLIČNO OLJE
KROG	ZELENA	NCH KERNITE	LUBRA KLC SUPER	LITIJ-KALCIJ POL SINTETIČNA MAST
	RUMENA	MA-ECO	MAESTIK 2	KALCIJEVA OPRIJEMLJIVA MAST
	RJAVA	LUBCON	TURMOGREASE LI 802 EP	LITIJEVA MAST
	ČRNA	NCH KERNITE	K NATE HEAT SHIELD	GRAFITNA MAST
	MODRA	MOBIL	MOBILGREASE XHP 222	LITIJEVA KOMPLEKSNA MAST
	BELA	JET-LUBE	AP-1W	VISKOTEMPERATURNA IN VODOODPORNA MULTIFUNKCIJSKA MAST
	VIJOLIČNA	SHELL	GADUS S2 V2202	VEČNAMENSKA MAST
	ORANŽNA	FAM AD	FOR PD 00	LITIJE MAST
	RDEČA	SHELL	ALVANIA RL 3	MAST ZA TESNILA

5. **Maintain** is the last step after the 5S model and represents the most demanding part of the model. They are tackling this step on a day-to-day basis, which presents them with a challenging test for all employees and those involved in the model. LIS and LUS require maintaining discipline and respecting all steps taken beforehand. Certain points in the company remind us of maintaining order and implementing the 5S model. It is interesting to

see how the mentality of the employees changes day by day and how they remind each other to implement the method. The system works completely according to the LIS principles. In the event of serious errors or new approaches, all employees are informed via advertising TV screens installed throughout the company, including the rest area, dining room and common meeting room in production.

Legal regulation and safety in the 6S model is present, as we also find the sixth component in the company, which represents safety. Safety is one of the key components that is important for achieving an efficient production process, so the company often hears the phrase: "safety first, then work begins" and this is especially true when there are overhauls or interventions in machinery. Of course, security, if we understand the 5S method well, appears in the first three steps, but some companies want to put extra emphasis on a certain set of 5S models. Legal security is based on legal norms that the company complies with the Employment Relationships Act (Official Gazette of the Republic of Slovenia, No. 21/13, 78/13 - amended, 47/15 - ZZSDT, 33/16 - PZ-F, 52/16, 15/17 - US decision, 22/19 - ZPosS, 81/19, 203/20 - ZIUPOPDVE, 119/21 - ZČmIS-A, 202/21 - US decision and 15/22), where the minimum rights and obligations of the employer and the employee are described. Individual areas are regulated by the Occupational Safety and Health Act (Official Gazette of the Republic of Slovenia, No. 43/11), which prescribes conditions for certain jobs. However, there is other legislation and especially the rules on organization and safety at work, which are organized in the company in the form of rules, instructions, protective equipment, etc. The provisions of the Companies Act must also be taken into account, which clearly states how companies are organized and what they must comply with in order to operate safely or economically (Murtič, Jankovič, 2018).

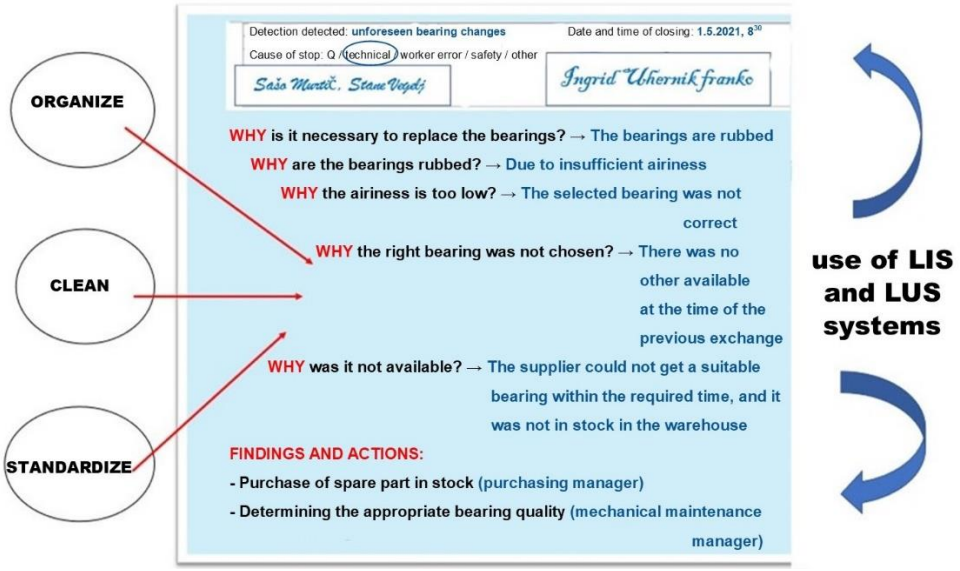
7 DISCUSSION AND CONNECTION OF ISSUES

For successful discussion and identification of individual LIS and LUS systems within the organization, we also examined the case of using 5x WHY in the company for comparison, which we identified as appropriate for quickly determining or identifying the cause of the problem. This method is very easy to use and learn. The company explains that several times it happened that new employees in the company did not know what they were involved in at the time, but after recognizing the system, they soon began to cooperate and answer questions about WHY. In most cases, the 5x WHY discussion is used by on-duty maintenance staff and line managers, who must quickly put together a team of three or four maintenance staff or others in the company to present at the site of a repair or accident.

If necessary, the answers to the question are written on paper, whiteboard or smartphone. In most cases, writing means following events and correcting mistakes, at the same time it is a form of gaining good practice that can be presented to all

maintainers and so the next time they get to the main problem faster and reduce downtime. This method is also very important because the goal is to get to the root cause and not immediately a clear consequence of the error, so the matter would have been resolved much earlier and there might not even have been a stalemate or error. For an example of a method, see the example below in Figure 8.

Figure 8: Example of method 5x WHY?



Source: edited by the authors based on a case study, 2022.

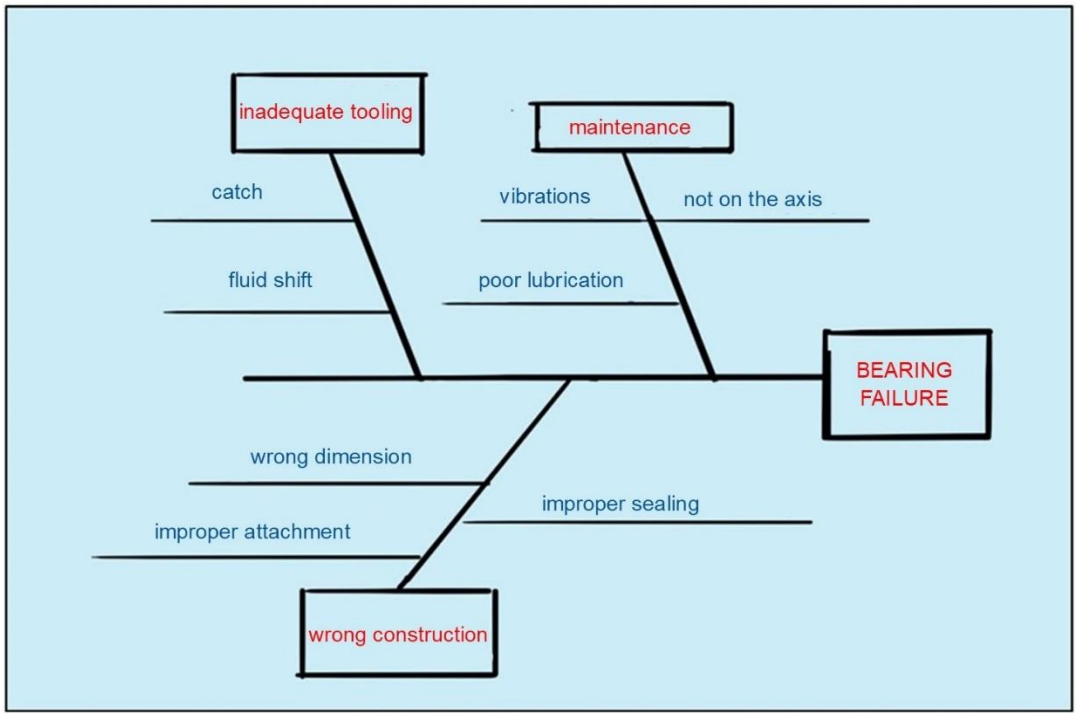
Another useful example is the use of a herringbone diagram. A herringbone diagram is used in a company when there are several causes for the problem and it is necessary to make an analysis or discover the main causes of complicated problems, and it is important to understand the connections between potential causes. Comapnies also use it if the process or work tool does not give the desired results or responds differently than planned. It is important for drawing or setting a fishbone diagram that there are no problems in the communication of LIS and LUS between team members and it is large enough for so-called "brainstorming".

Herringbone placement in the company is divided into five main and useful steps:

- identification and definition of the problem,
- identification of the most important factors (fish bones),
- identification of causes (brainstorming is very important)
- selection of the causes that could be the main ones for the problem and analyzing the diagram and
- development of a plan and proposed measures.

Figure 9 shows an example of herringbone where we have the three most important factors (inadequate planting, maintenance, wrong construction) and eight causes. The main problem, however, is bearing failure.

Figure 9: Example of a herringbone diagram.



Source: produced by the authors, 2022.

Based on experience, employees state that they are used to drawing herringbone diagrams because it allows them to quickly connect LIS and LUS, stating that the main disadvantage of such diagrams is that all causes are equally important (graphically speaking). It is also problematic in complex problems, as it is based on opinions and not concrete evidence that would be professionally or scientifically validated.

8 CONCLUSIONS

Through the research, we processed individual cases, examined simple forms of maintenance, presented the course of implementation of logistics and logistics processes in production systems and in systems of organization of maintenance of production systems. The starting point of the research was the search for sequential causes, which often require rapid interventions to eliminate the problems with the organization of production. We realized that only good organization of LIS and LUS in the company is the starting point for proper organization and implementation of maintenance, which in turn improves procurement time, intervention time and storage of successful cases to obtain examples of good practice in the company. We recognized the need to use improved systems, realizing that it is impossible to equate production systems and their organization with maintenance systems, which is otherwise completely independent, but the course of the company's production depends on it. Therefore, we put forward the thesis that with an appropriate system of computer recording and storage of stocks, it is possible to improve maintenance

interventions, which would eliminate the waste of time, space and labor. Through the study of individual methods, we have seen that systems can be controlled, and many models can be used in a variety of circumstances, which improves overall production. Individual examples, sketches, graphs or pictures clearly showed us how it is possible to organize logistics, logistics processes and individual systems of service activities in a particular production, and from individual models we learned that maintenance processes can be introduced into different forms of management amd are realized equally through LIS and LUS.

The company for the production of insulation materials has a huge potential to improve logistics processes in maintenance as well as in other areas. A lot of information is lost due to old-fashioned use and this also leads to confusion. Given the size of the company, the organization is expected to be at a high level in the future, for which it strives to make the systems as optimized as possible. There are already some advanced applications in the company, but they are not properly connected to each other, which leads to multiple data entry. To this end, a single application will be introduced for improvement, in which all data will be in one place and easily accessible to all users.
We are aware that our research provides only a cursory insight into the development systems of a manufacturing company, especially because our research followed only the review and understanding of logistics, logistics processes and methods LIS and LUS. Certainly, other research will show better systems, but in this research we confirmed our assumption and showed that improving systems, including those that take care of maintenance in the company, are useful and needed to be further developed.

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DEPLOYMENT OF ROBOTIC SYSTEMS FOR MOBILE UV STERILIZER

Abstract:
Universal social development, industrial development, economic development, development of social relations, global change, climate change, increasing human impact on nature, increasing encroachment on the earth's crust, pollution of the environment and space and many more factors caused changes in human relations, ways and forms of work, education, training and, last but not least, work in the 21st century. All these, one might point out, reckless interventions, led to the emergence of the Covid 19 pandemic, which caused great damage to the people and consequently forced people and industry into new forms of work. Science showed its key role, which in turn meant the development of many intelligent systems in general life, industry, manufacturing companies, public administration and beyond. In order to prevent the spread of infectious diseases it is not enough to have a general or abstract legal rule that restricts, commands or imposes, it is also necessary to find a technique and technology to disinfect rooms, objects, tools and prepare our environment for safe coexistence.

As an example of good practice, we present Robotic Systems - a mobile UV sterilizer to prevent and reduce the spread of infectious diseases of viruses and bacilli in industry, offices, schools, hospitals and elsewhere, which has proven to be very innovative, effective and highly successful. The robotic system destroys up to 99.99% of viruses and bacilli.

Key words: *intelligent systems, technology, robots, sterilization*

INTRODUCTION

In the last few years of industry 4.0's transition through digital management of industrial, manufacturing and other systems, society has changed quite a bit, forms of production, forms of social life have changed, we have become accustomed to newly formed social networks, new forms of social behaviour, and we are increasingly adapting as humans and as an economy to new intelligent systems that

[15] **Robert Mašeras's biographical notes -** see footnote on page 38.
[16] **For Ingrid Franko Uhernik biographical notes -** see footnote on page 38.
[17] **Sašo Murtič's biographical notes -** see footnote on page 1.

are increasingly penetrating our lives and pave the way for cyber-governance. We have come to realise that everything is related to the overall social development, the development of modern forms of industry and new forms of production, the development of the economy, the sustainable development of industry, production, supply and demand, the increasing changing of social relationships, the form of new forms of management, logistics and services, global and climate change, the increasing impact of man on nature, the increasing interference with the Earth's crust and atmosphere. We are witnessing unrestricted pollution of the environment and space... With the emergence of a new coronavirus or Covid 19, the task of effectively disinfecting working (as well as living) spaces has also become necessary in the public sector or in public spaces and other workplaces. The form of disinfection to date, which was carried out mainly by hand, required the use of protective agents, which were often themselves a threat to the health of the staff who carried out disinfection, and the disinfection required them to leave offices (workplaces), creating congestion in the internal work of the public administration, resulting in time losses, loss of space and workforce or civil servants. In order to protect humans, to ensure the safe and appropriate disinfection of the premises, they have identified intelligent systems that can carry disinfection safely and without consequences for human health, instead of the current implementation of this disinfection. Through the identification of intelligent systems, the civil service has been experimentally using robotic or mobile UV air sterilizers ...

THE RESEARCH AREA

Indirectly, the research area has been involved in the search for appropriate solutions in intelligent systems, which should enable the implementation of more complex and health-threatening tasks in the field of disinfection of work or accommodation. The immediate field of research identified forms of technique and technology that would meet the needs of safe disinfection or disinfection of work and living areas for the purpose of preventing the spread of the pandemic or Covid virus 19. There have been a number of changes in logistics, logistics processes and production, and a large-scale focus on the industry towards its own product in the globalisation phase of industrial production and the market all in view of the realisation that any activity in industry or elsewhere not directly linked to production is an activity that is at the risk of industry and should be considered separately. At this stage, the question is also what industry 4.0 means in service activites, management and permanent industrial development. A new technologically advanced generation of intelligent systems has emerged, which is increasingly conditional on the introduction of industry 5.0, which tells us from the very starting point that in industry 5.0 screws communicate with assembly robots, self-denary forklifts store goods themselves on high shelves, intelligent machines independently coordinate production processes, employees are connected to machines and products are directly connected to each other. The ongoing development and coordinated management of the new era has begun, showing the product flexibility and interconnectedness of production within the industry and

between several different industries. The interconnectedness and interdependence of industry, administration and countries is increasing, connected by the digital network, by the Internet, by the international web, making use of smart machines and coordinated processes of wider operation. It all meant, and still means the 4.0 slow transition of industry to a new generation of industry 5.0 or "Z" generation or "G", as they call it . With the introduction of new intelligent systems of industry 5.0, we increasingly recognize the need for greater cooperation of the production part of the industry with management and service work of logistics. Appropriate management using intelligent systems, automation and system management enables the reduction of costs of industry and public administration (Murtič, Uhernik, 2018). In the development of the upcoming industry 5.0, intellectual systems were envisaged, which would perform a number of tasks, changing people in the part of production where they needed labour, in order to ensure greater safety, reduce production time and cross out unnecessary costs. Through sustainable development, industry management has focused on customers, consumers who are increasingly converating and using intelligent systems in industry, manufacturing companies, public administrations, at home and everywhere, in the knowledge and use of intelligent systems. The interesting variety of intelligent systems is identified through the modularity of products which customers can design themselves according to their needs, their wishes and communicate their wishes to the industry. At the same time, we recognized the need for a modern industry that wanted smart products that have already been delivered and used by consumers to send responsive data to the manufacturer about their performance.

Gradually and very quickly, technology has been developed in the form of standing or moving robots, that have been able to perform a number of tasks, replace the workforce, eliminate the loss of time and space, while relieving the owner of those costs that he would otherwise have incurred with the workforce. A special attitude to intelligent systems has been developed, and research institutions, schools and individuals try to exploit the possibilities of using intelligent systems in all areas of the human environment, work and living through the development of science. This has developed an industry of various smart products or robots that have been able to work in tourism, hospitals, public administration and elsewhere. They are also found in a domestic environment, where in the form of a soil-sucking robot performs tasks that would otherwise be human (Rout and Others, 2020). The expansion of the Covid 19 pandemic was a challenge and a scientific research area that drew many industries to find solutions that would help prevent the spread of infectious diseases. The solutions have soon begun to be supported by individual countries, communities of countries and the whole world. This was a start of the development of completely new intelligent systems which the industry has recognised as its own challenge. More and more resources are being spent on the development of products that could perform tasks that are dangerous for people. They recognized that the virus could be destroyed and prevented from spreading with a UV air sterilizer, which led them to place or install it in motion robots. Communicable Diseases Act (Official Gazette of the Republic of Slovenia, No. 33/06 – Official

Consolidated Text, 49/20 – ZIUZEOP, 142/20, 175/20 – ZIUOPD2, 15/21 – ZDUOP, 82/21 and 178/21 – odl. US) identifies infectious diseases that pose a threat to health residents and hospital or nozocomial infections resulting in a causal connection with the pursuit of a medical activity and laying down measures to prevent and manage them. They adapted the technology to different forms and requirements of the law, so its use is convenient, easy and useful in different spaces such as industry, schools, offices, home and the like. These robots have been studied and taken over for research, where we try to present the usefulness, suitability and manageability of intelligent systems (Shin, 2017).

THE HYPOTHESIS

Work in public administration shall be linked to work in premises where appropriate technology and tools can be used to enable employees to achieve working effects. It is work that means service for citizens in different areas, so it is more tied to techniques, technology and modern intelligent systems. While Covid 19 has forced the services and industry to develop internet networks that allow work from home under certain security conditions, which is only one of the measures to prevent expansion, they are forms of work which cannot be carried out remotely, in such cases appropriate working conditions must be carried out. Constitution of the Republic of Slovenia (Official Gazette of the Republic of Slovenia, No. 33/91-I, 42/97 – UZS68, 66/00 – UZ80, 24/03 – UZ3a, 47, 68, 69/04 – UZ14, 69/04 – UZ43, 69/04 – UZ50, 68/06 — UZ121,140,143, 47/13 — UZ148, 47/13 — UZ90,97,99, 75/16 — UZ70a and 92/21 — UZ62a— requires the guarantee of the rights and fundamental freedoms which the State must also provide for the employees in public administration. According to the NIJZ, procedures are prescribed to conduct and prevent the spread of disease and have a legal basis. The government and ministries have set out the task of doing everything to limit or prevent the spread of infectious disease. In the current time of the virus exposition, disinfection of the premises shall only be carried out in cases where it is established that the actual longer presence on those premises has been carried out by an infected staff member at the workplace itself. It is usually one or more offices, common areas as well as meeting rooms where the infected staff member was present at that time.

Through our research, we set the following hypothesis: "UV sterilization of public administration workspaces can be performed with a UV sterilizer". We predicted that up to 99% of the Covid virus can be destroyed by an intelligent robot system. So through the hypothesis we wanted to prove that disinfection in business premises could be carried out continuously, as a preventative and automatically without a human factor. This would eliminate the disruption to the work processes themselves, as well as the waste of time, space and hours of work or work effect that is not possible due to disinfection in physical form. Using UV steriliser robots would avoid long-term disruptive unpleasant odours and traces caused by disinfection sprays, which normally takes some time to fully normalise.

BASELINE OF THE STUDY

In a number of studies a common definition by various authors can be found stating that technological advances are the guiding principle of industrial production, which, through the introduction of intelligent systems and in the production of autonomous devices, alter the way individual processes move, in order to ensure faster and better production and better preparation of goods for the customer (Nyhuis, 2009). These starting points have also been transferred to works and services which do not represent economic, industrial or other forms of production and can also be found in office space or in part of the public administration. The objective of technological modernisation and the deployment of intelligent systems in public administration has ensured a fully autonomous system of data processing and programmes that allow certain works to be carried out remotely, which in science is seen as the development of new generation of intelligent systems. These are theoretical starting points of science, where by combining mathematically measurable optimizations and data intelligence, through the development of IT tools, planning and operation can be carried out in all working systems (Burduk and Others, 2018). It is a scientific method of studying phenomena and acquiring new knowledge that enables the use of intelligent systems to improve certain processes. Of course, such a method is based on the research process on the collection of observable, empirical and measurable data subjected to certain criteria of understanding, preparation, management and planning of individual processes, specific work or activity. In our case of research, we used methods of identifying and comparing the effect of manual disinfection of public administration premises as our starting point, which we then compared with the service and activity of intelligent UV robot systems for sterilization.

We found out that in current cases of established coronavirus infections in the workplace the task of certain people is to identify and immediately afterwards inform the management about any close contact that a civil servant has had. This was followed by the immediate closure of the premises and then the physical disinfection of all the premises and areas in which that infected staff member was located. As a result, these premises were unsuitable for work, the employees did not carry out their work for a certain period of time, the working effect was reduced which can be mathematically and financially evaluated. This means a loss in the areas of working space, working time and the workforce. This procedure requires a long time elapses until the disinfection itself is actually carried out by manual spraying by a selected external service company. Thus, during all this time, all premises designated for disinfection due to the infected person are closed and other servants may not use them for some time after disinfection themselves. Through our research, we have seen the solution in the use of intelligent systems, using technique and technology or intelligent systems that themselves undergo disinfection or UV sterilization. Studying the field led us to data on the use of UV sterilizers robots in the field of pharmacy production facilities, in hospitals and in some technologically developed industries. Some cases showed that using a mobile UV rays destroy up to

99.9% of pathogens including coronavirus, which was the ideal data to identify a new intelligent system for the use of disinfection of public administration facilities. With this assumption, we found out that all premises would be quickly disinfected if disinfection was carried out during the absence of employees (at night time), thus ensuring a safe and secure work for all employees.

The associated costs would thus fall off, while raising preventive health protection to the highest level against other possible infections in all premises and workplaces where such an intelligent system could operate.

RESEARCH METHODOLOGY

The research methodology is adapted to the technological development of intelligent systems for the prevention of communicable diseases. That is why we have adapted the research to the research needs of intelligent systems and research in the field (Wilamowvski, Irvwin, 2018). Through various methods, we studied the individual elements of the covid 19 prevention and looked for technological and technical procedures that could leave the work to intelligent systems. We tried to get measurable data, so through the research we have predicted the effect of several possible variants, which would mathematically give us answers to our questions. Methodologically, the results of the survey can be interpreted differently, while at the same time looking for appropriate solutions to justify the use of intelligent systems for research purposes. We presented a scientific method of observing and studying individual phenomena through which we were able to acquire new knowledge and use it to improve individual processes. Systematically, the method was useful because it is based on the collection of observable, empirical and measurable data that are subject to certain thinking criteria and can be reflected in the improvement of processes, time or price units.

While the field of research could be addressed in sociological, legal, labour, administrative and other fields, we were interested in how and in which way, using intelligent systems and in our case, specifically, a UV sterilizer robot to disinfect public administration premises or other premises that companies, the economy, public administration, institutions and others use for their work, could eliminate the previously listed losses.

CONDUCTING THE RESEARCH STUDY

Act, the Organisation, company, industry, institute, or other form of organisation of work must, under the Labour Relations Act (Uradni list of the Republic of Slovenia, No. 21/13, 78/13 – 15/15 – ZZSDT, 33/16 – PZ-F, 52/16, 15/17 – odl. US, 22/19 — ZPosS, 81/19, 203/20 — ZIUPOPDVE, 119/21 — ZČmIS-A and 202/21 — odl. US) provide minimum conditions for a safe and healthy working environment. As we focused our field of work on the field of public administration and sought appropriate solutions, we also examined the provisions of the Civil Service Act (Uradni list of the Republic of Slovenia, No. 63/07 — Official consolidated text, 65/08, 69/08 — ZTFI-A, 69/08 — ZZavar-E, 40/12 — ZUJF, 158/20 — ZIntPK-C,

203/20 — ZIUPOPDVE, 202/21 — odl US and 3/22 – ZDeb) and sought the details through which they must provide additional security conditions for work in the civil service. Taking into account the provisions of the Infectious Diseases Prevention Act, we have come up with appropriate starting points for the appropriate use of intelligent robot systems in the process of preventing the expansion of Covid 19 in the premises. The research was conducted towards a solution to the current problems in this regard by using systems such as UV air sterilisers, the most important features of which are the following:

- the use of special UV lamps, which are a source of ultraviolet radiation that destroy pathogenic microorganisms and their DNA. A UV steriliser is a type of radiation device in which UV lamps are installed in a closed housing;
- in addition to one or more UV lamps, the device may include a fan ensuring forced air circulation in the room. Thus, the air that is infected with bacteria and fan viruses is sucked into the casing where it is preyed upon by UV light. Cleaned and sterilised air shall be returned to the room;
- due to forced air circulation, air sterilisation occurs even in distant corners. This way, all the amount of air in the room is sterilized within a certain time;
- the air sterilisation system can be safely used even when people are present in the room and do not need to remove plants or ventilate the room.

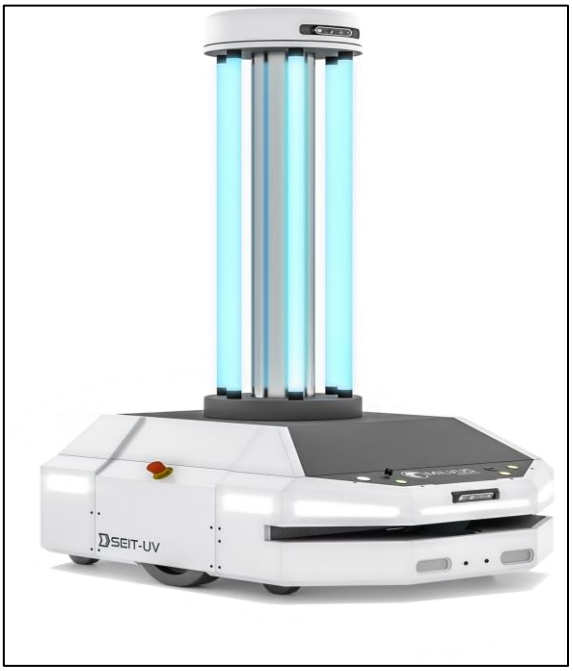

Figure1: MiLVUS ROBOTICS mobile UV sterilizer with a description of its technical characteristics
Source: retrieved at https://milvusrobotics.com/products/seit-uv, 20.2.2022

The preferred solution would be to install a UV sterilizer in a robotic system, the so-called mobile UV sterilizer, which is equipped with its own drive, autonomous

energy source, sensors that allow the robot to move past obstacles and have an intelligent charging control system. When the battery voltage drops to a critical level, the robot stops working and drives to the base station for charging. The device can operate continuously. It can also be a combined UV sterilizer - two in one, used for air sterilization, as well as for surface sterilization. They require simple maintenance and the lifetime of UV lamps is at least 9,000 hours.

Technical characteristics

UV wavelength	254 nm (UV-C)
UV coverage area	360 Degrees
Disinfection time	10 minutes (~25 m2 area)
Maximum speed	1,5 m/s
Total weight	120 kg
Running time	3 Hours
Charging time	3 Hours
Message	Wi-Fi (Wireless)
Security features	2D LIDAR 3D CAMERA Emergency button Led Light Indicator

DISCUSSION

In the survey we obtained sufficiently measurable data from which several different reports or conclusions can be drawn. However, this was not our original intention. We simply wanted to figure out how and to what percentage, with UV radiation or a sterilizer, the mobile UV sterilizer MiLVUS ROBOTICS could actively destroy

viruses that harm human health. The aim was to present the findings to potential users and thus to contribute to reducing the risk of a continuation of the pandemic.

We have identified a number of advantages of such robotic systems especially in their effect, which are shown as follows:

- they can be introduced and used immediately without any infrastructure investment and interruption of work processes;
- their use is envisaged without the assistance of physical markers, magnets etc.
- they can optimise doses of UV light by determining the time activity in each part of the room with disinfecting difficult access points in the room itself;
- the possibility of communication with automatic doors and personal lifts may also be upgraded with the intention of automatic movement on floors without human assistance;
- because they are equipped with a wide visibility camera, they can avoid obstacles they encounter on their way. You can also disconnect UV light when it detects that there are people in the room.

While some data tell us that there are currently no providers on the Slovenian market offering such robotised systems, but that there is the possibility of purchasing UV sterilizers themselves without a robotic upgrade, which is moved manually and disinfectes up to 36m2 surfaces in 14 minutes. The price of such a model is currently approx. 7,000 euros. Other data tells us that in pharmacy premises, hospitals and some industries they already have such robots and use them, in some cases it is a moving arm that performs time disinfections in a certain corner, namely when there are no people in the room. There are also examples of using a robot of the same base as a robot to clean and perform disinfection with its movement in space or in multiple rooms. The obtained data was processed mathematically. It led us to the conclusion that the use of the MiLVUS ROBOTICS mobile UV sterilizer would successfully destroy 99% of harmful microbes and viruses that harm the respiratory and other parts of the human body.

CONCLUSION

Through our research, we have made a comparison of manual disinfection of public administration premises and mentioned several timest hat the disinfection itself also put staff who carry out the disinfection at risk. In addition, we found a loss in time, space and in the workforce or in the business effect, because at the time of disinfection, the premises are empty and remain empty for some time afterwards due to the presence of disinfectants. The use of intelligent UV systems in various forms would speed up processes, citing the forms of fixed UV sterilizers and mobile shapes that we have displayed in the pictorial as well as with thier properties. The researchers agree that throughout the study we confirmed the thesis which states that UV sterilization of public administration workspaces can be performed with a UV sterilizer, which was also confirmed by the percentage of its 99% active effect.

In our general opinion the reason why they are not yet widely used is because of their high price, as well as because of the limited product market. Over time, however, it is predicted that this will become something normal and common, as is usually the case with all new technologies.

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Domagoj Rožac[18]

LEGAL VIEWS OF ARBITRATION IN THE CONTEX OF SPORTS LAW

Abstract:
The aim of this article is to emphasize sports arbitration, through basic concepts, principles, decision-making, individual decisions, proceedings on legal remedies, mediation, and proceedings before the CFF Arbitration Court. Therefore, the author wishes that certain decisions of the Court of Arbitration for Sport in Lausanne[19], Switzerland and the Federal Supreme Court of Switzerland in the field of sports, be elaborated and processed through this article. Since its establishment (June 30, 1984), the CAS has grown into a respectable institution and is known to the professional public as the "Supreme Court of Sports". In addition to key terms, the author refers to legal remedies against CAS decisions, primarily lawsuits for annulment of an arbitral award and the jurisdiction to decide on them.

The article will discuss party autonomy when signing contracts by the athlete and the association as parties to which it belongs, from which eventually derives the jurisdiction of the CAS or the Federal Supreme Court of Switzerland.

Keywords: *arbitration, CAS, arbitration award, legal remedies, mediation.*

ARBITRATION IN SPORTS

Most countries, including Croatia, regulate the scope of sport by Sports Act, through which it will take place as an activity, and it is important to note that most environmental legislation excludes litigation from domestic courts.

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[19] In the professional and scientific community, this body is called in English the Court of Arbitration for Sport (acronym CAS), in French the Tribunal arbitral du sport (acronym TAS), both terms are in equal use. Hereinafter referred to as CAS.

In order to understand the subtitle in question, it is necessary to state that proceedings in the field of sports have a long tradition of resolving through arbitration. Thus, in the Croatia, Article 63, paragraph 2 of the Statute of the Croatian Football Federation prescribes:
"In the event of a dispute falling within the jurisdiction of the judicial authorities of FIFA, UEFA, CAS, the Arbitration Court of the Federation or the legal bodies of the Union, the entities referred to in paragraph 1 of this Article undertake not to bring the dispute before the regular courts"[20]. Accordingly, and in connection with Article R27 paragraph 2 of the CAS Rules of Procedure [21], the arbitration procedure may be applied if there is a dispute "on the principle in sport, financial or other issues related to sports or development of sport, which may include, more generally, any activity or matter related to sport"[22]. Dispute resolution by applying these rules is very successful due to the fact that in international sports and sports in general the majority apply arbitration rules, provided that the highest percentage of proceedings before the CAS and thus the practice of the CAS is more uniform than in proceedings from other industries.

The procedure itself is not public, the parties agree to resolve the dispute in such a way, which is characterized by informality in the procedure, flexibility, expertise, independence, and impartiality of all persons before whom the procedure is conducted. Characteristic of decision-making is the speed of making the decision itself, lower cost and the duty to accept the decision by the parties[23]. The number of CAS Decisions reviewing before the Swiss Supreme Court has increased in recent years[24]. In accordance with all the above advantages, arbitration is an almost perfect solution, except for a few foreign legal sources and organizations[25,26], which will be

[20] Article 63, paragraph 1 of the CFF Statute reads: "The Federation, its bodies and officials, members of the Federation, leagues, players,
coaches, football referees, officials and other members of the sport recognize the jurisdiction of the Court of Arbitration for Sport... CAS... in accordance with the provisions of the FIFA and UEFA Statutes, the Federation Arbitration and the Federation Arbitration Court, as evidenced by their accession to the football organization. The entire Statute of the CFF is available on the website: https://hns-cff.hr/files/documents/118/Statut-2019-2.pdf, last viewed on March 3,2022.
[21] in force since 1 January 2019, which is identical to earlier versions of the same act
[22] CAS Code - Code of Sports-related Arbitration (hereinafter: CAS Code), available at: https://www.tas-cas.org/fileadmin/user_upload/Code_2019__en_.pdf, last viewed March 3,2022.
[23] Regulated by Section F of Articles 64-66 of the CAS Code.
[24] By visiting the website: http://jurisprudence.tas-cas.org/Shared%20Documents/Forms/AllItems.aspx, last viewed on March 3,2022., one can get an insight into a particular CAS case and the final decisions of the Federal of the Supreme Court of Switzerland on web site: http://www.swissarbitrationdecisions.com/case-list, last viewed on March 3,2022., an insight into case law- seeking the annulment of a CAS decision can be made.
[25] Thus, Article 13 of the Statute of the Croatian Olympic Committee (voted by the COC Assembly under number 928/2015 of 6 November 2015) was amended under numbers: 216/2016 of 1 March 2016 and 358/2018 of 19 April 2018, hereinafter referred to as the Statute of the Croatian Olympic Committee) regulates the exclusive authority to represent cro. sport at the Olympic Games, world, European and regional multi-sport competitions held under the auspices of the IOC or the European Olympic Committees under the COC... "
[26] Article 80 (3) of the COC Statute provides that: "An appeal against a dispute arising in connection with or in connection with the Olympic Games shall be submitted exclusively to the Lausanne Court of Arbitration for Sport in accordance with the Code of Sporting Arbitration."

touched on later in the paper, and they make this form of resolving proceedings mandatory. Several sources that regulate the subject in this way are the Swiss Private International Law Act[27,28], and the Act on the Federal Supreme Court of Switzerland[29,30]. For example, in the case of membership in one of the Croatian sports federations: swimming, tennis, football, basketball or any other federation, their legal rules in relation to arbitration must be respected.

The specificity of arbitration as a type of procedure is that it is the result of freedom of contract as regulated in Croatian legislation - the Arbitration Act[31](Official Gazette No. 88/2001, hereinafter AA). Therefore, the voluptuousness of the parties is irrelevant except when they decide to waive the right to annul the decision of the CAS.

CAS-ARBITRATION COURT WITHIN THE IOC

It is important to bring closer the very beginning of the consideration of the establishment of an institution for international dispute resolution in the field of sports. Thus, in the early 1980's, the number of international sports-related disputes increased and there was a lack of an independent institution that would address issues in sports and be empowered to decide on it with binding effect, which ultimately led all senior organizations to comment. the issue of resolving sports disputes. After the election of Juan Antonio Samaranch as President of the International Olympic Committee (hereinafter: IOC), the idea was born to establish a specialized sports jurisdiction within the IOC. Furthermore, it should be noted that in 1982, during a session in Rome, IOC member Keba Mbaye, a judge who was a judge of the International Court of Justice in The Hague, was appointed to a working group to draft the statute of the Arbitration Court for Sport.

Thus, in 1983, the IOC officially ratified the CAS Statutes, which entered into force on June 30, 1984, and on that date the CAS became a functional body under the leadership of President Mbaye and Secretary-General Gilbert[32]. CAS is a highly organized and independent international sports court with more than 35 years of

[27] The Federal Act on Private International Law (hereinafter referred to as the AIPL of Switzerland) can be viewed on the following page in three mother tongues http://www.admin.ch/ch/d/sr/c291.html, last seen on March 3,2022.
[28] see Matjaz Sophie-Katharin, Introduction to Swiss Law, Carl Grossmann Verlag, 2018, p. 335.
[29] The Federal Law of the Swiss Supreme Court can be viewed at the following page https://www.admin.ch/opc/search/?text=The+Federal+Supreme+Court+Act&lang=en&facet=&product%5B%5D=cc&product%5B%5D=oc&product%5B%5D=fg&product%5B%5D=ba&product%5B%5D=jcd&language%5B%5D=en&productAll=all&date_range_min=&date_range_max=&d_compilation=both&d_is_in_force=yes (last seen March 3,2022.).
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[31] Regulates the definition of arbitration in Article 2 (1), paragraph 1. (selected court) is a trial before an arbitral tribunal, whether organized or operated by an arbitral tribunal or not ", and point 3 of the same article and item "arbitral tribunal" (chosen court) is a non-state court which derives its authority to try from the agreement of the parties... ".
[32] website: https://www.tas-cas.org/en/general-information/history-of-the-cas.html, last viewed March 3,2022.

existence. It consists of the Regular Arbitration Division, the Anti-Doping Division and the Appeals Arbitration Division. There are regional or local or permanent or ad hoc arbitrations as well as alternative hearing centers in the event of major sporting events such as the Olympic Games or world sporting events. Jurisdiction derives from an arbitration clause contained in a contract or regulation or as a reason for a subsequent arbitration agreement or may be in connection with an appeal against a decision rendered by an association, federation or sporting body which has granted the right to appeal in its statutes or regulations or special agreements CAS[33]. The CAS consists of a panel of one or three arbitrators[34]. The purpose of the panel is to resolve disputes related to regular arbitration, anti-doping related issues in the capacity of a first instance body or the only body that resolves the issue in question, ie resolving disputes through appellate arbitration proceedings regarding decisions of sports associations and other bodies within the scope of sport or regarding a special agreement governing this, and finally resolving disputes referred through mediation[35]. Through its commitment, the CAS assembles councils, provides the necessary infrastructure and oversees the effective implementation of the process.[36]

The selection and appointment of arbitrators and mediators is carried out by the International Council for Arbitration in Sport[37]. Article S6. the duties and obligations of ICAS as a body are listed. To date, 380 arbitrators have been registered on the list of CAS arbitrators[38], while 60 mediators have been entered on the list of CAS mediators[39]. From the above lists, the parties elect an arbitrator or mediator, the choice is limited to lists and arbitrators can be appointed as persons who are exclusively on the list. Persons ICAS requires to be listed as arbitrators must be legally educated, recognized for their qualifications in sports law and / or international arbitration, have a good knowledge of the sport in general and a good knowledge of at least one official CAS language, and which names and qualifications have attracted the attention of ICAS by IOCs, IFs, NOCs. ICAS may also appoint an arbitrator with specific expertise in resolving certain types of disputes[40]. This way of choosing arbitrators ensures efficiency in resolving disputes and uniform practice

[33] Article R27 paragraph 1 of the Section Application of the Rules of Procedure of the CAS Procedural Rules.
[34] Article R40.1 of the CAS Procedural Rules, from the website: https://www.tas-cas.org/en/arbitration/code-procedural-rules.html, last seen on March 3,2022.
[35] Article S12 paragraph 3 of the CAS Procedural Rules, the full document viewed from the website: https://www.tas-cas.org/fileadmin/user_upload/Code_2019__en_.pdf, last seen on March 3,2022.
[36] Article S12 paragraph 2 of the CAS Procedural Rules, the full document viewed from the website: https://www.tas-cas.org/fileadmin/user_upload/Code_2019__en_.pdf, last seen on March 3,2022.
[37] The International Council for Arbitration for Sport or in English as one of the languages used by the International Council for Arbitration for Sport (acronym ICAS) is the same as the CAS body involved in the dispute resolution process in sport. While the duty of ICAS to select and appoint to the list of arbitrators and mediators is prescribed by Article S6. POINT 4. CAS Procedural Rules
[38] The list is available on the website: https://www.tas-cas.org/en/arbitration/liste-des-arbitres-liste-generale.html, last viewed on March 3,2022.
[39] The list is available on the website https://www.tas-cas.org/en/mediation/list-of-mediators.html, last viewed on March 3,2022.
[40] Article S14 CAS Procedural Rules

as the basic and primary advantage of such a system, but such a list also implies a limitation of party autonomy.

There must be no less than 150 arbitrators on the CAS arbitrator list and less than 50 mediators on the mediator list[41]. The CAS Rules of Procedure pay special attention to ensuring the objectivity, independence and impartiality of arbitrators and mediators, so upon appointment they are obliged to commit in writing to accept and perform the function in accordance with the CAS Rules of Procedure[42]. They may not participate as advisers to a party to proceedings before the CAS[43]. They are obliged to apply the principle of secrecy in the performance of their duties in relation to the CAS Rules of Procedure, noting that in particular they may not disclose to any party any information or any other information relating to proceedings before the CAS. Arbitrators and mediators may be removed from the CAS list immediately or permanently if they violate any CAS Procedural Rule or if their conduct harms the status and reputation of ICAS and / or CAS[44]. This rule also applies to department presidents.

In order for the parties to initiate proceedings, it is necessary to submit a request, which the CAS sends to the other party for comment, and invites the party to choose the applicable law regarding the merits of the dispute. In the absence of a choice of applicable law, Swiss law under Article 45 of the CAS Procedural Rules shall apply.. Within 20 days, the opposing party must respond, if necessary, propose an arbitrator from the CAS list, submit a counter-request and all evidence on which to base its position, as well as witnesses. The panel to which the case has been assigned before initiating arbitration proceedings will decide on its jurisdiction (as a preliminary ruling or in the case of a question of merits). In the event that it finds that an objection has been raised to the CAS's jurisdiction, the CAS Council Office or the Council itself, if constituted, shall invite the parties to submit a written request accepting the CAS's jurisdiction[45].

The arbitrators shall be elected by agreement of the parties, in the case of a panel of three members (arbitrators), each of the parties shall elect one, and the selected arbitrators shall elect the president of the panel. The arbitrators will only be confirmed after the confirmation of the election of the parties by the President of each department. Prior to his decision, the President of the Department shall verify that each of the arbitrators meets the prescribed requirements under Article 33 of the CAS Procedural Rules[46]. The procedure is conducted by hearing the parties, presenting material evidence, examining witnesses and experts proposed by the parties.

[41] Article S13 paragraph 2 of the CAS Procedural Rules
[42] Article S18 paragraph 2 of the CAS Procedural Rules
[43] Article S18 paragraph 3 of the CAS Procedural Rules
[44] Article S19 CAS Procedural Rules
[45] Article R39 of the CAS Procedural Rules
[46] Articles R40-40.3 of the CAS Procedural Rules

The arbitrator or the panel of arbitrators may decide not to hold a hearing of the parties or an individual witness or expert in the event that it considers them irrelevant for determining the merits and making a final decision. The decision is made by a majority vote.

REMEDIES AGAINST THE CAS DECISION

CAS decisions can significantly affect the lives of athletes and thus they enjoy a high degree of independence. Decisions must be respected and implemented by all parties to the proceedings. This is determined by Article 46 of the Procedural rules in such a way that the decision, by which the parties are notified through the CAS office, is final and binding on the parties[47]. An appeal may be instituted against a decision of the CAS in which case the decision of the first instance body is deemed to have been taken[48]. Decisions of federations, associations and sports bodies / associations may be appealed to the CAS, if the statutes[49] or regulations of the body that made the decision provide (allow) or if the parties have signed a special arbitration agreement, and the appellant exhausted the legal remedy before filing an appeal with the CAS, all in accordance with the statutes or regulations of the body that previously made the decision[50].

Thus, it is stated that the only legal remedy against the decision of the Appeals Department (in case such an option is not excluded by a clause or agreement) is a lawsuit for annulment and only before the Federal Supreme Court of Switzerland[51]. This is governed by the Swiss Private International Law Act (hereinafter CPIL), which is governed by Section 12 of the International Arbitration Act, Articles 176-194[52]. Namely, Article 176 of the CPIL stipulates that the rules of the Act in the part relating to arbitration apply if the seat of the court is in Switzerland and if at the time of concluding the arbitration agreement she is not of Swiss nationality or habitual residence. regulated in the same way as in Article R46 of the CAS Procedural Rules.

As the CAS seat is determined by Article 1 of the CAS Procedural Rules in Lausanne, Switzerland, then the court has jurisdiction to set aside the arbitral award of the CAS

[47] Read more on the website: https://www.tas-cas.org/en/arbitration/code-procedural-rules.html- under Article R46, last reviewed on March 3,2022.
[48] Article R47, paragraph 2, CAS Procedural Rules
[49] Thus, Article 11, paragraph 2, indent d) of the Statute of the Croatian Football Association (adopted at the General Assembly on June 5, 2017, and amended at the sessions held on April 6, 2018, March 28, 2019 and December 19, 2019) regulates how "The Federation, its bodies and officials,... shall: d) recognize the jurisdiction of the Court of Arbitration for Sport (CAS) in Lausanne (Switzerland), as established by the relevant provisions of the FIFA and UEFA Statutes..."
[50] Article R47 (1) of the CAS Procedural Rules
[51] Article 191 of the Swiss Federal Act of Private International Law (English acronym CPIL, German acronym IPRG), in force since 18 December 1987, last amended on 1 January 2017 (CPIL available at www.andreasbucher-law.ch, , www.umbricht.com),
[52] See Arroyo Manuel, Arbitration in Switzerland - the Practitioner's Guide, Kluwer Law International, 10.2015, p. .1018,1019,1026,1030-1037

under Article 192 (2) in conjunction with Article 191 of the CPIL by the Federal Supreme Court of Switzerland[53,54]. The said legal remedy may only be filed by a person who is a party to the arbitration proceedings within 30 days of receipt of the decision[55] which deadline is preclusive, and the same may be extended for an additional 30 days[56].

The legal regulation regarding who can represent a party (or be its lawyer) in a lawsuit against the Swiss Federal Supreme Court stipulates that it can only be a lawyer who is a member of the Swiss Bar Association or a lawyer authorized to practice law in Switzerland[57].

It is important to state the reasons why a lawsuit can be filed with the Swiss Federal Supreme Court, so it is arranged that the procedure can be initiated only if one of the following reasons is met: if the only arbitrator is incorrectly appointed or the arbitral tribunal is incorrectly established. declare competent or incompetent, if the arbitral tribunal has ruled beyond the proposed request (beyond the limit of the request) or failed to decide on one of the requests, if the principle of equal treatment of the parties or their right to be heard is not respected[58], and where the decision is contrary to law[59].

If the CAS Arbitration Council consists of a president and two members, the decision is made by a decision of the majority, and in the absence of a majority by a decision of the president, where different opinions are not communicated to the parties.

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[53] The lawsuit can only be decided by the Federal Supreme Court. The revision is regulated by Article 77, paragraph 1, indent a. Of the Law on the Federal Supreme Court, which was passed on June 17, 2005. "

[54] Governing the following rule: "Appeals against arbitral tribunals are allowed in civil matters: a. In international arbitration under the terms of Articles 190-192 of the Federal Law of 18 December 1987..." which is available at: https://www.admin.ch/opc/de/classified-compilation/20010204/, last reviewed March 3,2022.

[55] Article 100, paragraph 1 of the Federal Law on the Federal Supreme Court of Switzerland, passed on 17 June 2005, as last amended by the amendments which entered into force on 1 January 2019.

[56] Article 50 (1) of the Federal Law on the Federal Supreme Court of Switzerland provides: "If a party or his representative is prevented from acting in due time for any reason other than improper opening, the time limit shall be returned obstacle clearance... "

[57] Article 40 (1) of the Federal Law on the Federal Supreme Court of Switzerland

[58] V.Puljko- Arbitration and mediation in sports, Informator, number: 6454, 23.1.2017. page 2. Subheading Annulment proceedings, paragraph 5, footnote 27. Judgment of the Federal Supreme Court of Switzerland No. 4A: 544/2014 by which Josip Šimunić, Croatian national football team member, filed a lawsuit in violation of the right to be heard regarding the hearing of another expert the parties, considering that the factual situation was sufficiently established on the basis of the presented expert finding, and that further testimony of the expert would not affect the decision of the Disciplinary Body (first instance body FIF Disciplinary Board fined J. Šimunić CHF 30,000.00, confirmed the same decision). After which the party complains to CAS, which appealed on May 10, 2014. rejects, on which decision the party ultimately files a lawsuit with the Federal Supreme Court of Switzerland. The Federal Supreme Court of Switzerland rejects the request for annulment of the CAS decision, stating that the prosecutor's representative failed to point out the violation of rights, but stated that he was satisfied with the way the Disciplinary Board treated the prosecutor. At the same time, the Federal Supreme Court of Switzerland presented a legal provision that further questioning may be refused if the body considers the legal and factual matter sufficiently established.

[59] see Article 192 (2) of the CPIL

Therefore, the signature of the president or two members of the council is sufficient if the signature of the president of the CAS council is missing from the CAS decision.

Before the decision is signed, it will be handed over to the CAS Secretary General, who can clarify the text of the decision in a clean copy, and can point out and "draw" the attention of the members of the council to fundamental and fundamental issues[60]. Due to such an attitude, there is no hearing of the parties according to the latest amendments, but the law in question did not exist even after the amendments that were valid in the past.

CFF ARBITRATION COURT AND ITS DECISION

In order to get better acquainted with the arbitration procedure before the CFF Arbitration Court (hereinafter: the Arbitration Court), it should be emphasized that it is regulated by the Procedural rules of the CFF Arbitration Court (At the CFF Executive Board meeting on October 11, 2013 ., adopted, and at the sessions of November 26, 2015, February 22, 2017, January 29, 2018, June 4, 2018, November 21, 2019 and April 15, 2020, amended and supplemented, hereinafter: Rulebook)[61] which implies the regulation of: competencies, composition, seat, election of members and rules of procedure of the Arbitration Court.

At the same time, in order to facilitate understanding of the scope of the CFF Arbitration Court, it is necessary to determine the jurisdiction regulated by the Ordinance as follows: property disputes. The above-mentioned occur in connection with certain subjects of the CFF, such as: players, coaches, and other members of the football organization whose decision-making is related to the territory of the Croatia. The aforementioned body is competent in the procedures of assessing the legality of final decisions on rights, obligations and responsibilities exercised in the CFF and football in the Croatia[62].

The legislator under a single-instance court means that this is a procedure that ends with a decision of the CFF Arbitration Court, whose decision is final on the day the court makes it[63]. This rule is contrary to Article 31 of the Arbitration Act and the CAS Procedure rules, which allow for second instance arbitration, while the CFF Arbitration Court has not established higher arbitration within its institution so that the first instance decision can be reviewed.

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[60] Article 46 CAS Procedural Rules
[61] See the preamble of the Procedural rules of the CFF Arbitration Court, on the website : https://hns-cff.hr/files/documents/1339/Pravilnik%20o%20radu%20 Arbitraznog%20suda%202020.pdf, last viewed on March 3,2022.
[62] Article 3, paragraph of the Procedural rules of the CFF Arbitration Court
[63] Article 48 of the Procedural rules of the CFF Arbitration Court stipulates that no appeal may be lodged against the Court's ruling, ie that the ruling is final, but that exceptionally the proceedings may be resumed within 2 months from the date of receipt of the ruling. stated reasons in which circumstances this is allowed)

The arbitral tribunal is not competent to decide on those disputes that are the result of mutual relations of entities in the football organization regarding the application of the Rules of the Game and other discretionary powers that derive from football as a competition dispute (disputes under the Rules of Football Competitions), the Complaints Election Commission and those arising from the procedure of licensing clubs. At the same time, the arbitral tribunal is not competent in those disputes in which not all legal remedies within the CFF have been used[64].

In order to clarify individual procedures and in its work, it applies the CFF regulations and the Statute, primarily those regulations that were adopted on the basis of the Statute and the FIFA Regulations. In cases where relations in the aforementioned area are not regulated according to the CFF, the FIFA Statutes and Regulations are indirectly applied. On all other issues that are not regulated with all the above, the CFF Arbitration Court will apply the Civil Obligations Act, the Arbitration Act and other positive regulations of the Croatia[65]. In case certain procedural issues are not prescribed by the Procedure rules of the CFF Arbitration Court, the CFF Arbitration Court will apply the Arbitration Act, and indirectly the Civil Obligations Act, which is regulated by Article 4, paragraph 3 of the CFF Arbitration Court Rules of Procedure.

The method of decision-making is regulated so that the CFF Arbitration Court conducts proceedings and makes decisions in chambers composed of three members. In case of non-selection of the arbitrator by the defendant, the President or Deputy of the CFF Arbitration Court shall elect him within eight days, which is regulated by Article 7 of the Rules of Procedure of the CFF Arbitration Court[66]. In all those cases where the Court finds that there has been sufficient deliberation in the proceedings to reach a decision, it shall close the hearing and render its award. It is final and binding on the parties to the dispute[67], and has the same legal validity as a final judgment of a regular court, due to the fact that it cannot be reviewed by regular remedies before a higher arbitration body and a regular court[68]. The principle that decisions are made by a majority vote is established, and the CFF Arbitration Court makes a ruling by a simple majority of the members of the panel[69]. When deciding on the arbitration panel, all members present are required to vote. In the procedure when deciding without holding a main hearing in compliance with the conditions prescribed by Article 31 of the Rules of Procedure of the CFF Arbitration Court, and the decision is made by written opinion of the members of

[64] See Article 3, paragraph 2 of the Rules of Procedure of the CFF Arbitration Court
[65] Article 4, paragraph 2 of the Rules of Procedure of the CFF Arbitration Court
[66] The list of arbitrators is available on the website: https://hns-cff.hr/files/documents/804/ARBITRI%20ARBITRA%C 5%BDNOG%20SUDA.pdf (last viewed March 3,2022.)
[67] Article 45 of the Rules of Procedure of the CFF Arbitration Court
[68] More about that Dika, Mihajlo, Marginals with the problem of the effectiveness of the arbitral award, Law in economy, vol. 45, no. 2, 2006, p. 37 - 55.
[69] See Article 39, paragraph 1 of the Rules of Procedure of the CFF Arbitration Court

the panel on the proposal of the president CFF court[70]. The President of the Council may decide on the management of the procedure outside the session of the Council. During the deliberations and voting, the court may reopen the hearing in order to supplement the proceedings or to establish better and clearer facts more important for decision-making. If the procedure is conducted by an arbitrator, the individual performs all the actions from the above independently. The above is an exception to the rule when the arbitration proceedings are conducted by the chairman of the panel as an individual judge, by prior agreement of both parties or in accordance with Article 7, paragraph 10 of the Procedure rules of the CFF Arbitration Court

It is important to note that, as in all other proceedings, the CAS principle of official confidentiality of arbitration, which in itself implies that neither party nor arbitrators may disclose any facts that become known to them during the proceedings. especially the content of the dispute (therefore data from evidence, minutes, or some decision of the CFF Arbitration Court on persons and their content). It is precisely the secrecy and confidentiality of proceedings in relation to regular proceedings that many consider to be an advantage of arbitration proceedings.

Decisions of general interest may be published by the CFF in the manner determined by the Arbitration Court, provided that the identity of the parties involved is not disclosed, which rule is prescribed by Article 47 of the Rules of Procedure of the CFF Arbitration Court. It is important to note that the same Court has not published any of its decisions to date. Namely, Article 47 itself. The Rules of Procedure of the CFF Arbitration Court stipulate that the form of publication without the identity of the parties involved will be published as determined by the Court, but applying the provision of paragraph 21 of paragraph 3 of the Rules of Procedure of the CFF Arbitration Court. deliveries unsuccessful that the third delivery is made by publishing a letter in the official gazette of the CFF. This rule may also apply to the publication of the decision of the Arbitral Tribunal. Another argument in favour of such thinking is the fact that the Official Gazette of the CFF is a public bulletin of the CFF in which other important decisions of all organizational units and members of the association are published, and as such available on the website of the Croatian Football Association.

Some shortcomings compared to the CAS and AA rules regarding deadlines and procedural rules, it was concluded that the CFF Arbitration Court does not have a deadline for drafting and submitting its decisions, and this shortcoming could be avoided by prescribing the same, but in the current the legal loophole of the Rules of Procedure of the CFF Arbitration Court is supplemented with the rules of the AA. Furthermore, the lack of two-stage decision-making or review of the first-instance decision of the CFF Arbitration Court, the lack of publication of decisions in the CFF

[70] Article 39, paragraph 3 of the Rules of Procedure of the CFF Arbitration Court

media. The deficiencies in question should be modified using the CAS Procedural Rules, which have better and more detailed regulation.

CONCLUSION

It can be concluded that until the Decision of the Federal Supreme Court, arbitration was dominant in sports proceedings. However, although the procedure was conducted more efficiently and economically than in regular courts and was conducted by arbitrators who are closely specialized in the field of sports law, there is still doubt about the "voluntary" nature of the procedure. Namely, the very good will of the parties, as this paper has shown in several individual discussions, has become questionable primarily through equality and freedom to regulate the agreement itself. Such an attitude stems from the fact that athletes are bound by clauses through agreements, contracts or applications for individual competitions, without themselves understanding them both in their content and in their far-reaching effect. The customs or sample copies of them have been edited and written by international sports associations such as IOC, FIBA, ISU, FIFA, ITF, FINA, which have regulated the obligatory competence of CAS with their basic acts (statutes and regulations). decisions will affect further amendments to the CAS Procedural Rules on Arbitration towards greater independence and autonomy from external influences, and that the CAS will regain the full confidence of all parties and that when they go to arbitration all rules and that their human and economic rights will be protected.

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COMPREHENSIVE INTERNAL LOGISTIC SYSTEM

Abstract:
Warehousing represents a significant cost to the company, both labour and storage space. In particular, we note the important role of storage in the case of more complex products and storage of more demanding materials. A comprehensive system of internal logistics contributes to uniform control over raw materials, finished products and their economical consumption. An outstanding contribution of this type of system is also the optimal use of storage capacity and the possibility of ordering raw materials "just in time".

To increase worker safety and reduce costs, more and more companies are opting for this kind of comprehensive storage automation. The sophisticated automatic storage system consists of a set of racks, automatically guided trolleys and transport lines.

Their connection and control are taken care of by computer support. Such a system significantly reduces the need for manpower and increases the factor of reliability and safety. This type of system is taken care of by a group of operators and maintenance staff.

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***Key words**: intelligent systems, internal logistics, racks, automatic guided vehicles, conveyors*

INTRODUCTION TO THE RESEARCH

In recent years, in addition to the efficient use of production processes, companies have also placed great emphasis on the efficient planning of logistics processes. We usually think of external logistics, but the real breakthrough was achieved by automating logistics within companies. The characteristics of internal logistics are reflected in the complexity of the connection with the entire production system and, as part of Industry 4.0, are combined into a comprehensive production process management system.

This type of implementation brings us some challenges at first, but in the long run extremely efficient and flexible logistics within the company. Proper "in-time" planning simplifies the whole process, as it reduces the required stocks of raw materials and finished products.

Transport is an economic activity that deals with the movement of people and things in a geographical area. This relocation takes place on various transport routes with the help of technical means - means of transport and on the basis of the appropriate organization. A transport route is a route along which a means of transport moves from one place to another. Internal transport is transport that takes place within a location. [1]

Storage can be defined as an important area in the management of each manufacturing company. It is strongly associated with inventory, as its main task is to maintain inventory. Warehouses are buffers, which with their stocks enable to bridge fluctuations in the production process. Warehouses are designed to bridge time, which means to compensate for time differences between the production and use of goods. [2]

Continuous progress activities are encouraged to improve speed, reliability and efficiency. The automated transport system is a huge step forward in this development. Companies in principle opt for automation in logistics when they have sufficient funds at their disposal, as investing in automation is a fairly high cost. Above all, it is a long-term investment. Transport automation ensures the accuracy and traceability of tasks and, of course, repeatability. Automation is generally considered to speed up, simplify, increase accuracy and cheap procedures that are otherwise performed by humans. [3]

RESEARCH FIELD

The research area is internal transport, within which we are studying the possibilities for the deployment of comprehensive intelligent systems, which enable comprehensive management and control of the internal logistics system. At the forefront is a system for monitoring and managing the entire logistics and production process, which is also fully prepared for the transition of Industry 5.0, where the process is controlled and coordinated to the last screw. The robots take care of their own production of raw material, which is stored in high-rack storage systems and is autonomously transported to the place of use via transport lines and self-propelled forklifts using the "just in time" method. In the same way, the final products are "stored" through the system of comprehensive internal logistics in an automated high rack warehouse, which is connected to the external logistics system, which also receives products for delivery via the "just in time" and "first in first" system. out ".

With this type of system, we ensure high reliability of the production and logistics system, and it is extremely cost-effective.

Due to the exceptional complexity and breadth of the latter field, the research task focused on the study of the technology of providing such a system as a single whole. The system takes care of the storage and transport of raw materials and finished products within the factory. It is crucial to emphasize that the research of such a system on the products in question can be limited only as the basis of some research findings, which may differ depending on the available resources and the production process of an individual factory. It is certainly possible to extend the research in the future to the application of ensuring the uniformity of a comprehensive internal logistics system.

RESEARCH THESIS

Our research, we will obtain the results that are the subject of the study of the system of comprehensive internal logistics at the medium-sized factory in our area. We will review the operation of the latter system, its integration into the whole, and its administration and maintenance. The review of security systems is also a major highlight. We will also check the possibility of upgrading and applying a comprehensive internal logistics system to various areas of production systems. The purpose of the thesis is to provide a starting point for modernizing systems, so we named it "modern systems in logistics enable faster control of individual processes", and through the research we looked for those arguments that justify it. We tried to present the advantages of the development of logistics systems from a technological point of view. For this we used data that are available to us on various media, we mainly relied on concrete results in individual forms of production, available literature and examples of good practice. Data are measurable and can be classified by mathematical, economic or other forms of processing, analysis, and can be used to find modern solutions in the development of intelligent systems.

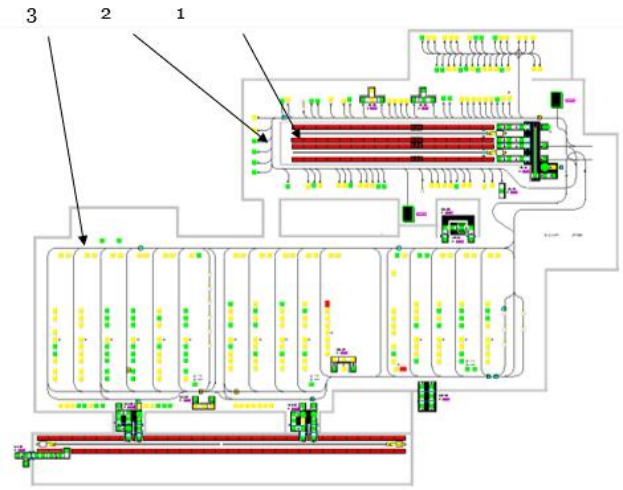
BACKGROUND TO THE RESEARCH

As a starting point for the research, it is possible to summarize various areas in production organizations, and we have opted for research in areas that are closely related to finding solutions in logistics and logistics processes. This is an area that can be considered from different angles and study individual processes of procurement, transport, transition of materials to production systems, but the design of the research is so broad that our interest was to explore one area and present technological modernization in the direction of industry 4.0 and in search of possibilities for the coexistence of natural and artificial intelligence systems in the generational development of industry 5.0. The field of research is broader and many authors try to study it, who understand the topic differently, as a result of which their research is different but aims to improve the field of logistics and logistics processes. Among them, it is necessary to mention Zelenika [4], where he clearly researches and describes logistics systems, Zelenika [5], where he describes the management of logistics systems, and Zelenika [6], where he defines the economics of the transport industry. Many authors summarize it and link their research to it, presenting it through their articles, monographs or textbooks. During the organizational integration in logistics, Murtič and Jankovič [7] summarize Zelenika, but add new forms of organization, while Uhernik and Murtič [8] provide guidelines for technological modernization of the input of materials into industrial production.

In logistics, transport is divided into the type of infrastructure use, usable means of transport and forms of transport, and it is directly divided into internal and external. The external part is road, rail, water and air, which in the final part can be connected directly to industry, production or other organization, this form of transport also has the sign of transport in public transport. Internal transport is a specificity of an individual industry, production or other organization, which is tied to the form of infrastructure, means of transport and the form of movement of raw materials, goods or materials through production. We have shown the system of integrated transport in domestic transport and linked to it individual procedures that are closely related to this form of logistics.

The internal transport system consists of:

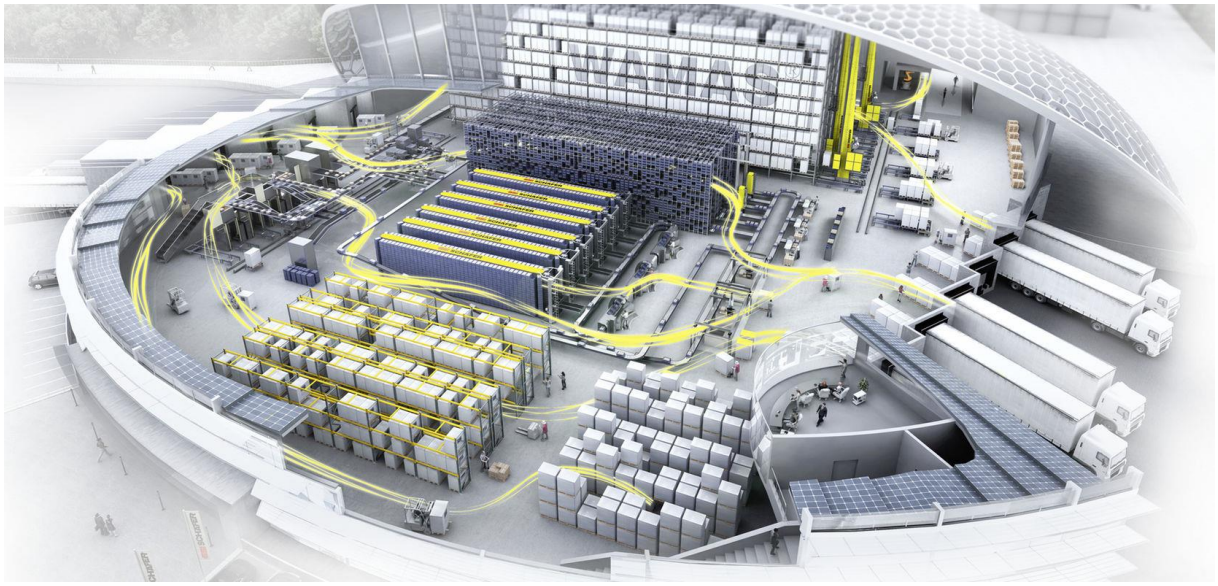
1. an automated high-bay warehouse in the middle of the production building,
2. automated horizontal transport system (conveyors),
3. a system of automatically guided trolleys that move vertically by means of a lift.



Source: Tovarna zdravil Krka d.d., 2020

For the smooth operation of the system, comprehensive internal logistical care for application support, which combines two-way communication computer-supported systems, ie. external logistics transport, internal logistics transport, operation of the production line storage system... etc.

For the system user, it is integrated into a system management unit.



Source: Schaefer (Available at https://www.ssi-schaefer.com/)

THE COURSE OF THE RESEARCH

AGV – automatid guided vehicle

An automated guided vehicle (AGV) is a mobile robot that transports material, tools, components, or products over long distances in factory halls without an operator using a wire (inductive loop), laser system, or floor marking system. warehouses.

The use of automatically guided trolleys spread in the late twentieth century and is no longer limited to the industrial environment.

There are two types of automatic guided trolleys: laser guided vehicles (LGV) and self-guided vehicles (SGV).

The first automatically guided trolley appeared on the market in 1950. The first implementation was simple, instead of driving on rails, the trolley followed the wire. Over the years, trolleys have advanced considerably and are now used mainly by laser-guided ones. In the automatic transport system, automatically guided trolleys communicate via the server to ensure safety and smooth transport. [9]

An example of an automatic self-propelled forklift is Optomatik 160, a Slovenian manufactured by TPV Automotive. Automatically guided trolleys are in charge of providing jobs and transport to the automatic transport line.

Source: TPV Automotive (Available at https://tpvinnovationstation.com/)

Source: Swisslog (Available at https://www.swisslog.com/)

The RM-GP is an automatically guided ROBOMATIC® forklift truck. It is a combination of an induction loop-guided trolley and a laser-guided trolley. The trolley follows the inductive loop and is equipped with lasers, mainly to ensure safety and efficiency. The front and rear lasers provide an emergency stop for the trolley in the event of an unexpected obstacle. Manual on-site intervention is required to correct the error. Laser readers also take care of identifying pallets and collection points. It is a three-wheeled vehicle with a driven, steerable wheel at the front and two non-driven wheels at the rear. The RM-GP is designed as a so-called "jaw vehicle", meaning that the rear, non-powered wheels are mounted in the jaws on both sides of the load. In most uses, the vehicle drives forward faster than reverse. [9]

There are three different modes of operation:

- Automatic mode: Fully automated operation of all vehicle functions.
- Semi-automatic mode: All vehicle functions are performed automatically as long as the START button is pressed on the connected manual control unit.

– Manual mode: Driving, steering and loading functions are controlled on the connected manual control unit.

Source: own source, 2020

The trolley consists of two main parts:

• The front part consists of a tower, which contains the drive unit and electrical and electronic modules, and the batteries are mounted on the sides, on the pole has connectors that are used to charge the batteries. Security elements are also installed on the front.

• The rear part is intended for cargo and consists of a strong frame and automated forks used for loading cargo. There is also a built-in code reader that serves to verify the identity of pallets and stations. Security elements are also installed on the sides.

The vehicle is powered by a lead-acid battery on the vehicle. The battery is charged on chargers that have a specific position. The vehicle is usually connected to the charging station automatically, and the sliding contacts on the vehicle allow contact with fixed wall poles or floor charging contacts. The vehicle ensures a balance between charging cycles and operating time, in addition to controlling the recharging process.

The latter self-propelled truck offers quite a few different driving functions: route search, map orientation, data transfer, route tracking, vehicle position, distance maintenance, obstacle detection, loading and unloading functions and safety functions.

Finding the way

The vehicle is equipped with a detailed storage plan for specific use, which is entered into a computer and then stored in the vehicle. Once the vehicle is given the command to perform the transport, it can only determine the route and then follow it.

Orientation on the plan
In order to be able to steer, the vehicle must have information about its position. Therefore, the vehicle is equipped with a code reader that reads the position codes embedded in the ground or the position code is entered by the operator.

Data transfer
The vehicle is equipped with a communication system for communication with the fixed position controller. Depending on the installation, the communication can be done via infrared or radio connection, but it can also be done with the help of inductive loops in the ground. A communication system is needed to ensure that vehicles receive commands and prevent collisions at intersections. If the vehicle is equipped with both a keyboard and a display, data can be entered manually into the vehicle.

Track trail
On straight sections of the route, the vehicle follows the guide - both when driving forward and when reversing. The bus consists of a wire embedded in a channel in the ground and alternating current flows through it (tracking by induction). The vehicle travels curves with the help of tabular data so that the guides do not require curved elements. Bend data tables are calculated using a utility program and then stored in vehicles.

Vehicle position
Each vehicle is precisely placed in a stopping position, cornering and the like by means of steel or aluminium plates on the ground or magnets detected by the vehicle with special sensors. To prevent malfunction, the AGV measures the length of the floorboards along the way. If the length is not within the required range, the system will interpret it as “no floorboard” and ignore it.

Maintaining distance
In order to allow several vehicles to travel on the same section of line at the same time, without having to be divided into blocks, the vehicles are equipped with a distance maintenance system. This allows vehicles to detect other vehicles traveling in front of them and to slow down or stop appropriately before a collision occurs. As the leading vehicle continues on its way, the vehicles behind it can begin to move.

Obstacle detection

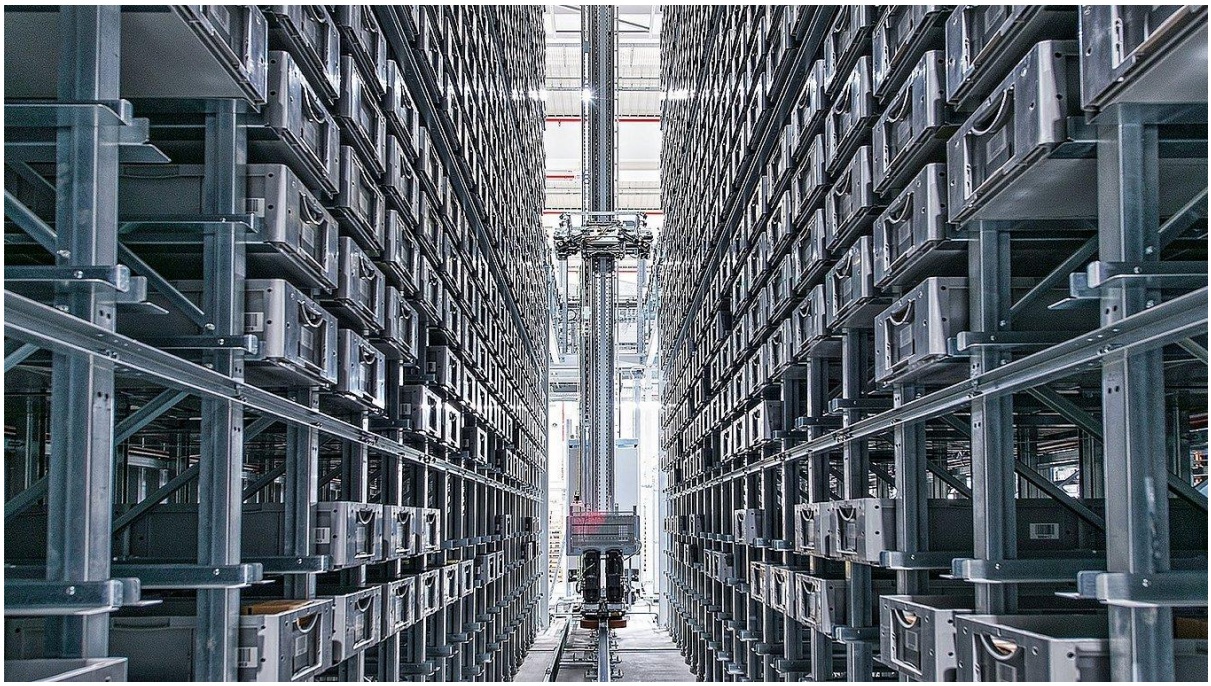
The vehicle is equipped with an obstacle detection system, which allows it to detect other objects and people, the obstacle detection field is shown in Figure 11. In most cases, the vehicle slows down and stops before contacting the bumper. The functionality of this system depends on the nature and size of the barrier. Therefore, this system is not a security system.

Loading and unloading functions
The forks raise and lower automatically. The amount of cargo transfer is permanently determined within the warehouse plan or is transferred together with the transport order. The cargo is monitored during loading, and the presence of cargo is checked during the journey. The vehicle is equipped with an identification system used to read TIRIS TAG coded marks on specific loads. The same device is used to identify the station.

Security features
The self-propelled forklift is equipped with bumpers that immediately trigger an emergency stop when contact with an obstacle occurs. The bumpers are designed so that when the emergency stop is triggered, the vehicle stops in a path that is less than or equal to the extent of the bumper deformation. Emergency stop switches are located on the left and right sides of the vehicle. Safety switch straps are located on the left and right.

HIGH ROCK ELEVATORS

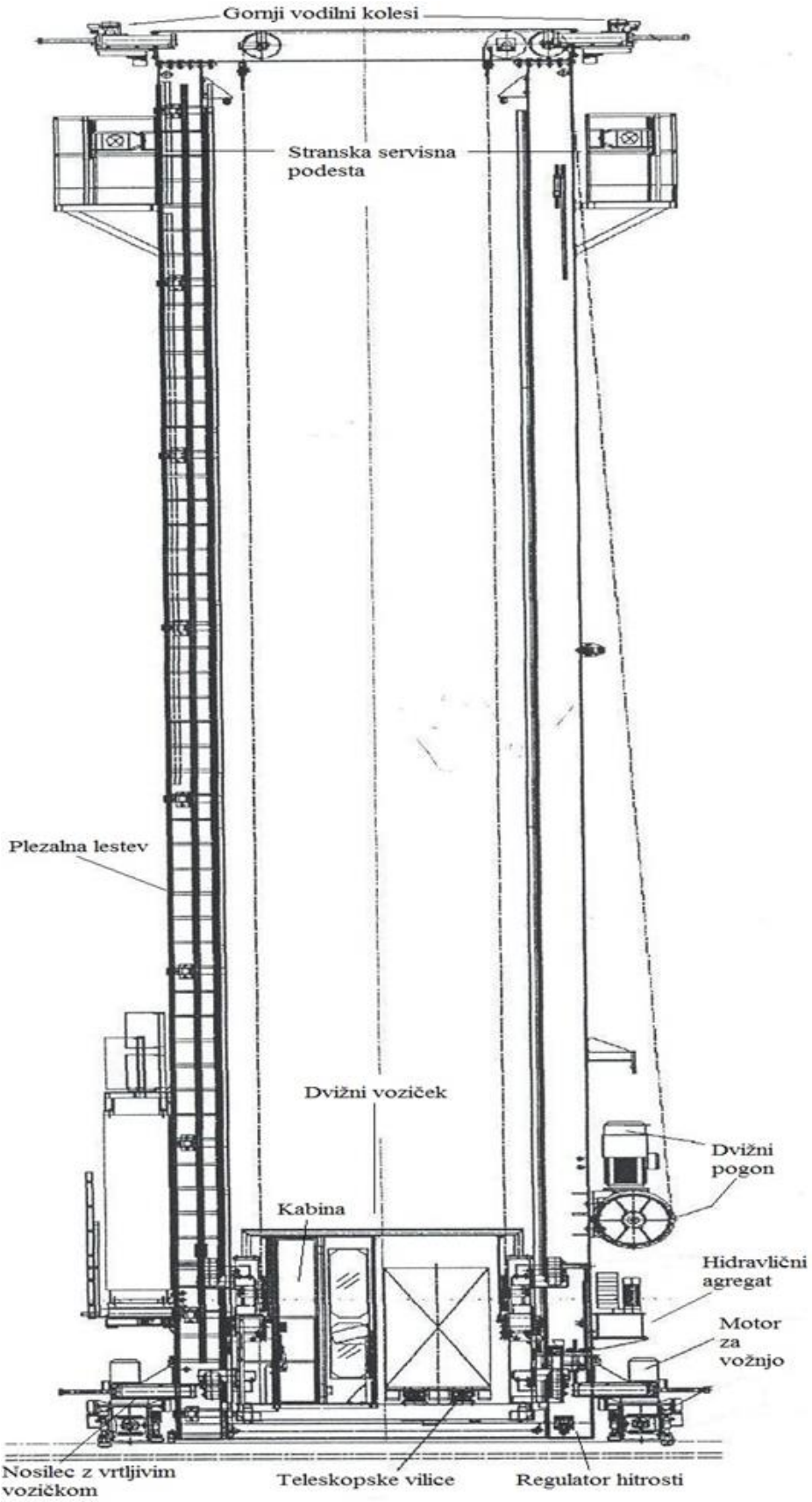
Racks and an automatic rack elevator are also an extremely important part of a comprehensive internal transport system. Components of the automatic rack lift (upper guide wheels, side service platform, climbing ladder, lifting trolley, lifting drive, hydraulic unit, cab, telescopic forks, driving motor, speed regulator and swivel carrier.



Source: Koerber (Available at https://www.koerber-supplychain.com/)

We know manual and automatic rack elevators. Manual rack elevators are operated by an operator who sits in the elevator car and performs tasks manually. Automated rack elevators run an automated logistics system that gives the elevator tasks on where and when to pick up cargo and where to store it. Shelving lifts operate between racks in the warehouse.

Computer-controlled automated rack elevators perform storage of pallet units in high-rack warehouses, where the high height of rack structures ensures maximum use of space. The lift is adjusted to the weight of the load. Two-post lifts are available for heavier loads. The structure of the rack lift consists of a trolley, the mast along which it moves and a storage area where standard pallets are loaded [6].



Source: Tovarna zdravil Krka d.d., 2020

Vertical structure

The vertical structure of solid walls, tubular or mesh in shape, guides the lifting trolley during lifting and lowering and absorbs the bending moments created by the eccentrically mounted weight of the load. The columns are made of rigid, welded full wall (box) tubes. The columns, the lower bracket and the upper bracket are connected by rigid screw joints. The pillars serve as guides to guide the lift table. A bracket is welded to one of the towers, to which a lifting drive and an electrical cabinet with a platform are attached. Ladders are attached to both pillars, extending from the floor to the top of the elevator. The ladder allows intervention access to the lift truck at any height.

Trolley

The trolley consists of two wheels and other components necessary for movement in the horizontal direction to which the mass is attached. The driven wheel is fastened to the trolley frame with screws. It consists of a housing, bearings, shaft, impeller and electric motor-mounted gearbox with torque lever. The force to drive the lift is transmitted from the gearbox via the shaft and the torque ring to the impeller. The non-powered wheel is assembled in the same way as the driven one, except that there is no electric motor gear with a torque lever.

Lifting trolley

The lifting trolley is equipped with a load handler (telescopic forks), a catch brake and a control cabin. The trolley has built-in guide wheels to guide the trolley around the tower. By adjusting these wheels, it is possible to level the trolley in all directions. The guide wheels, which run along the pillars and guide the hoist in the transverse direction of the corridor, are made of Extrathane® polyurethane and have permanently lubricated roller bearings. The guide wheels, which run along the front surface of the trap brake head and guide the lifting trolley in the longitudinal direction of the aisle, are made of metal with a built-in lubricator. In the event of a break in the lifting rope or damage to the electric motor gear unit, the lifting trolley is protected against falling by an automatic catching mechanism. A catching jaw is mounted on the lifting trolley, which is connected to the speed regulator by a steel rope. In the event that the lowering speed of the lifting gear is exceeded, the speed controller activates the catching jaw, which blocks the movement of the lifting trolley along the steel guides. Unlocking of the catching jaws (after repair) is performed by manual intervention and manual control of the lifting drive with low speed upwards. The released brake is immediately functional again. The lifting trolley is centrically mounted on the lifting rope. This type of fastening prevents additional loading of the lifting columns with the bending moment and enables easy leveling of the lifting trolley. Power supply and transmission of communications to the table is carried out with a hanging cable in a movable bus.

Telescopic forks

Two-part telescopic forks with a single extension are installed on the lifting trolley to manipulate the load in the transverse direction of the corridor. They are powered by an electric motor gear with spur gears and a built-in brake, sliding clutch and chain drives. The two parallel forks are driven by a common shaft and move from the middle position synchronously, without jerks, to the left or right end position. The operation of the telescopic forks is protected by a sliding clutch, which prevents damage to the stored material or steel structure in the event of any fault. The frequency regulator ensures smooth starting and stopping of the extension, shock-free operation and prolongs the life of vital parts of the fork. The frequency regulator allows the unloaded forks to move at twice the speed.

Lifting drive

The lifting drive is performed with a steel rope, which is routed through the drum mounted on the electric motor gear and the ropes through the lifting table and fastened to the upper link. Each steel rope has its own drum (one with left and one with right thread) and is routed from the upper girder to the lifting trolley and back to the upper girder parallel to the inner surface of the columns. This method allows the rope to be visible at all times during operation, which allows for easier visual control.

The frequency regulator ensures smooth starting and stopping, operation without shocks and at different speeds, and prolongs the life of all vital parts of the lifting drive.

Service platform

At the top of the pillars are screwed service platforms that allow maintenance and replacement of the upper guide wheels and hydraulic bumper.

Cabin

The cab is mounted on a lifting table next to the telescopic forks. The load capacity of the cabin is for two people. It has a control panel and a seat for the operator. The upper part of the cab, facing the telescopic forks (and load), is open. Access to the cabin from the ladder is possible through the cabin door, which is protected by a safety switch. The stop from the cab to the lift table is possible through the half door, which is also protected by a safety switch. A safety glass is installed in the cab doors and sides, which allows a better overview of the lift operator's operation.

Speed regulator

The speed regulator mechanism is mounted on the trolley and connected to the speed regulator via a wire rope. In the event of an excessive lowering speed of the lifting trolley, the speed regulator activates the catching jaws via a wire rope and mechanism, which engage in special guides on the column (catching rail rail) and stop the lowering. The mechanism is completely mechanical and completely

independent of other systems, so it is always on standby to prevent the lifting table from falling and consequently from direct material damage and congestion.

Hydraulic unit
The hydraulic power unit is installed under the lift drive and takes care of the movement of the guide wheels that guide the lift along the rail. Hydraulic lines are made of flexible pipes, except at the lower support, where they are made of rigid (metal) pipes. Flexible pipes are at the place where they come from the cable chain, connected with a quick coupler for easier replacement (assembly, disassembly).

Wheel leading upper - left, right
The brackets with the upper guide wheels are screwed to the upper bracket. The main upper guide wheel is made of plastic and runs in a guide (U-profile). Next to it, a movable auxiliary guide wheel is mounted, which guides the elevator only when driving straight down the transverse corridor. The movement of the wheel is done with an electric tire. A hydraulic bumper is attached under the bracket.

Swivel trolley bracket
On the lower bracket are screwed brackets with swivel impellers and hydraulically adjustable guide wheels. An electric motor gearbox (drive - direction X) is mounted on the impeller shaft. The complete guide and impeller assembly is designed to be easy and quick to maintain (disassembly of the guide wheel assembly, disassembly of the entire impeller assembly with shaft and bearings with housings). The swivel trolley can rotate 90°. The bearings need to be lubricated.

Steering
The rack elevator (ARD) is a computer-controlled automatic device for the transfer of material in a high-rack warehouse. The application software in the PLC on the ARD allows the elevator to operate in the corridors of the high-bay warehouse. The lift transports transport storage units (TSEs) between storage and entry-exit locations. It operates in remote (automatic and semi-automatic operation) and local (semi-automatic and manual operation) mode. In automatic mode, ARD communicates with the control system.

TRANSPORT LINES

A very important role in the entire system is also connected by the transport lines, which take care of the transfer of pallets between the high-bay warehouse and the automatically guided trolleys. The automatically guided trolley places the pallet in a suitable place where it is picked up by a transport line and transported to a suitable place where it is picked up by a high-lift elevator. Transport also takes place in the opposite direction, for the purpose of dismantling the finished products.

Source: CHC (Available at https://conveyorhandling.com)

Transport lines consist of: [10]
• rack transport lines and
• ordering lines.

Rack transport line
The rack transport serves as a connection between the trolleys and the automatic rack lifts in the corridors. It is mounted on an auxiliary steel structure in front of the rack rows in two levels, at the head of the warehouse.

Order line
The transport system in the order form enables the entry and exit of the transport unit from the warehouse to the floor of the extension at the front. The transport loop is installed at the entrance and exit of the high-bay warehouse.

By automating logistics, we achieve:

- automatic loading and unloading of crates,
- optimally used space enables a smaller storage area,
- humanisation of the workplace,
- box recognition systems (with bar code or other readers) enable tracking and provide accurate data on storage status,
- informing and printing all storage data,
- automatic data protection.

DISCUSSION

Throughout the discussion, we obtained the necessary information that uniquely shows us the quality of operations in logistics processes, which we used to find innovative solutions for introducing approaches in each process. Technology systems provide an overview of individual processes that can be gradually changed,

new technology added, and even connected through an intelligent system. Individual sets have impressed us with their innovation, which shows us the increasing possibilities of introducing individual autonomous devices and their interconnection into intelligent operation. In the discussion, we had a sufficient amount of information in the data, which showed us what is the current situation in logistics, what are the individual cases and procedures of the organization and operation. Of course, we were aware that we are studying logistics systems in more advanced and technologically more developed forms of logistics, so we focused our research on the introduction of more technologically advanced systems. Examples of good practice in individual companies, industry or other organizations confirm our assumption that other developments are needed. In our case, we presented a system of improved performance, so we confirmed our thesis that modern systems in logistics allow faster management of individual processes.

The purpose of all research is to come up with advanced logistics solutions and verify their implementation in practice. It is extremely important that even a company that may not yet be thinking in this direction is educated and well acquainted with the latter option, as only taking advantage of technological advances in this field allows them to exist competitively in the market.

CONCLUDING THOUGHTS

In addition to industrial, corporate, or other production, logistics is an area that is in constant development and is looking for advantages for improvements and disadvantages for eliminating waste of time, space and labour. Increasing modernization of systems, increasing introduction of technological achievements, increasing introduction of intelligent systems and lean production methods require the adjustment of logistics, which consequently together means economic development.

Automation, introduction of autonomous devices, introduction of intelligent systems and technological inter-organizational integration in production, transport, storage and other areas of production, services or other processes brings higher quality, more reliable operation, and inappropriately higher cost efficiency, which contributes to better competitive position in the market. It is expected that in the future only one system will take care of the whole process, which means that the need for labour will be drastically reduced. Even today, the workforce poses the greatest challenges. It is expected that companies will need higher educated staff to implement the latter systems.

The development systems of large industries are moving in the direction of transferring individual works and tasks or tasks to artificial intelligence, thus achieving great savings in production and supply processes, achieving greater accuracy of individual processes, resulting in quality products, better services, and soft production. Modernization also means lower energy use, lower environmental

impacts, and greater efficiency, which is the goal of development systems as well as our research.

We are aware that our research is only a part of individual attempts to identify individual technological achievements, which we will expand in further research and look for better solutions. In the research, we connected more widely in the industries of the European Union and third world countries, which will enable us to cooperate in a wider area and to discover individual achievements in the field of modernization of logistics and its processes.

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Matej Trapečar[74]

ORGANIZATION AND IMPLEMENTATION OF MASS-ACCIDENT VICTIM'S IDENTIFICATION PROCESS IN SLOVENIA

Abstract:
The purpose of the contribution is to clarify certain investigative acts at the scene of the accident. The treatment aspect focuses on the starting points of sightseeing activities, organisation, and involvement of different services and procedures for identifying victims of mass disasters. The first part of the paper uses the method of studying sources of scientific and professional literature, especially plans, instructions, guidelines of the Ministry of the Interior, Defence and Police. In the second part, the collected data are processed using synthesis and analysis methods. The possibility of a mass accident in the Slovenian territory is, of course, a reality. The process and methods of identification of victims of mass accidents need to be modernised. Despite national plans and instructions, there were uncertainties regarding the sampling and identification of victims. Police investigators and medical personnel are not fully trained to carry out such investigations. In the future, the equipment of investigators and working groups on identification of victims of mass accidents needs to be improved and an identification procedure protocol should be provided. The contribution addresses the problems of identification procedures. The findings are addressed to researchers of such issues as well as to those responsible and investigators.

Keywords: *victim, identification, mass-accident*

INTRODUCTION

A crime scene or accident is the starting point for the successful use of physical or material evidence by forensic laboratory and criminal investigators (1). Every scene is unique. The most difficult forms of crime or events can also be investigated and successfully completed with experienced and trained investigators and the use of a logical and systematic approach. The method of identification is determined by

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Institution/affiliationAREMA, Academy for logistics and management**, Slovenia**
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police legislation (2). The most difficult forms of crime or events can also be investigated and successfully completed with experienced and trained investigators and the use of a logical and systematic approach. The method of identification is determined by police legislation (2). The identification of the missing person and the identification of the body found allow police officers to locate and secure various identification materials. These are biological material and fingerprints.

Police officers may publish a photograph and a personal description of the missing person and the body. The identification procedure consists of checking the data in the records of police, administrative authorities and other databases authorised by law, comparing fingerprints and palm prints, photographs and personal descriptions of the person, DNA profile and other operational and criminal technical tasks.

The investigating judge, who liaises with police, judicial medicine or pathology, odontology, anthropology and other services, plays a leading role in the sightseeing of the site. Usually, the headquarters are designed to carry out the investigation. In the case of a large number of victims, a specific place for the storage of the dead bodies and identification (base of identification) shall be established. The preliminary identification procedure shall be carried out at the site of the event.

According to the law (2, 3), the police have to do everything possible to trace the offender. He must detect and secure traces from the crime scene and the items of evidence. The tour has two purposes. The first is the search, the collection of operational and evidence information, planning, verification, and the second is the evidentiary purpose, which means a record of the traces or evidence found. According to the Maver (4) the tour is divided into five phases, namely: arrival and protection of the place of the act, location orientation, static and dynamic phase of the visit and documentation of the place. When arriving at the site, the first task of police officers is to assist the victims, remembering or noting the state of theft and determining whether anyone has changed the place. They must protect the place of the event and adequately protect traces that could be destroyed by, for example, weather conditions. They also collect first notifications in the first phase and set up an input and exit corridor for sightseeing and other teams. During the orientation phase, the investigations groups are informed about the location and the first findings. It is necessary to gain insight into the wider and narrower surroundings of the place of the action and to give a tactic of conducting the visit. The next static phase is the stage where investigators do not touch anything but only record or documents their observations. Then is a dynamic phase where investigators examine all the details and secure the traces they send for further investigation. In the final stage, however, police officers must record their findings. This is important for a procedural act and has probative value in court.

In the past, various methods were used for identification purposes, such as identification parades, mutilation, stamping, and anthropometry. By the 19th century, criminals had been cut off with fingers and hands and branded with hot iron. The French used an identification parade in prison to identify returnees, where a police officer, who recognised the criminal, as a prize received tobacco. In 1882, Alfonso Bertilon began a systematic study of identification. He used the measurement of individual parts of the human body called anthropometry or berthionage (5).
Today, biometrics are used for identification (6). Biometrics are based on measurements of biological characteristics of humans, e.g. fingerprints, facial recognition, DNA, iris pattern, etc.

The identification of the bodies is one of the basic tasks of the investigators. In the identification, the investigators have to deal with decaying bodies. The rules of the profession require that in the process of identifying the body at the place the body should be viewed several times and a sketch is made. Clothing, personal effects and luggage are searched. A forensic medical expert performs a morgue toilet. Then the description of the body, fingerprinting, securing the DNA material, identified by the witnesses. In the end, there is a separation of the body, where the cause and time of death are also being tried. Investigators also protect or investigate other material such as hair, nail tips, dental status. The identification of victims of mass accidents is subject to specific instructions. Special identification teams are usually set up consisting of criminal technicians, criminals, doctors, reporters and others. The first is a toilet, followed by detailed photographing of the victim, fingerprinting, securing clothing and personal effects (5).

When an accident occurs, the services involved must agree on a procedure with the victims. This is about creating conditions and technical capabilities for transport, transfer, collection, etc. In many cases, there are specific requirements equipment and expertise that can only be provided through wider cooperation (7). It is also important to find the first meeting point of the victims after arriving at the site and to determine the way in which the bodies are treated in a criminal and forensic manner. Only investigators should be allowed access to this place. It is also necessary to determine in advance, where the victims will be transported and where the follow-up procedures to identify victims will be carried out.

Identification of mass accident victims (DVI) is a difficult investigative task that can lead to a successful conclusion only if the work is properly planned. Another condition of success is the involvement of investigators and experts from various organisations, including police and medicine.

When reviewing national protection and relief plans (8), such as fire, earthquake, airplane accident, we also find information on the unit for the identification of the dead. Units or services activated within six hours also include the Unit for the

Identification of the Dead in the event of mass accidents. However, in order to identify the dead (e.g. terrorist plans, earthquakes, airplane accidents), a direction is given that, in addition to the regular services providing the identification of the dead, a unit for the identification of the dead at the Institute of Legal Medicine at the Faculty of Medicine in Ljubljana can be activated. The plans mentioning the involvement of the forces also include a police identification unit. In the case of human victims, the internal organisational unit of the General Police Directorate or the Police Administration participates in the process of identifying persons. In the case of a large-scale disaster, the Disaster Victim Identification group in the event of major natural and other disasters may be activated.

IDENTIFICATION

In Slovenia, the organisation of identification of victims of mass accidents is defined in State emergency response plans and Operational plans of Ministry of the Interior. These plans address different types of accidents, e.g. railway accidents, earthquakes, aircraft accidents, fire, nuclear or radiological accidents, terrorism. In the case of human victims, investigators must carry out identification procedures and identify the victim (8).

Slovenia and most European countries have DVI groups. Investigators generally use methods and procedures in accordance with Interpol (International Criminal Police Organisation). They use forms to identify the victims of the accident, which are divided into forms for collecting data on the missing person, the body and the final identification report. The final report is a condition for the surrender and burial of the victim.

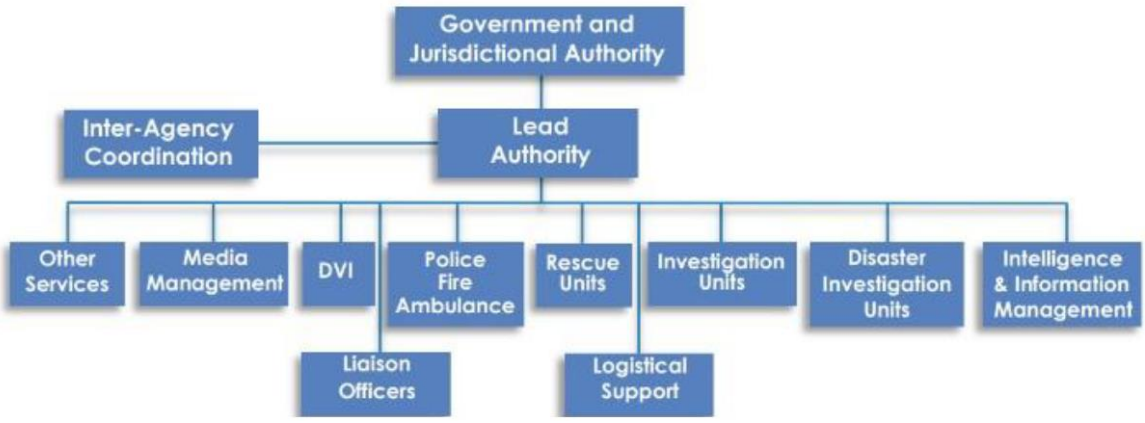


Figure 1: Disaster response management structure
Source: Interpol DVI Guide, 2018

The investigating judge has a leading role at the site of a mass accident and cooperates with experts from the police, medicine, pathology, odontology,

anthropology and other services. The services in Disaster response management structure are in the Figure 1.

In disaster response management structure, the logistical support is very important. Logistical support must be very well organised. Their tasks include the installation of tents, the transport of investigators, the transport of corpses and human remains, the delivery of water and electricity, etc.
If the accident has a large number of bodies, a place to store bodies and human remains is established. The following teams are formed to view the site of a mass accident and individual actions:

- accident site securing, consisting of accident site closing, protection of participants and property. Police and technical personnel provide securing.
- forensic and criminal investigations with the task of collecting notices and preliminary procedures for the identification of dead bodies. The process consists of an examination of the dead bodies and objects carried out by police, criminals, forensics and medical personnel.
- the identification of victims shall be carried out by police officers, forensics, medical personnel, pathologists.
- identification of the cause of the accident involving police officers, forensics and other experts.
-

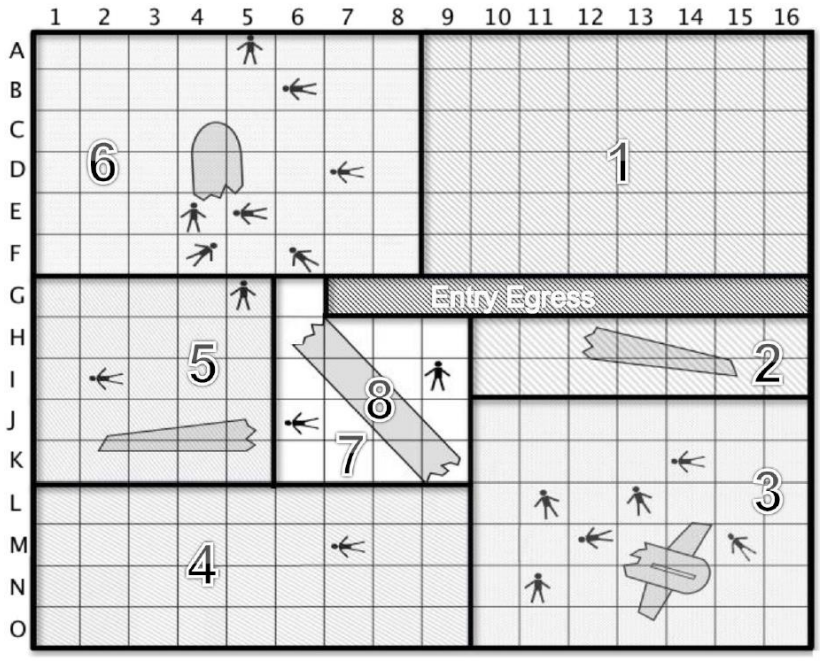


Figure 2: Accident scene divided into several sectors
Source: Interpol DVI Guide, 2018

Police work at the site of a mass accident: First, the location of the accident involving the location of the accident and its consequences shall be identified, the number of investigators and the number of investigator teams, etc. In the event of a large scale,

the location of the accident is divided into several sectors (Figure 2). The location of the accident must be marked, also dead bodies, human remains, identity documents and objects and other traces shall be marked. The location of the accident, including a sketch, measurement, photographing and video documentation, must also be recorded.

IDENTIFICATION OF VICTIMS

Interpol has developed guidelines and forms for identifying the victims of mass accidents (DVI forms). The forms are divided into three sets. Data on missing persons are entered into yellow ante-mortem forms (AM), and pink post-mortem forms (PM) are intended for data on the dead bodies.

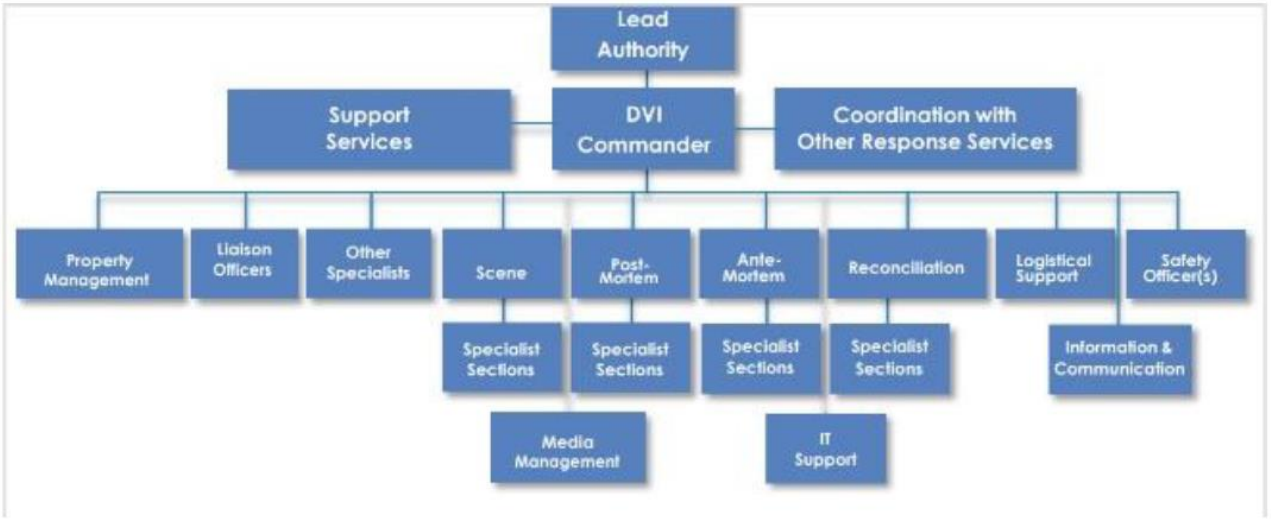


Figure 3: Disaster response management structure
Source: Interpol DVI Guide, 2018

The first identification stage is scene examination. Depending on the incident, and where it happened, it can take days or even weeks for all the victims and their property to be recovered. The second stage is Post-mortem. Specialists to detect forensic evidence to help identify the victim examine the human remains. This can include fingerprints, dental examination, DNA profiling and physical indications. The next stage is Ante-mortem with dental and medical records, fingerprints and DNA, recovered from the victims' homes or provided by family members. The last stage is reconciliation. When the PM and AM data is collected, a team of specialists compares and reconciles the two sets of information to identify the victims. The basic organizational chart for DVI command structure is in Figure 3.

Missing persons

In order to collect data on missing persons (AM data), a missing persons unit is set up, led by the so-called pre-mortem coordinator. The main task of the department

is to draw up a reliable list of victims as soon as possible. This unit uses a yellow form to identify accident victims to record pre-mortem data on all persons reported as possible victims of an accident. It is very important that the first interview with relatives, friends, etc. obtains and enters as much data as possible into Interpol's AM form. When specific medical or dental data are required, the names and addresses of family doctors and dentists should be obtained together with as much information as possible on the medical and dental history. Once all available data has been collected, the completed forms must be handed over to the pre-mortem record unit. This unit is responsible for checking that all pre-mortem reports are complete and for obtaining missing data. If the fingerprints and DNA profile of the potential victim are not yet in the record, they can be obtained from the person's home or workplace.

Photographing, video or other documentation

Documentation should start as soon as possible in order to record the location of the action and all activities. Photographic and video recording of bodies at the scene of the accident and in the morgue is important as evidence, and in many cases, they can help experts to identify the cause of the accident. Photographers should therefore be included in the search teams. Each recording must clearly show the reference numbers of the carcasses. The bodies should also be photographed in the morgue.

Finding dead victims

The search for dead victims does not begin until all survivors have been rescued. In principle, rescue teams do not move bodies and body parts, except for attempts to save lives, where a lot of bodies and evidence can reasonably be moved. The search for bodies should also be seen as part of the process of finding and securing evidence. Search teams should be aware that they are the first of many articles in the identification process and that success depends on their conscientious performance of their tasks. Their first task will be to locate and mark all bodies and body parts, locate them and mark other relevant evidence.

Each search team must be in charge of a specific area at the place of the event. A similar but separate numbering system should be used to indicate evidence and property. However, since there are likely to be many personal effects on the site, the decision whether to mark all individual items depends on the circumstances. When it comes to finding parts of the body, care should be taken not to assume immediately that they belong to the nearest body. They should be numbered and described as complete bodies. Even in the case of personal items found near the bodies, we must not assume that they belong to the nearest body. It is followed by

the work of teams that remove the bodies and bring them to the assembly point for the victims or to the place where the bodies are temporarily stored.

The team may use the so-called DVI Recovery Booklet (Figure 4). The form has several pages and is pink. The introductory page has the PM code, the country code number (e.g. for Slovenia is number 386) and the body number. An important part of the form is the labelling system. This contains a large number of labels (stickers) of varying sizes.

Figure 4: DVI Booklet
Source: NFL Forms

Label/labelling material is suitable for all types of weather and other environmental conditions (e.g. blood). On the first page of the form, information on the investigators involved in the finding of the body. The time when the victim was found dead, the forensic data and the location of the body, the sketch of the human silhouette shall indicate which part of the body is found (e.g. whole body, part of the body), the recording of the photograph of the place and the body and other information relevant for identification. Then a section with information on the time of the finding of the body, the time when the body was handed over to the death centre, the transport of the body and the receipt to the morgue. Sheets for possible sketching and other records are attached.

Coronary station

This station is the place of temporary storage of bodies and parts of bodies in bags until transport to morgues is organised. A record of accepted and stored carcasses with reference numbers should be kept here. At a later stage, data on the transfer of carcasses should be added.

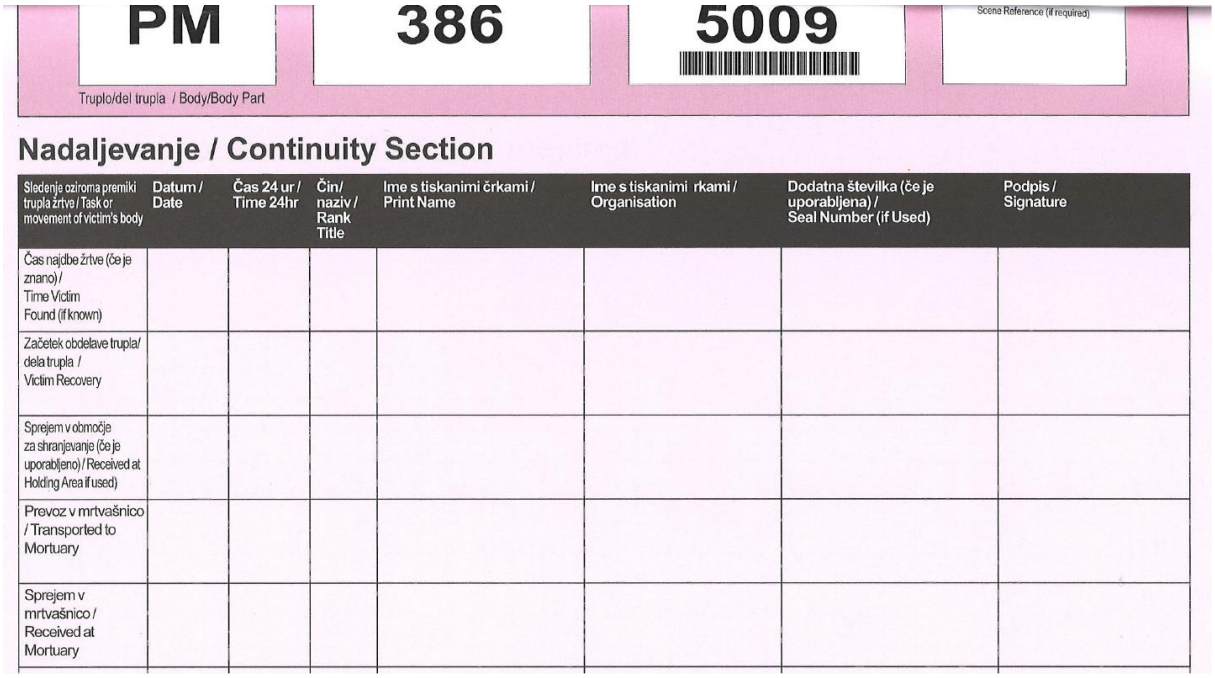
Morgue

Adequate protection from natural elements, adequate installation, running water, drainage and safety must be ensured. Ideally, it is possible to keep the bodies in a cool place (but not frozen), so it is necessary to consider truck-fridges and mobile refrigeration units. DVI groups of some countries already have their own refrigeration units, and private rentals are possible.

Post-mortem data

The post mortem or AM data unit is responsible for the collection of post-mortem or AM-related descriptions and findings for each body. A worker of this unit should be charged with collecting copies of all pink forms to identify the victims who arrive with the bodies at the point where the bodies are received. The collection of post-mortem PM data is usually carried out in the premises of the morgue, for example, in the premises of the court medicine, and, depending on the scale of the accident and other factors, by agreement also elsewhere, of course, with appropriate equipment (e.g. mobile morgues).

The recommended procedure comprises several stages. When accepting a body into the morgue, it is good to use because of good practice the already described form DVI Recovery Booklet (Figure 5) completed by the investigators in finding the body at the scene of the accident and attached to the body. In the first phase, a body is taken over in the morgue, which must have its own (unique) number. After a forensic assessment of the possible existence of traces that can assist in a criminal investigation, there is a CT painting or radiography.



PM

386

5009

Scena Reference (if required)

Truplo/del trupla / Body/Body Part

Nadaljevanje / Continuity Section

Sledenje oziroma premiki trupla žrtve / Task or movement of victim's body	Datum / Date	Čas 24 ur / Time 24hr	Čin/ naziv / Rank Title	Ime s tiskanimi črkami / Print Name	Ime s tiskanimi rkami / Organisation	Dodatna številka (če je uporabljena) / Seal Number (if Used)	Podpis / Signature
Čas najdbe žrtve (če je znano) / Time Victim Found (if known)							
Začetek obdelave trupla/ dela trupla / Victim Recovery							
Sprejem v območje za shranjevanje (če je uporabljeno) / Received at Holding Area if used)							
Prevoz v mrtvašnico / Transported to Mortuary							
Sprejem v mrtvašnico / Received at Mortuary							

Figure 5: DVI Booklet, traceability of the DVI process
Source: NFL Forms

The second phase begins with photographing or other documentation of the body. Each photo must show an identification number. It follows the completion of Interpol's DVI forms to identify victims of mass accidents and to take or scan the victim's fingerprints, especially if undressing and securing clothing can damage the fingers, such as the decomposition of the body. After fingerprinting, clothing, jewellery and other items are removed and documented. We are looking for possible external injuries on the body, tattoos.

Phase 3 is autopsy. Suitable samples (saliva, hair, blood, deep muscular tissue, teeth or bone) shall be protected for DNA analysis, and anthropological principles shall be observed. This is followed by a fourth stage, during which teeth are examined or dental status is determined.

After the quality check, i.e. the examination of all documentation, samples and photographs and other material, PM data shall be handed over to the identification centre.

Identification centre

This compares AM and PM records. A considerable amount of time is saved if a computer comparative program is used. It shows which cases are most likely to match and identifies potential cases for exclusion with a very high degree of probability. However, we must not forget that any computer program is merely a tool and that decisions and decisions can only be made after a personal assessment of all available data. After comparing all relevant data, the findings are sent to the identification commission.

Identification commission

It checks the results of the comparisons made by the various specialised sectors, identifies and reconciles possible inconsistencies and consolidates the results into the final list of identified persons. The commission is responsible for the final identification of each individual victim and must therefore be composed of the most experienced identification experts involved in the entire operation, i.e. heads of different specialised sectors at the head of the DVI. The identification commission must decide whether and when individual identification documents should be collected and issued. The commission usually includes forensics, police investigators, forensic physicians or pathologies, dentists, anthropologist. After identification, the bodies can be handed over to the locals. A transfer certificate with body number, personal details of the body and accompanying documents is issued for each body (9).

CONCLUSION

Cooperation between different services is very important for successful DVI identification. Interpol's identification process is good practice. The identification process has three areas. The first is the collection of data on persons who may be the victims of a mass accident; the second is the collection of data and the examination of dead bodies and human remains. If they match, then there is positive identification of the accident victim. With good logistical support, the primary task for DVI investigators is to identify the victims of mass accidents successfully, but they must be healthy for this task, which means they have to wear protective equipment.

The reasons for the good organisation of DVI groups in some countries are sufficient cash and adequate operational equipment, international training and also the fact that the victims of mass accidents were their citizens.

Based on the good practice of international DVI teams, the use of Interpol DVI forms is recommended. Due to the complexity of the investigations, the identification process of victims and the use of DVI forms, members of the team must be voluntarily, internationally qualified, have good equipment and resources at their disposal.

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CONTROL OF INTELLIGENT SYSTEMS IN AUTONOMOUS VEHICLES

Abstract:
The technological development of society, the technical and technological progress of industry, and especially the modernization and development of products, products and service activities to control production, services and the market, are today much more demanding procedures than in the past. We have been able to see this through the industrial development of Industry 1.0 all the way to Modern Industry 5.0, which is currently in a very fast development period. New forms of industrial production, modern forms of mobility and the ever-increasing integration of the world are forcing us to develop and to coexist more and more with natural and artificial intelligence. This can already be recognized in the use of autonomous systems in the industrial production of vehicles, in the service industry, there are more and more perceptions of the use of intelligent systems in tourism, healthcare, logistics, education and elsewhere. Industry, especially the automotive industry, mobile systems and modern technology are areas of development where intelligent systems are finding their way. More and more production systems are newly updated and they learn, improve and add new value in production processes, in mobility, in the global market, which puts the vehicle industry at the very top of the use of intelligent systems. In this, for science positive and constant development war, we were looking for mobility systems that would be safe and useful in the management of autonomous or smart vehicles involved in road transport. We looked for systems of coexistence of natural and artificial

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intelligence, which are most recognizable in mobility through transport or transport processes, where intelligent systems are expected to operate independently of man in the future, but still for human needs.

Key words: *intelligence, autonomous systems, mobility, coexistence of natural and artificial intelligence*

1 INTRODUCTION

We live in an age of industrial development 5.0, where fast transport, fast movement, time and space management are the key factors of a modern society that constantly pursues capital interests and the interests of development and science. We are aware that everything in space, environment and society is moving, circulating, changing and therefore we are not surprised that the interests of transport, mobility, logistics, information and management systems have always been and are the task of sustainable development, which means achieve the quality of a particular movement and transport. In the capital world, the definition of "time is money" is true, as modern systems of mobility, movement or flow of information, materials, capital and people affect the speed, security, mass, regularity, accuracy, frequency, accessibility and comfort of human movement. capital or things, which in the modern industrial age 5.0 is a great advantage for both industry and the market and supply of the population. Through the mastery of autonomous or intelligent systems in mobility, with the help of information and management systems, it is possible to regulate commodity, capital or human flows, which represents the mastery of the market. Therefore, regulated mobile transport systems are crucial for the development of the economy, industry, production, market and supply of the population. We can define that the main goal of regulated transport systems is movement and mobility in traffic, which should run as smoothly as possible, as safely as possible (also from a legal point of view) and as little as possible dependent on man. Industrialized countries invest heavily in systems of technical and technological improvements and through various forms of initiatives and reforms of transport systems try to place in the space with urban planning transport systems that work as consistently as possible without hesitation, without errors and do not cause damage to the environment, space, society or man and his living space. These are attempts by industry, society and man to reduce the carbon footprint and encroachment on the natural environment, space and, in particular, to reduce man's impact on climate change.

Achieving appropriate improvements in mobility and managing intelligent systems in transport has meant and still means studying individual systems, subsystems and looking for excess motivation to improve. Therefore, in order to better understand the reform and create new and much better forms of transport, we classified the systems into three categories, namely infrastructure reforms, modernization of mobile systems and education of mobile system users. infrastructure reforms and

education of users of mobile systems, we will not be able to ensure such traffic safety as envisaged by the "Vision of zero traffic accidents". From the definition, we extract the thought related to man and argue that natural intelligence (man) is still the most useful and advanced, and it should be understood that this is often unpredictable and changeable. The comparison is very weak because we do not have enough autonomous transport systems that would allow wider measurements and comparison of individual data, which would provide statistical statements and a basis for comparing performance. By reviewing the statistical data of DARS, the Road Safety Agency and the Ministry of Road Infrastructure, we get information that in road traffic most violations of road traffic regulations by man or natural intelligence, in which we see the will and activities of man as a driver. The data tell us that unadjusted speed and drunkenness of drivers are still too often the cause of accidents in the road transport system. The causes are still attributed to the person, the driver, who arbitrarily, aware of his consequences, caused the conditions for the occurrence of a traffic violation and the traffic consequences (the cause is in man or in natural intelligence). Modern development systems are looking for new solutions where they want to relieve man of the burden of managing mobile systems and put him in a position to use mobile systems run and operated by artificial intelligent systems, intelligent vehicles and intelligent infrastructure.

To identify autonomous intelligent mobile systems, we studied a number of systems, their capabilities, identifying and detecting barriers, studying and learning systems, and recording the necessary data to improve systems. To achieve this, we had to exclude human influence as much as possible and only then use the achievements of natural intelligence, which we left to recognize individual movements, movements, procedures, decision-making, perceptions and responses, so artificial intelligence itself learned necessary movements, otherwise performed by man. The assumption was that the highest possible level of safety in the transport system will be achieved only by gradually excluding natural intelligence from the vehicle management process and replacing it with artificial intelligence, which we believe is more predictable and unchanging. We estimate that the development of intelligent systems will go in the direction of automation of mobility, where autonomous vehicles will significantly contribute to safety in the road transport system, relying on the claim that intelligent systems are more predictable and reliable in structure, functionality and properties than natural intelligence or a person who has emotions, emotions, adrenaline, quick decisions, etc. To adequately demonstrate this, we tackled four key research questions, the answers to which provided the basis for our claim. First of all, it was necessary to investigate the current situation of road safety, to study the operation of currently operating intelligent systems and to prove or disprove the claim that the key factor in road safety is still human, or to confirm through research that modern autonomous systems can work flawlessly and without impact. man, which raises many questions to which we do not yet have answers.

Mastering autonomous intelligent systems means knowing all the advantages and disadvantages of autonomous vehicles and through the obtained data, measurements, comparisons, analyzes, etc. look for solutions to upgrade them. We started from the assumption that in the future there will be more and more vehicles in mobile systems, which will be more and more sophisticated and will offer drivers and users fast and safe movement in space and time. The best possible solution would be the introduction of autonomous vehicles in public road transport, so we took a closer look at the situation on the market of autonomous vehicles, which in time and space achieve capital values and scientific progress. We had an insight into the data of the current offer on the market, which was presented in the field of autonomous vehicles by the automotive industry. Numerous conferences, talks with manufacturers, participation in some development projects were the basis for even deeper thinking and finding answers. This raised the question of whether and to what extent automated or smart vehicles will improve road safety. We have information on available information, management systems and technology built into autonomous vehicles, many tests and studies of the performance and usability of these vehicles are underway, but we do not have useful information on the integration of these vehicles into mobile systems. We knew that before the introduction of autonomous vehicles in the transport system of independent operation of the vehicle, a thorough legal reform will be needed, which will define the use of intelligent systems in public road transport. It is a question of current legislation, which in its norms directs, commands, warns or imposes forms and procedures of road traffic, where only the driver (man) is mentioned and orders him to keep the entire course of driving under control to monitor the flow of traffic. to behave according to traffic regulations and take care of the safety of everyone in road traffic. The question is how autonomous systems will respond in traffic, how they will recognize traffic density, how they will recognize traffic signs, how they will respect traffic regulations and how they will behave during mobility. In addition, a thorough reform of criminal law is needed, as the introduction and use of autonomous vehicles raises the question of who bears criminal and material responsibility in the event of an autonomous (self-driving) vehicle involved in the accident.

The autonomous vehicle industry is still in its infancy to introduce new forms of mobility. Much has been written about autonomous vehicles (intelligent systems), but there is a lack of actual data (because autonomous vehicles are not yet sufficiently present in transport systems) mainly for predictions and theoretical models of new vehicles, which can be a fad and a marketing way to acquire new ones. customers. Thus, we must point out that our research is also about questionable hypotheses and we must recognize that the actual analysis of the situation will require much more time and data on how autonomous vehicles will actually behave in the transport system and how they can be included in road transport and the acquis. These are mainly technological issues that will have to be transferred to the

real life situation when an autonomous vehicle is involved in natural road traffic between people.

2 SYSTEM AUTONOMY AS A RESEARCH AREA

Through its research programs, the vehicle industry is constantly looking for models and systems that will help drivers, while looking for technological advances that will systematically allow the vehicle to move only in road traffic, with the driver or individual was a silent observer of the capabilities of these vehicles. So the industry is looking for conditions where, with the help of computer intelligent systems, the brain or smart systems would be installed in the vehicle, which will enable the vehicle to move in road traffic, as it would be operated by the most qualified person. We are talking about an autonomous vehicle which, with sufficient technological and technical characteristics, with the help of information and management systems, should perform mobility in road traffic, without the help of a driver or natural intelligence. It is about industrial trade secrets, it is about industrial technological or intellectual war, it is about market control and, above all, it is about gaining and retaining customers for new products. At what stage of development is the industry and how far has it changed mobility with the introduction of new systems, we can only guess and use only the results of publications and presentations that the industry publishes and leaves to readers, viewers and future users to admire. In some previous articles and diploma theses at the higher education level (Agovič, 2021) we presented some published advantages of modern mobility, where representatives published part of their intelligent technology, which is built into mobility, but we did not get concrete data that would showed us modern technologically advanced vehicles that would be autonomous and would actually perform mobility on their own. These are, in fact, prototypes of vehicles that are technologically advanced for technologically advanced infrastructure, and their testing is performed on certain road surfaces, which are the only ones that enable such mobility. Throughout the development of movement and the development of means of transport, the vehicle industry has strived to modernize, starting with the introduction of hydraulics, better electronics, better use of propulsion energy, introduction of aesthetics, introduction of accompanying technology that allows relaxation while driving (radio, telephone). however, there is more and more digital navigation and management technology to help the driver. Rare examples show that it is possible to include in the market a fully autonomous vehicle that systematically recalculates the environment, space, infrastructure, people and safely travels from point A to point B or to one place and another and performs the transport of goods or passengers.

2.1 Autonomous vehicles

When we talk about autonomous vehicles, most those unfamiliar with the development of technology will not know what we are talking about and will imagine

that it is only newer vehicles that are technologically updated, have new technology and are more popular with customers. Those who follow technological advances will know that autonomous vehicles are smart vehicles that, with the help of built-in computer control and monitoring systems and environmental identification systems, enable the vehicle to be driven or operated without human presence. Some improved electric, hybrid and motor vehicles are already in circulation today, with new fully autonomous systems (Boston Dynamics) already operating, but most of these (autonomous) vehicles on the market are only partially autonomous and are currently mainly autonomous. to help man, but they are by no means his substitute. Fully autonomous vehicles would be categorized by the Association of Automotive Engineers (SAE, 2004), vehicles with full autonomy of Industry 5.0 or Industry "Z" or Industry "5G" as the Japanese call it, which should operate completely independently, with human control in the vehicle it would not be necessary. For the time being, it is assumed that such an autonomous vehicle will only control the operation of its components, modify or supplement programs accordingly, which means that it would respond appropriately and adapt to the constant road conditions and safely withdraw from traffic if driving assessed that this was urgently needed or that there were needs for it, which we perceive in natural intelligence. The authors usually list several types of autonomous vehicles from different manufacturers, and in the present article, due to the scope and breadth of the research area, we will focus mainly on two types. Some vehicles are autonomous only in a certain environment and these are mainly industrial vehicles whose environment is pre-programmed or otherwise defined (infrastructure is defined, management is in the internal management system, vehicles are of local importance, such as AGV as an industrial vehicle), then its purpose is determined. The second type of vehicles are systemically more sophisticated vehicles that are able to perform their function with the help of information and management systems, constantly drawing information from the environment and are consequently able to operate in an unfamiliar environment through learning about the environment in which they operate. because they learn and keep all the data in their system (Martinčič, 2019). In this part, it is worth noting the difference between automated driving, where some driving systems or vehicles are systematically, informationally and managerially designed to perform their mission alone (trams, subways, etc.) and autonomous driving, where the vehicle as a person takes over all tasks or part of the tasks) in the operation of the vehicle, as would be done by a human, while in the case of an autonomous system it is expected that it is not error-prone. We looked for a comparison in automated production systems, where autonomous systems are made in such a way that the software itself adapts to the type of product, time and usability, which is too early to say about the final products or autonomous vehicle.

The authors explain that the idea of autonomous or self-driving vehicles (originally called self-driving vehicles - trams) is relatively at least 100, maybe 200 years old. Through time and space, technological advances have guided capital, users and the market, so developers of modern systems have been dealing with the development

problem for almost two centuries and have only recently devoted themselves to developing automation in the road and automotive industries. Here, with the help of information, navigation and management systems, useful solutions have been found that have the potential to develop autonomous vehicles for wide use. The biggest problem facing autonomous systems engineers in road vehicles is the density and number of road systems, which was the main reason why the automotive industry lags so technologically behind solutions in, say, aviation developed autopilots). This is due to the fact that road transport was and still is considered to be the most complex form of transport, where there are countless more variables present at all times than in air transport (Zelenika, 2010). The preparation of an autonomous mobility system and vehicles capable of performing transport or transport actions on their own require a lot of research, mathematical calculations and, above all, recognition of the human nervous system and its eye, ear, smell (natural intelligence). It is therefore understandable that technological progress has been gradual and so as early as 1912, just nine years after the invention of the airplane, Lawrence Sperry introduced the first working autopilot based on a gyroscope (W. Schneck, 2004). Below we have information that Xwing in 2020 presented a fully functional autonomous prototype aircraft (Xwing, 2020), which, like man, systematically manages the aircraft in its takeoff, flight and landing, without passengers noticing that there is no human during maneuvering. pilot. In rail transport, automation also imposes certain modernization requirements, but the infrastructure is simple because rolling stock runs on rails that fully define its rolling stock or infrastructure, so it is possible that rolling stock can run completely autonomously today. Trains are autonomous vehicles that run in completely closed systems, the most famous being Rio Tinto in Australia (IRJ, 2019), noting that testing of autonomous passenger and rail connections in open systems is a long way off.

It is the number of variables in road traffic that has played a decisive role in a vehicle with simple mechanical solutions, such as Geddes 'system of driving vehicles with magnetic relays on the road, which did not work despite public interest and car manufacturers' efforts (CHM, 2014). It became increasingly clear that such vehicles (cars) were not suitable for the road because they were dangerous and cumbersome, and a major problem was to set up lane-changing systems on the motorway. There was also no data on the operation of the vehicle in traffic centers and the question was how to give such a vehicle the autonomy necessary to operate in an open transport system. Despite the unknowns, progress has continued, and even then some computer pioneers, including John McCarthy, wrote about the concept of autonomous vehicles, which in the future will use video cameras to obtain information from the environment, processed in real time by computers installed in vehicle and the vehicle will receive the necessary driving information. McCarthy presented the theoretical idea of an autonomous vehicle based on reverse engineering of animal systems. He argued that vehicles would receive information about the environment through sensing systems, process it, and respond to

information appropriately, which would be recognized by proper vehicle movement (Mccarthy, 1968). The first such car was introduced in the 1980s by German Ernst Dickmans. His vehicle (car) was very similar in shape and characteristics to McCarthy's vision, but the computational power of analog computers at the time was still significantly too small for his vehicle to safely integrate into the existing transport system. Interesting is the data of Dickmanns, who says that the calculation showed that he would need a computer that would analyze at least 10 frames per second in order for the vehicle to respond appropriately to the traffic situation. Unfortunately, he had a computer available that could only analyze one in 10 minutes. At that time, information and management systems were still in development, and computer systems were not yet able to keep up with developments. It was clear that the key to autonomous vehicles is hidden in a powerful computer system and advanced sensors that would allow to identify the situation in road traffic (appropriate deviations, safety). Confirmation of this opinion is obtained in recent decades, when autonomous vehicles controlled by complex computer systems appeared on the market with the development of artificial intelligence, which instead of Dickmannson's projected 10 frames per second process as many as 2400 frames (in the case of Tesla HW3). Progress has been very great, but it is still impossible to talk about the complete autonomy of passenger cars, which would at least perceive and perform transport and road transport in the same way as humans. From the findings, data on the complexity and complexity of the road transport system and the system of perception of artificial intelligence.

Technological progress in the field of introduction of autonomous systems in the field of mobility and especially in the field of road transport requires a lot of research, system adaptations and the introduction of new technologies. This progress is a trade secret, which is why there are differences in the quality of individual new vehicles and their technology. Due to the degree of autonomy of different vehicles, it made sense to classify vehicles according to the degree of autonomy, which was done by the SAE (Society of Automobile Engineers), which classified autonomous vehicles into six categories according to the degree of vehicle autonomy. Level "0" means completely without automation and man manages all aspects of driving, and level "5" means full automation, which means that the vehicle autonomously and only regardless of road or surrounding conditions recognizes driving conditions and uses them for its intended purpose . Due to many development and legal issues, only 3 levels of automation are currently on the market, which are conditionally automated vehicles, where the vehicle takes control of all aspects of driving with the expectation that a person will respond to specific and unexpected road events. It is worth mentioning that in richer EU countries, legislation is already being prepared or is being prepared that allows level 3 autonomous driving. In addition to the EU, this area has been regulated by China, Japan and the United States. Special mention should be made of China, which is the only country in the world where t.i. robotaxies that work with the 4th and in some

places even the 5th degree of autonomy. Unfortunately, third-level driving is not yet possible in Slovenia. (ZPrCP, 2010).

2.2 Road safety – natural or artificial intelligence

Road traffic safety is theoretically regulated by the Road Traffic Safety Act (Official Gazette of the Republic of Slovenia, No. 56/08 - official consolidated text, 57/08 - ZLDUVCP, 58/09, 36/10, 106/10 - ZMV, 109/10 - ZCes-1, 109/10 - ZPrCP, 109/10 - ZVoz, 39/11 - ZJZ-E, 75/17 - ZMV-1 and 10/18 - ZCes-1C), which in Article 2 imposes that road users should be careful and ensure that traffic is smooth, calm and safe. Therefore, there is a general belief that all road users and those responsible for road safety and regulation will comply with road safety and public road regulations. The law specifically states that when road users are children, the elderly, the blind, the disabled and other persons who are not fully capable of participating independently in road traffic, other participants are obliged to pay special attention to them and, if the law so provides, also help. The provision of Article 3, which states that physically or mentally handicapped persons whose impairment poses an increased risk to them or others in road traffic, may be included in traffic when they themselves or those responsible for them do everything possible. not to endanger themselves or other road users. These are legal provisions or rules of road traffic regulation that are oriented towards natural intelligence and are not recognized by artificial intelligence, cannot be observed and cannot show life situations in traffic. Road users must follow traffic rules, citing exceptions that artificial intelligence cannot detect, as it involves simultaneous perception, recognition, listening and inspection, enabling rapid decision-making. Therefore, road users must act in a way that does not obstruct or endanger or harm other road users.

From what has been said, we must understand that the problem of road safety, despite numerous modernizations, improvements and systemic regulation of transport and transport infrastructure and means of transport, is still a central topic of European and Slovenian transport policy, which is still not regulated. The issue of regulation is especially raised when we talk about the inclusion of autonomous vehicles in road transport, because they do not have all the perceptions as stated in the legal provision and the same treatment cannot be expected. Statistics show that road safety in Europe is improving significantly, with the number of victims of road accidents declining, but the numbers are still worrying. This is a broader problem, where road accidents are a major health problem in the EU, which is up to 30 times higher than the risk of injury to an industrial worker compared to the risk of injury to a road user.

If we believe that natural intelligence is erroneous and claim that artificial intelligence is perfect or infallible, we must review the causes of traffic accidents, which would be the starting point for identifying comparative patterns where artificial intelligence could make road traffic safer. . Data from DARS, the Agency of

the Republic of Slovenia and the Ministry of Road Infrastructure show that the worrying data for road deaths is speeding and driving under the influence of alcohol or other prohibited substances. In this direction, a number of activities have been carried out to prevent the occurrence and consequences of traffic accidents, which are organized throughout the European Union. The aim was to educate drivers and prepare them for more careful and safer participation in road traffic through various campaigns. This sentence is information on natural intelligence, which is unpredictable and unreliable and will, despite all initiatives, remain a major factor in road accidents. To control, change, control and sanction it. We used only a few criteria for clarification, which does not represent data through which we could talk about speeding and driving under the influence of alcohol or illicit substances. This is the basis for explaining that the functioning of natural intelligence in road transport depends on a number of factors over which we have no or at least insufficient influence at the legislative level. The essential human factor is people's incoherence and fatigue, which is a completely characteristic of natural intelligence, which in the case of artificial intelligence cannot be set as a concept or criterion for data processing. In addition to the technical, capital, market and other elements involved in the development of intelligent or smart vehicles, thinking is moving in the direction of avoiding the factors that affect natural intelligence with artificial intelligence. The primary characteristics of artificial intelligence are reliability and predictability, which theorists argue that autonomous vehicles can be included in traffic safety with great certainty and that transferring the entire process from natural intelligence to artificial intelligence will significantly contribute to a safer and more controlled transport system. The question is also how to integrate autonomous vehicles into the world of natural intelligence or to have separate mobility with natural and especially with artificial intelligence. There are many unknowns, but there are interests and technological advances that want to change the world, so we submit to this and study systems and subsystems and look for scientific answers.

3 ADVANTAGES AND DISADVANTAGES OF AUTONOMOUS SYSTEMS THROUGH THE RESEARCH THESIS

The starting point for setting hypotheses or theses of the research field is very questionable, as it is a field that is very interesting from a production, marketing, useful, theoretical and also scientific point of view. To measure it, set values and benefit, however, there are too many unknowns that inhibit quick decisions. It is very interesting to see improved electric, hybrid and motor vehicles, it is very interesting to see and use new forms of infrastructure, it is especially interesting to test individual autonomous vehicles in the internal infrastructure of industry, which are carriers of production. and technologically upgraded existing systems, which are in the form, type of energy, method of performing improvements used by man. This is a major leap forward in the fifth generation of Industry 5.0, which introduces new perspectives, seeks market opportunities and offers a surplus of technical and

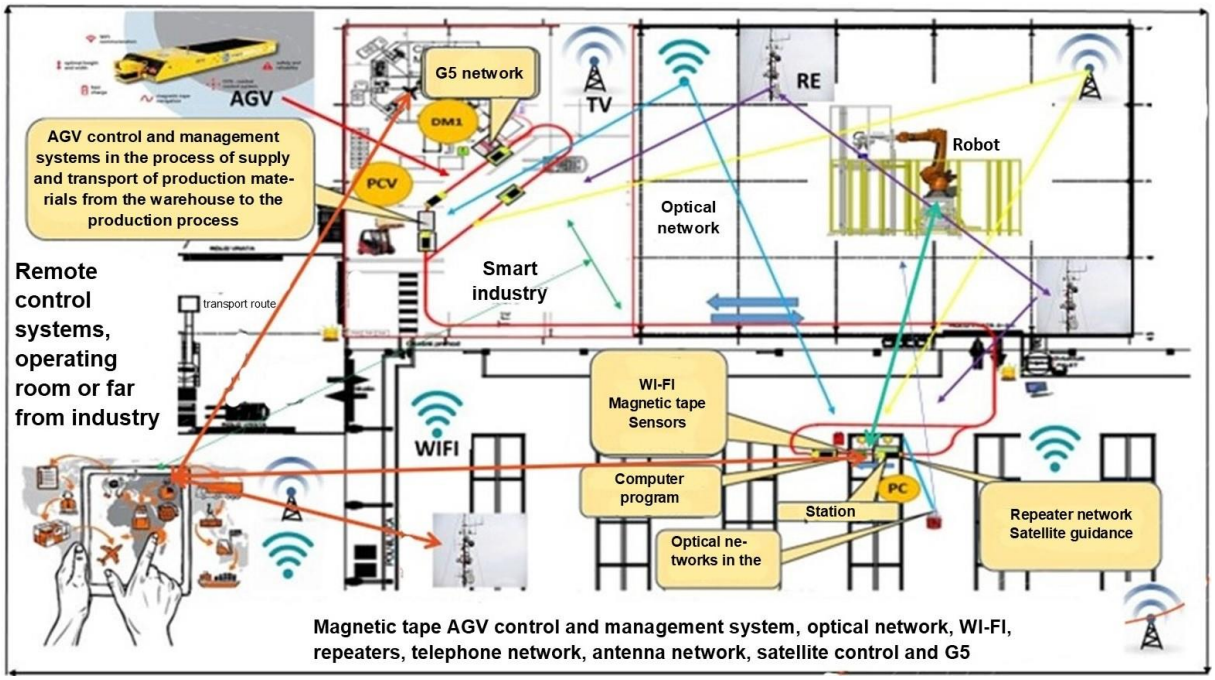
technological advantages, but we are still in the world of the existing transport system, which is slowly but steadily introducing new mobility. In the research area, we deliberately described the chapters autonomous vehicles and road safety, which gave us a basis for determining the thesis of the research, which reads "Intelligent systems could significantly contribute to improving road safety." Therefore, through the review of the obtained data, the study of available research and the achievements of individual industries, we sought answers that would confirm or refute the thesis. Many demonstrations are interesting to read and know about the advancement of technology, information, management systems, sustainable and industrial development, but the wide use and applicability of the theory and the mentioned achievements is questionable. At the same time, we understand that this is a newer form of mobility that will not be accessible to a wider range of users, as it is expected that usable autonomous vehicles in road transport will achieve high market prices, as with the advent of electric vehicles and that their use will possible only in the third lifetime or service life (periods are divided into the first period of use of new autonomous vehicles, which should be between 5 and 7 years, the second period should be between 7 and 12 years and the third period over 12 years). Autonomous vehicles would not be available to all users after 12 years of use, which is theoretically true, as today the market scheme of motor, hybrid and electric vehicles is similar. The thesis covers new forms of mobility, which should enable the preservation and protection of the environment and space, reduce the use of various energy sources, preserve infrastructure and relieve man as a driver, as autonomy means that the vehicle moves without the influence of natural intelligence.

4 MODERN MOBILITY AS A STARTING POINT FOR AUTONOMOUS VEHICLE RESEARCH

As part of the economic development of an individual country and globally much wider in relation to usable markets, industry is a factor that constantly takes care of internal development, modernization of production, introduction of autonomous systems, robots and digital forms of control, developing better information and management systems. All efforts are towards better production, a better and more attractive product, market advantages and, in terms of capital, a better financial surplus, which is reflected in capital values. The technology of modern industry, ie digitalization, informatization, robotics, intelligent systems and autonomous devices, represent the industrial technological development of generation 5.0, which also includes the system of introducing modern forms of mobility. The Mobility Review shows that technological advances are first used in the airspace, as airplane autopilot systems have been around for decades and have long successfully detected the shapes and uses of modern navigation technology, which is the foundation of autonomous aircraft. Also in the field of railway mobility, processes have been modernized and intelligent systems have been introduced, which enable the management and administration of vehicles on driverless tracks (high-speed rail, trams, metros ...). The introduction of newer systems means the improvement of

existing ones, which is already part of the sustainable development of mobility in rail transport. In the field of water transport, more modern ships and other vessels are equipped with intelligent systems that detect water depth, side and other obstacles and allow vehicles to sail without constant supervision by a natural person. The most widespread forms of mobility use are road transport and road infrastructure, which is constantly being developed, updated and adapted to new forms of vehicles and transport. There are more and more examples of fully intelligent infrastructure that allows the navigation of cars and other road vehicles, but it is still impossible to talk about autonomous driving, safe driving with automatic drivers or intelligent systems. We found that improvements to vehicles, mobile systems, information and management systems, forms of energy for movement, aesthetics and software 4.0 Industry represent only technological improvements that are of marketing importance and do not represent autonomous vehicles. Everything helps the natural intelligence, ie the driver who still drives the vehicle, takes care of road safety and is responsible for the consequences. Whether we can talk about semi-intelligent or intelligent systems is too early to say, because we are very close to the time when the infrastructure in green Europe will be so arranged that it will allow the slow introduction of electric and then smart vehicles in road transport. Despite this finding, we must clarify at the outset of our research that we are talking about the advantages and disadvantages of autonomous vehicles, noting that we do not yet have accurate data, because these vehicles are not yet sufficient (in the case of autonomous vehicles 3rd autonomy) or not at all (in the case of autonomous vehicles of the 4th and 5th autonomy levels) involved in road transport. Thus, our research and our conclusions are very limited, so we need to clarify that much more data on how these vehicles behave in road traffic will be needed before we can make a reliable assessment of the usability of autonomous vehicles. Through data analysis, we can only assume that autonomous (smart) vehicles enable error-free driving because they do not depend on concentration, physical ability, health, fitness, readiness to drive and other circumstances that plague the human driver. If our assumption is correct, then we can say that the driving of autonomous vehicles is optimally calculated and such vehicles should operate continuously and be able to consistently observe safe operation or compliance with traffic regulations. A comparison can be found in the research of TPV Novo mesto and FINI Novo mesto, where the research project studied, measured and controlled the operation of AGV (robot) in the process of supplying materials for production, where AGV plays the role of a transport vehicle guided by eight different systems (Murtič et al., 2019). The vehicle is interesting and suitable for internal transport within the industry, and based on verified data we tried to find out how a personal vehicle would behave in public road transport, with at least these eight intelligent autonomous vehicle control and management systems.

Figure 1: Combined AGV autonomous vehicle control systems in industrial production – also applicable in road transport



Source: Authors' own simulation 2021.

We are talking about an autonomous vehicle that is supposed to transport passengers in road traffic, and we do not yet know the type, shape, make, brand, characteristics of the vehicle, source of propulsion energy ... There are many unknowns, but everything needs to be checked , test, test and only then find solutions for use. It is encouraging to talk only about experiments and individual research, but it is too early to talk about a useful autonomous vehicle. British experts warn that naming assistance technologies with inappropriate names can lead to overestimation of their abilities by drivers. Otherwise, the production of an autonomous car is one of the long-term priorities of many car manufacturers. Some already offer technologies that enable at least partially autonomous driving or at least take over part of the driver's tasks, but there are no real and reliable autonomous passenger cars in public road transport yet and the question is when they will be used (Avtomagazin https: // avto-magazin.metropolitan.si/novice/uporaba-izraza-avtonomno-vozilo-je-lahko-nevarna/).

They are a bit more self-evident in the German Volkswagen industry, where they state that they anticipate that intelligent systems will soon be able to operate even in complex autonomous driving situations. In the field of freight transport, Germany is also introducing hybrid and electric lorries, which combine electricity as a propellant and diesel fuel on parts of the road where there is no electricity, using a system of sliding wire along the mains as with electric trains. Tesla is also very active, with an advantage in the system of electric vehicles, which collect the necessary driving data using artificial intelligence during use, which helps to quickly improve

existing systems, including neural networks that teach the car to drive better. and better (https://www.rtvslo.si › zabava-in-slog › avtomobilnost). The googlemaps system works with an intelligent system and enters all road measurements with satellite coding, which Tesla's vehicle writes in memory and learns to drive only. The starting points of the given data require clarification in the form of a definition, so we could already say from these collected data that an autonomous vehicle could be given a definition, which says that an autonomous or self-driving vehicle is a useful vehicle capable of perceiving its surroundings. space, orientate yourself and drive safely in road traffic without human supervision. These vehicles have various sensors such as radar, Lidar, sonar, GPS, then and inertia measuring units, which the control system collects and interprets by steering the vehicle in the right direction, taking into account traffic signals, which aim to cover a certain distance with the correct avoiding possible obstacles (https://sl.wikipedia.org ›wiki› Samovozeči_avtomobil).

Interestingly, Omid Ebadi argues in his study that only if 10% of vehicles on the road drive autonomously, the number of accidents, especially collisions and collisions, would be significantly reduced. This is a completely theoretical research that should be checked and tested in the natural environment or in road traffic or practice. It further shows that an autonomous vehicle reacts to an unforeseen event on average about 1.2 seconds earlier than a human (Ebadi, 2018). Continuing the theoretical assumptions, the author Goldin expects that the morning and afternoon peaks will be practically non-existent or will be significantly reduced, but he does not state any solid practical argument and everything remains only in theory. His conclusion is based on the claim that with the help of optimal driving, which would be theoretically capable of autonomous driving, we would significantly improve traffic flow and consequently reduce road congestion (Goldin, 2018). Whether autonomous vehicles are a fact or a technological search for marketable products, it is too early to say, as we assume that these vehicles will have a major advantage in reducing the energy needed to drive in the future, and research shows that theoretically and they would not have to overcome air resistance (just an interesting theory). In addition, greater mobility of the population would be possible, as such vehicles could be used by all persons or the concept of public vehicles applicable to all under the same conditions. What does this mean for the future and what can we expect from the economy, society and science? Given the autonomy, another advantage is possible, which is reflected in the reduction of the need for individual garage, as these vehicles could leave or arrive at the desired destination at the request of the owner, take the owner (or client) wherever he wants and return to starting point or to the parking lot. Theoretically, these are very remote solutions that require many adjustments at both the infrastructural and social levels (Kattan, 2018). It is interesting to see how the company will cope with changes in movement and the loss of many jobs of people who carried passengers, because the company will have to retrain many drivers and ensure a successful transition to other areas of work. Cohen and Hopkins warn that the jobs of carrier, bus driver, delivery man,

driving instructor, and many others will be taken over by autonomous systems, so these professions will no longer be needed (Cohen and Hopkins, 2019). In the following, many authors point out the need for control and special attention in the field of cyber security of modern vehicles. These vehicles are merely high-performance computer systems that are presumed not to be completely secure (100%), especially not those whose operation is conditioned by a continuous connection to the Internet.
The growth of autonomous vehicles in the future will be mainly defined by energy consumption and consumption, which is why a green agenda is emerging in Europe, which is increasingly trying to promote the use of electricity https://ec.europa.eu/info/strategy/priorities-2019-2024/ european-green-deal_en). In order to increase this, the public will need to be reassured that autonomous vehicles are safer and safer than vehicles with a driver. Education on how autonomous vehicles operate in public road transport today can be compared to the characteristics and capabilities of automated and autonomous vehicles, with the former being sophisticated but sophisticated driver assistance systems, and unlike the latter, vehicles are completely independent and operate with the help of their own intelligence, taking into account information and management systems and built smart infrastructure. Unfortunately, we can only talk about such vehicles in the internal transport industry (Murtič, Franko, 2019), where vehicles perform the function of transport and the function of autonomous systems, which we would like to have in public road transport.

4.1 Legal security in autonomous vehicle traffic

One of the biggest challenges in introducing autonomous vehicles to the market and integrating these vehicles into public road transport is undoubtedly the legal aspect, which includes (requiring) compliance with legal regulations, identification and compliance with traffic signals and liability for any damage resulting from use and participation. autonomous vehicles in public road transport, which would be involved in a traffic accident where harmful consequences would occur. Even greater is the issue of dealing with the participation of an autonomous vehicle in a traffic or other accident where injuries or death of natural persons would occur. It must be understood that the legislator cannot keep up with constant technical and technological progress, and therefore cannot foresee all the life situations that will arise when using autonomous vehicles. For the field of legal regulation, autonomous vehicles represent a novelty, consequently all actions, legal legislative processes, procedures and also the use are unique in the legal field. Uniqueness is the level of ignorance about the technique and technology of autonomous vehicles, which are recognizable or known in the field of engineering from an engineering point of view. These are vehicles that are not yet covered by the acquis and in which the emphasis is not on man as a driver (natural intelligence), but on an intelligent integrated (computer) control system that operates the vehicle independently of man. There is no appropriate legal regulation for these vehicles and their use and participation in

road traffic (not written because it is not yet known) and coexistence with man-made vehicles is not known, which explains that most of the legislation that regulates the field today road traffic and prescribes what vehicles can be driven on the roads, is not suitable for regulating relations in road traffic in which autonomous vehicles are or will be involved. As an example, we can give the requirement of the Road Safety Act, which states the need for constant grip of the steering system while driving (ZPrCP, 2010). Despite many unknowns, many countries are supporting the development of autonomous systems in line with the Green Agenda, including Germany, the United Kingdom, France, Spain and Italy. vehicles on these roads and allow autonomous level 3 driving, while in the western United States, China and Japan such driving is already allowed, but they still hide information on how they legally regulated this area.

It should be noted that at the general level of the EU, the revised Geneva Convention has been in force since 2016, which slowly and with the help of legal regulations allows the transfer of vehicle control to autonomous systems (Unece, 2016). This is a modern field of mobility within the EU, so in the future it is expected that the introduction of autonomous vehicles in road transport will be regulated at EU level and guidelines for infrastructure and legal framework will be provided from the EU center. . The legal field that is supposed to regulate the use of autonomous vehicles includes a wide range of law and legal norms that are supposed to regulate the field of development, production, testing, use and finally the participation of these vehicles in road traffic (Jankovič, Murtič, 2019).

4.2 An overview of interesting events related to road safety

The definition of an autonomous vehicle has already taught us that this is a new form of mobility, in which an autonomous (intelligent) vehicle is expected to be just a vehicle in public road transport and will only manage all life situations in traffic that natural intelligence currently needs. master at every moment when a person is involved with a vehicle in road traffic. As this is a new form of mobility that reduces and completely excludes the role of the human driver (natural intelligence) in its operation, the capabilities of autonomous systems need to be further explored and the transfer of vehicle management to intelligent computer control systems needs to be examined. From a legal point of view, the question of who is responsible (materially and culpably) for the conduct of an autonomous vehicle, for the consequences and damage that could occur as a result of a traffic accident is particularly interesting. The data show that vehicle manufacturers and legislators are on opposite banks, bearing in mind that capital dictates the development, advancement of technology and technological systems, so different studies and different responses are expected in the market and in road transport. Currently available autonomous vehicles are autonomous vehicles presented as vehicles with a maximum of level 3 autonomy, where the constant attention of the driver is still required, who, despite autonomous systems, must be involved in traffic throughout

the driving process and ready to take control of the vehicle. The driver (natural intelligence) is responsible for the movement, movement and driving of the vehicle in public road transport. The key to learning about improved systems is to familiarize the driver with the capabilities of the systems, handling and management procedures, because he will be responsible for all movements with such a vehicle. These are information management systems that help the driver in the form of technological advances, easier vehicle management, faster and safer driving, as the systems detect many deviations from the rules of the road and warn the driver that he must correct his driving. In order to obtain more useful information, we need to review some responsive traffic accidents that support thinking and deciding how to include an autonomous vehicle in public road transport.

We cite an accident that occurred in March 2018 in the US state of Arizona, in which a test autonomous vehicle Uber drove to death a pedestrian who illegally crossed a two-lane road. The autonomous computer system detected it on foot, but as a detection and apparently did not recognize it as an obstacle on the road, so it neither braked nor warned Uber's test driver, who was in the vehicle, of the danger. As it turned out, the Uber test driver was not paying attention to what was happening on the road, otherwise she could have prevented the accident by taking control of the vehicle in time. There is no legal basis for punishing artificial intelligence, so the prosecution accused the driver of the Uber vehicle of reckless driving, stating that the accident could have been avoided if natural intelligence had been involved with the proper use of the autonomous system. The complexity of the case has not yet received a judicial epilogue, and the case serves as an example to many researchers of ambiguities related to the production, use and integration of autonomous systems in public road transport. Research has shown that modern technology is not yet sophisticated and ready to take control of traffic, so it is imperative that the driver is still a key component of driving. The case of the accident was the reason that Uber's license to test only driving vehicles was revoked, which was the reason why they soon stopped developing intelligent systems and withdrew their products from the market, as did some other manufacturers (Pavla, 2018). Some other cases are known in Germany where similar tests have been carried out, showing that the autonomous vehicle has sufficient systems for detecting paths, detecting obstacles, detecting rain, temperature, slippery roads and many others, for driving in public important factors in road traffic, but they did not leave anything to chance and carefully monitored all tests with human or natural intelligence.

5 RESEARCH METHODOLOGY

This scientific research defines the content that is systematically defined in the design and conception of the model of new mobility represented by new vehicles and especially new autonomous systems that combine vehicle and driving system (artificial intelligence) into a driver component, which should mean independent integration of autonomous vehicles in public road transport. It is a study of the

technique and technology of various systems of the fifth generation or industry 5.0, which is a significant problem mainly because the data is still under development and is a trade secret of the motor, hybrid or electric industry and it is impossible to get concrete data. Therefore, we were forced to obtain data through numerous researches in the development centers of individual industries, individual institutes for technological development, agencies and institutes, for which the study of autonomous systems is a key task. The conceptualization of the data alone was not sufficient; the procedures and methods of study apply to an individual country, an individual federation of countries, to an individual industry and also to an individual faculty or institute. Therefore, we had to study the extensive literature of various authors, we studied a number of known examples of the participation of autonomous vehicles in road traffic and the consequences of individual tests of use. In doing so, we were given concrete indicators that guided us in the process of creating autonomous systems and indicators that reminded us that for certain scientific achievements in law it is necessary to have a legal norm that allows the use or application of new systems. As these are new information and management systems, it was necessary to study a number of internal legal bases that apply in the territory of Slovenia. We studied the Roads Act (Official Gazette of the Republic of Slovenia, No. 109/10, 48/12, 36/14 - US decisions, 46/15 and 10/18), the Road Traffic Safety Act (Official Gazette of the Republic of Slovenia, No. 56). / 08 - official consolidated text, 57/08 - ZLDUVCP, 58/09, 36/10, 106/10 - ZMV, 109/10 - ZCes-1, 109/10 - ZPrCP, 109/10 - ZVoz, 39/11 - ZJZ-E, 75/17 - ZMV-1 and 10/18 - ZCes-1C), Motor Vehicles Act (Official Gazette of the Republic of Slovenia, No. 75/17 and 92/20 - ZPrCP-E), Road Traffic Rules Act of Official Traffic (Official Gazette of the Republic of Slovenia, No. 82/13 - official consolidated text, 69/17 - amended, 68/16, 54/17, 3/18 - US decision, 43/19 - ZVoz-1B and 92/20), The Drivers Act (Official Gazette of the Republic of Slovenia, no. 85/16, 67/17, 21/18 - ZNOrg, 43/19 and 139/20), Rules on driving licenses (Official Gazette of the Republic of Slovenia, no. 68/11, 55/12, 4/13, 7/14, 32/16, 85/16 - ZVoz-1 and 200/20) and many other legal literature, which gave us many concerns about the general inclusion of autonomous vehicles in road transport. Most of all, we have recognized that the inclusion of autonomous vehicles is not yet regulated at all and there is no legal or theoretical basis for guarantees, guilt or other consequences that could arise from the use of such vehicles. It was necessary to study the extensive professional literature and the results of previously identified shortcomings in autonomous systems, which should be the basis at least for the assessment of new mobility through the inclusion of autonomous systems. We relied on the basic features of scientific description and were not satisfied with only collecting and verifying existing knowledge, but we analyzed, compared and sought individual knowledge and sought appropriate solutions that would direct us to a specific case. The obtained data and findings were compared in a qualitative combination of many methods or models, including or at least attempts to include autonomous vehicles in road transport. We scientifically relied on inductive and deductive approaches and processes of analysis and synthesis, and finally applied general cognitive processes of emerging autonomous

systems based on the hierarchy of sequence of individual tasks and thus took into account all possible combinations and variations of solving a specific case. Individual published examples were samples for the comparison of intelligent systems in the process of identifying systems of use and integration of autonomous vehicles in road transport, and we did not have enough examples to make comparisons or mathematical calculations or statistical findings on quality, usability, skills, etc. In this field, we re-examined the systems of the transport industry, as described by Zelenika (2010, p. 329), where he clearly shows the implementation of the model of sustainable development of the transport industry in micro transport systems.). In methodological terms, it can be clarified that broader knowledge and knowledge of research techniques and methods had to be used for thinking and research, but not all of them were useful enough, which made it necessary to look for already tested uses of autonomous systems in industry . We have found that conceiving data is almost impossible, as we always return to natural intelligence, which is crucial in the awareness that modern fifth-generation technology is the starting point and will make radical changes in a short period of time.

6 THE COURSE OF THE RESEARCH THROUGH THE IMPLEMENTATION OF THE OBTAINED DATA

The introduction of autonomous vehicles (autonomous or smart systems), which are supposed to carry out transport, transport and movements in public road transport, is a difficult task for the vehicle industry, society and the legislature. Throughout the research, we ran into data that was and is technically and technologically in a very enviable place, representing the modernization and improvement of existing mobile systems, but still not sufficiently improved for independent integration into public road transport. Upgraded existing motor, hybrid or electric vehicles represent only technical, technological, systemic, informational and managerial improvements, but all of them only help the driver (natural intelligence), who has a greater overview, greater reaction power to changes and sudden phenomena. , but it is by no means yet possible to confirm a fully autonomous system. We looked for a sample in the internal transport industry, where we tried to determine the systems that would be sufficient for the safe integration of autonomous vehicles in road transport, following the example of the use of autonomous systems (robots). Implementation of this data is almost impossible, as in the case of using AGV (robot, which represents a towing vehicle in industry), which has a certain infrastructure, a certain form of management, many obstacle detection systems and stop commands, we tried to equip an autonomous vehicle. was involved in public road transport. The industry boasts autonomous vehicles that park on their own, come out of the garage on their own, stop in front of an obstacle, etc., but it is too early to talk about vehicles that would drive without a driver. It is impossible to compare internal infrastructure systems in industry, where eight different systems can be used for management or navigation individually or in combination and ensure at least 60% safe driving (the

remaining 40% is a shutdown that the operator must eliminate). The same use would mean that the carriageway has a magnetic stripe, coded or dotted road, optical network built into the carriageway, WiFi connection, relay connection, satellite connection, ie all sensing systems that would identify obstacles on the road. The industrial production of autonomous vehicles has not yet realized this need, as it relies on autopilots, which are supposed to recognize everything on the road and be sophisticated enough to operate a vehicle, with which scientists do not yet agree. As we have described, in the system of using autonomous vehicles on the road, automated vehicles with a range of assistance aids can be seen to help the driver drive, but we do not see the possibility of not replacing him in almost any driving element. In writing, we emphasized that the most crucial thing in these systems is that the driver knows the advantages and disadvantages of these systems and uses them in accordance with the instructions, as these systems do not replace the driver. In this category, we know radar cruise control, which allows the driver to set the desired driving speed and the vehicle then maintains it until canceled. The modern version of cruise control can automatically adjust the speed based on the traffic flow in which the vehicle is engaged. This allows it to accelerate, brake or automatically maintain the distance of the vehicle in front of you. Another such system is the automatic parking system, where instead of the driver, artificial intelligence parks, which has previously calculated at what speed and at what angle it is necessary to park the vehicle according to the parking space. This is an attractive feature especially in cities where it ensures that the vehicle is parked as efficiently as possible. A third such example is the case of t.i. lane assist system, where the vehicle detects the carriageway, floor markings, edges, etc. with the help of various sensors. and allows greater control over the vehicle. In this way, the vehicle can take control of the vehicle with the help of data supplied by sensors to the CPU (one such system is the lane assist, which was standard in the AUDI A8 and allowed the vehicle to drive only during rush hours). at speeds up to 60 km / h). Another key element of automated and later autonomous driving is the recognition of existing traffic signals. Today, they are setting up traffic signals with signals that tell us what needs to be done, so smart vehicles should already be able to recognize and act on traffic signals themselves. For the time being, it is the level of sensors or detectors or transponders that have the task of communicating the situation on the road. In the case of automated driving, these primarily serve to warn the driver not to follow traffic signals, and in contrast to autonomous driving, these are a condition for the vehicle to be able to enter traffic at all. Their operation must be tested and perfected, otherwise use does not make sense. Central to the introduction of both automated and currently available 3rd generation autonomous assistance systems is that the industry presents them as improved in-vehicle systems that provide driving assistance. The driver still has to react to the situation in the road traffic, because there are too few tests performed to leave driving to an autonomous system.

The goal of the industry is primarily to conquer the market, gain customers and multiply capital, for which the owners will do everything. Today, the most talked

about type and type of vehicle, form of mobility, ability, aesthetic appeal, usability, performance, price range, purchasing power, etc., which led the industry how and when to convince customers that their vehicle is the best. The autonomous vehicle is the future, but the data certainly show that it is a fashion fad that is developing from beautifully decorated motor, hybrid and, more recently, electric vehicles. Already here you can see the purchasing power, you can see brands like Tesla, MBW, Mercedes. Increasingly, better and lower-priced vehicles are slowly entering the market, achieving favorable and acceptable prices in terms of quantity, which is somehow balanced for industry and consumers.

What about guilt in 5th degree autonomy vehicles? These are vehicles with full or complete automation (autonomous or completely smart vehicles), where the vehicle drives only regardless of the conditions on the road or in the surroundings. The legislature wrote that negative guilt for society can be defined as intentional acts or negligence. It is a behavior that has the properties of natural intelligence, that is, man. What about artificial systems, where everything is recalculated, there are no emotions, emotions, attitudes towards the environment? From what has been said, it is to be understood that the driver is not to blame for a possible accident caused by artificial intelligence or an autonomous vehicle, as the passenger in the vehicle (in the future) is only a passive observer in the vehicle. vehicles. This has already been announced by autonomous vehicle manufacturers (including Volvo, Mercedes Benz, Google, etc.). In the event of an accident, we expect some kind of shared insurance in the insurance of vehicles of the 3rd and 4th level of autonomy, and in the case of vehicles of the 5th level the blame for the accident and the burden of insurance will be exclusively on the car manufacturer. Industry has not yet given its last word and agreements are being made, as industry is the main bearer of power in the country and also the largest payer of all state systems. So what to expect from an economic, legal and popular point of view? All indications are that the concept of liability in legal terms will be one of the key elements in the introduction of autonomous vehicles into transport legislation. From a legal point of view, the responsibility of the manufacturer for the products derives from the purpose and manner of use of the product as envisaged by the manufacturer (these are warranty effects related to the use or utilization of the product). If the control system no longer needs a human (and if the accident or damage occurred without the passenger's involvement or some external force / influence), then we will come to the question of whether any fault in the vehicle control system can be understood as a material defect. the producer is civilly liable or indemnified (Murtič, Jankovič, 2018). Current legislation, as we have already shown, operates mainly with the responsibility of the driver (intent or negligence), in the event of an accident (excluding of course possible vehicle faults, which are already the fault of the car manufacturer) it is not known how to act. When dealing with complex legal irregularities in the use of an autonomous vehicle, the situation becomes significantly more complicated. The first question is whether artificial intelligence error can be considered a material error or whether a new category will need to be introduced here. Another problem is that in

the case of autonomous vehicles, the responsibility for the accident is not only towards other road users, but also towards the owner of the vehicle, who operates only as a passenger. Procedures are not yet known or defined, much less legally defined. The current regulation is based on a completely different understanding, which is reflected in the recognition of "unavoidable events" that affect the decision on the distribution of responsibility for the accident. Since we have defined autonomous vehicles as more predictable from a technical point of view, we can say with great certainty that there will be fewer of these unavoidable events in the future. And if the current system leaves room for accidents and damage, it seems that it will need to be completely reduced for autonomous vehicles (Gasser, 2015). It is assumed that even if the industry manages to provide vehicles that are highly predictable and less likely to have accidents, the fact remains that road safety is significantly reduced, precisely because it includes autonomous vehicles that are not controlled by anyone. (meant by natural intelligence). There is still the fact that traffic is always somewhat unpredictable, so it will still remain, even with autonomous systems, that not everything can be completely predicted. We expect that autonomous vehicles will bring more control into critical situations due to many systems and shorter reaction time. However, since the autonomous vehicle is an object or entity that decides with an autonomous decision-making system in its internal system, the question of the quality of its decisions arises, which is a novelty for us and will have to be studied.

The question is when and how to talk about a car accident through the fault of an autonomous vehicle, if all movements are recorded in advance and all autonomous vehicles are cybernetically recognized and read by collision avoidance systems. People do not have this ability, if they had it, it would be telepathy (which is possible in the future), where they would perceive or know what the opposite driver intends to turn in the intersection, at the roundabout, on the road and the like. Properly understood, autonomous or artificial systems will communicate quickly, so the transition and time when artificial and natural intelligence will be involved in public road transport is unknown. Is coexistence to be expected, as in industrial production? The autonomous system has written decisions that are left to the thinking individual in the classical transport system, and the autonomous system only cybernetically implements because its properties and abilities are written in the decision-making system as in natural intelligence (Gasser, 2015).

7 DISCUSSION AS A CRITICAL ANALYSIS OF THE SITUATION

Researchers usually argue in a critical analysis of a dilemma situation that it should always be an exceptional case, as at least two natural, financial, economic, industrial or legally protected goods, products or services are confronted. In this case, we had natural and artificial intelligence, where we sought the coexistence of the two in the system of development or inclusion in public road transport, where after finding solutions to put artificial intelligence at the forefront and which should perform as

many functions for natural intelligence. We met with an autonomous decision-making system and its consequences, as well as with all previous preventive measures and alternative solutions that are supposed to improve mobility systems aesthetically, financially, usefully and systemically. We were looking for solutions and improvements that we did not present the best, as this is a field of trade secrets, so we did not get better results or improvements within this system. In business and economic terms, it is a matter of maintaining and taking over those elements of the market that mean the confirmation of autonomous systems or the incompleteness of systems, and natural intelligence will still prevail in the mobility system. There are many unknowns, many fields of science that need to be studied first in the virtual world and only then, after the answers obtained, look for solutions for the real use of autonomous systems. If the company wants to eliminate some of the shortcomings in traffic that are the main causes of accidents (unadjusted, normal, appropriate, prescribed speed...), it should make radical changes and eliminate the beliefs that are rooted in our understanding of traffic. Whether this could be achieved by introducing autonomous systems is not yet known, at least not for this existing form of autonomous vehicles. If society wanted to ensure traffic safety by introducing new vehicles operated by autonomous systems, it would have to do much more than Green Europe envisages. When we have autonomous vehicles in mind, we have a number of unknowns that are reflected through issues such as or in individual situations (example: driving past a pedestrian) there is a risk that should be adjusted before an emergency arises (Gasser, 2015). We must start from the concept of analysis of critical situations or situations of expectation, where we should expect at least the same behavior of the autonomous system that we expect in humans, although we rely on the system (machine, computer) more reliable than humans. We have defined this by the definition that intentional errors are attributed to natural intelligence and that artificial intelligence does not have intentional errors because it does not know them.

Addressing such issues is not in the domain of an autonomous decision-making system, but stems from the nature of traffic regulation and may be sought in pre-dilemma events (speed and other causes). If it turns out that such a decision is left to an autonomous decision-making system, this ethical and social issue should be resolved in principle in a public debate and such a social response should be included in the identification system. A scientific comparison of the situation of the dilemma between the autonomous system and natural intelligence or the classic driver would show that in an equivalent situation, the classic driver would be mostly exempt from guilt and responsibility (example: shock, reaction time...). There is also no difference in cases where damage or traffic accident would occur in any case. The main argument for autonomy should be the goal in the future (probably) to reduce the number of accidents with autonomous systems, and through preventive and alternative actions we will be able to expand our scope of control and reduce the number of cases or reduce damage (Gasser, 2015). We have data on the unpredictability of natural intelligence, we have insights into the behavior of human

drivers and we know that many life situations are in the hands of natural intelligence because it can master, change and repeat them. When we study autonomous vehicles, we are without data to tell us how the autonomous system will behave in actual public road transport. These are modern systems or just driving vehicles that use advanced technology as an aid, which makes it safe to say that driving with them will be safer, but we have no comparative factor or element to show improvement or deterioration. We know that artificial intelligence systems will be able to better assess the possibility of a collision, the faster the response to change, which provides greater security when compared to artificial intelligence.

Autonomous systems will communicate in the cyber world very quickly, they will recognize obstacles, changes and life situations, but we do not know how they will communicate with natural intelligence. We do not know if the autonomous vehicle will be safer and more predictable, nor do we know if the legislation will allow their use, which is why we are facing many unresolved issues. Collisions are also expected to occur between autonomous vehicles (Goodall, 2014) and a major challenge for car manufacturers is how to program vehicles to respond appropriately in such unpredictable situations. These questions can be summarized in a series of questions, such as how an autonomous vehicle should behave in the event of an accident, decide who the autonomous vehicle should prioritize in the event of an accident (driver, children, elderly or disabled) and whether the vehicle should decide on the best possible principle. outcome (i.e. to save as many lives as possible, cause as few injuries as possible) or to prioritize the vehicle owner. There are still many questions that we do not have answers to. It seems to us that the burden of these decisions cannot and should not be shifted to the car manufacturer, but that these issues must be regulated before autonomous vehicles enter the market. One of the many problems that could arise is, for example, that manufacturer X decides to design cars in a way that always protects the community, and manufacturer Y that the car always protects the owner - this could be a competitive advantage for car manufacturer Y when selling. Therefore, it is necessary to regulate this, determine the conditions, determine the directions and define the meaning of the use of such vehicles. The next dilemma is even more interesting, namely, if we take two vehicles X and Y, of which vehicle Y is significantly better rated in the crash test. Let's say these vehicles inevitably collide and the vehicles calculate that the collision is strong enough that someone among the passengers will die. How should vehicle X (which is poorly assessed in the crash test) behave - take risks and try to save the life of its driver in any way, or prioritize the life of driver Y, who is significantly more likely to survive? We now expand on question number 2 (who should prioritize the autonomous vehicle) and introduce the trolley problem. Suppose an autonomous vehicle is inevitably approaching a collision. It has two options - either drive a child standing on path A or drive 2 adults standing on path B. How should the vehicle decide? We can exacerbate the problem - let's assume that a child is standing on route A and an adult is standing on route B. How should the vehicle decide? Can we justify sacrificing one person for the benefit of another? According to experts, the

ability to control the driving of autonomous vehicles today is at least comparable to the ability of drivers of classic vehicles, which is not enough. It follows that the risk of errors will not be completely eliminated even with the introduction of artificial intelligence, but based on the collected data we can conclude that it will probably not be higher than the risk of conventional vehicles driven by natural intelligence. As this is a major revolutionary change, it will be crucial that the arrival of autonomous vehicles on the market, which will certainly significantly change the relationships and rights of road users, be addressed by the legislature. and the gradual introduction of driver assistance. With all the knowledge of technical and technological properties, capabilities and applicability, the legislator will eventually set safety standards in the formal law, where he will determine the expected level of danger of autonomous vehicles in traffic. It is likely that the milestone for autonomous vehicles will be that they will achieve a level of “at least as safe and reliable as conventional vehicles” (Gasser, 2015). Through this discussion and review of many unknowns, we come to the question of confirming the hypothesis "Intelligent systems could significantly help improve traffic safety" and find that there are too many unknowns in the study. Industrial development is moving forward, intelligent systems are present at all stages of industrial production, there are more and more intelligent systems in rail, air and water transport and they are gaining ground in road transport, but there are still too many questions and answers. provided arguments to confirm the hypothesis. We will not confirm or refute the thesis and we will continue our research, as we expect that in the near future there will be more information in the public, media and scientific journals that will shed light on our cases and may already offer answers to our thesis. We will expand our research to new diploma theses, new examples of the use of intelligent systems and the behavior of society and the legislature to the growing presence of intelligent systems in the social environment.

8 CONCLUDING THOUGHT ON RESULTS AND FINDINGS

The aim of our research was to present the future of autonomous transport systems through examples of good practice and examples of existing and established intelligent systems, focusing on the possibilities of improving traffic safety, which we believe is one of the most important consequences of autonomous systems. Thus, we presented the main factors of autonomous systems and described the conditions necessary for the coexistence of natural and artificial intelligence in the vehicle. We described the difference between autonomous and automated driving and highlighted important aspects in the history of autonomous vehicle development. We particularly highlighted the fact that not all autonomous cars are fully autonomous, moreover, that there are no such vehicles on the roads and in public road transport yet. We cited the levels of autonomy according to the SAE, which dictates the autonomy of vehicles from 0 (non-autonomous) to 5 (fully autonomous). We have been dealing a lot with vehicles of the 3rd level of autonomy, as these are the vehicles that are already on the market today and about which we

have the most data - both in terms of technological specifications and especially in terms of how they behave on the road. We also devoted a large part of the task to the legal justification of autonomous vehicles, presented the situation in the legislation today and showed how the legislation in the field of autonomous vehicles will or should be regulated in the future. Here, we also highlighted the problems faced by autonomous vehicle manufacturers in programming and integrating autonomous vehicles into traffic and their handling in road transport. The key to the present work was to describe how, in our opinion, autonomous vehicles will be integrated into the transport system, pointing out both the positive and negative consequences. We looked at the impact of autonomous systems on society and the economy, which we believe autonomous vehicles will have. Driving autonomy is expected to change mobility, ie transport, transport and movement, and will be one of the key factors in the transport and technological revolution. Systemically, it is the development of Industry 5.0, which represents the latest development in the digital world. Here we are at the very beginning and during the article we have repeatedly pointed out a problem that was faced not only by us, but also by the existing literature. As this is a completely new field, data on the behavior of autonomous vehicles is sparse, deficient, hidden, a trade secret and impossible to access. An additional problem that we only mentioned, but did not deal with too much, is the fact that the primacy in the development of artificial intelligence in cars is taken over by private companies and because it is closed coding systems, it is difficult to verify the authenticity of data. that Tesla is already capable of technology 5.0). Therefore, it is crucial that the professional public closely monitors the development of autonomous technologies and adapts its findings to new data. This is especially true for the integration of autonomous vehicles into the normal transport system and everyday life. The role of the legislative services (coercive authorities) will be important here, as they will have to properly regulate the autonomous vehicle market, especially since we know that the interest of capital is such that it achieves maximum financial effects with the best possible technology. We hope that in the future they will be more careful in the introduction of technologies and that we will ensure the appropriate legislation before these vehicles become part of our daily lives. Here, some accidents of autonomous vehicles serve as a warning, the most resounding Uber accident was also discussed in the article. It is crucial that we are aware of the pros and cons of autonomous vehicles and not skip steps, as happened in Uber's case, where both the legislative service, which dropped an unsuitable vehicle on the road, and natural intelligence, which trusted artificial intelligence too much, failed. We hope that our research will contribute to this and will be an inspiration for further research, but we will certainly continue our research ourselves and try to come up with better solutions. Unfortunately, we were not able to study the actual effects of autonomous vehicles in the study, because there are simply not enough of them on the roads, so we limited ourselves to the virtual world.

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POSSIBLE FORMS OF MANAGEMENT AND ADMINISTRATION OF INTELLIGENT SYSTEMS IN INDUSTRIAL LOGISTICS

Abstract:
Intelligent systems are the future of industry and therefore of logistics, enabling industry, business, manufacturing organisations and public administrations to carry out certain processes, procedures and work stages that enable production, sales and supply. Systems represent advanced technology that performs complex

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processes and tasks that natural intelligence cannot. Industry, manufacturing organisations and companies are increasingly moving towards the introduction of intelligent systems, which is causing intense international economic and trade competition, changing the dynamics of production, and leading to the introduction of digitalisation and robots in production. Logistics is evolving with the advances in technology and is trying to modernise its own processes and keep pace with intelligent production systems. The aim of the research was to find out how and with what development potentials intelligent systems can be implemented in logistics and thus actively participate in the search for modern solutions that would enable production to achieve better results. A comparative method was used to study the management and governance processes of intelligent systems in logistics and to learn about their effects. The implementation of intelligent systems was evaluated through the system classification of production and the adaptation of logistics to production. We were looking for quantifiable data that would give us a starting point to validate the research through mathematical calculations or %. It is a scientific method of studying phenomena in industrial logistics and of gaining knowledge using intelligent systems in the process of improving individual processes, tasks, or procedures. The method is based on the collection of observables, empirical and measurable data, which are subject to certain criteria of reasoning and can result in process improvement, reduced time complexity and lower cost. The objective was to find a starting point for reducing logistics costs in the pre-production of raw materials, which we identified in the deployment of intelligent systems.

We focused our research on the measurement and study of the individual control processes of autonomous devices or intelligent systems in the delivery of materials from storage to production. In doing so, we have focused our research on the AGV robot and its control systems. We were looking for system solutions for the continuous operation of the autonomous device and for possible data for the efficient operation of the control systems. Limitations were revealed in the application processes of the individual systems, and in particular the individual systems are inaccessible because they are protected by industry and do not allow simultaneous use for scientific purposes.

Key words: *intelligent systems, AGVs, logistics, technology, costs.*

INTRODUCTION

Research data leads us to think that the current era is a watershed in terms of mastering production and human systems and shows a growing need for synergies between humans and AI. This is a modern evolution of society in which natural influences, climate change, high vulnerability to health changes and many other reasons point to the need for technological solutions that will simultaneously protect and interact with humans at work in production, transport, care and beyond. Modern industrial development is focused on the search for technical and

technological improvements that will enable production processes to be modernised, lead to more technologically sophisticated products and, at the same time, reduce the costs of all industrial production processes. A historical overview of technological development provides answers which show that industry was gradually achieving visible development results as early as the end of the 18th century, which science considers to be the first form of Industry 1.0 (1). This was the introduction of mechanical generation, harnessing the energy of water and steam. The introduction of electricity into manufacturing led to the development of the conveyor belt system of organisation, which revolutionised the world in the 20th century. This period has been called Industry 2.0, or a new era of development in the economy, trade, and the movement of people (2). Although progress was visible for some time, it was not fully exploited until the 1960s, when the development of Industry 3.0 began, which meant the automation of individual production or transport systems in analogue terms, with electricity doing the heaviest work, leading to rapid industrial growth, market development and consumption. (3). Major industrial advances in production processes have been made, and there has been a great expansion of development from individual countries to all the continents of the world (4). As the industry grew, so did the market, competition, and development interests, which, in competition with each other and the need to control the market, led to the rapid development of information systems, which in the first phase had the task of supporting and planning production processes as well as business management. In a later period, data became the basis for the development of newer production systems. Increased competition, increased supply, conquest of markets, acquisition of consumers, new products, rapid development, were the causes or stimulating steps that led the development of science to seek ever more modern production systems and ever better products. Industry 4.0 has been the biggest step forward in the search for new solutions, eclipsing all previous periods of development, and is still today the highest form of industrial production organisation, market control, development of new technologies and the achievement of market values (5). Developments in information systems have brought us to the point where we use computers to solve technological problems, manage machines and overall production, and the computer network is becoming the backbone of industrial networking. Industry has moved from an analogue system of operation to a projection of the digital and virtual world, which has enabled production systems to be much more functional. The strong impact of computer technology through all phases of design, as well as the management of production processes by computer technology and the introduction of robotics in production processes, has contributed to the development of smart factories and virtual production (6). The introduction of intelligent systems has brought a higher level of synergy between humans and artificial intelligence in all areas of production processes.

Many researches go in the direction of arguing that a new industrial revolution 5.0 is underway or in the making, in which a full personalisation of intelligent systems

of autonomous devices (robots) is expected, where human and modern device or autonomous machine will fully participate in production, which will meaningfully increase creativity in industry, in production, in the market or in logistics (7). Through the development of technology, information systems, the internet, informatics and computing, industry has shifted production processes to entirely new forms with the introduction of digitalisation. They have recognised the need to eliminate the waste of time, space and labour and have sought to modernise processes and improve products through the introduction of intelligent systems. The introduction of intelligent systems has been seen in Japan, where they are entering the era of Industry 5.0, which they call Industry "Z" or Industry 5G (8). They are increasingly trying to reach production levels where the ratio will be 60% intelligent and 40% natural systems. And the proportion of intelligent systems is set to rise more and more. After 2020, most of the world's industries have recognised the need to deploy intelligent systems also in logistics, which, although not considered as part of the production process, they are aware that without logistics, production cannot function. Logistics in industry, business, public administration and wherever it is necessary to make certain preparations, carry out certain processes or carry out certain phases of work to enable production, sales, or supply to continue. Logistics also involves several interrelated processes which, like production, often depend on the use of machines, computer equipment, computer programmes, information systems, various apparatuses, and aids to enable the performance of particular tasks.

New intelligent systems in logistics, mitigating international economic, industrial, and commercial competition, are adapting to rapid changes in production, digitisation, robotization and individual changes in logistics that require increased investment in technology development. These are factors which, also in the professional and scientific fields, are driving research into the use of intelligent systems in the phases and processes of logistics, in the preparation of industrial production itself and, more broadly (8). Logistics and logistics process companies and industry are working together to find solutions on how and in what ways to use as many intelligent systems as possible in logistics processes and to make the industry more competitive in the market.

RESEARCH AREA

Through our research, we have learnt that there has been an ineffective recognition in Industry 4.0 that any activity in industry or elsewhere that is not directly linked to production processes is simply an activity that is a burden on industry, even though they had the notion that industry could not function without these services or favours (10). This realisation has led industry to eliminate all work and tasks that are not directly productive processes and to leave them to those legal entities (natural or legal persons) that are qualified and for whom the activity constitutes the basis of their work. We have recognised that the globalisation of production, and

in particular the globalisation of the market, has led to an international economic crisis, in which industry has realised that it needs to focus its resources and development on technological progress, preserving the market and consumers, and has therefore excluded from its activities warehousing, the transport of raw materials and finished products, relief logistics and service activities that it does not need to perform, and has outsourced them to third parties (outsourcing). Already in the initial phase-out period, certain organisational and management constraints were evident, which the industry passed on to logistics and logistics service providers at a cost. While there was an apparent reduction in the cost of production itself, helped using modern technology and information systems, there was still the problem of the high cost of the accompanying logistics activities, which was reflected in the cost of marketing the final product. Data analysis shows that the original cost ratio of industrial production and logistics was 50-50% for the final product on the market, but with various financial and technological interventions the ratio has been changed to 62-38% in favour of production (11). New options had to be found to improve this ratio. In the newer part of Industry 4.0, with the introduction of the new intelligent (smart) industry 5.0, the need for more cooperation between the manufacturing part of the industry and the service or logistics part has been recognised. The breakthrough year was 2020, in which it became clear that, even within industry, it was possible to organise telework, but not service work, and it was therefore necessary to start introducing intelligent systems in logistics that would enable the replacement of humans. Through the use of technology, automation and system management, many logistics activities can be transferred to intelligent systems and costs can be reduced in pre- and post-production (12), and there is no need for humans everywhere. In 2020, with the introduction of intelligent systems, the industry has also started to automate processes in logistics. This has enabled the modernisation of logistics processes, operations and procedures. Initial analyses in the motor vehicle industry (interviews carried out) show that, in the early stages of the introduction of the industry 4.0 guidelines, 3% of smart machines were introduced into production processes, then 5% and then 9%. Increasingly, virtual technology was used to develop the various processes, checking, and testing individual systems in the service area, which proved to be an advance and kept production constant, without any hold-ups. It is too early to talk about statistics or positive effects, but there are many perceived benefits, which are reflected in the industry's interest in deploying at least 50% of smart machines in production and 30% in logistics processes. The industry's aim is to improve the ratio through intelligent systems and to arrive at cost results that show a product with a ratio of 80% production cost and 20% service labour cost, which is utopian for once, but not impossible (13).

The number of operational industrial robots in production is growing year on year, with figures showing that in 2009 the total number of robots in production was one million, in 2017 it will exceed two million for the first time and in 2020 it will reach three million. According to our calculated projection, the figure of 4 million is

expected to be exceeded before 2023. The values of robots installed for industrial use are shown in Chart 1.

Asia is the largest market in the world, with 71% of global robot production installed in 2020. China is far ahead of all countries in terms of the number of robots installed, with 168,400 robots installed in that year, a record for a single country

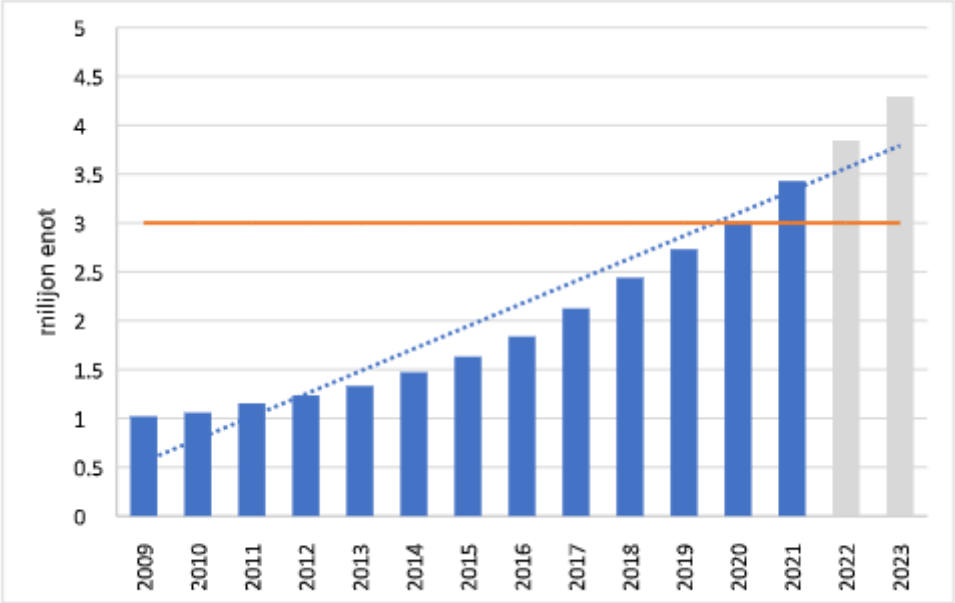

Chart 1: Number of robots installed worldwide (12)

Countries at the top of the world for investment in robotics are also the world's best performers (13). An overview of the global market is given in Chart 2.

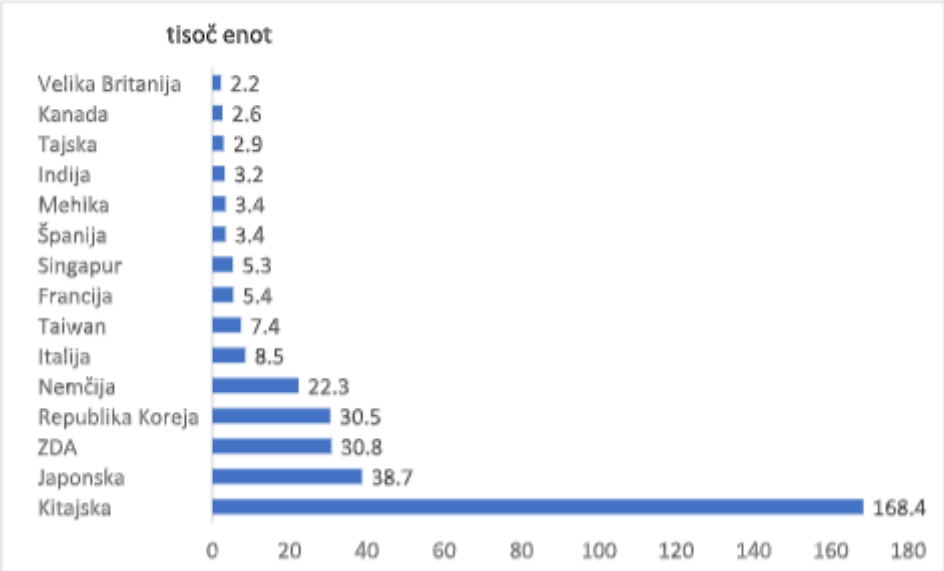

Chart 2: Industrial deployment of robots in 2020 (12)

1.1 Creative hypotheses

The introduction of intelligent systems, new technology, information systems in the implementation of individual procedures and processes in the pre-production phases of industrial production and in the care of finished products gives importance to the service activity, which calls for the introduction of technology (computer software) that will enable fast, accurate and professional support to industry (14). In this research area, we were interested in several hypotheses, to which we wanted to obtain innovative answers, which were the basis for the improvement of a concrete system of control and management of intelligent systems in the pre-preparation of raw materials or semi-finished products for industrial production. The hypothesis was "Intelligent systems are the future of industrial production and service activities". In order to be able to justify or refute our hypothesis, we first had to obtain answers through research to the following questions:

- Is the AGV[84] - Optimatik 160 "flat to flit" suitable for the delivery of raw materials from warehouse to production?
- Which navigation systems can the AGV use besides the magnetic conveyor?
- What possibilities do intelligent guidance and control systems offer for AGVs?
- What are the possibilities of remote control and management of an intelligent AGV system?
- What are the cost implications of deploying intelligent AGV systems?

The research raised the question whether AGV intelligent system, which has already positively recognised in industrial motor vehicle production processes, can, with some fine-tuning and appropriate programming, also be used in industrial or other logistics processes. For our research, we have studied and identified the industry 4.0 trends, which call for a rapid response to market, environmental, health and other changes, reducing inventories in pre- or post-production, gaining market advantage and becoming more competitive. This has served as a starting point for us to identify impacts in the service sector. The logistics service delivery system described before the survey was based on physical work, with the use of prepared rules, policies and internal instructions, high operational and procedural burdens, and often unnecessary complaints. It was particularly vulnerable to rapid changes such as those caused by the Covid 19 pandemic. It was for this reason that we realised that introducing intelligent AGV systems into a logistics or service business would mean implementing delivery, carrying, distribution, scanning, weighing and other equipment to eliminate time and service errors in the individual phases of the logistics service.

1.2 Research vision

The aim of the research was to study the management, control, and guidance of AGVs in the process of introducing intelligent systems in logistics, to ensure accurate, safe, time-coordinated delivery of materials to production processes,

[84] Advanced Guided Vehicle

eliminating the physical preparation of individual pieces of raw materials, physical counting and inventory, load transfer, the use of hand trucks and forklifts guided by workers. Recognising the need for manufacturing to work with logistics to ensure fast JIT "Just in Time" delivery of components for production. This leads to timing coordination, considerations of using individual intelligent systems, autonomous devices (robots) in pre-preparation, transport, packaging, scanning, palletising, storage, and loading. Our vision in this research was to find ways to implement logistics in industrial production through the deployment of intelligent systems, to use modern technology to improve logistics processes, and to enable industry to keep production running quickly and smoothly. Above all, our task was to find safe and efficient ways of managing intelligent systems such as AGVs in the process of carrying out service activities in industrial or other production.

THEORETICAL BACKGROUND TO THE RESEARCH

Theoretical guidelines for the deployment of intelligent logistics systems in the automotive industry

The motor vehicle industry was suitable for our study because the specificity of the motor vehicle industry lies in its continuous technological and technical development and in the search for intelligent advanced technological, information, digital and other systems and elements that should enable smooth industrial production, reduce production costs, and retain customers or the market. For these purposes, industrial production introduces intelligent and fully autonomous pre-production processes and procedures throughout the production process, with the aim of improving the preparation of goods for the customer (17). Processes refer to modern procedures for the introduction of specific technologies for the reception of raw materials, semi-finished or finished products for further production, the introduction of intelligent devices for cutting, counting, coding, storage and delivery to the production programme, and other deliveries. In the downstream end of production, intelligent systems can be used to perform packaging, palletising, warehousing, and a range of other logistics processes that are necessary, taking advantage of the benefits and experience offered by Industry 4.0 and related processes (18). The aim of implementing and managing intelligent systems in logistics is to provide a fully autonomous data processing system from ordering to planning and final assembly of pallets of different products. By combining mathematically measurable optimisation with data intelligence, industrial expertise would be used to IT[85] developing tools to design and operate intelligent industrial production systems. In the process of exploring the possibilities of controlling and managing AGVs in industrial logistics, we have combined scientific methods of studying phenomena with the generation of new knowledge that will be used to improve industrial production. The methods are based on the collection of

[85] information technology

observables, empirical and measurable data, subject to certain criteria for understanding industrial production. As a comparable performance method, following the industry 4.0 guidelines, we have applied the Lean Manufacturing method[86] for modern logistics process management, which allows us to improve the overall values of key performance indicators (KPIs[87]) in the industry, by means of a set of tools for detecting and continuously eliminating time or production wastage, for improving quality, for reducing production times and for reducing costs. The term Lean Manufacturing - the Toyota Production System, which is a system of Toyota's philosophy of organising production and logistics, including supplier and customer interactions, supported by a variety of tools, the best known of which are continuous process improvement (Kaizen) and error-proofing (Poka-Yoke) (19). We also used Toyota's second lean approach, which focuses on steady supply flows through systems by balancing production by quantity or product and on a pull production mode (Kanban). The same approach was used in the measurement process for AGV control systems, where we tried to discover and validate as many systems as possible that would allow continuous and uninterrupted safe operation of the system. The advantage of the steady-state AGV approach in the workflow is that it naturally captures the entire production system, identifying existing quality problems and thus contributing to the reduction of losses. The research was also validated against AGV activities, which are designed to ensure timely action to improve the quality, productivity and efficiency of production in the motor vehicle industry. For this purpose, other methods are also comparable, such as the use of appropriate tools, methods, techniques and strategies such as: 6-sigma, 5S, 20 keys, total productivity management, TPN[88], SMED[89], JIT[90] and JIS[91] and many other technologies that are also relevant to logistics and its processes. All these methods are original methods for verifying the operation of the AGV Intelligent System in the process of providing raw materials for production. A parallel comparison of the methods is carried out. The main task of the research is to discover the multiplicity and continuity of the different intelligent systems that would ensure the operation of AGVs in the direct grid or in the remote-control process.

Specific features of intelligent logistics systems in the automotive industry

Opinions on the importance of logistics in the automotive industry vary, depending on the interpreters of each system. Importantly, there are views that suggest that these are a range of preparatory and implementation services without which industry cannot carry out its industrial mission (4), Logistics services include the many processes, procedures and tasks that enable industrial production to take

[86] philosophy of process management
[87] Key Performance Indicator
[88] Total Productive Maintenance
[89] Single-Minute Exchange of Die
[90] Just in Time
[91] Just in Sequence

place, which are narrowly defined as purchasing, supply, storage, and transport for the needs of industry. In the late stage of Industry 4.0 (the phase of industry moving into the new era of Industry 5.0), logistics in industry uses scientific and other methods that, based on the collection of observables, empirical and measurable data, allow the continuous evolution of several processes and procedures, thus ensuring the smooth functioning of industry. In a concrete example, we sought the specificity of the application of logistics to the needs of production assurance in terms of the delivery of materials from warehouses to production with AGVs, where we studied autonomous plant control systems and comparable well-known industrial methods. We have adopted the Kanban system, which refers to the allocation of tasks and the supply of jobs according to the "pull" principle, where there are no forecasts, as the system operates on the recall of quantities in the production itself (20). It is about sensing the needs that an intelligent device needs to detect in order to deliver timely care, using a signal that can be in the form of a card, an empty box [92] or empty space. The type of product and the number of items to be brought from storage to production or to be produced are recorded on the Kanban card. The Kanban card tells the intelligent device (robot or machine) what and how much it needs to deliver or deliver at a given time, which commands it needs to follow and which route it needs to take. Based on the sensing, the AGV will only pick up, deliver or drop off as much goods as it needs at the time, and the manufacturer then needs to replenish this amount. It is a system that is suitable for large scale industrial production, where there are fewer fluctuations in needs and changes, and where a steady and balanced production process is ensured. In such a system, through virtual tests, we have searched for the most optimal possibilities to control and manage the AGV, which has proven to be the most suitable form of autonomous intelligent device that already at this stage communicates with natural intelligence.

Intelligent systems as exclusive support for logistics in the automotive industry

Technology and the modernisation or evolution of industry can be spoken of from the very beginning of industrial production and is also present in the field of logistics and logistics processes. It can already be seen in the earliest forms of use of various machines for industrial pulling, pushing, lifting, handling, loading in warehouses and in manufacturing. In its original forms, it was more a case of machinery which, in its structure, form, purpose and utility, was not intended solely for logistics and the implementation of logistics processes, but which carried out those jobs and tasks that were an integral part of logistics. It is only in the modern industrial development of Industry 4.0 that we have seen the widespread use of modern technology and techniques in the form of intelligent machines, robots, and software to perform individual tasks of a continuous nature (repetition of certain services in

[92] Means that there are no items in the bin - this is detected by the sensor and the device triggers the bin replacement process.

sequence). Our research was limited to the use of an AGV robot in the pre-production of an industrial car manufacturing plant, where we studied the capabilities while looking for useful forms of guidance and control in the work process.

Figure 1: *Optimatik 160* (21)

As an exclusive technological support in industrial production, the AGV OPTIMATIK 160 (FLAT TO FIT). It is used for logistics tasks to pull trolleys of goods and materials from convenient storage areas to different parts of production. These are next-generation smart or intelligent devices that are able to learn and make decisions on their own, based on experience, the infrastructure in place and the appropriate form of control. We found that AGV OPTIMATIK 160 uses a fixed-track method along a mapped path, which is precisely encoded in the software. In doing so, it follows a magnetic stripe, which is its infrastructure, uses RFID technology and is connected to a production system that controls its trajectories. The AGV transports dedicated trolleys along the magnetic stripe or mapped path to supply industrial production. It can also be installed to take finished products from production to the warehouse. We have established the importance of its productivity, functionality and energy saving. The cost effect achieved by industry in relation to the use of labour for the same work is of key importance. We have virtually tested several forms of control and management with several forms and methods, showing that several possible control and management systems can be used to manage AGVs, thus making the intelligent device and system safer, more optimal and more accurate. Figure 2 shows a system of five dedicated trolleys and three AGVs. The infrastructure of the system is a magnetic stripe, with virtual semaphores and RFID tags installed. The code D610 indicates the initial loading location and the code D510 indicates the final unloading location. The two sites are interconnected by a circular loop.

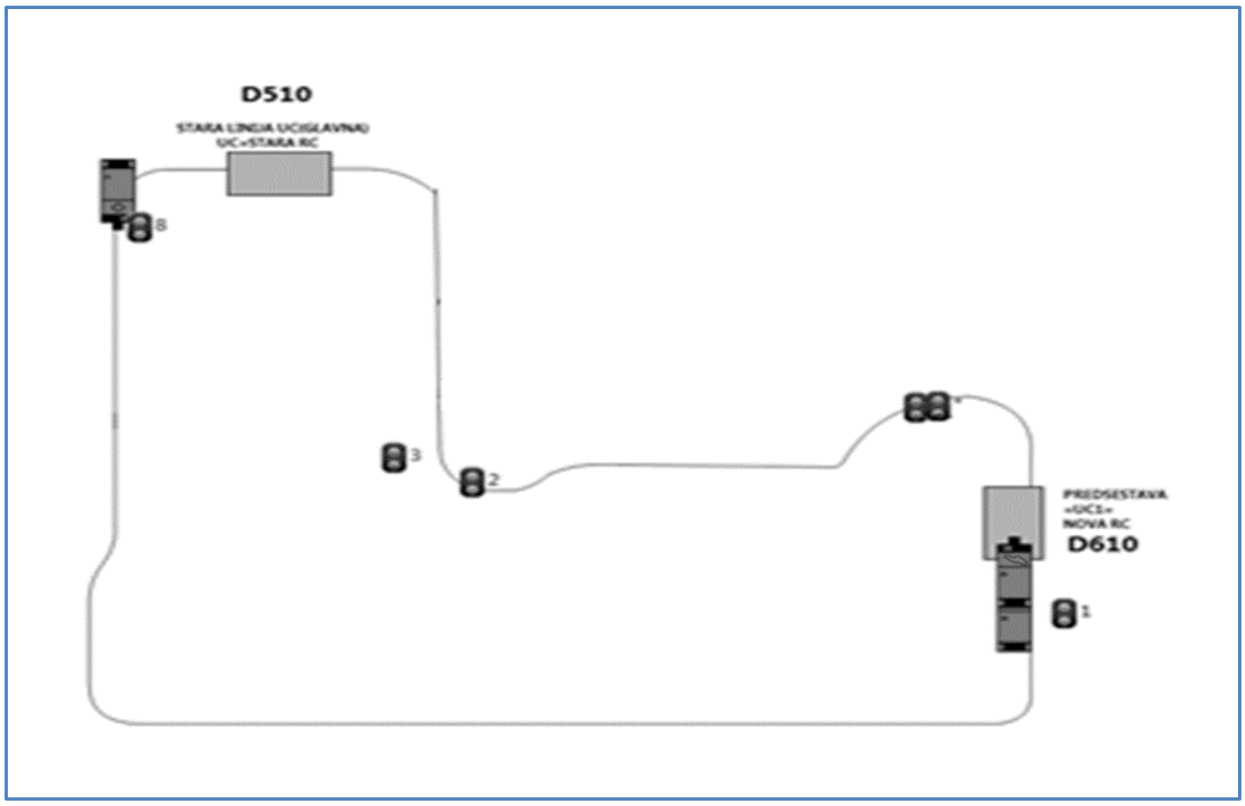

Figure 2: Schematic of a simple magnetic path used by AGVs

We have learned that AGVs are highly sophisticated, technologically advanced machines that perform all the work required to clamp the trolleys, pick up the boxes and transport them to the production process without a human being. Through virtual research, we have found that AGVs can be guided by coded optical or current loop, wireless, radio, repeater, telephone, satellite and other systems, in addition to magnetic stripe. Unfortunately, manufacturers and programmers do not yet allow all parameters to be displayed, as this is both a business secret and a smart technology that represents modern Industry 5.0.

SYSTEMS RESEARCH

Analysis of the need for intelligent logistics support in the automotive industry

Industry, especially the automotive, recognised early enough the need for technological modernisation of service and service activities, or logistics, to organise its own production, which was the basis for the increasing introduction of intelligent systems in the service sector as well. In the past, in the service or logistics sector, most of the work and tasks have been carried out manually (physically lifting, pushing, carrying, transferring, packing, palletising, counting items, making decisions based on regulations, instructions or management direction, considering the human factor). This has meant heavy workloads for operators and workers, the need for more operators and more workers, frequent complaints about inadequate

or unprofessional work, damage, incorrect use of materials, pieces, weighing, etc. The consequences were frequent return of materials or products by the customer, correction of defects, recounting and reworking, increased costs, unnecessary expenses and exhausted labour. The analysis showed that it was necessary to modernise processes as soon as possible and also to introduce modern intelligent systems and autonomous equipment in the service sector to eliminate all the problems that had arisen.

Intelligent systems in support of logistics in the automotive industry

In the automotive industry, autonomous devices (robots or equipment) have been present in the manufacturing sector for many years, performing a variety of jobs that cannot be said to be the case in the service sector. There are some forms of equipment and tools in use, but they cannot be compared with those in production. Existing types are mainly found in the process of storing industrial semi-finished products, products for further production or finished products for the market. The equipment consists of various forms of machines for lifting, storing, sorting materials according to certain codes and numbers, which are read out by a computer programme and with the help of readers, and which carry out repetitive or sequential processes, although they can be quickly reset to carry out different forms of work. The analysis has confirmed that it is almost impossible to talk about intelligent systems at this stage, at least not in the form used by the production section, which results in time wasted and unnecessary costs that are consequently still linked to the cost of the final product or service. In the delivery part of the raw material or in the process of raw material flow from a convenient warehouse to the production belt, we have identified the possibility of using AGV OPTIMATIK 160 (FLAT TO FIT), which is used in various types of industry. In addition to the automotive industry, the AGV is used in the pharmaceutical, food and other industries. The specific process involves the use of a smart device in the form of a robot that autonomously transports materials for industrial installation from the warehouse to the production conveyor belts, during the production processes and when taking the finished products to the packaging, palletising, and storage process in the warehouses (22). From an organisational point of view, the introduction of AGVs has meant a reduction in the number of natural person jobs, a reduction in operators, computerised control, operational control from a control centre, accuracy of service delivery and energy savings. For the automotive industry, the introduction of AGVs in logistics has meant cheaper services, fewer employees, less administrative work. (23). From a technologically innovative point of view, the introduction of AGVs has meant precise and safe processes, the achievement of quality service without defects, complaints, and easier control. And the scientific study of observable, empirical and measurable data in service or industry using the AGV robot has given us the potential to detect intelligent systems in the service industry. To supply the three production lines in the automotive industry, and in view of the three-shift work schedule, three workers must be employed. Therefore,

nine workers are needed to supply nine production conveyor belts, in three shifts, preparing the material for production, loading it into trolleys and physically pushing it to the production conveyor belt. This is a waste of time and an excessive cost, which is reflected in the total price of each product, which, although negligible in terms of the number of products, is very high in the long run. Calculating this, this amounts to an average of €9,000 in employee salary costs in one month and multiplying this by twelve months gives an industry cost for logistics operations of €108,000. If we compare this with the cost of purchasing and using the technology or robot, the figures were more than impressive (24). In addition to reducing the cost of the service activity, our research sought to find arguments to justify the process of introducing intelligent systems in logistics, starting with the search for safe and complete forms of control and guidance of intelligent systems.

In our research, we focused on the search for forms of governance, as we were convinced that several different governance and management systems could be introduced into the coexistence of natural and artificial intelligence in industrial logistics, validated, tested, and validated for their usability, reliability, and cost-effectiveness. We also looked for other relevant data that would give us a starting point for updating and improving these new systems.

Magnetic stripe as a form of AGV management system in logistics

For the purposes of a basic or simple AGV deployment model, in the process of service tasks or logistics for production supply, a magnetic stripe can be placed in the area or infrastructure between the convenient warehouses and the production (typically corridors, courtyards, industry lobbies, production areas), which represents the first form of AGV control and management. It is a magnetic stripe navigation using key points defined by RFID[93] transponder. Other important features include a special clip-on and clip-off mechanism, fast battery charging, wireless (WiFi) communication, a central control system (CNS) and integration with WMS[94] and MES[95] or SAP[96]. Magnetic stripe guidance and control of AGVs is already in common use in the automotive, pharmaceutical, food and other industries. The system is relatively simple and reliable and has already justified its deployment and use in both production and logistics in its first application. It represents the first form of intelligent systems in the service industry or logistics.

[93] Radio-frequency identification
[94] Warehouse Management System
[95] Manufacturing Execution Systems – provides full control, visibility, and optimisation of company processes
[96] System Applications and Products in Data Processing – software solutions for the management and development of business process in enterprise data processing

Fibre optic cable network as a form of AGV management in logistics

The experiment was carried out in the laboratory, where we placed 50 x 50 cm vinyl tiles on the floor, in the grooves of which we placed a fibre-optic cable, which we connected to the operating centre. In this way, we obtained an infrastructure of 50 m^2 in the space between the warehouse and the production area, where we created a fibre optic network made up of several fibre optic squares. Using a computer program, the existing 50 x 50 grid was subdivided into smaller sub-grids of 5 x 5 cm, which was sufficient to create a basis for AGV navigation using the optical grid. For the simulation, we plotted a path on the ground in the room and used computer software to create a path that was recognised by the AGV using sensors and software and used this grid to perform exactly the same functions as the magnetic stripe.

Indoor antenna network as a form of AGV management system in logistics

The experiment was carried out in the laboratory, where several antennas were installed, and an internal radio link was created between them to connect the AGV to the system. We used an optical network software solution. We set up several obstacles in the room, representing production machines, trolleys and crates made of different materials. We found that the system could operate on a specific USW[97] radio frequency if there was no interference. This interference is caused by users generating frequencies in the same frequency band used to guide the AGV and therefore indirectly interfering with the AGV's movement. We found that the system could work, but not completely on its own, but rather in conjunction with a magnetic tape or fibre-optic mesh system. The systems would complement or duplicate each other, which would help AGVs in their service activities. To operate at the appropriate frequency, they would need to have external protection against interference within the industrial facilities. The system could not be fully tested because we did not get the appropriate approval from the automotive industry, which protects its processes and systems.

Wireless system as a form of AGV management system in logistics

In the process of finding suitable intelligent systems, we also used wireless technology (Wi-Fi), which allows the AGV to connect to a computer network using 2.4 GHz and 5 GHz radio frequencies. The wireless system network is used in a wide variety of devices such as smartphones, tablets, cameras and other digital devices that can be embedded in intelligent devices that perform different tasks in the logistics delivery system. Intelligent devices can connect to this network via a wireless access point ("hotspot"), which connects systems to each other and transmits communication commands to devices or different systems. A wireless hotspot has a range of about 20 metres when talking about an AGV management system within buildings. While the system is reliable and useful, it has the disadvantage of providing security when compared to direct connections. It also has

[97] Ultra Short Wave

the disadvantage of having a firewall or security, since the system can also be accessed via the Internet. The use of wireless systems is therefore questionable, at least as regards the protection of business secrets and the protection of production or services. The network uses certain security protocols such as WPA[98] and WPA2[99], which are not the most reliable protection for the network. Therefore, the test was carried out only virtually, and the AGV, with the exclusion of other systems, operated smoothly, thus confirming that a wireless system can also be used as a form of AGV management in logistics.

The repeater network as a form of AGV management system in logistics

In this part of our research, we studied the operation of intelligent systems in logistics with the help of repeater networks. A repeater is a telecommunication device that has the task of sending, receiving or amplifying signals and, if necessary, regenerating received signals that may be weakening along the transmission medium. It is a device that maintains the quality of the signals as high as possible while allowing the signal to be converted as it transitions between systems (for example, between copper and optical transmission media). This functionality also allows to support outdated systems in the management and control of AGVs in a logistics service delivery system. The repeater can bridge larger geographical distances by acting as a shared point of wiring to which data from multiple directions arrive and from which data is sent or dispersed in all other directions. The system operates at the physical level of the ISO OSI model and therefore does not inspect the data packets it receives, neither is it aware of the addressing of the packets. As a result, it does not slow down the data flow. As the number of users increases, the number of collisions also increases because the repeater does not inspect the traffic on the other segments.

The telephone network as a form of AGV management in logistics

In theory, a telephone network[100] is the transmission of data in the form of words, pictures and even writing to different places, which is done by a telecommunications network. Systemically, they are complex telephone networks that connect at least two users connected to the same network. In economic terms, we were interested in the coverage of the mobile network and its availability in wired, fibre-optic and wireless formats, which would ensure the transmission of commands for the management of AGVs in the logistics implementation processes (25), using wireless networks with network security keys, which can be used to protect the network from unauthorised access by uninitiated people. The most common use of WPA2 in the processes of industry and its logistics is to transmit commands in a relatively secure way. The use of telephone systems for the management of AGVs in logistics service delivery processes is appropriate and, like a wireless network, is useful for linking internal communication systems that complement each other to create a secure

[98] Wi-Fi Protected Access – device security standard in a wireless network
[99] Upgraded version of WPA, allowing AES encryption and the use of longer passwords
[100] From Greek: tele = far away and phone = voice

system network for the management of AGVs. The use of the telephone network as a form of AGV management in logistics was tested virtually, the data obtained was identical to that from the wireless network, with the difference that the latter operates over the Internet, while the telephone network can be stand-alone, or it can be systemically connected to the Internet and often constitute its infrastructure.

Satellite network as a form of AGV management in logistics

The very word satellite turns our heads skywards, and we think that a satellite network somewhere in space beyond planet Earth is needed to send audible, written, or pictorial messages. The system or device sending the shapes of signals needs an unobstructed view of the sky. A satellite communication device tries to send information to a satellite or receiver in orbit, where the system will recognise the signal and send it forward or back to our planet as commanded (programmed). Typically, a narrow beam of signal is sent from a specific part of the Earth by a system device to a satellite, which scatters the beam and sends it back. This allows information to be accessed or the system network to cover the lit part of the planet. Satellite networks are used by individuals (natural and legal persons), companies, governments, and many users to achieve greater communication with a wider range of users or to connect users when other means of connection are not possible. However, the operation of this network is quite limited and requires specific conditions. It is not affordable for a wide range of users but can be used for a wide range of roaming by different mobile operators. As part of the research, we looked at the possibility of using a satellite network in the management of AGV systems in logistics. As with the telephone network and the Internet, the system proved to be very reliable. It can be used as a basic system, and it is even more suitable for complementing AGV management systems, proving that the intelligent device is designed in such a way that it can be adapted to many forms of management systems, which enriches the system of AGV use in logistics.

5G network as a form of AGV management in logistics

The development of industry and modern technology, the development of telecommunications systems and networks, gives us the possibility of using the most modern forms of intelligent systems, which in fact mean the full cooperation of intelligent and natural systems. The G5 network is a fifth-generation wireless mobile network that operates using radio waves in higher frequency bands (26). 5G networks are available in two frequency spectrum bands, where the first frequency band operates from 450 MHz to 6 GHz and includes the frequency band LTE[101] and a second frequency band operating from 24,25 GHz to 52,6 GHz (26). The development of this network dates to 2008, when NASA, in collaboration with M2Mi, conceived the concept of (27). In 2012, telecoms infrastructure providers (Huawei, Samsung, Telefónica Europe, Fujitsu Laboratories Europe, Rohde & Schwarz and Aircom International) join the mobile network roll-out. (28). The

[101] Long-Term Evolution – standard for wireless broadband communications for mobile devices

advantages of 5G over its 4G predecessor are data speeds of up to 20Gbps[102], which is 100 times faster than 4G (29), less than 10 ms latency and 90% less network power consumption compared to 4G (30). . Telekom Slovenia was the first to implement it in Slovenia. Today, there are several providers, all of which allow both individuals and legal persons to use it. The network is certainly the best form of integration of natural and artificial intelligence, and advanced industries are taking advantage of this to modernise their processes and deploy autonomous production systems.

People and AGVs in the creation, management, and operationalisation function in logistics

The initial forms of autonomous systems deployment in production or logistics led to disengagement of employees in production and industrial logistics. Ignorance of the systems has led to the thinking that autonomous or smart devices (robots) will take over the work of the employee and, consequently, redundancies in industry will follow. Adequate education and training of employees was needed, and they quickly realised that smart devices (AGVs) in all their form, structure, and function, are there to help employees and to do the difficult or dangerous jobs that would otherwise have to be done by humans. They soon realised that they did not have to physically lift objects and materials, that they did not have to carry out inventories and calculations, that they did not have to perform specific movements or inclinations that would, in the long term, constitute a chronic occupational disease; or that they did not have to be unnecessarily exposed to unsafe or unhealthy working conditions for human beings. There has been recognition of the usefulness of smart devices where the AGV and the worker can perform their tasks in a coordinated way in the warehouse, on the factory floor or elsewhere. Intelligent systems, robots, technological equipment, and computer-controlled equipment work in harmony with the worker and complement each other. In the process of AGV management and logistics implementation, the human is in the role of a supervisor, supervising and reviewing the work done by the AGV. In the ratio of heavy work, the AGV as a smart robot performs heavy work in a ratio of 85-15 %, which is favourable for production, logistics and human health.

RESEARCH RESULTS AND FINDINGS

Proposal for a technology management model for AGVs in logistics

We found that the automotive industry has been introducing intelligent technology into production systems for a number of years, monitoring global market trends and looking for opportunities to introduce intelligent Industry 5.0 development systems. These are technologically sophisticated systems that introduce a new virtual world into the processes of research, innovation and technological modernisation of production and also service activities, on which a new modern and technologically improved way of creating production and using intelligent devices, systems and tools is based. The development departments develop virtual systems using

[102] This is the value we expect when the 5.5 G comes into force (between 2025 and 2030)

digitisation, computer equipment and simulated programmes to create virtual tools for the production of motor vehicle parts. In the virtual environment, the programme renders the part, gives it shape, colour, weight, resistance, flexibility, usability and technologically tests its performance. The advantages of virtual testing allow numerous tests to be carried out, thousands of tests to be carried out in a short space of time. Once a reliable product has been certified, the process of production or concrete use of the system begins. In a similar way, we have tested AGV management systems in logistics. This has the task of ensuring the flow of raw materials for production from the storage areas. The concept of an AGV management model in logistics was designed through individual operations and successful simulations in a virtual world, which would examine the individual processes of material purchasing, convenience storage, sorting, preparation and internal transport. Through measurable data and technological solutions, we looked for ways to improve logistics services and, consequently, cheaper industrial production.

Relevant elements and components of AGV management in logistics

In order to find the relevant proposals, elements and components of a model for the use of AGVs in the process of supplying production with raw materials or semi-finished or final products, we have searched for solutions through cognitive systems, existing technology and virtual tests, considering the many processes that are already in place and that make up the production system, in the search for forms of management of intelligent systems. The data obtained showed us that it is possible to manage AGVs and logistics services without errors, without delays, without complaints. Using virtual systems and computer technologies, we tested the new design, identifying possible errors and problems in management and supply. In the process of automating or implementing intelligent systems, we have tried to use as many forms of control and management of the AGV as possible to improve its logistics services. We were aware of the many problems and failures of manual delivery of raw materials to production. We also learned about the many causes of loss of reputation, the difficulties in applying the IATF 16949 standard[103] (31), causing unnecessary extra costs in the form of shortages or excessive quantities of raw materials, and indirectly disrupting the smooth production. The goal of implementing intelligent AGV systems was to: speed up logistics work, eliminate errors, eliminate time wastage, and prevent logistics complaints. The creation and implementation of new technology along Industry 5.0 lines required the use of known and proven methods of AGV management in logistics to be considered. An example is the use of the Kaizen method (32) which can be used to find a suitable and acceptable solution by using a device to scan and weigh all production pieces before reception, pick-up, transport, and dispatch. The device works by sending all the pieces through a scanning line before dispatch, where the code and all the data on the galley are first scanned by a scanner (thus already fulfilling the first condition of barcode readability). The data is then transmitted to the next software station

[103] It is a globally recognised standard in the automotive industry and refers to the supply chain

(AGV sends the data to the robot on the production conveyor). At the next programming station, a camera is used to check whether the correct crate has been selected in the system, whether the crate is damaged, whether all the products are correct in type, weight, code number, shape and type of raw material or semi-finished product. The AGV identifies the crates, also identifies the codes of the individual components and, if the products are finished, weighs the products to determine whether there are enough products in the crate. If any of the criteria are not met, the system detects errors and automatically rejects the crate for re-inspection and manual verification. In the implementation of the Kaizen programme, logistics complaint conditions based on unit packing by crate have been eliminated. With the virtual programs, we looked for other solutions that would fully satisfy all the criteria of AGV management, thus eliminating all fears of errors, claims and unnecessary costs. In this way, we have approached the principle of lean manufacturing in the automotive industry through virtual technology and hardware experiments. We realised that the virtual programme does not suffer from the unintentional errors that we perceive in human work in logistics or production. We therefore had to carry out a further test of intentional error and intentional error avoidance, using the Poka Yoke technique[104] (33) based on the law that neither man nor machine can completely avoid errors (34). In the elements and components of the AGV management model in logistics, we also had to consider the correct supply and distribution of materials and sequencing processes. We achieved this by using a Kanban technique for the distribution of tasks and the supply of jobs, which operates according to the "pull" principle. Systematically, there are no forecasts in this principle because it works on quantity recall, which allows the customer to get exactly what he needs and exactly when he needs the material. The system works by means of a Kanban signal, which can be in the form of a magnetic record card, an empty crate or an empty space. The form of movements or task requirements are recorded on the Kanban card. The AGV card tells the user what to do at a certain moment. The AGV system tells it to always take only as much raw material as the production line needs, which is the repetition or learning of intelligent systems that repeats a function or service and keeps the production line running smoothly all the time (20). We have found that this is a challenging Kanban system to use in industrial production because it can only prove to be a valid method in large-scale production. In the automotive industry, electronic Kanban is used in the production of small materials, to call AGVs to bring in new material from the warehouse, and at the end of the line when an assembled pallet needs to be taken away and a new empty pallet delivered.

Expected impacts of AGV system management in logistics

The objectives of the introduction and use of intelligent systems in logistics were to modernise logistics processes to increase industrial production capacity, speed up production, simplify individual logistics processes, reduce the consumption of all

[104] Japanese term meaning the avoidance of unintentional mistakes

forms of energy, increase productivity, reduce lead times and reduce the material costs of the final product. In order to achieve this through the use of intelligent technology (robots), it has been necessary to consider certain systems that make it possible to reduce costs in industry. In the last phase of the development of Industry 4.0, lean production has become very widespread, requiring the introduction of new methods of raw material supply JIT (Just in Time), production without inventory, without congestion and without lead times. JIT requires a precise quantity of raw materials, semi-finished or finished products at a precise time and place. Raw materials, semi-finished or finished products must be made or delivered by JIT at exactly the right time when the production or service process needs them. The system operation must have stable production, a flexible workforce, high quality materials and products, good durability of machinery, reliable suppliers, fast tool changes on machines and continuous maintenance of other elements of the business. With the introduction of intelligent systems, productivity is increased, unnecessary time, energy and labour are eliminated, new intelligent machines (AGVs) and new forms of management systems are introduced.

Expected economic impacts of intelligent systems in logistics

The automotive industry is characterised by its evolution and complementarity and will continue to evolve with the introduction of modern technology and the modernisation of specific processes and procedures for the assembly of different types and types of vehicles. (4). Therefore, the introduction of intelligent systems and automated smart devices (robots) is expected to have economic effects in production and logistics. These are reflected in reduced labour consumption, better use of existing machinery and more modern production and better logistics. With the introduction of technology, the industry has avoided manual operations, physical counting, no decision-making by written instructions, less workload for operators, fewer employees, fewer complaints. Intelligent warehouse management systems are being introduced, based on WMS software, which completely changes the form and working procedures of logistics, and the economic effects are becoming visible. In the future, modern software is expected to complement and enrich the existing technology with processes, system data processing and electronic data transfer. The deployment of AGVs has been driven primarily by the need to test their physical capacity in the function of internal transport of raw materials, semi-finished or finished products, and there is a growing need for the introduction of intelligent control systems to allow jam-free and remote management and control. At this time, a phase of virtual testing of individual systems is underway, which are comparable and high economic impacts are expected. We have therefore set the hypothesis "Intelligent systems are the future of industrial production and service activities" and we expect our research to confirm all the assumptions and objectives.

Expected relevant learning outcomes of intelligent AGV management systems in logistics

In the previous research (11), we have shown that with every new technological change, there are visible logistical effects. With the introduction of intelligent

systems and smart devices or robots, the effects are visible in all phases of the preparation and implementation of internal services for the needs of production implementation in the automotive industry. With the development of the field of automatic generation of individual intelligent systems in the processes of preparation, storage or transport of raw materials, materials, semi-finished or finished products, the system has required new and novel functionalities and logistic procedures through which the intelligent devices recognise or read the data directly from SAP or the corresponding SQL database and perform the required movements, motions, or activities. The system recognises requests, commands, and tasks for service executions. It executes services based on the management and control systems described in the previous sections. The management systems identify the management formats, infrastructure, AGV clamping trolleys, pallets and boxes, codes, shape, weight and other parameters. For each pallet, box or other shape, it compiles a final list of raw materials, semi-finished or finished products (including empty boxes) and calculates the exact coordinates of each trolley, pallet and box. All data shall be recorded in a results table which shall be stored in a database. This data is later used to print pallet labels and to create robotic instructions for transport or packaging. The management module integrates the SAP/SQL data interfaces (read and write) and handles all communication with the design engine and manages the system and configures the operating parameters. Some procedures have been tested directly in industry, others in laboratories and others in virtual programmes. All of them confirmed the excellent integration of intelligent AGV management systems in the logistics service. In this way, the first question in the hypothesis "Is the AGV - Optimatik 160 "flat to flit" suitable for the delivery of raw materials from warehouse to production?" was answered. The question was also: "Which navigation systems can the AGV use besides the magnetic conveyor?". We found that the AGV can be guided by magnetic tape, fibre optic, wireless, internet, repeater, radio wave antenna, telephone, satellite and G5 networks, as described in sections 3.2.1 - 3.2.8.

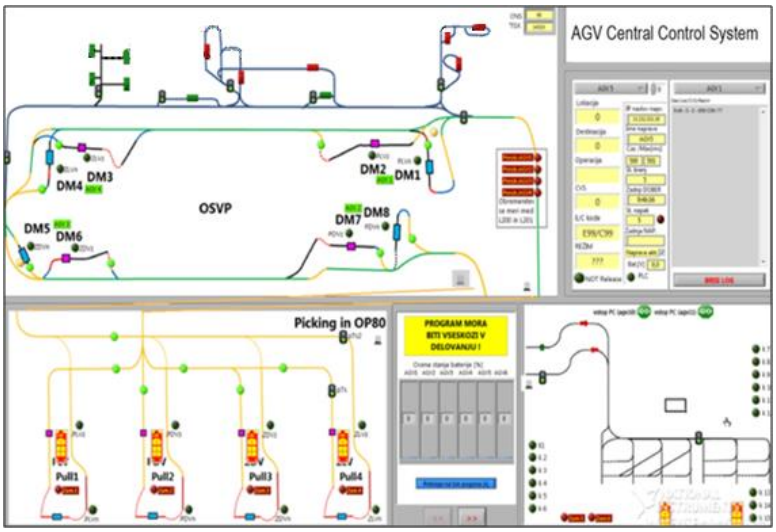

Figure 3: Demonstration of the use of AGVs in a less demanding magnetic stripe system and software

Expected achievements of intelligent AGV control systems in logistics

Through the questions raised about the suitability of the AGV - Optimatik 160 "flat to flit" for the delivery of raw materials from industrial warehouses to production and navigation systems for the management of AGVs, we have obtained confirmations which, in terms of expected effects and system management, have been a great success, demonstrating both economic and logistical viability. A new system for the use and management of intelligent devices in logistics has been developed as a product in the industry, following all the methods outlined in the study, and at the same time achieving the goal of an autonomous system for the deployment of modern Industry 5.0. All forms of management were tested individually and showed a high percentage performance (theoretically between 70 and 98%). In the interconnection, we observed a more precise and safer execution of individual movements, motions and functions. Tasks were performed much more accurately than humans. The advantages are also reflected in the system management of intelligent systems that check transport routes, trolleys, pallets, boxes, raw material, semi-finished products, products, code recognition, weight, quantity, shapes and complete the entire operation without human intervention. In this way, AGV intelligent control systems offer a range of new possibilities for the application and development of production and logistics systems in industry or elsewhere. The expected developments are cutting-edge, and the industry will not stop there, as there are interests in the increasing deployment of smart devices and the co-existence of natural and artificial intelligence, with natural intelligence having a control function.

DISCUSSION

In the research case of the search for models for the management of intelligent systems in logistics, it is the result of teamwork and experience, backed up by methods for finding appropriate systems, technology and technological processes to improve production. In the process of improving a service activity or logistics, we were looking for appropriate technology and systems that would eliminate unnecessary physical work in the pre-production process, eliminate wasted time and unnecessary labour, while providing intelligent devices and systems to manage and control them to deliver better products, reduce wastage in the pre-production processes, and allow for improved material flow and increased production productivity. We were aware that in science everything is relative and everything can be upgraded, updated, modernised, improved, modified, changed, innovated, which gives us the answer that we are not done with research. We have studied the phenomena of material flow, from the entrance to the industry (supply of materials for production), to marking, sorting, checking and storage preparation, the determination of individual signs, numbers, codes, etc., the ordering of individual materials for individual production conveyor belts and the preparation for internal transport in production. We were gaining new knowledge to improve the individual

processes of using AGVs in logistics, which opened up the need to find appropriate intelligent systems for the management and control of AGVs. Our aim was to collect observable and quantifiable data that could be measured by measurement and evaluation methods and, based on this, to participate in the development of new intelligent systems and technologies that would contribute to the management and control of AGVs in a better quality logistics management in industry.We hypothesised "Intelligent systems are the future of industrial production and service activities" to confirm that in the evolutionary era of Industry 5.0, there will be an increasing coexistence of natural and artificial intelligence, as technology is key to the development of industry and all the processes that accompany industrial production. We have backed up our claim by applying relevant methods in industry such as Kaizen, Poka Yoke, Kanban, Pull, JT and tested all of them through virtual processes. We assessed that we have achieved our objectives, as the economic effects seen in the system management of smart devices by WMS have been demonstrated. We are aware that this is not the end of the research, but it continues in the search for new possibilities, better solutions and competitive advantage for the automotive industry. All the questions asked have been answered, which have been the basis for confirming or rejecting the hypothesis. We have confirmed that the use of AGV - Optimatik 160 "flat to flit" is currently the most suitable format for the delivery of raw materials from warehouse to production. We looked for useful navigation systems that could assist the AGV in its work, in addition to the magnetic conveyor belt, and we examined useful intelligent control and management systems for AGVs and found that intelligent systems offer direct or remote control, and that the cost benefits are promising.

CONCLUSION

As pointed out by the author Zelenika in his book "The Economics of the Transport Industry", the automotive industry, a specific field of production that regulates the world market, regulates economic, inter-organisational and inter-corporate relations. It is often an element of inter-state and political relations, a driving force for development or a force for creating economic and other crises. States, communities, international associations and the entire economy of a country, a community of countries or a continent depend on it. It is precisely in recognition of such a demanding responsibility that industry is seeking sustainable solutions for the development of technology, intelligent systems, infrastructure, and systems and production (35), to enable larger processes and professional solutions for the development and modernisation of production. The introduction of intelligent systems in industrial production offers the right balance between supply and demand, between interference with nature and the environment and human needs. It offers methods and mechanisms for commercial and other opportunities, as well as mechanisms for attracting customers. This ensures the continuation of industrial work and development. The introduction of intelligent systems and new technologies is a major module in the development and modernisation of the

automotive industry, and the modernisation of logistics and logistics processes makes an important contribution to this. The introduction of the AGV as a smart device or robot has already inspired many manufacturers in other areas: pharmaceuticals, food production, the metals industry, and other areas, where they have introduced innovations into their processes, thereby saving on energy, on human resources, on safety, on environmental protection and much more. The introduction of new intelligent systems in logistics: new technologies in robots, AGVs and autonomous forklifts, the introduction of smart warehouses with automatic restocking, machines that perform various physically hazardous tasks, are a step forward in the overall development of science, the economy and society as a whole. In the debate, we touched on safety or the dangers that could arise as a result of the malfunctioning, movement or operation of intelligent systems. We started from the point of view that intelligent systems do not know about deliberate errors, but it was nevertheless necessary to draw a line between natural and artificial intelligence when talking about safety and about responsibility for the damage that might be caused. The legislator has defined the actions of natural intelligence through legislation, dividing them into actions that are more dangerous to society and those that are less dangerous, recognising intent as deliberate human action and negligence as omission (36). Both segments are impossible to apply to artificial intelligence because there is no intentionality or negligence. It is possible to argue for insurance as safety, but otherwise one could only use the strict liability of the owner of the industry, the capital or the person charged with ensuring the necessary safety, which is not the subject of our research.

In a concrete example, we have shown how new AGV management systems in logistics can be developed in a systematic way, through the use of different intelligent systems and methods, through experiments in the field and through virtual research, to support industry. The presented intelligent AGV control systems and smart machines (robots) are proof that Slovenian industry is developing in step with the global industry, in some cases even ahead of the global industry, which can be a source of proud for the development centres of individual industries and also for schools, colleges, universities, institutes and all of us who are involved in the development processes. In a concrete example, we have demonstrated intelligent systems for the control and management of smart machines in logistics, where we have demonstrated AGVs through several different systems and validated the performance of the individual systems and their combination. The systems complement each other, improve operational processes and even enable remote control of intelligent systems.

The scientific findings on intelligent control systems give us a starting point for further research, thus fully confirming our hypothesis and giving the reader the opportunity to learn about new developments in the industry, knowing that we have only been able to describe and present those parts of the development of intelligent systems that do not constitute trade secrets of a particular industry or manufacturer.

For this reason, we have also not mentioned where the scientific research was carried out and where the data presented was obtained.

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IMPORTANCE OF INTERGENERATIONAL COOPERATION FOR AN AGEING SOCIETY

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Abstract:
A human is a living being who needs another living being by his side all the time. Sociologists stress that human is a living being who cannot live alone. It is necessary to ensure that human remains social being from birth (primary socialization) until death. This is also important for the elderly in the third and fourth ages, when there is a great need for intergenerational cooperation.
Intergenerational cooperation also takes place in the context of intergenerational learning, which takes place between young people and older people, as well as between older people. Our visits to older people's homes have also shown us that this type of lifelong learning is very often taking place.
In this contribution, we used an online survey to explore the importance of intergenerational cooperation in the aging society.
We asked ourselves the following research question: Are young people willing to work with and help older people?
The survey was conducted from February to March 2021 using the 1KA online tool. We collected data from 265 respondents, 78 men and 187 women. The age of the respondents ranges from 18 to 65 years.
The key finding of the survey is that young people are willing to participate, help and socialise with older people, but this depends on the age of the young people. The younger they are, the more they are willing to help and socialise with them.

Keywords: elderly, young, society, relationships, cooperation, help.

1 INTRODUCTION

The older people often feel that they are not able to express their full potential in society and in relation to young people. They even point out that their rights are often infringed in different areas. For example, they argue that they do not feel recognised, encouraged and supported for their contribution to the society. They feel that they often do not have the opportunity to participate in economic, political and social life; moreover, they do not have the opportunity to be paid for their work after retirement, although over the last few years this has also slightly improved. At the same time, society does not recognize the needs and rights to a decent life of the elderly (Macuh, 2020). Moreover, the society does not recognize the role of the elderly in voluntary engagement in society, although it is precisely this area of cooperation between young and adult people that acts as an important social factor. They often feel that they do not have equal access to digital technology and education information. They are also concerned by the attitudes of younger generations towards sick and disabled people. We will discuss these problems with young people in relation to elderly in more detail in the central chapter of the paper.

The phrase Intergenerational programs', which was used in the 1970s and 1980s in the USA, refers to 'activities or programs that increase cooperation, interaction or exchange between any two generations. 'Intergenerational programs' involve the

sharing of skills, knowledge or experience between old and young' (Kaplan & Sánchez, 2014).

Macuh (2019) states that a human is a human being, who more or less needs another human being by his side and cannot live alone. Loneliness kills, they say, so it is necessary to ensure that man remains a social being from birth (primary socialization) to death. This way the man improves, fills its primary human gaps, which is being a man who cares about his fellow human beings. The cohabitation must be learned and it is the primary task of the parents – the family, educational institutions, the social system as a whole and is learned throughout our lives within society. Below, we will briefly present a very important part of life for every individual in the society, i.e. regulation of life between generations in modern society. To begin with, perhaps only a generally confirmed finding, regarding the life quality in the family (community of young and old), requires the coexistence of all members in community (Macuh, 2020).

The analysis is based on data collected by the study "The importance of intergenerational cooperation for an ageing society". The survey was carried out in 2021 using a field survey in Slovenia.

The purpose of the contribution is to determine whether intergenerational cooperation and coexistence contribute to a better-quality ageing of elderly.
We have formulated the following research *question: Are young people willing to work with elderly and help them?*

The results of the survey can help decision-makers and providers to upgrade and to plan mobility policies to adapt it accordingly to the elderly.

In this direction this work is organised and planned for the present survey. The introduction presents the subject of the research, the research question, the research methods used and the content structure of the work. The second part presents the theoretical background regarding intergenerational cooperation. The third part presents the research methodology and the results of the research. The last part is dedicated to a discussion related to the theoretical background with conclusions and suggestions for further research.

2 BACKGROUND

Intergenerational cooperation

The population of aging requires adjustments that sometimes are difficult to achieve for already stressed welfare systems. In this context, intergenerational solidarity

may play a significant role. Demographic shifts over the past century have also increased the percentage of grandchildren who, as young adults, have living grandparents. Adult grandchildren could become an important source of intergenerational solidarity, but few studies have explored intergenerational relationships, including grandparents, adult children, and adult grandchildren. None to our knowledge have examined which aspects of intergenerational solidarity affect the positive view of elders, positive expectations toward the future, and old-young divides (Mebane & Pezzuti, 2020).

Intergenerational cooperation has a number of positive effects, both on older and younger participants in this process. Mlinar writes about how the participation of different generations improves conditions for health and well-being (Mlinar, 2009). In the intergenerational studies literature, we have seen slow but steady growth in the base of record indicating ways in which intergenerational programs, depending on program design, setting and underlying objectives, can have an impact on participants' knowledge and skills, the level of civic involvement, health, arts and recreations, social relationships, self-fulfilment, and sense of cultural pride and identity (Kaplan & Sánchez, 2014). The inclusion of elderly in intergenerational activities reduces problems associated with metabolism and nutrition, improves their well-being and reduces thinking about the meaningfulness of life. We can add some very important components to this. Krajnc discusses the findings of the inclusion of the elderly, that were found in the intergenerational project "Intergenerational Cooperation through the Eye of Primary School" in 2017: the feeling of loneliness is reduced, increased or re-emerged the social network as well as a sense of belonging and importance for society (Krajnc, 2022). The impact on health, which was most perceived at the time that the project was emerging, is particularly noticeable in the intellectual and psychological field, consequently in the larger care of one's own body (hygiene, exercise) and general well-being. The same author adds the thought of one of the participating residents to the study – "Children revivify us". Young people, especially those who do not live with grandparents and have no contact with them in this cooperation, learn about the obstacles and limitations that age brings and, on the other hand, gain a great deal of knowledge and life experience. Above all, they see that there is a lot of things one can do when he or she grows old, just in a slightly different way as in other life periods (Krajnc, 2022). For centuries, in both traditional and modern cultures, intergenerational learning has been the informal vehicle within families for "systematic transfer of knowledge, skills, competencies, norms and values between generations – and is as old as mankind" (Hoff, 2007). It can be seen that intergenerational cooperation between young and elderly has positive effects, but in practice it takes place as shown in Figure 1.

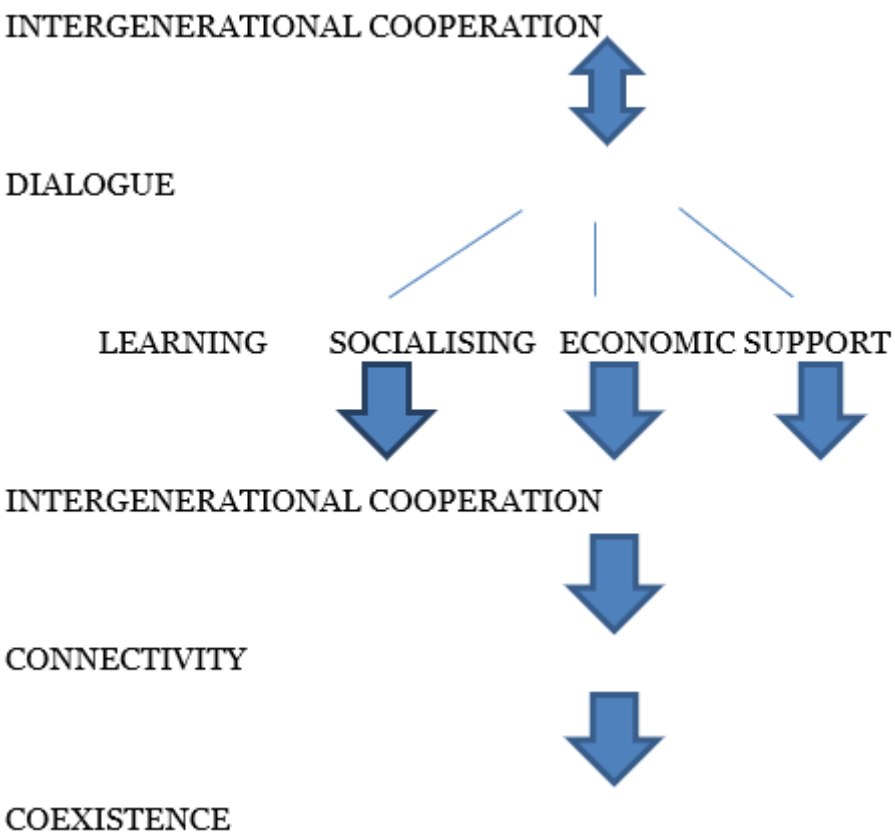

Figure 1: Intergenerational cooperation
Source: a.k.a. by Hozjan, 2010.

Intergenerational solidarity is defined as social cohesion between generations or intergenerational cohesion between parents and children once the children grow up and create their own families (Yilmaz et al., 2018). Hozjan states that intergenerational cooperation covers all programmes or activities carried out in the country in this field. Cooperation takes place through a dialogue, which is carried out by means of various methods (e.g. socialising, learning, economic support) (Hozjan, 2010). All these methods help to increase intergenerational solidarity and cohesion, resulting in coexistence between generations. Intergenerational solidarity plays a significant role in older adults' psychological well-being, but it remains unclear whether the influence would vary by distance (Li et al., 2021).

Coexistence and solidarity between generations

Intergenerational coexistence and solidarity between generations are among the most common concepts of today's debate on the ageing populations (Ramovš, 2013). According to Ramovš (2013), a large-scale representative survey from 2008 entitled "Views, needs and capabilities", in which participated Slovenian people aged 50 and over, raised many of the issues related to different aspects of intergenerational integration in the field of health and social functioning – some issues are addressed later on, in chapter on care, coexistence, happiness, volunteering, property and

other topics. Here in this chapter, we have clarified the concepts of intergenerational solidarity, intergenerational relations and other concepts related to them from the point of view of today's scientific theories and political views. Quantitatively and qualitatively, we have processed respondents' views on how much personal contact the young, medium and retirement generation have with each other, what connects them, how much of their life experience and insights they believe they can give to younger people, and solidarity in the form of neighbourhood assistance. The most commonly reported experience was that the elderly and young people understand each other equally well (40.6%), followed by the experience of older people better understanding young people (37.2%), young people and old people do not understand each other (18.7%) and that young people better understand older people than vice versa (3.6%). The analysis by gender and age groups, from 50 to 64, 65 years and older, showed significant differences. Older women are most convinced of their understanding of young people, younger women less, but at the same time, younger women stand out for their confidence in young people, to understand the elderly. Also, younger women have more pessimistic experience, that neither younger nor older people understand each other. Possible reasons for the specific answers of a group of younger women are: they are close to their growing children, most of them carry the elderly, belong to the self-realising "baby-boom" generation, they are going through a midlife crisis. Very encouraging finding was that whether older people should learn to understand and communicate with young people. This confirmed 77.2% of the participated population; those with a bad experience stated that neither younger, nor older understand each other, are not less committed to the intergenerational communication. In a qualitative analysis the two questions stand out more than others: According to your opinion, “the younger and the elderly understand each other" or "do not understand each other"? The following categories to the analyses are good attitudes, kindness, respect, cooperation, socializing, etc. Categorizing over a thousand answers to these two questions gives an exhaustive outline of the opposites in intergenerational communication. Responses on the frequency of good contacts with the young, middle and retired generation showed that the elderly population in Slovenia has the most contacts with the middle generation, aged between 25 and 60 years (in average 9.3 days ago), less with people over 60 years (in average 129 days ago) and good connection with young people between 15 and 25 years old (in average 26 days ago). In terms of passing over some life experiences and insights to younger people, half of respondents think that young people take a little, a tenth of them think, that younger take nothing, and a good third think that younger take on a lot. More than 90% of the population surveyed would immediately offer help to their neighbours if they needed it, but barely a percentage less believe that the neighbours would do the same (Ramovš, 2013).

Typically the elders or grandparents of the family share their wisdom and are valued for their role in perpetuating the values, culture and uniqueness of the family (Newman & Hatton-Yeo, 2008).

Štuhec states that the young, medium and old generations form an indivisible social whole. In his view, the development, stability and existence of society is based on intergenerational solidarity (Štuhec, 2011). As the share of the old population rapidly rises in the coming years this will create increasing uncertainty and confusion in all generations. The alternative is to quite rapidly create the conditions for better intergenerational cognition, communication and cohesion, which is the basis for the new solidarity between generations. The EU Council in the Green Paper (2005) states that the solidarity between generations is the main objective and method for solving Europe's demographic problems. The development of the conditions for strengthening the new intergenerational coexistence is to boost the education of the middle generation, which lives and works with the oldest generation.

For intergenerational cooperation is also important to educate older people. According to Goriup and Lahe, in the learning process the elderly often compensate their already acquired knowledge and work experience with new educational content when they detect a decline in some of their material cognitive processes (e.g. memory functions and psychomotor abilities) (Goriup & Lahe, 2018). Thus, they experience the results of lifelong learning and learning for sustainable development also as mental growth, which is the story of (their) successful ageing.

Intergenerational coexistence, cooperation and solidarity are also present during the stay of the elderly in nursing homes. Macuh writes that the research carried out among homes for the elderly in 2016 shows that different forms of solidarity in the activities of the elderly in the homes for elderly people are intertwined, because they are complex and conditioned (Macuh, 2017). Moreover, people would not be able to implement solidarity in the activities at all, if there were no interaction and reciprocity of the co-participating people who have respect for the elderly and their experiences, solidarity. Awareness of the importance of social inclusion of older people, or the possibility of their loneliness or desire to learn about a new, useful thing, mean a lot to the elderly. In carrying out intergenerational education, it is very desirable to understand family members and their direct and indirect involvement in life of their families (elderly), especially in homes for the elderly.

Intergenerational cooperation is also carried out in the context of intergenerational education, which takes place in the relation young people – the elderly, as well as the elderly - elderly. Even on visits to the homes for the elderly, we have witnessed that these forms of lifelong learning are also carried out very often. Their mission is not just to care for the elderly, but above all to ensure that the elderly feel good and comfortable at the place they are staying. They can only achieve this by focusing on the continuous improvement of the quality of life of the elderly, encouraging the elderly and at the same time giving them opportunities to participate as actively as possible in the new life frameworks they have chosen in the third and fourth life ages. In the context of mutual solidarity, friendships are formed between the elderly, as well as between the working and the elderly, which prevents loneliness, isolation,

passivity, a sense of irrelevance, intellectual and physical decay and neglect (Macuh, 2020).

Intergenerational cooperation and generational chasm

Intergenerational cooperation plays a decisive role in reducing the intergenerational gap and reducing conflicts, but is also crucial in active ageing, career planning, individual development and knowledge transfer. Intergenerational cooperation is a way of working and a system of bringing different generations of employees together with a purpose of ensuring mutual learning, cooperation, respect and understanding (Macuh, 2020). All this is approaching a representation of a challenge to international solidarity within (and beyond) the family context (Hortová & Souralová, 2019). Diversity between individual generations is reflected in the conflict of work ethics and can create cultural friction.

The most common problems at work due to intergenerational gaps are (Ličen & Bolčina, 2010):

- communication difficulties among younger and older people,
- disrespect and intolerance between generations (due to different working methods or/and life goals),
- the contrast between structured and open mentality,
- problems in the relationship between younger managers and older subordinates.

Successful knowledge sharing between generations shows that exist benefits inherent to diversity, particularly in terms of age (Martins, 2018).

As measures to balance the needs and attitudes of individuals of different generations however to prevent unnecessary conflicts, states that companies can use (Ličen & Bolčina, 2010):

- *Intergenerational learning* (exchange of experience and knowledge between generations) as the first important resource of going beyond such a gap and achieving new solidarity and trust between generations;
- introducement of *intergenerational integration* (e.g. trainings) into the practice of work, which helps generations to elaborate indifference of each other, distrust and a rejection to work together.
- establishment of *a system of intergenerational cooperation*.

Intergenerational cooperation is an “antipode” to the dominance of one generation and the tightness of another generation. Of course, this is only present occasionally, as both young and old people try to avoid similar situations as rarely as possible (Ličen & Bolčina, 2010).

There is also a more direct way in which children can benefit from benefits directed against the elderly and vice versa, namely within the context of extended (or

multigenerational) households. When three generations cohabit within the same household, pension benefits can reduce child poverty, and child benefits and working income can reduce old poverty. Such extended families are commonly observed in Southern and Eastern Europe. The prevalence of such families in some countries and their virtual absence in other countries is driven to a large extent by cultural factors. Nonetheless, the decision to form a multigenerational household or not is likely to depend on need and financial circumstances as well (Verbist et al., 2018).

2 METHODOLOGY

The survey was conducted from February to March 2021, using the online tool 1KA. Online tools are today already widely accepted facts in scientific research, despite some weaknesses that we have also encountered in our research. The most important are certainly the poor responsiveness of respondents, the incompetence to support respondents and the lack of traceability. All demographic data (gender, age and educational structure) are indicated in Table 1.

Table 1: Sample structure

	Number	**Share**
GENDER		
Man	78	29%
Women	187	71%
Together		100%
AGE		
Younger (18–26 years)	92	35%
Elderly (over 26 years)	173	65%
Together		100%
EDUCATION		
High school	11	7%
College	59	36%
High school	69	42%
Another	26	16%
Together		100%

Despite this, we successfully collected data from 265 respondents, including 78 men and 187 women. The age of respondents is 18 to 65 years. For the purposes of the survey, the respondents were divided into two groups. The first group includes 92 respondents (18–26 years) and the second group 173 respondents over the age of 26.

The vast majority (Figure 1) of respondents have occasionally helped the elderly. Only 18 respondents do not yet have experience helping the elderly.

Data on respondents' opinions were collected using *The Likert's five-step scale*. All questions are positively oriented, which means that "1" means the lowest, and "5" means the highest level of agreement. When they were asked about readiness to help older people, "1" means "never", while "5" means every day.

Respondents were requested to measure the level of willingness to help the elderly, in everyday activities, outside their home and in their free time (see the results in Figure 2). To measure the level of willingness to help in-house, we asked respondents how many times they are willing to help the elderly in the form of talking, reading, playing social games or taking care of health. The willingness to help outside the house was covered by questions about accompanied shopping, walks, doctor trips. Among the urgent tasks we included an accompanied trip to the doctor, an accompanied shopping and health care visit. Walks, conversation, reading, board games and excursions were combined into relaxation activities. Respondents' opinion on the financial situation of the elderly was obtained by questions about the financial situation and the price of services on the market. On the factors, that make it impossible for the elderly, we have counted poor organization of activities, poor pre-knowledge of the elderly, poor infrastructure and prices of performances.

For the purpose of checking hypotheses, we used a T-test and linear regression. The consistency of the Likert scales was confirmed by a Cronbach Alpha test with a result exceeding recommended value 7 (Hair et al., 2010) in all cases with the exception of scales consisting of two or three questions. In these cases, too, the result of the Cronbach Alpha test is acceptable, since for cases where the scale consists of less than 5 Likert units (questions), the lower limit is 5 (Pallant & Manual, 2001).

3 Hypothesis

In the research work, we set out the following scientific hypotheses:

H1: Young people between the ages of 18 and 26 are more willing to help the elderly than those over 26 years of age both in and outside their home.

H2: Age and level of education affect the willingness to help the elderly within their home tasks.

H3: Young people between the ages of 18 and 26 are more willing to help the elderly with emergency tasks, than those over 26 years of age.

H4: Young people between the ages of 18 and 26 are more willing to help the elderly with free-time activities, than those over 26 years of age.

H5: Willingness to help with free-time activities depends on the view that the weakness of the elderly is influenced by their financial capabilities and other external factors.

H6: Willingness to assist the elderly with urgent tasks depends on the view that weakness of the elderly is influenced by their financial abilities and other external factors.

4 RESULTS

Figure 2 shows the results of preparedness measures to help the elderly by individual factors (as questions to respondents) and the difference between the observed age groups.

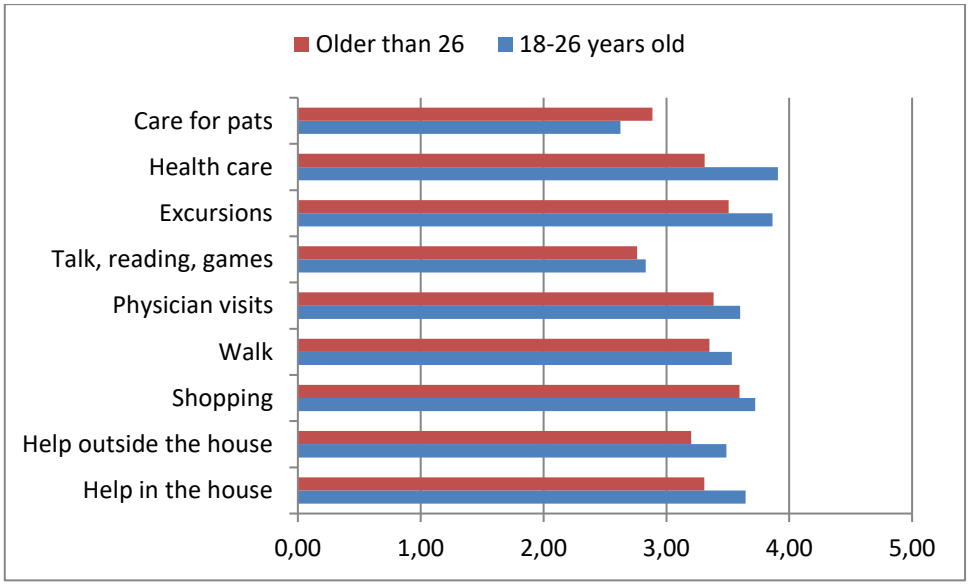

Figure 2: Willingness to help by activities

For all observed factors, the level of willingness to help the elderly is higher in the group of younger respondents (18 to 26). The only exception is the willingness to help them to take care of pets. It should be noted that this exception is a question to which only 43 respondents have answered and has therefore been excluded from further analyses. The biggest difference between the two groups is in health care.

Figure 3 clearly shows respondents' opinion measurements, of what constitutes an obstacle to free-time activities for older people. Here, too, respondents gave their assessment of the impact of a particular factor on a scale of 1 (small obstacle) to 5 (a major obstacle). No significant differences were observed between age groups.

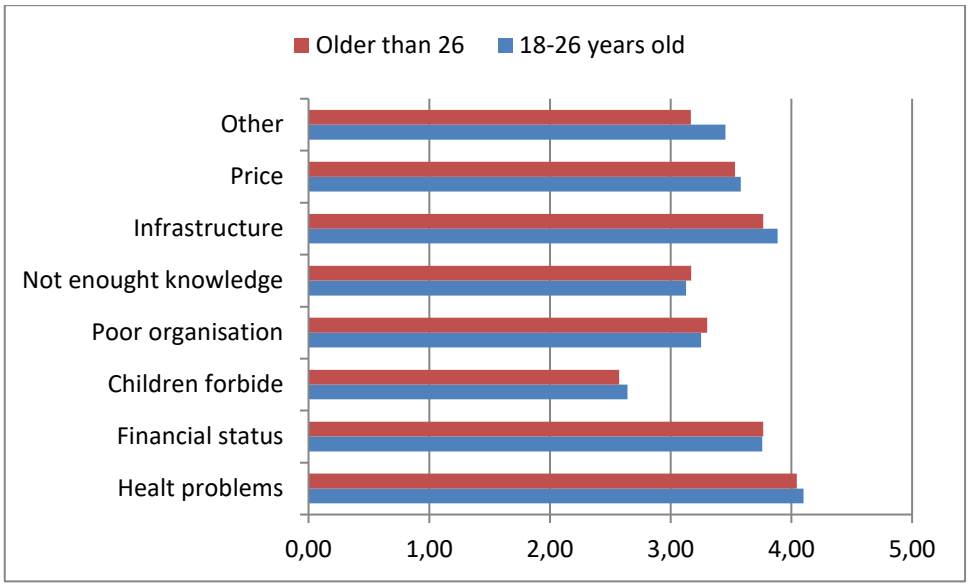

Figure 3: Opinion on obstacles to leisure activities

For the purpose of testing the hypotheses, we generated individual variables. By averaging the corresponding Likert scales, therefore to the intended methodology, and compared the values of these variables between the observed age groups using the T-test. The results of the comparison are given in Table 2, which shows the willingness to help the elderly in their homes and beyond, a statistically significant difference was observed between the age groups in favour of younger respondents ($r1 = 0.01$ and $r2 = 0.02$).

Table 2: Comparison of age groups by variable

T-test of the mean		N	Mean	Std. dev.	Std. Error	t	Sig.
Help in the house	over 26 years	165	3.31	1.0038	0.0781	-2.5548	0.0112
	from 18 to 26 years	90	3.64	0.9979	0.1052		
Help otside the house	over 26 years	164	3.20	0.9794	0.0765	-2.2813	0.0234
	from 18 to 26 years	90	3.49	0.9271	0.0977		
	over26 years	155	2.30	1.0153	0.0816	-0.9759	0.3301

Taking care during pandemics	from 18 to 26 years	77	2.44	1.0195	0.1162		
Frequency of visits	over 26 years	153	3.32	0.7938	0.0642	-2.4678	0.0143
	from 18 to 26 years	85	3.58	0.7732	0.0839		
Opinion that free-time activities are inaccessible	over 26 years	153	3.46	0.5400	0.0437	-0.2714	0.7864
	from 18 to 26 years	77	3.48	0.5201	0.0593		
Helping with free-time activities	over 26 years	160	3.21	0.8771	0.0693	-1.6876	0.0928
	from 18 to 26 years	87	3.41	0.8313	0.0891		
Helping with necessary activitties	over 26 years	154	3.44	0.8638	0.0696	-2.6314	0.0091
	from 18 to 26 years	88	3.74	0.8281	0.0883		

This **confirms our H1 hypothesis**. Young people expressed a statistically significantly higher level of willingness to assist emergency services (r=0.0091), confirming **our H3 hypothesis**. **The H4 hypothesis**, which expected a higher level of preparedness in young people even in the area of assistance to the elderly in leisure activities, was not **confirmed** (r = 0.0928).

The H2 hypothesis was tested using a regression model, where the calculated coefficients are represented in Table 3. Based on the results, **the hypothesis of H2 can be partially confirmed**. Age has a statistically significant effect on the willingness to help with the home work, while we did not detect statistically significant dependence at the level of education.

Table 3: Regression coefficients to the H2 hypothesis

	Unstandardized coef.		Standard. coefic.		
Dep. var.: willingness for helping in the house	B	Std. Error	Beta	t	Sig.

1	Constant	3.5685	0.2120		16.8365	0.0000
	Age	-0.0152	0.0066	-0.1645	-2.3062	0.0220
	Education	0.0457	0.0676	0.0482	0.6754	0.5001

Based on the results of the T-test in Table 2, we find that young people between the ages of 18 and 26 are more willing to help with performed than those over 26 years of age. The observed difference in averages is highly statistically significant ($p < 0.01$). This confirms **our H3 hypothesis**. **The H4 hypothesis**, which assumes greater regard for the younger population (18–26 years), to help the elderly also in free-time activities**, was not confirmed,** as in this case we did not detect a statistically significant difference ($p=0.0928$).

Table 4: Regression coefficients to the hypotheses H5 and H6

	Dep. var.: willingness for helping with free-time activities	Unstandardized coef.		Standard. coefic.		
		B	Std. Error	Beta	t	Sig.
1	(Constant)	2.9172	0.3173		9.1942	0.0000
	Finance	-0.0760	0.0992	-0.0692	-0.7657	0.4446
	External factors	0.1790	0.1138	0.1420	1.5721	0.1173
	Dep. var.: willingness for helping with necessary activities	Unstandardized coef.		Standard. coefic.		
		B	Std. Error	Beta	t	Sig.
1	(Constant)	3.1833	0.3194		9.9652	0.0000
	Finance	0.0050	0.0987	0.0046	0.0502	0.9600
	External factors	0.1059	0.1140	0.0846	0.9291	0.3539

In Table 4, we give the coefficients of regression models for hypotheses H5 and H6. Based on the results, we conclude that the **H5 and H6 hypotheses have not been supported**.

5 CONCLUSIONS

As part of the empirical survey, data were collected from 265 respondents, 78 of whom were men and 187 women. Respondents' age was 18 to 65 years. For the purposes of the survey, the respondents were divided into two groups. The first group includes 92 younger respondents (18–26 years) and the second 173 over the age of 26. The vast majority of respondents have already helped the elderly from time to time. Only 18 participants do not yet have experience helping the elderly.

Our preliminary research hypotheses were tested:

H1: Young people between the ages of 18 and 26 are more willing to help the elderly, than those over 26 years of age both in and outside their homes. When the willingness to help the elderly in and outside their homes was shown, a statistically significant difference was observed between the age groups in favour of younger respondents ($r1 = 0.01$ and $r2 = 0.02$). On the basis of the results obtained, **we confirmed H1**.

H2: Age and level of education affect the willingness to help the elderly with house work. We found that age has a statistically significant effect on the willingness to help with home tasks, while at the level of education we did not detect statistically significant dependence. On this basis, **H2 could only be partially confirmed**.

H3: Young people between the ages of 18 and 26 are more willing to help the elderly with emergency work than those over 26 years of age. Young people between the ages of 18 and 26 are more willing to help with urgent tasks, than those over 26. The observed difference in averages is highly statistically significant ($p< 0.01$). Based on that finding, **H3 has been confirmed**.

H4: Young people between the ages of 18 and 26 are more willing to help the elderly with free-time activities, than those over 26 years of age. We assumed greater affection for the younger population (18–26 years) to help the elderly also with leisure activities, but this is not the case. **H4 has not been confirmed.**

H5: Willingness to help with free-time activities depends on the view that the weakness of the elderly is influenced by their financial abilities and other external factors. Based on the results obtained (Table 4) **we were not able to confirm H5**.

H6: Willingness to assist with urgent tasks depends on the view that the incapacity of the elderly is influenced by their financial abilities and other external factors. Based on the results obtained (Table 4) **H6 could not be confirmed**.

Answering on the research question (Are young *people willing to work with elderly and help them?)* we can state that young people are willing to work, help and socialise with the elderly, but this depends on the age of young people. The younger they are, the more willing they are to help and spend their free time with them. Also,

other authors have come to such findings. From this point of view, Slovenia is in no way different from other countries.

Now, the challenges are, how to proceed or move ahead? We are becoming an ageing society, where we will have to provide more satisfied conditions for a worth ageing. Intergenerational cooperation, coexistence and solidarity will also contribute to a large extent. Are we enough aware of the fact that entire society has to actively participate in this? Only individuals, civil initiatives and humanitarian associations will not be enough.

After all, we propose improvement of our research. We have not achieved the desired objectives with all results and findings obtained, i.e. confirmation that young people are always and in different ways willing to participate, socialise and partially coexist and co-produce with the older population.

We believe that it would be useful to perform a study on the subject of intergenerational cooperation where elderly people are also included and then compare the results with the present research. In this regard, the current research would be supplemented or upgraded. This would give more relevant results on the importance of intergenerational cooperation.

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EXPERT ARTICLES[109]

[109] professional articles; sicris / cobiss methodology 1.04.

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COMPANIE'S ATTITUDE TOWARDS SUSTAINABLE LOGISTICS

Abstract
Sustainable logistics development requires activities that lead to the greatest economic and social gains while reducing negative environmental losses. The purpose of the paper was to explore topics and challenges in the development of environmentally sustainable logistics activities. An inductive research method was used and the paper is designed as a combination of case studies and literature review. According to the literature review and case study, the paper presents various suggestions for improvements that can help logistics companies, as there is not much research on the selected topic in the Slovenian literature. The proposals are useful for achieving a competitive advantage and more sustainable operation of logistics companies.

Keywords: *logistics companies, sustainability, logistics development*

INTRODUCTION

To start with, over the centuries, but even more intensely since the mid-20th century, we have seen sustainability levels decline in all areas of business, society and politics. Environmentalists have been warning us for decades that our habitat is becoming increasingly more polluted, biodiversity is shrinking, and soon half of the world's population will have difficulty accessing clean water – a key condition for healthy living [1].

Sustainability has many different definitions but most often it was designed to meet the needs of the present without compromising the well-being of future generations. Many topics have been linked to sustainability, including prosperity and environmental and socio-economic health. In addition, the concept is often associated with the stabilisation of the human population, equality between generations, universal human rights and addressing existential challenges such as climate change [2].

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Next, sustainable development of logistics requires activities that lead to the greatest economic and social gains, while reducing negative environmental losses. The European Union [3] highlights some current and future trends such as migration and internal mobility, aging, urbanization and globalization, which can all pose a challenge for social and economic development, and challenges such as climate change.

Logistics as a sector plays a key role in reducing greenhouse gas emissions and in reducing our economy's dependence on non-renewable energy sources. The potential contribution of the logistics sector to sustainability has so far focused on measures that reduce the costs of logistical. However, its potential is greater as logistics can make even greater steps toward reducing CO2 emissions through cost-neutral measures leading to small cost increases [4].

SUSTAINABLE LOGISTICS

The sustainability of the supply chain has been in the spotlight more and more in recent years, both among organisations and among the search topics in literature. At first, many companies considered sustainability initiatives mandatory and guided by regulations, however, recent literature shows that organisations are also introducing voluntary environmental programmes as possible alternatives to gaining or maintaining a competitive advantage [5].

To continue with, sustainable logistics is an important element of the corporate sustainable strategy, and sustainable growth is defined by non-financial areas of company value creation. In this context, sustainable logistics is created at company level. Regarding the entire network of participating companies, the concept of sustainable development is dealt with at the supply chain level, where the concept of sustainable development is realized at all stages of production, that is, from the first to the end stage of the product lifetime. The principle of sustainable supply chains is to integrate resource, business and information management in order to increase the company's revenues and wealth and to reduce the environmental impact [6]. The framework for sustainable logistics is presented in Figure 1.

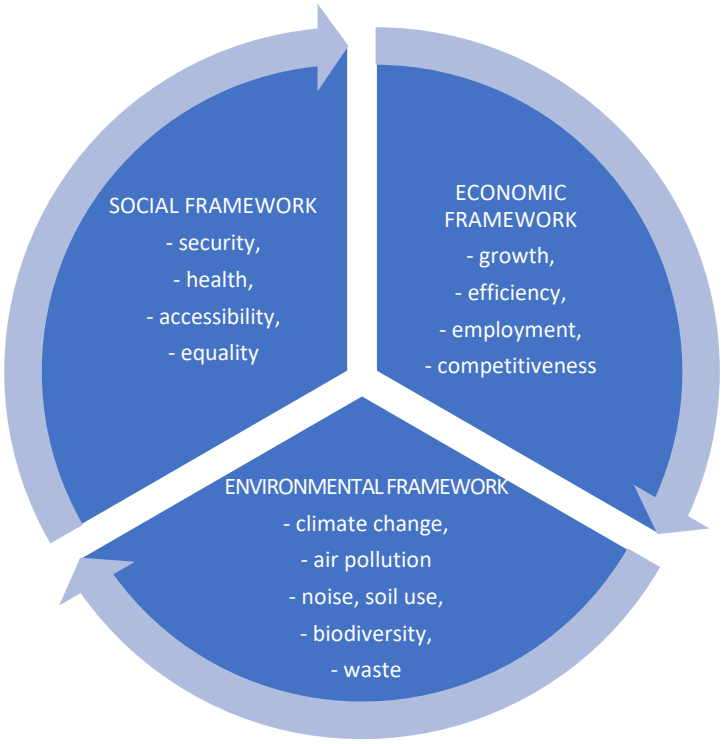

Figure 2: The framework for sustainable logistics
Source: Helm, 2018, 12

In the logistics network many players will have an impact on business costs and an appropriate environmental impact. The main players are suppliers, manufacturers, consumers, logistics operators and third parties, involved in testing, renewal, recycling and energy production for end-of-life products. These players carry out most of the activities affecting business and the environment [7].

PRESENTATION OF EXAMPLES FROM PRACTICES

The contribution of Bjorklund and Forslund [8] was intended to investigate how companies conduct sustainable logistics business practices, thus increasing understanding of how perceived challenges can be addressed. The literature identified potential challenges of business case models in general and of cases of sustainable logistics. Since independent logistics providers contribute significantly to emissions and are often responsible for planning logistics layouts, the empirical study focused on them. The way how business cases of sustainable logistics were conducted was investigated on the basis of interviews with managers, responsible for managing business cases of sustainable logistics, and responses that were supported with information from actual business cases. Despite the careful selection of independent logistics providers, which were very advanced in that area, only a few challenges were identified by the companies examined. However, this does not mean that the challenges do not exist; moreover, they can be described as a result of their pragmatic and inward oriented perspectives.

Even in other processes or logistics processes sustainability can be considered. In the case of packaged products packaging affects each logistics activity and thus the overall economic and ecological efficiency (eco-efficiency) of supply chains [9].

EXAMPLES OF GOOD PRACTICES

DB SCHENKER

With the innovations in logistics the German group DB Schenker together with its partners is breaking new ground. DB Schenker has quite a few innovations that contribute to more sustainable logistics. One of them is certainly the first commercial CO2-free flight, which is the result of a successful partnership with Lufthansa Cargo. The first carbon neutral air freight service ran from Frankfurt in Germany to Shanghai in China and back to Frankfurt. To be fully carbon neutral in the summer Lufthansa Cargo and Schenker are going to use a carbon offset scheme. In practice this means that they will invest money in afforestation and therefore buy and replace the missing greenness [10].

Figure 3: The first carbon neutral air freight service
Source: https://www.dbschenker.com/global/about/press/gaining-further-altitude-776100

The company is trying to operate as sustainably as possible in Slovenia. They put a lot of emphasis on the planning of processes and logistical routes. In addition, they ensure the optimal spatial efficiency of the loaded cargo, they optimise driving routes, provide education about economical driving for drivers, combine various modes of transport (multimodal solutions and shifts to railways if the customer and the type of goods allow). Furthermore, they consider the ecological aspect when purchasing new vehicles and other equipment, as well as when renovating their business premises and terminals. Moreover, they provide education for their employees in this area and as an employer promote initiatives such as reforestation campaigns and similar initiatives. MAN and DB Schenker are already building a

successful cooperation in sustainable logistics on a global scale. They teamed up with MAN Slovenia and have started using an electric delivery van around Ljubljana, their motto being "the sound of clean delivery", which is meant to draw attention to the problem of noise in urban centres [10].

PRIGO

On Friday 11th of December 2020 Igor Pristavec, the CEO of PRIGO, took over the first electric delivery van MAN eTGE, upgraded for transports under the temperature regime, thus setting a new milestone in the field of delivery logistics in the urban centres of Slovenia. It was the first electric delivery van in Slovenia, which PRIGO now uses in the distribution of pharmaceutical products, and it was the first on the way to sustainable delivery logistics. At the same time PRIGO has started testing the MAN eTGM electric truck, thereby contributing to a reduction in CO2 emissions of at least 8 tonnes on an annual level [11].

THE POST OF SLOVENIA

The Post of Slovenia has adopted the Energy Efficiency Strategy until 2025, which is part of the objectives of the corporate Sustainable Development Strategy in the context of the Strategic Development Programme until 2025. The main objectives of the strategy until 2025 are the following [12]:

- Reducing fuel consumption for means of transport by 12 % relative to 2018.
- Reducing overall energy consumption per building surface area by 6.4 % relative to 2018.
- Increasing the proportion of electric vehicles to 46 % in 2025.
- Reducing the carbon footprint by 14 % relative to 2018.
- 55 % share of renewable sources in buildings in 2025.

Figure 4: Electric van from the Post of Slovenia

Source: https://www.posta.si/o-nas/predstavitev/trajnostni-razvoj

DHL, Sweden

DHL has been declared the most sustainable logistics company in Sweden for the third year in a row according to the largest survey of brands in the Nordic region,

the Sustainable Brand Index B2B. Based on the Paris Agreement objective DHL has set a long-term global climate target for achieving zero net greenhouse gas emissions by 2050. Like many others multinational company DHL operates locally around the world as well. The company has achieved a 48 % reduction in emissions since 2008. In Sweden DHL Freight works with various biofuels and streamlines transport in a way that almost halves greenhouse gas emissions per tonne kilometre. The decrease is largely due to the fact that they have invested in increasing the share of non-fossil fuels thereby reaching a level where they represent 45 % of their total fuel consumption [13].

RESEARCH ISSUES

Past studies have examined the economic, environmental and social impact of e-commerce. Given the current situation on the food market the delivery model is not sustainable as the cost of delivering products to consumers' homes is higher than the profits from the products delivered. When assessing the performance of a logistics operation the carbon footprint intensity of the last kilometre of delivery should be considered as well. Neither home delivery nor conventional shopping has an absolute advantage in terms of CO2 production. Both consumers and retailers need to be aware of the environmental consequences of their shopping behaviour and distribution methods in order to achieve potential CO2 emissions savings. Each retailer should create their network according to the location and size of the stores and consider how to minimise the sum of their costs as well as consumer's travel expenses. The objective of this process is to minimize operating costs, however, the optimal solution can raise the level of emissions sharply compared to the minimum [14].

The logistics of the last mile or kilometre focuses on parcel delivery to the desired location of final customers rather than on buying goods in various physical stores, which increases the number of cargo movements, which is even more difficult when considering that each package is often small. Moreover, the last kilometre is an important part of the cost of parcel delivery, which usually represents almost 50 % of the total cost and is often labelled as the most polluting and inefficient part of the supply chain. Reducing the environmental and economic effects of the last-mile delivery in congested urban areas while satisfying final customer’s needs is an important logistical challenge involving a number of stakeholders with different and sometimes contrary needs and constraints [15].

Costs are a major obstacle to sustainable supply chains and for smaller companies it is especially hard to afford upfront costs in order to make the supply chain more sustainable. However, investing in something, such as compact packaging for example, can lead to a reduction in the size and number of shipments, a smaller environmental footprint and, over time, cost savings. Other companies have concluded that there are simply no sustainable component options or that they have

inherited supply chains from acquisitions that are difficult to refocus on sustainable practices due to the complexity or organisational structure. These challenges can be overcome; however, 20 % of respondents in the survey reported that customers were simply not interested. This is what makes it difficult for some companies to justify their additional costs or efforts [16].

PROPOSAL FOR IMPROVEMENT

In its contribution Smokers and colleagues propose the following solutions to reduce fossil energy consumption and CO2 emissions in the logistics sector, which they believe can be achieved by combining several of the following levers:

1. Less transported products (reduced shipment);
2. Less tonnes or m3, the same shipment (reduced weight or volume of production packaging);
3. Less tonne-kilometre or m3km, the same ton or m3 (shortened distance from production to consumption, optimal location of the hub, etc.);
4. Fewer vehicle kilometres, the same tonne-kilometre or m3km (increased load factor, increased load capacity of the vehicle, mode of shifting, etc.);
5. Less fossil fuel consumption, the same vehicle kilometre (improved vehicle energy efficiency, efficient driving style, replacement fuels, transition to more energy-efficient ways, etc.).

The possibilities for reducing CO2 emissions in logistics are presented in the following Figure 4.

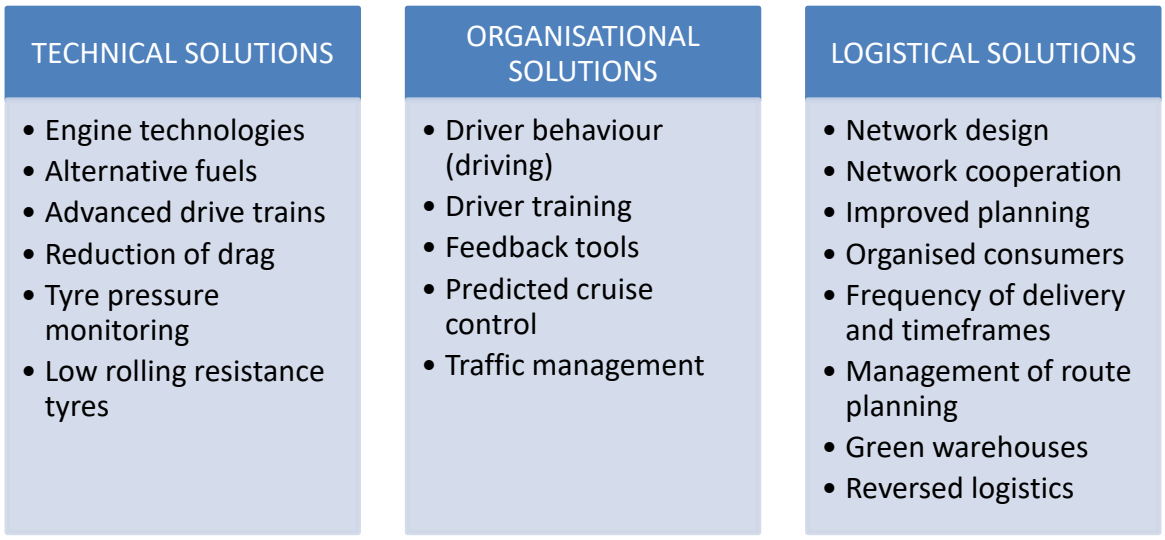

Figure 4: Options for reducing CO2 in logistics
Source: Smokers et al., 2014, 7

DISCUSSION

An effective strategy for tackling some of the recent and serious problems facing global supply chains is to comply with a sustainable approach. Due to such efficient management companies can improve their performance in order to achieve superiority in the market through a sustainable approach. Since the sustainability paradigm has become even more integrated into supply chains the traditional evaluation of suppliers has been replaced by an evaluation of their sustainability and environmental and social criteria are now being considered alongside economic criteria. By contrast, suppliers were assessed exclusively according to economic criteria in the past, including price, quality, business history, supply, technical capacity and desire to do business [17]. This is also evident from the examples of good practices that were presented in the previous chapter.

Several sectors have shown positive examples of resource optimisation and waste reduction. Multinationals, such as DB Schenker and DHL, have set ambitious goals to improve the sustainability of their business through their services. These are very positive steps, some of which are driven by entrepreneurs and industry and some are supported by government policies, while others are driven by consumers who are increasingly demanding alternatives.

Despite the positive examples there has been too little progress in practice so far and the COVID-19 pandemic has even worsened the situation. The United Nations Report on the Sustainable Development Goals (SDGs) observes that although some progress has been made considering the SDGs, carbon emissions continue to rise and climate change is occurring faster than expected; land degradation continues; a huge number of species are at risk of extinction; food insecurity and poverty is increasing; unsustainable consumer and production patterns remain widespread [18].

This suggests that despite progress most industries have not yet undergone the necessary transformations to truly integrate environmental and social sustainability into the way they do business. In addition, on the basis of the literature review Ritala et al. [19] have concluded that the acquisition of sustainable business models by corporations was limited. The researchers argue that companies need to go far beyond current initiatives and try to ensure a meaningful net positive environmental and social value. They have introduced the terminology of "regenerative business models" as a choice, with the industry actively working to address the environmental (and social) damage caused in recent decades.

Generally speaking it can be noted that examples of a sustainable business model are still not widely used, and even if they are used, they do not seem to provide the necessary level of transformation. Ritala and others [19] observe that unsustainability is embedded in many of the world's usual business models and in

our economic systems. The breakdown of these institutionalised models is crucial for a successful transformation into a more sustainable system. Successful innovations of business models for sustainability and circularity require a broad focus on the social level. It seems necessary to better understand the unsustainable dimensions of current business models and networks in order to see which issues are currently being addressed or could be addressed by sustainable business models, and whether there are issues that our current conceptualisation of sustainable business models cannot adequately address [18].

In Slovenia there are currently no such examples as mentioned in DB Schenker for Norway, however, we can see shifts in the right direction as evidence from the presentation of Slovenian companies shows that they are increasingly following sustainable policies and objectives. This is certainly helped by the fact that sustainable logistics in urban centres is supported by regional and local policies that encourage stakeholders to take on such projects (there are more and more urban centre access restrictions and restrictions relating to types of vehicles). Unfortunately, such projects are still rare in Slovenia.

CONCLUSION

In conclusion, the sustainability of the supply chain relates to the efforts of companies to examine the impact that their products have on the environment and people through the supply chain, from raw material extraction to production, storage, delivery and every intermediate transport link. The aim is to minimise damage to the environment from factors such as energy consumption, water consumption and waste production, while also positively affecting people and communities, both within them and outside them. These concerns are additional to the traditional concerns in the company's supply chain regarding revenue and profits.

Furthermore, we conclude that monitoring companies' achievements in a fair and objective way, combined with a labelling or comparison system, can be an important tool for encouraging those companies that are already well ahead of others in their willingness to take further steps in the process of transitioning towards sustainable logistics.

Finally, we presented the topic extensively in the paper, defined the concepts and presented case studies on the basis of which we made proposals for improving and measuring sustainable logistics in companies. We hope that in the future these proposals will help logistics companies in Slovenia to aim for a more sustainable business that can bring them competitive advantages and other improvements in their business operations.

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INTERNATIONAL ORGANISATION OF EXTRAORDINARY TRANSPORT AND IMPACT OF COVID-19 PANDEMIC

Abstract:
Extraordinary transport is the movement of vehicles, a group of vehicles or a vehicle with its load on the road which exceeds the maximum permissible axle mass by it is dimensions, width, length and height, as defined by the regulations or by a road traffic sign loads or dimensions. Extraordinary transport services may be operated on the basis of licences issued by the Chamber of Commerce and Industry of Slovenia. The operation of emergency services requires proper organisation. Emergency services are operated by suitable means of transport, accompanied by one or more escort vehicles which warn other road users of the obstacle ahead. The means of transport must be adequately secured and illuminated. In 2020, a pandemic broke out in the world, with major impacts on supply chains around the world. It is assumed that the impact of the pandemic in Slovenia was strong, as the pandemic changed Slovenia's links with the rest of the world, with mainly negative effects and fewer positive effects.

Key words: *extraordinary transport, granting of a licence, pandemic.*

EXTRAORDINARY TRANSPORT

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Extraordinary transport is a carriage of a load representing a movement of vehicles (a motor vehicle) or a group of vehicles (a motor vehicle with a trailer or a motor vehicle with a semi-trailer) which, with the load, exceeds the overall dimensions (width, length and height), mass and axle load permitted by the regulations or by the road sign.

Extraordinary transport is also a carriage where the vehicle, alone or with its load, is within the limits of the total mass, axle loads or dimensions permitted by the regulations, or exceeds the limit of any of these elements, which is imposed by a traffic sign on the road or on a part of the road. (eGovernment, 2017). A vehicle may not exceed the axle load, total weight or dimensions authorised by regulation or by a traffic sign on the road, either alone or with the load, except to the extent and subject to the conditions laid down in the exceptional transport authorisation. (eGovernment, 2017).

The operation of extraordinary transport operations requires proper organisation in the choice of the transport route, the means of transport, and the escort accompanying the extraordinary transport when moving the goods. All necessary permits/consents need to be obtained, statistical inspections of bridging structures need to be arranged. Escorts accompanying emergency transport need the appropriate permits and must have passed the escorting exam.

LEGISLATION

The organisation of extraordinary transport operations requires the necessary documentation to accompany the transport of goods. EGovernment (2017) argues that extraordinary transport can be carried out when the relevant permits are obtained. We arrange for the permit to be obtained from the official organisation designated for this purpose. Goods are transported when all the necessary permits have been obtained, and these are obtained when the goods cannot be transported by rail or other means of transport, from the start of loading to the final unloading.

The licensing process requires an application, which can be submitted in written or electronic form, signed by a secure electronic signature with a qualified certificate. When the relevant documentation is obtained, it must be accompanied by the relevant information on the means of transport and the planned transport route, information on the load relating to the width, length, height and permissible total weight and axle loads of the load, the applicant for the exceptional transport authorisation (natural or legal person) and the time of the journey. Based on the documentation and information we have collected; we will determine which type of licence to obtain. The types of permits are divided into different categories.

Licences in Slovenia are issued on the basis of categories of extraordinary transport and the duration of the licence, which can range from 30 days to 12 months, with longer validity periods. Authorisation may be granted for a single exceptional load or for a group of vehicles carrying the same load in the same transport direction. The application for a licence in Slovenia can be submitted electronically via the internet, making the process easier and faster.

Types of categories of emergency services

Extraordinary journeys are divided into five categories. Each category has certain restrictions imposed on the carriage of goods.

- **Extraordinary category I. transport** is transport by a vehicle which, alone or together with the load, does not exceed 44 t gross mass, 3 m width, 4. 2 m height, a length of more than 25% of the maximum permitted by the regulations or imposed by road signs and axle loads permitted by the regulations or imposed by road signs.
- **Extraordinary category II. transport** is transport by a vehicle which, alone or together with the load, has a value of the total mass (over 44 t up to a maximum of 60 t), dimensions of width (over 3 m up to a maximum of 3. 5 m), height (over 4. 2 m up to a maximum of 4. 5 m), length exceeding 25% up to a maximum of 40% of the maximum permissible limit and axle load exceeding by a maximum of 20% of the maximum permissible axle load capacity.
- **Extraordinary category III. transport** is transport by a vehicle which, alone or together with the load, exceeds the upper limits of the total mass, dimensions and axle loads laid down for category II. exceptional transport.
- **Extraordinary category IV. transport** is transport by an unladen work vehicle registered for use in traffic and not exceeding 60 tonnes.
- **Extraordinary category V. transport** is transport by work machine, towing a convertible towing vehicle or tractor unit without load. This category includes machines that may exceed the regulations, but must not exceed the maximum permissible gross laden weight.

TRANSPORT VEHICLES

The transport of emergency goods is facilitated by a transport vehicle, which must be constructed accordingly. Transport vehicles must have suitable engines that have been specially modified, their powertrains adapted and their gearboxes adapted. The chassis is an integral part of the truck and plays a key role in achieving reliability, efficiency and long service life. The load-bearing frames or chassis are made up of a stack of cross members. (Cehner, 2016). Transport vehicles also

include trailers with two or three axles. For larger movements of emergency goods, trailers with multiple axles and hydraulic steering are used.

On each transport route, freight vehicles are accompanied by an emergency transport escort. This is a person who has passed the examination and knowledge test for an escort for emergency transport. The vehicles are equipped with wireless communication devices with an emergency transport attendant who plans and guides the transport route.

Transport vehicle signalling

Any vehicle carrying out an emergency service must be equipped in accordance with the legislation. The lorry must be fitted with a properly visible marking on the cab with the words. 75. article 1 of the Road Traffic Rules Act (Official Gazette of the European Union, No. I. RS, no 109/10) stipulates that if the load extends more than one metre from the rear of the load, it must be marked at the most exposed point. The lorry must be properly marked with traffic signs so that road users can see it and allow it to travel safely and smoothly. When carrying simple loads, the accompanying vehicles are marked with a flashing yellow light and the words »extraordinary transport«, or, in the case of more complex loads, with an additional light displaying the prescribed contents.

COVID-19 PANDEMIC

Coronavirus disease (COVID-19) is an infectious disease that threatens the human respiratory system. COVID-19 is the virus that causes severe acute respiratory syndrome SARS-CoV-2 (Severe Acute Respiratory Syndrome Coronavirus 2). A large percentage of the population survive with mild symptoms and recover without any specific treatment, but this is not the case for the elderly, people with chronic diseases or those with weakened immune systems, where the course of the disease can quickly become severe and fatal. Patients with more severe symptoms also need hospital care with oxygen and ventilation.

SARS-CoV-2 was first detected in December 2019 in Wuhan, China (World Health Organization, 2020) and has since spread worldwide. Slovenia had its first confirmed case of COVID-19 infection on 4 March 2020, in a traveller arriving in Slovenia from Italy via Morocco (RTVSLO, 2020). A week and a day after the World Health Organisation (WHO) declared a pandemic, an epidemic has been declared in Slovenia.

All countries in the European Union have started to take various measures to stop the spread of the epidemic, such as stopping public life, schooling, working from home, closing borders and a mandatory 14-day quarantine on entry. The measures taken have had a major impact on various sectors, including emergency transport.

Passenger transport was either completely halted or operated under strict conditions.

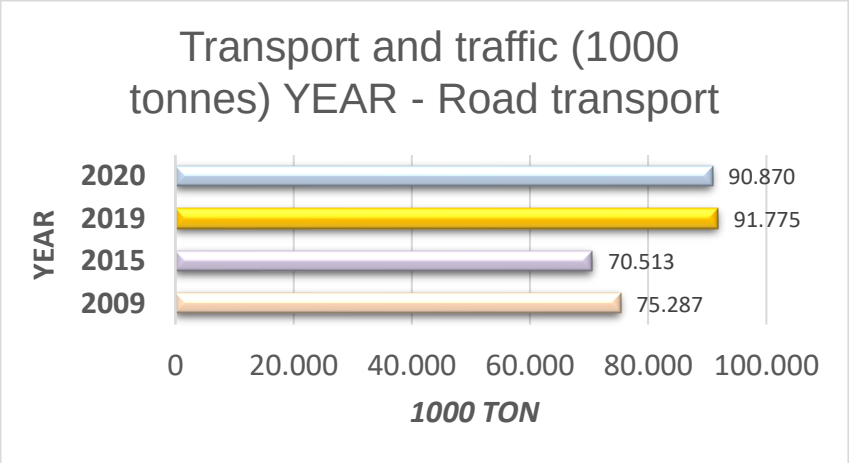

Image 5: Transport and traffic (1000 tonnes) by: YEAR - Road transport
(Source: Statistical Office of the Republic of Slovenia)

As the graph shows, transport has decreased from 2009 to 2015. Between 2015 and 2019, Slovenia's transport and traffic increased from 70,513 to 91,775.

During the declared epidemic, road transport has decreased. Freight transport has faced new challenges throughout the epidemic, such as longer times at border crossings and a shortage of drivers at times of action, which has had a negative impact on road transport. To enter Slovenia and other countries, drivers had to meet the PCT (pre-treated, vaccinated, tested) condition. They had to show a certificate at the border crossing point to enter the country, otherwise they were sent to a 14-day quarantine. After a while, the quarantine for the drivers was lifted, as the population was dependent on the food supply of the supermarket chain.

The graph shows that the percentage of 2020 and 2021 traffic has not decreased much. Despite the declared epidemic, the shippers needed to supply the food chain, as this kept the shelves full. A positive impact was seen in the reduced percentage of drivers in the road traffic, as this made the emergency load shifting easier to handle without obstructing other traffic. A number of derogations from the freight transport laws were also adopted to ensure that the route could run as smoothly as possible.

CONCLUSION

In the article *International organisation of emergency transports and the impact of the COVID-19 pandemic*, we have established the definition of emergency transports, how to obtain an emergency transport licence, the types of emergency transports, how to organise emergency transports. The research shows what

COVID-19 is, when it first appeared in Slovenia and what impact the pandemic had on our country Slovenia. On the basis of the findings, I consider that the epidemic has had an impact on the exceptional transport of cargo, as the government decree required the PCT condition to be met at the entrance to the country. The transport journey of drivers was drastically lengthened due to the requirements of the PCT condition, because of longer waiting times at border crossing points. Despite the demands and waiting times at border crossings, freight forwarders needed to supply the food chain to fill our shelves.

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Robert Mašera[116]
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THE FUTURE OF ROAD TRANSPORT

Abstract:
In the project task we are addressing the issue of new technology for heavy transport vehicles which would be massively implemented into road freight transport, with the aim of reducing the environmental impact, increasing road safety and improving efficiency in an economically justified way.

We compare promising and meaningful alternatives that would suit different situations and find out where new technologies need to be further developed in order to be safe and efficient.

Key words: *electricity, autonomous driving, infrastructure, technology*

INTRODUCTION

Advances in development of technology always bring advantages and disadvantages that show up quickly, or only after years. Technological development has eased many problems and offered new opportunities in the field of transport. Machines and equipment that are powered by fossil fuels make transport possible, but at the same time they pollute the air and consequences of pollution are shown in many ways.

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Primary goals of future road transport vehicles are eliminating or minimizing the impact on the pollution, improving safety, and efficiency as much as possible, without causing economic and other damages in the end result.

Along with the global demand for transport services, every year we witness the rise of the demand for heavy transport trucks, and with higher demand comes greater pollution. Governments are trying to minimize the impact with stricter emissions regulations and other actions, but the main cause to the increasing problem are mainly consumption and purchase of unnecessary goods mainly from major online sellers like Amazon.

The primary interests of a transport or logistics company is, in fact, the satisfaction of the customers' needs as well as positive finances. Only after that all the environmentally friendly actions are taken into consideration. The most important thing is to find solutions for all problems in the same package in the way that we do not compromise the stability of the company and workers' jobs with all the environmental restrictions.

This short paper is a brief summary of (our active project) the most important possible actions and technologies that can, or hopefully will improve the safety and efficiency of road transport, and at the same time reduce or eliminate the impact on our environment. We are currently working on adding to the project chapters connected with: impact of covid 19 and Russian invasion on prices of our future tehnologies and prices of fuels and energy.

ALTERNATIVE FUELS

E-fuels in particular represent the so-called mild switch to electricity, which is currently the cleanest alternative to replacing fossil fuels until most vehicles are completely switched. When we talk about a mild crossing, it is important that we do so in a way that allows everyone to have a level playing field over a reasonable period of time and does not allow dominance for those who initially have more capital and can adapt to change much more quickly. After the transition period has been completed, the authorities must ensure, that what we have replaced can no longer compete with the new system and the new conditions. (Evans, et al., 2020)

Natural gas is most definitely one of future fuels if the conditions are right, for example city driving and short and possibly long trips up to 800 km. For this to happen we need to develop and build the infrastructure that is economically viable for mass production of such fulling stations as they are expensive to build, run and maintain. There are some disadvantages with refueling the natural gas tanks compare to diesel, but this can be solved with many solutions like refueling robots. (Ambrald, 2020)

Cleanest energy is electric energy produced from renewable sources, and electric motors are most efficient at converting energy to motion. Batteries are currently the best choice for storing electricity, especially for fully electric vehicles because of easy recharging that is possible almost everywhere, but they are still not equivalent to fossil fuels in the area of usability, as they are heavy and take lots of space and a long time to recharge. Battery mass, size and charging time are the maximum limits of the current battery technology. Improving those could make a significant difference, even with much higher selling price than diesel unit. Main use of current electric trucks is in cities for package delivery and utility needs. (Lewis, 2021)

Natural gas has some disadvantages and same goes for hydrogen powered trucks, where one of the major problems is lack of infrastructure and low range compared to diesel powered trucks. Hydrogen fuel cells, which produce electricity through the chemical process, also have great potential. The only product is water, but it is worth noting that hydrogen production is very energy wasteful. The production of hydrogen from renewable sources is ecologically acceptable. The hydrogen vehicle is eco-friendly and efficient but the cost of new unit is very big, compared to diesel trucks. Bringing down the cost of new units is the key to convincing companies to buy electric trucks. (Ambrald, 2020)

As already mentioned, a mild transition will be needed to new alternative fuels such as electricity and hydrogen, and less likely natural gas in large scale. This transition poses a huge challenge to the part of the economy that does not have the capital for rapid adjustment, and especially to companies from less developed countries.

Systemic transition will have to be carried out in a very thoughtful and calculated way, in our case the European Union is the one that decides, encourages and dictates the situation in many countries.

It is necessary to create an equal plan which provides guides to countries and businesses so that they know how to invest in infrastructure. At the same time, leaders must put legislation in favour of those who have decided to switch to new technologies in the early stages in which no one yet knows whether this new alternative will be effective and profitable. It is also proposed to set up expert teams to participate in all the planning.

However, it is also necessary to provide adequate investments in the field of development, as billions in investments are expected to be needed to achieve a level of development that achieves the priority objectives like low pollution and cost effectiveness.

Companies that produce trucks massively are actively trying their best to deliver new products on the market in form of new alternative fuels or fully electric trucks. (Evans, et al., 2020)

AUTONOMOUS DRIVING

Different countries and continents have different priorities when it comes to automation and autonomous driving. The European Union advocates competitiveness, innovation, environmental protection, energy security, employment and human education. This raises a question how to provide jobs and protect people who would be replaced by autonomous devices and automation of systems. The very opposite is the US's focus, where profit, efficiency gains and, above all, softer climate change policy are at the forefront.

Autonomous trucks or semi-autonomous trucks are unavoidable in the near future as we push forward to reach the ambitious goal of minimal accident rate on the public roads, which are the most dangerous way of travel and transport. We want to make transport faster, safer, cost efficient and driver friendly.

We are currently talking about level 4 automation or high automation, which involves automation of approximately 70-90% of the driver's working time and shifts the driving of the vehicle to manual control only when it is defined and planned. The main objective of automation 4.0 is to make fully autonomous decision-making and to deal with all traffic situations, which means that a driver is not theoretically necessary even for supervising the autonomous driving actions, which are intended to be carried out autonomously. (Maurer, et al., 2016)

What needs to be made for autonomous vehicles to arrive on the roads:

- High performance sensors
- Measuring instruments
- Artificial intelligence
- Interconnection
- Social acceptability
- Additional regulation
- Visualization of traffic areas
- Navigation systems
- Additional infrastructure

Autonomous driving will eventually become part of our daily lives, but the real current picture is quite different. Vehicles that are currently being tested are able to drive without a driver in an environment that offers a sufficient amount of information. The problem arises with predicting situations and with changed traffic regimes, as well as possible obstacles. The advantage of autonomous vehicles is operation without pause and greater efficiency, as the driver is influenced by the surroundings, mental state, and by many other factors. (McDermid, 2020)

Autonomous vehicles will first be in use on short routes that offer a sufficient amount of information until we make a system that will actively have the necessary information for the operation of such a vehicle on a road with difficult conditions. Autonomous trucks are also being accelerated in development.

Artificial intelligence is an area that covers the so-called Machine learning. Autonomous vehicles and future information and operating systems will operate on the basis of artificial intelligence, as the key is that the vehicle self operates and can use new and old information, analyze it and transmit it to the central database. Vehicles have to learn and cooperate with each other. Therefore, all autonomous vehicles must predict situations, adapt and make changes without the presence of a supervisor. Such vehicles can be expected between 2025 and 2030, which will be first, cars or trucks, is unknown because development is still in progress. (Maurer, et al., 2016)

As soon as the technology allows, truck platooning will be added, which means at least two or more trucks driving in a convoy supported by autonomous driving. The aim is to take care of the convoy by at least one driver or not to need the driver at all, but the practice will show whether each vehicle needs additional monitoring.

The plan of the convoys based on the phases expected:

a) Convoys of one brand with their operating system
b) Convoy of different vehicle brands, with a single operating system
c) The driver only monitors the vehicle and rests on the majority of the journey
d) Full automation, convoy accompanied by one driver at the front
e) The system will no longer require physical presence of a person but only a remote supervisor

THE FUTURE CITY CONCEPT

The image below shows the concept of transport in an urban environment as well as the way distribution and transport should look like. Blue figures represent electric heavy-duty trucks which would be operated by a driver, orange figures represent smaller trucks, and pink figures are vans. Drones for airborne delivery are also mentioned as an attraction. All these vehicles would provide at least level 4 automation or full automation.

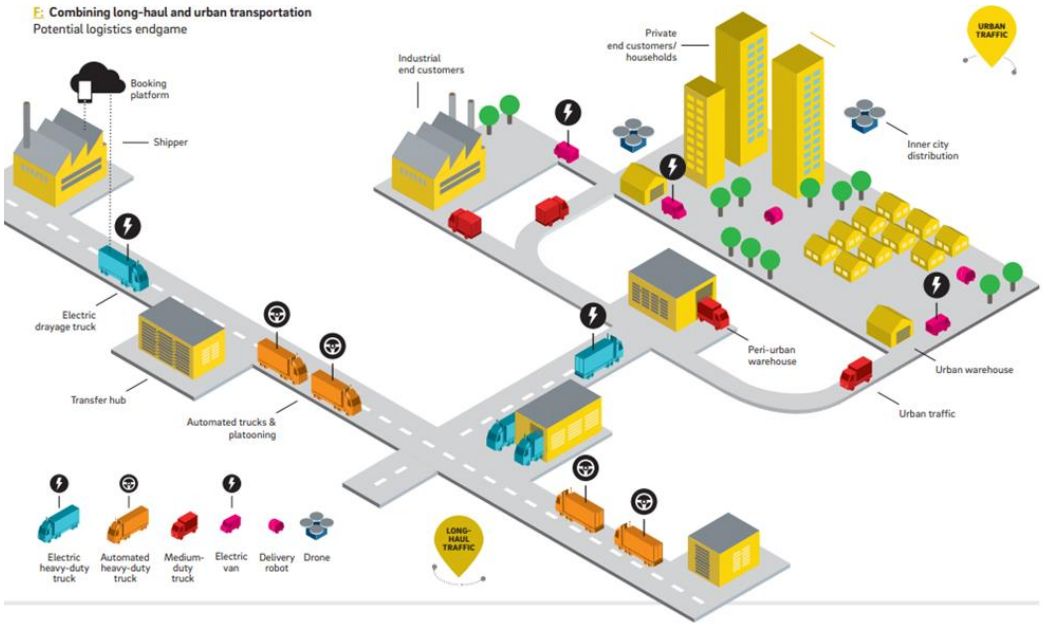

Figure 4: Future city
Source: https://www.rolandberger.com/en/Publications/The-future-of-trucking-Challenges-for-the-transportation-sector.html

In our opinion, heavy-duty trucks powered by hydrogen and natural gas, suitable for long distances should be added. This image shows, in particular, the link between the vehicles that travel a longer distance and the smaller vans that make the final delivery to the customer. Autonomous buses and public passenger transport are also placed in the concept of a smart city, which would operate on the same principles as freight with minor differences, but in this project task we are limited to freight vehicles for the transport of goods. (Kesse, 2018)

In conclusion, to achieve the above-mentioned goals as fast as possible, huge investments, smart guidelines and improved laws will be needed.

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Patricija Jankovič[118]
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Tilen Medeot[120]

DIGITAL BUSINESS TRANSFORMATION IN THE AGE OF DIGITALIZATION

Abstract:
The article deals with the revolutionary aspect of digital business transformation and its impact on modern sales organization operations, the connection to state of the art user experiences, customers satisfaction, cost efficiency, opportunities and advantages that a thorough and well executed digital transformation presents to modern companies.

Key words*: digital business transformation, digitalization, modern sales organizations, e-commerce*

INTRODUCTION

The world is now, more than ever, recording rapid advances in digital technology and the growth of e-commerce. The implementation of digital technology in business operations has gained considerable importance in the last decade, but during the COVID-19 pandemic it has become a "to be or not to be" question for

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[120] **Tilen Medeot's biographical notes** – please see footnote on page 24

modern day sales organizations. Not only have governments, through overnight “ordinances” that have been particularly rigorous for the economy in the form of total closures and strict “lockdowns”, prevented organizations from the traditional form of physical contact with users and consumers, but events have also pushed the wider population into a new digital reality, from whom the latest technology enhancements require an ever-increasing technological literacy. Public administration, government offices, state-administrative bodies, education, health care, service providers and sellers of all kinds, as well as users and consumers are forced to look for new, especially digital remote contact points. With this, advanced digital business functionalities and its implementation in all spheres and segments of life, especially the economy, has become the number one priority.

Innovations, advances in mobile and other technologies, new programs, applications, social networks and improved processes are being created practically overnight, and all indications are that further development of digital technologies will only intensify in the future. The effects of these advances for organizations that successfully ride the waves of change represent a host of new opportunities. From new forms of interaction with consumers, greater exposure and accessibility, state-of-the-art user experience to greater process efficiency, and meeting the expectations of the most demanding modern customers. This is also confirmed by the fact that the global highest annual sales revenues are recorded by organizations that, while using the omni-channel sales concept, are the driving force of innovation in digital business, such as Amazon, Walmart, E-bay and others. However, organizations that do not pay (enough) attention to the phenomenon or were already lagging behind the trend before the outbreak of COVID-19 are very likely to drown in the battle with time, modern technology and increasingly demanding consumers. This is also supported by the studies which show that the COVID-19 pandemic accelerated the digital business transformation from 3-7 years. This, of course, puts additional pressure on lagging organizations. Without the digital business transformation, the opportunities listed above remain an unattainable goal, and the benefits it offers to modern sales organizations are becoming a prerequisite for success. However, no organization can allow itself to turn a blind eye to the fact that the future is definitely digital.

More and more organizations are also adding two new positions to their traditional job structure - CTO - chief transformation officer and CDO - chief digital officer with a clear focus on the "digital first" future.

It is more than evident that a new "business Bible" for modern sales organizations has sprung into existence which consists from a couple of fundamental innovative marketing and business strategies/ideologies that ensure the emergence, penetration, development and/or even survival of modern-day sales organization in an increasingly demanding and competitive global market.

The four main "Amen's" of the new "business Bible" are:

1. Digital business transformation and constant optimization and innovation in this field;
2. Omni-channel marketing-sales strategy;
3. focus on state-of-the-art user experience and after-sales activities, which is primarily related to customer returns and complaints;
4. Efficient, functional and optimized reverse supply chains.

We must understand that the implementation of the above listed elements is no longer a matter of "nice to have" but a matter of survival.

WHAT IS DIGITAL BUSINESS TRANSFORMATION?

Digital Business Transformation (DT) means the adaptation of digital technologies into the business processes of an organization. It is a fundamental change in the way we provide value to modern customers. It is an imperative for all organizations, both small and large, but can also be understood as a kind of study of the ways on how an organization remains competitive, relevant and interesting in an increasingly digital world and business environment (The Enterprisers Project, 2022).

The Digital Business Transformation is a reflection on how the organization uses available modern technology, people and processes in finding new business models and new revenue streams driven by change or rising customer expectations for products and services. It is therefore the process of using digital technologies to create new - or modify existing - business processes, culture and user experiences to meet changing business and market demands.

Digital Transformation means the prioritized transformation of business activities, processes, competencies and models by fully exploiting the changes and opportunities of digital technologies and their impact on society. The term refers to companies that use enhanced technology to improve their business performance, operational efficiency, and ultimately their customer experience. If companies approach the digital transformation in a structured and timely manner, they can reap the benefits that could give them an improved competitive advantage (Boulton, 2021).

The Digital Business Transformation goes beyond traditional roles such as sales, marketing and customer service. Instead, it just starts and ends with how you think about customers and work with them. As we move from paper to spreadsheets to smart apps and even artificial intelligence to manage our business, organizations have the opportunity to redefine the way they do business and work with customers with digital technology (Salesforce, 2022).

Digital transformation, digitalization and digitalization of business are prerequisites for e-commerce as we know it today.

THE EVOLUTION OF DIGITAL BUSINESS TRANSFORMATION

With the invention of the first smart computer technologies, the development of these intensified at the speed of light. Below are some of the monumental milestones in the development of digital technologies (Heslop, 2019):

The past

1940 - Claude Shannon, the father of the theory of modern digital communication, paves the way for digitization in his article "A Mathematical Theory of Communication".

1950 - Invention of the microchip and today's the most widespread semiconductor transistor, which means the transition from analog to digital computing.

1960 - The first message sent via ARPANET as the foundation of the Internet as we know it today.

1970 - The first home computers and arcade video games appear. The first digitization of business processes is also recorded, where information is changed from analog to digital

1980 - The invention of the Word Wide Web (www) and the general expansion of computers in the more advanced parts of the world at the time, and the emergence of automation in work environments and processes.

1990 - The World Wide Web becomes a publicly accessible and integral part of international culture by the end of the decade. The 1990 FIFA World Cup is now available on digital HDTV, and sales of digital mobile phones and 2G networks are exploding.

2000 - More than half of American families own a computer and the Internet population exceeds one billion users. Digital transformation is spreading all over the world.

CRITICAL MILESTONE 2010 - the digitization of existing analogue and handheld systems has been completed and a new revolution called - DIGITAL TRANSFORMATION has begun.

2014 - Pioneering digital transformation projects show first successes - understanding of DT is changing from one-off infrastructure projects to strategies of constant implementation and exploitation of technology.

2015 - MIT and Deloitte articles cement that integrated strategies are drivers of digital transformation and not just advances in technology. Media, telecommunications and consumer finance services, followed by retail and the technology segment, are the areas that are beginning to record the most drastic changes.

2016 – Forrestter's Digital Transformation Forum proposes that digital transformation should be an endless effort to find improvements and optimizations. Companies are creating sophisticated and agile staff for the purpose of digital business transformation.

2017 - Budgets for digitization and digital transformation increase significantly and the implementation of smart technologies in business explodes. The gap between " offline " and " online " customer interaction is closing.

2018 - the strategy of digital business transformation dominates and becomes the driving force of growth of most organizations. Initiatives are built on "third party platforms" and consist of mobile technology, social networks, cloud computing, processing and targeted use of data.

2019 - 40% of all technology expenditure is spent on digital business transformation. Expenditure on technology globally exceeds $ 1,5 trillion.

2020 - COVID-19 - accelerating the digital transformation of business from 3-7 years. The future of many companies depends on the ability to create digitally transformed products, services and user experiences. 30% of the companies on the GLOBAL 2000 list allocate capital equivalent to 10 percent of annual revenues for the purposes of digital business transformation.

2021 - the prevalence and dominance of applications, payments, bots and other digital technologies in our daily lives. Almost every activity involves one of the digital giants - Google, Apple, Facebook, Youtube, Instagram, Amazon, Alibaba and others.

THE FUTURE - 2022 - Global spending on digital transformation will exceed $ 2 trillion, representing 60 percent growth since 2016. The future is “fully digital”.

THE PURPOSE AND OBJECTIVES OF DIGITAL TRANSFORMATION

The purpose and objectives of digital transformation is to prepare, enable, support the organization in maximizing its added value, thus better or even best serving its main stakeholders: customers, employees, partners and shareholders (Pratt and Saparapani, 2022).

Integrating computer-aided digital technologies into business operations helps organizations do the following (Pratt and Saparapani, 2022):

- increase the speed of entering the market with new products and services;
- increase employee productivity;
- increase responsiveness to customer requests;
- gain more insight into individual customers for better anticipation and personalization of products and services;
- Improve customer service, in particular by providing a more intuitive and attractive user experience.

THE ADVANTAGES OF DIGITAL BUSINESS TRANSFORMATION

The biggest advantage of digital transformation for organizations is enabling success in the age of business digitalization. For companies, this success means higher revenues and higher profits. It allows other types of organizations, such as non-profit institutions, to better "serve" their stakeholders (Pratt and Saparapani, 2022).

Although the ultimate advantage of digital transformation is the power of survival and future, transformation initiatives bring many other benefits to organizations. Some of them are listed below (Pratt and Saparapani, 2022):

- Increased efficiency and effectiveness, as the implementation of technologies such as artificial intelligence and robotic process automation increase work productivity, reduce errors and speed up market entry time - while renewed business processes enabled by digital technologies further increase productivity and business pace;

- superior user experience, which is reflected in improved cooperation with customers, employees and business partners, as organizations can better process data, make smarter, more accurate decisions and better anticipate the needs of their various stakeholders;

- more agility and responsiveness to market changes and market trends, as the culture and capabilities of the organization change in support of constant change;

- Improved capacity for innovation, as a faster workforce and modernized technological capabilities support and encourage experimentation while limiting risk.

These benefits help drive continuous transformation, as automation allows employees to shift to more innovative work with higher value, and greater agility allows the organization to better identify opportunities and direct its own resources to exploit them (Pratt and Saparapani, 2022).

THE CHALLANGES OF DIGITAL BUSINESS TRANSFORMATION

The Gartner report for 2020 showed that 91% of organizations are involved in some form of digital transformation and 87% of leading companies say that this is the only priority. Less than 30% of organizations have succeeded in materializing digital transformation initiatives to some extent (Pratt and Saparapani, 2022).

The Everest Group found that 78% of companies fail in their digital transformation initiatives, citing project abandonments, difficulties in prioritizing initiatives and limited user assimilation of innovation as the main reasons for failure. Here are some of the most common reasons for the failure of digital transformation cited by experts (Pratt and Saparapani, 2022):

- lack of employee engagement;
- Inadequate management support;
- poor or non-existent cross-functional cooperation;
- lack of responsibility;
- concerns about privacy and data security;
- budgetary constraints;
- limited internal skills and expertise;
- regulatory and legislative changes;
- immature digital culture;

One of the biggest challenges of digital transformation for companies that were not “born digital” is the use of old systems and applications - older technologies that do not support digital initiatives but cannot be easily replaced. If the management team refuses to pay for the replacement of old technologies or does not obtain the necessary support at the management and board level to invest in technology renewal, digital transformation is unlikely to happen (Pratt and Saparapani, 2022).

DIGITAL BUSINESS TRANSFORMATION STATISTICS

Recent projections suggest that by 2023, digitally transformed organizations will contribute more than half of global GDP. The growth trend from 2018 onwards can be seen in the graph below (Liu, 2019).

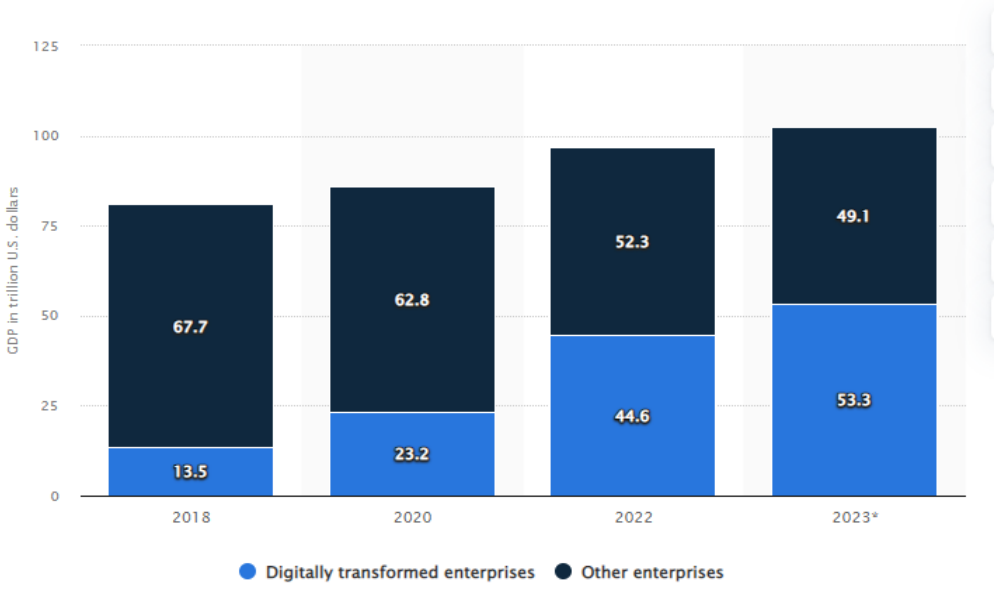

Figure 5: GDP contribution of digitally transformed organizations by years
SOURCE: Statista, 2022

Using the statistics below, we will evaluate global expenditures for the purposes of digital business transformation in the last few years, including projections of future expenditures (Eira, 2022):

Global digital business transformation expenditure statistics

- 40% of all expenditure on technology is spent on digital transformations (CIO, 2018);
- $ 1.18 trillion - total corporate spending on digital transformations in 2019, $ 1.31 trillion in 2021 and $ 1.8 trillion in 2022 (Statista, 2022);
- When it comes to technology initiatives, 54% of companies worldwide have stated that digital business transformation is a priority (Flexera, 2021);
- $ 6.8 trillion - projected value of direct investment in digital transformation between 2020 and 2023 (IDC, 2020);
- By 2023, global spending on services and technologies that will enable digital transformation is expected to be $ 2.3 trillion (IDC, 2020).

The graph below shows the global real and estimated value of annual investments for the purposes of digital business transformation in billions of USD.

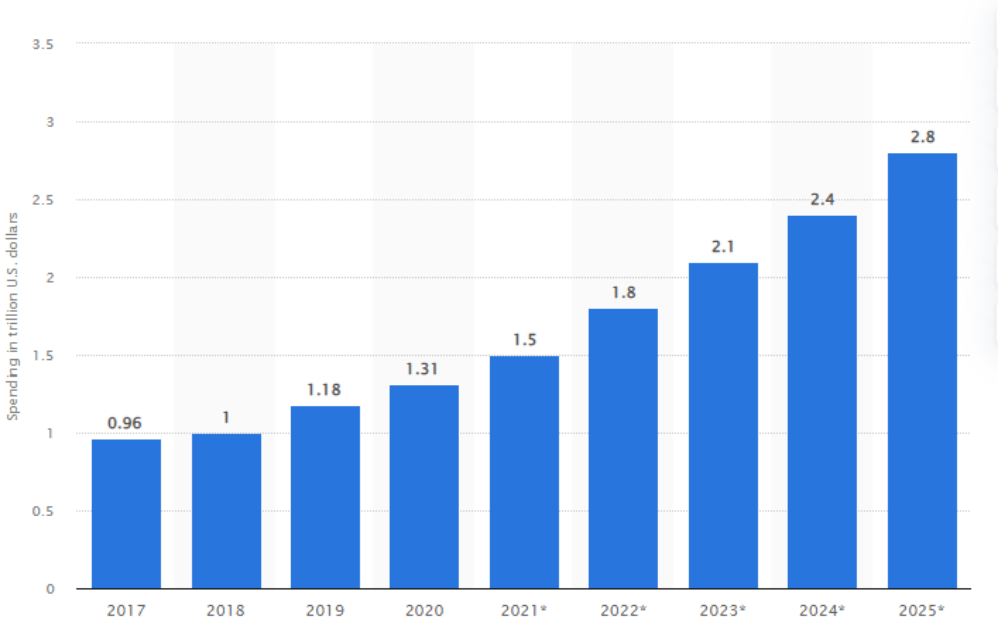

Figure 6: value of annual investments for the purpose of digital business transformation
SOURCE: Statista, 2021

Recent analyzes and statistics also show that e-commerce digital sales increased by as much as 27.6 percent in 2021 compared to 2020 - a record annual growth over the past ten years. In the same year, a record number of internet shoppers was recorded - 2.14 billion, and the internet literacy of the EU population is at its highest level since the Internet existed with as much as 89 percent of internet literate population. Total e-commerce sales in 2021 amounted to an incredible 4.921 trillion USD, which is 13 percent more than the year before, and in 2022 the value of global e-commerce sales is expected to exceed 5.4 trillion USD, thus recording another 10 percent growth compared to 2021. At the same time, revenue in traditional physical sales is declining, but slowly stabilizing, and several retail giants have intensively shrunk their physical store portfolios which will definitely continue in 2022. This adds to the importance of remote digital business capabilities, and confirms that success lies in the digital future (Liu, 2019).

Statistics of implementation and adaptation of digital technologies into business processes

Digital transformation will not be possible without adapting technology. Slow adoption of technology could prove to be a problem, as many companies have acknowledged that they are slow to implement it. Below we present global statistics on the adaptation of digital technologies into business processes (Eira, 2022):

- 15% of companies have been using artificial intelligence since 2018 (CMO, 2018);

- 31% of companies are expected to adopt artificial intelligence in 2019 (CMO, 2018);
- 76.6% of companies say that their attitude towards technology and digital transformation is generally average or above average (Futurum, 2018);
- IT departments, customer care and marketing were excellent in technology adoption (Futurum, 2018);
- analyzes show that the human resources, manufacturing and legal sectors are likely to be subject to fundamental technological change (Futurum, 2018);
- 30% of companies still lag behind in embracing technology and innovation (Accenture, 2020);
- 25% of organizations worldwide have largely embraced cloud-distributed technology (KPMG, 2020);

Revenue statistics in relation to digital business transformation

Digital transformation has proven to be crucial in increasing the added value of organizations. Below are some relevant statistics (Eira, 2021):

- in 2016, high-tech B2B companies reported a 10 to 20% reduction in costs and a 10-15% increase in revenue due to the digital transformation of their processes and user experience (McKinsey, 2016);
- in the same year, revenue growth of leading digitally transformed B2B companies was five times higher than others (McKinsey, 2016);
- 60% of marketers say that technology has significantly increased competitiveness (Adobe, 2021);
- by 2018, it was found that start-ups can increase revenue by 34% using digital strategies (IDC, 2018);
- Companies with higher digital maturity reported 45% revenue growth compared to 15% growth for companies with lower maturity (Deloitte, 2020).

IMPACT OF COVID-19 OUTBREAK ON DIGITAL BUSINESS TRANSFORMATION

The global digital business transformation was also significantly affected by the outbreak of COVID-19.

In 2020, investments for digital business transformation reached $ 1.3 trillion, increase of 10.4 percent vs. Previous year - a threatened but still strong growth despite the economic recession caused by the coronavirus pandemic (COVID-19). In fact, the pandemic has significantly accelerated the digital transformation and highlighted the need for companies to increase operational efficiency and improve their user experience, as these are decisive factors influencing a company's fate in times of economic hardship. More than half of corporate customer interactions were

digitized during the pandemic, compared to just a third immediately before (Liu, 2019).

Below are some more relevant statistics related to the digital business transformation during COVID-19 (Performance Improvement Partners 2022):

- Global spending on digital transformation in logistics is expected to reach $ 84.6 billion by 2027 due to the effects of the COVID-19 pandemic (ReportLinker, 2020);
- Leading IT professionals worldwide reported an average additional spending in the value of additional 5% of the total IT budget to tackle the COVID-19 pandemic (KPMG, 2020);
- It is estimated that the COVID-19 pandemic has accelerated the adoption of digital technologies for customer interaction and supply chain needs by 3 to 4 years (McKinsey, 2020);
- North America made the biggest leap in digitization during the pandemic, with 60% of products and services being fully or partially digitized (McKinsey, 2020;
- 72% of companies that were the first in their industries to experiment with digital technologies during the pandemic reported very effective responses to COVID-19 (McKinsey, 2020);
- Among companies with declining revenues due to COVID-19, 45% said they are increasingly focusing on digital transformation (McKinsey, 2020);
- 96% of top managers report that Covid-19 will accelerate their digital transformation by an average of 5.3 years (IBM);
- 63% of senior managers state that the Covid-19 pandemic encouraged them to embrace the digital transformation earlier than originally planned (Celerity);
- COVID-19 has moved social and collaborative tools from the “appropriate have” column to the “mandatory” column, as evidenced by the projected 14% increase in revenue in these areas by 2022 (Gartner);
- 71% of IT professionals have seen an increase in security threats or attacks since the beginning of Covid-19, with phishing being cited as a leading threat (Check Point).

CONCLUSIONS

The key findings show that the future is definitely digital and confirm the importance of digital business transformation for modern sales organizations. The data also highlights and confirms the correlation between the digital business transformation and the sustainable growth and development of modern sales organizations, as well as the connection with the satisfaction of modern customers, superior user experience and other opportunities such as cost and process efficiency.

The importance of the phenomenon will drastically increase in the future with the growing trend of e-commerce, the demands of modern consumers and the development of technology, and any neglect of it will not spare organizations.

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Matej Trapečar[121]
Violeta Žurga[122]

SERVICES INVOLVED IN AIR ACCIDENT INVESTIGATION ON EMPHASIS ON FORENSIC INVESTIGATION

Abstract
Air transport is the safest trip. However, as traffic has never been completely safe, there is also an accident in aviation. In most cases, an aircraft accident is caused by a human error or a human factor. An accident may also be the result of a technical factor. In air accidents, various investigation services investigate and determine the cause of traffic accidents and investigate suspicions of crime. In this case, criminal sciences and forensics are sciences that make it possible to identify and determine the causes of air accidents. The paper describes the methods and procedures for investigating air accidents of different services, with a focus on forensic investigation.

Keywords*: investigation, air transport, accidents, forensics*

INTRODUCTION

People have always been striving to fly to the sky like birds. However, flying has always been associated with danger and accident. A major mass plane crash in Slovenia occurred in 1966 (Figure 1). When approaching Ljubljana Brnik Airport, Britannie Airways hit trees near the village of Lahovče due to its low altitude. This is the worst aircraft accident on the territory of today's Slovenia, with 98 out of 117 passengers and crew killed on board. Investigators concluded that the likely cause of the accident was an incorrectly set altimeter (1).

[121] **Matej Trapecar's biographical notes** – please see footnote on page 115

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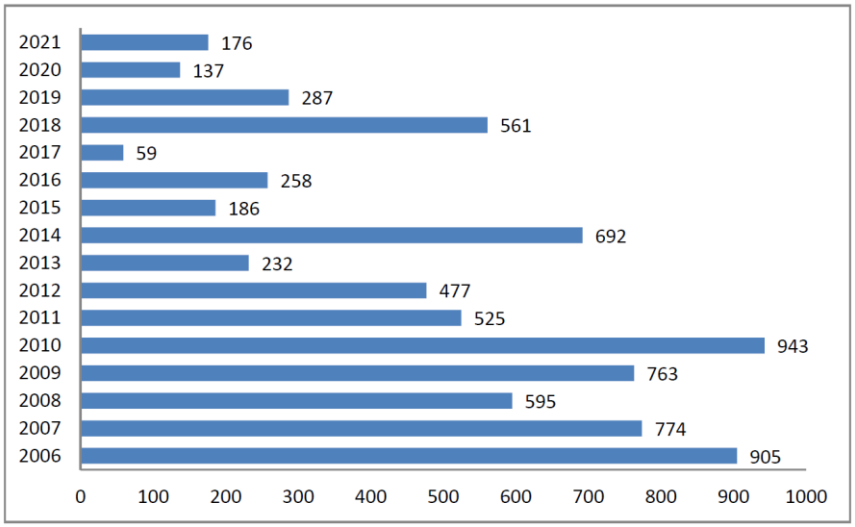
Figure 1: Britannie Airways accident with 98 dead passengers

Source:https://upload.wikimedia.org/wikipedia/commons/b/b8/Britannia_Airways_Flight_105_crash_in_Lahov%C4%8De_1966_1.jpg

In a statistical overview of the number of aircraft accidents in the world (Graph 1), fatal accidents occur every year. There were 176 deaths in 2021. The highest number of 943 victims in the last 16 years was in 2010. Despite differences from year to year, we can see that the overall trend is a reduction in the number of fatalities.

The increase in passenger numbers also increases the number of aircraft involved in accidents. However, there is a general trend to reduce the number of air fatalities. Passenger air traffic has increased by more than 66 % since 2004. Considering the number of accidents per distance travelled, aviation is statistically the safest form of transport.

Graph 1: Worldwide air traffic – number of fatalities 2006-2021

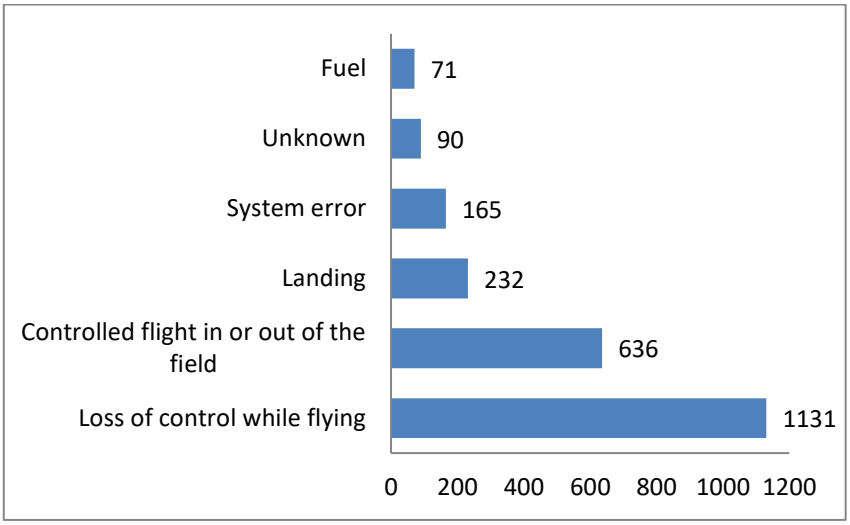


Source: https://www.statista.com/statistics/263443/worldwide-air-traffic-fatalities/

REASONS FOR THE OCCURRENCE OF AIR ACCIDENTS

Between 2008 and 2017, loss of flight control was the leading cause of an air accident (Graph 2) with 1129 deaths on board and 2 civilian deaths. From 2013 to 2018, collisions or crashes accounted for 57 % of all aviation insurance claims in value terms, corresponding to USD 9.3 billion.

Graph 2: Most common causes of aviation accidents 2008-2017 by number of fatalities



Source: https://www.statista.com/statistics/1093239/most-likely-reasons-fatal-accidents-aviation-industry-fatalities/

INVESTIGATION OF AIR ACCIDENTS

The Aviation Act (2) provides that an aviation accident is an event where:

- one or more persons killed, seriously injured or seriously injured,
- damage or structural defect occurred on the aircraft and
- aircraft lost or completely inaccessible.

On the other hand, the Ministry of Defence (3) states that an aircraft accident is characterised by the fact that:

- usually happens without warning, sudden and unexpected,
- often the victims of an accident are all passengers and crew members,
- may occur in places that are not immediately or easily accessible and
- residents may also be victims if the aircraft falls into a populated area.

In the following, the State Protection and Rescue Plan in the event of an aircraft accident counts as one of the main causes of aircraft accidents mainly technical causes. These are engine failure, aircraft design, loss of control of the aircraft, air traffic control error, human and other factors. Natural and other accidents, e.g. adverse weather conditions, fire, accidents involving the transport of dangerous

goods, are also responsible for the occurrence of an aviation accident. The causes include terrorist attacks and other forms of mass violence (3).

Among the above causes of flight accidents, loss of control during flight and the human factor are the most common and thus the most important reasons for the occurrence of an aircraft accident.

The state protection and rescue plan in the event of an aircraft accident divides the aircraft according to the type of aircraft (passenger, cargo, military). A second division according to the location of the accident e.g. inhabited area, difficult terrain, water surfaces, and airport area. The last division to be quoted (3) is in the light of the consequences of the disaster. This includes victims, aircraft destroyed or damaged, infrastructure, building and cultural heritage, and environmental impact.

INTERNATIONAL AND NATIONAL RULES FOR INVESTIGATING AIR ACCIDENTS

Slovenia is a member of the following international organisations covering air transport:

- International Civil Aviation Organisation (ICAO),
- European Civil Aviation Conference (ECAC),
- European Organisation for the Safety of Air Navigation (EuroCONTROL) and
- Joint Aviation Authorities (JAA) (2001).

Membership of those organisations is particularly important for the organisation and safety of air transport. Slovenia has ratified and incorporated into its legal order all relevant international conventions within the designated international organisations IACO, EUROCONTROL and ECAC. The Directorate of Civil Aviation of the Ministry of Transport also regularly implements all standards, which are also mainly developed within the designated international organisations.

The Convention on International Civil Aviation is most important for the investigation of air accidents, the first version of which dates back to 1944 in the United States. Slovenia is also bound to this Convention. It contains 18 annexes, the most important of which are Annex 12 (Investigation and Rescue) and Annex 13 (Investigation of Aircraft Accidents), which provide more detailed guidance for the investigation of aircraft accidents (4).

In 2006 Slovenia adopted the Aviation Act (OJ RS No 81/10 — official consolidated text, 46/16 and 47/19), which also summarises all the provisions of international conventions and regulates the rules of the air. The law also contains a chapter on aircraft search and rescue and aircraft accidents and incidents.

The Decree on the Investigation of Air Accidents, Serious Incidents and Incidents (Official Gazette of the Republic of Slovenia Nos 72/03, 110/05 and 53/19) is relevant for the investigation of air accidents. It provides the objectives of the investigation, the tasks of the investigating body, the protection of the area of the aircraft accident, the reporting of air accidents, the drawing up of an accident report and the sanctions for breaches of these provisions. Operational documents defining the organisation and conduct of the investigation of aircraft accidents are also important. This is the National Plan of Protection and Rescue in the event of an aircraft accident (3).

INVESTIGATION OF AIR ACCIDENTS

Several different services are involved in investigating air accidents. Police, military, protection and rescue forces, civil protection, medicine and air accident and incident investigation services are involved. The involvement of individual services depends on the scale of the aviation accident.

The investigation process begins with the reporting of an aircraft accident. Based on the communication received, the police, the PSAP or the air traffic control centre must inform the investigating authority of the Ministry of Infrastructure. In the event of a military aircraft accident, the Ministry of Defence shall also be informed. Usually, the police are among the first at the scene of an aircraft accident. In accordance with its powers and powers, secure the place of the accident and its tracks. Ensure the establishment of public order, the protection of people and property. Supervises and directs traffic to allow access to intervention forces for protection, rescue and relief. The police also inform the public about the plane crash. If foreign nationals are involved in an aircraft accident, these countries shall be informed. Interpol, an International Police Organisation, is also included.

In certain cases, the military is also involved, e.g. search for a missing aircraft (3), the involvement of a military aircraft. The military may also provide the material resources at its disposal for protection and rescue.

Aviation accidents also involve protection and rescue forces. In the event of an accident involving the presence of dangerous substances, they shall establish radiological, chemical and biological protection. In the event of explosions and fires, the measures are aimed at extinguishing and evacuating people at risk. These forces help to detect casualties in wreckage and save people and things from wreckage, water or hard-to-reach terrain. Civil protection shall be included in the event that the consequences of an aircraft accident are far-reaching. State forces and means of protection, rescue and relief shall be included.

In the event of injuries, emergency medical assistance at the scene of the accident, transportation to hospitals and identification of victims should be organised. The police are also involved in the identification of victims.

An important service in investigating air accidents is the Air Accident and Incident Investigation Service, which operates in the Ministry of Infrastructure. The investigating body shall initiate the investigation procedure as soon as it becomes aware of the aircraft accident. He is the investigator-in-charge and the investigation committee. In the case of a minor and complex air accident case, the investigator-in-charge may even carry out the investigation himself. In particular, investigators with work experience in flying (pilots, flight controller, aviation engineers and mechanics, etc.) are involved.

As with other accidents, the police first protect the plane crash area until the tour is completed. The powers of the investigator-in-charge limit the powers of the investigating judge or police in the case of a visit to the theft following criminal proceedings. An investigating judge and a public prosecutor can also view the location.

Investigator-in-charge who drafts the report in accordance with Annex 13 to the Chicago Convention and the Manual on Air Accident and Accident Reporting (ICAO Doc. 9156-AN/900). The report shall be drawn up in several stages. The first is an introductory report and the second is an interim report. The investigator-in-charge shall make the interim report once the facts have been established. The last one is the final report. This includes an analysis of the event, conclusions and safety recommendations.

If a crime is suspected, the police, the investigating magistrate and the chief investigator or commission for the investigation of the air accident carry out a visit to the location of the aircraft accident.

A police crime scene investigation is a unique and basic point of successful use of material evidence, which in the continuation of the investigation is provided by the forensic laboratory, criminal technical and forensic investigators (5). Crime scene is part of a police investigation. The investigation also attempts to answer questions related to the criminal behaviour of the participants in the accident, if the accident is the result of a criminal offense and if the result of an accident is the general danger. On the basis of mutual cooperation, the police can, in addition to the investigation, focus more on the material evidence which will they use for further investigation, they can search traces for a possible criminal offense and forensic investigations (6).

Police work at the site of a mass accident: first, the location of the accident involving the location of the accident and its consequences shall be identified, the number of

investigators and the number of investigator teams, etc. In the event of a large scale, the location of the accident is divided into several sectors (Figure 1). The location of the accident must be marked, also dead bodies, human remains, identity documents and objects and other traces shall be marked. The location of the accident, including a sketch, measurement, photographing and video documentation, must also be recorded (7).

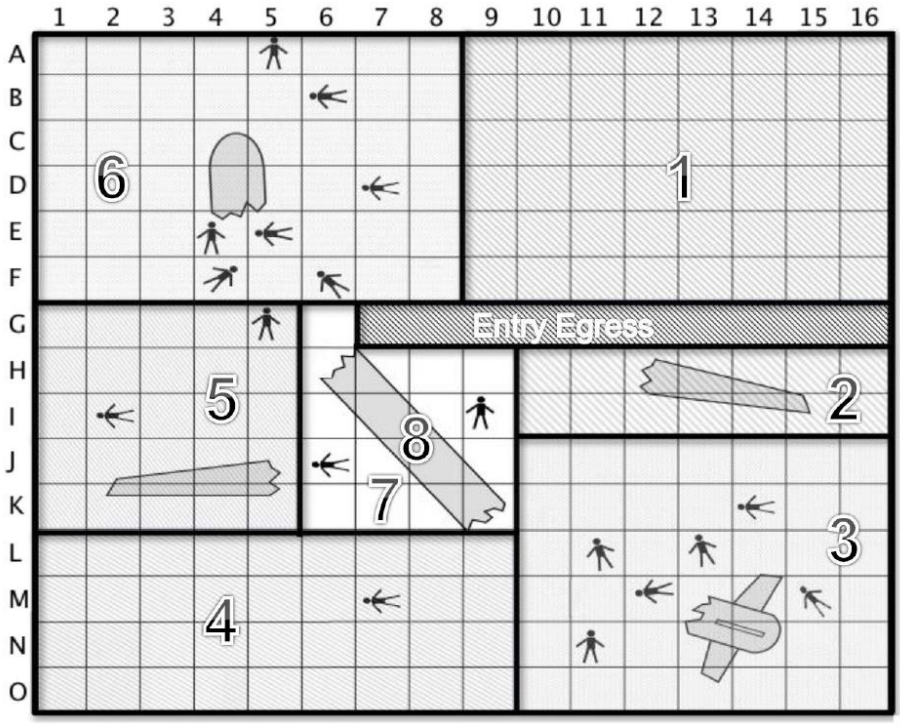


Figure 1: Airplane accident scene divided into several sectors
Source: Interpol DVI Guide, 2018

CONCLUSION

In principle, Slovenia is well prepared for any such event, especially in legislative and regulatory terms, matters and competences are well defined and follow the practice of other countries. In the event of a mass accident, we are also operationally well prepared, since the same organisation and competence of the services for any type of mass accident, including an aircraft accident, applies. Civil protection and other protection, rescue and relief forces have proven themselves many times and there is no doubt that it would not be in the event of a major air crash.

However, since each accident is a chapter for itself, it must be borne in mind that new circumstances always arise. As the past teaches us, there will always be mistakes.

Good cooperation between different services is therefore particularly important for successful aircraft accident investigation.

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PROBLEMS OF DRIVER DEFICIENCY IN SLOVENIA AND EUROPE

Abstract:
In this article, we present the issue of road freight transport, related to the growing shortage of truck drivers. Through the spectrum of threats to the industry, we fully illustrate the numerical shortage of staff in both Slovenia and Europe.

Special emphasis is placed on the presentation of various strategies that could help improve the situation in the industry in the future.

Key words: *road freight transport, lack of drivers, staffing issues, supply chains, education*

1 INTRODUCTION

Transport is considered to be one of the most important and also the oldest industries in the world. The need to transport people and cargo appeared at the beginning of the development of human society. The first major settlements and later cities developed precisely in those geographical locations that allowed transport. Either along large rivers or seas (waterways), or in those areas where land routes intersected. Transport facilitated migration, trade, military campaigns, research, and travel.

Road transport is, at least in logistical terms, much more flexible than other modes of transport. Therefore, it is not surprising that the industry, both in Europe and in

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Slovenia, has experienced an extraordinary boom. It has many advantages, among which we can undoubtedly include:

- possibilities of cargo delivery to all locations (supply of industry in intermediate production, supply of organizations, companies, supply of the market, supply of the population),
- an extended road network that allows freight to be delivered to all areas (strong competition by rail, sea and air),
- ensuring the speed of delivery of cargo, safety, minor losses and damage, it is possible to predict the time of delivery,
- possible transport of special cargo, fuels and gases to places where there is no railway,
- can offer services to all, including those offered by rail, sea and air,
- easily integrates into multimodal transports.

From the logistical and cost point of view, road transport also has its weaknesses, which, according to Murtič (2021) are mainly manifested in unused and empty return journeys, consequently in empty kilometers, high competition affecting the price of transport, rapid depletion of trucks. requires the purchase of new vehicles. A potential weakness is also technological advances, which require ever new changes in cargo control and monitoring, etc.

Another weakness, which in our opinion is becoming more and more dangerous, is the issue of human resources. In recent years, we have witnessed an enormous increase in road freight transport. Both the number of transport companies and the number of transport vehicles are increasing. Unfortunately, these numbers are not followed by the number of truck drivers. According to employers in transport companies and the Employment Service, the demand for truck drivers is growing from year to year. In the past, many transport companies have managed this deficit by "importing" foreign labor, especially from the countries of the former Yugoslavia. Recently, this pool of staff has also been shrinking.

There are several reasons for such a large shortage of truck drivers. Unfavorable wage policy and employment contracts can be mentioned as the main ones. In most cases, these drivers had fixed-term contracts and a minimum wage, which was artificially raised by employers (for them, of course, tax-free) with per diems, which is completely wrong, as the per diem is a subsistence allowance and not a salary supplement.). This, of course, does not constitute adequate social security for employees. Further shortcomings are also reflected in stricter road traffic regulations, requirements for educational qualifications and working conditions themselves. We should not forget about the problems with breaks during rides and inadequate infrastructure for stopping or. parking of lorries. All of this, however, has made the truck driver's profession invaluable, and even those who once practiced it are happy to flee it. All of the above is not only an obstacle to the

development of the industry, but even a factor that could jeopardize its development.

2 LACK OF DRIVERS IN FIGURES

Over the last fifteen years, the global road haulage market has been markedly affected by a shortage of drivers. The data given in the previous chapters show how great the expansion of road freight transport has been in Slovenia, Europe and the world. However, problems arise because the demand for transport is growing and the number of drivers is shrinking.

In the world economy, the demand for transport has increased, which has put a strain on human resources, especially for van drivers and drivers of t.i. last mile. As a result, of course, labor costs are rising, which means increasing pressure on road hauliers and fares. There are many reasons for the growing shortage of drivers, as well as the solution, but implementation is difficult and time consuming.

With the new problems for supply chains and logistics, the COVID-19 pandemic has exacerbated the already worrying issue of driver shortages, which has been at the forefront of the industry in recent years and has in itself posed a long-term challenge. Factors such as an aging workforce and a shortage of new employees due to working conditions and image problems have plagued the industry for many years.

According to Ti (2021) estimates, there was a shortage of around 400,000 drivers in the European road haulage industry in 2020. The most affected European countries are Poland, Germany and the United Kingdom. The latter is in a particularly difficult position, as it is struggling not only with Brexit but also with the departure of many European workers who left the country for fear of prisons during the pandemic.

These (2021) provide the following worrying figures for European countries:

- Poland: In 2020, there was a shortage of around 124,000 drivers, or as much as 37%. It is one of the most affected European countries.
- United Kingdom: The shortage of truck drivers in 2020 is estimated at 60,000-76,000.
- Germany: In the German market alone, between 45,000 and 60,000 truck drivers were missing in 2020, according to DSLV and BGL, this number is only increasing. The IRU predicts a gap of up to 185,000 missing drivers by 2027 in Germany.
- France: In 2019, several newspapers reported that France felt a shortage of around 43,000 drivers.
- Spain: In 2020, there was a shortage of 15,340 truck drivers in Spain.

- Italy: According to various sources, the deficit in Italy in 2019 was estimated at around 15,000 drivers, including the national newspaper Corriere della Sera.
- Denmark, Norway and Sweden: the numbers in the Scandinavian countries are not so high, but the shortage of drivers has spread across Europe. The 2017 deficit figures for Sweden, Denmark and Norway are 5,000, 2,500 and 3,000.
- Belarus: In 2019, it was estimated that there was a shortage of 4,500 drivers in Belarus.
- Ukraine: The driver deficit in Ukraine in 2019 ranged from 12,000 to 120,000, depending on the region.

The shortage of drivers in the UK is reaching a "crisis point". Truck drivers are lost in a sort of Bermuda triangle of Brexit, pandemics and tax reforms / high seasons, leading to a burning shortage of staff. Brexit has effectively ended recruitment from the EU, making it legally impossible to recruit foreign drivers of heavy goods vehicles. The COVID-19 pandemic has caused the departure of about 15,000 Eastern European drivers from the country home. Finally, the newly introduced tax reforms have exacerbated the emigration of EU drivers from the UK, which will only get worse this summer.

From 2010 to 2017, the number of EU citizens driving heavy goods vehicles in the UK increased from 10,000 to 45,000, and in early 2020 it fell to 42,000, probably related to Brexit. From March to June 2020, the number of drivers of heavy goods vehicles from the EU decreased by another 15,000 to 25,000, and by the end of the year it had only slightly recovered to 28,000 (Ti, 2021).

In addition, the pandemic is also thought to have accelerated retirement in the industry. The so-called IR35 reforms carried out by the British Revenue and Customs Administration HM have exacerbated this issue. The reforms required all operators with £ 10 million in turnover or 50 employees to pay full taxes and insurance for their drivers starting in April 2021. These reforms further contributed to the reduction in the number of drivers, leaving another 5,000 after leaving the UK. -10,000 drivers of heavy goods vehicles, mainly due to tax changes[126].

2.1 The situation in Slovenia

When we checked the employment in road freight transport, we found that until 2020 there was no one in Slovenia with the profession of heavy truck driver (CAP

[126] Brexit was not the only reason for the general increase in prices for most products in stores. Fuel prices have also risen. Aware that there is a drastic shortage of truck drivers, some stores have also started to offer triple prices to carriers in order to maintain the supply chain. Most of them, of course, tried to pass on these costs to the end customer - the consumer. Carriers also offered higher salaries to drivers, but the industry did not recover, despite human resources.

08). In 2020, there were 27,554 such employees (of which 152 were women), and in 2021, 27,816 (of which 156 were women).

Figures in the industry itself show that in the last six years, employment in the industry has risen in total, but the number of self-employed persons has fallen compared to 2015.

	2021	2020	2019	2018	2017	2016	2015
H49.410 Cestni tovorni promet							
1 Delovno aktivno prebivalstvo - SKUPAJ	28.405	28.413	28.771	27.133	25.215	23.300	21.449
11 Zaposlene osebe - SKUPAJ	25.821	25.797	26.079	24.390	22.416	20.424	18.541
12 Samozaposlene osebe - SKUPAJ	2.585	2.616	2.692	2.742	2.799	2.876	2.908

Figure 1: Employment in numbers.
Source: SURS, 2022g.

Of course, these figures are not just for truck drivers but for all work profiles employed in the industry. From 2019 onwards, the number of employees in the industry is declining. However, the number of drivers fell the most.

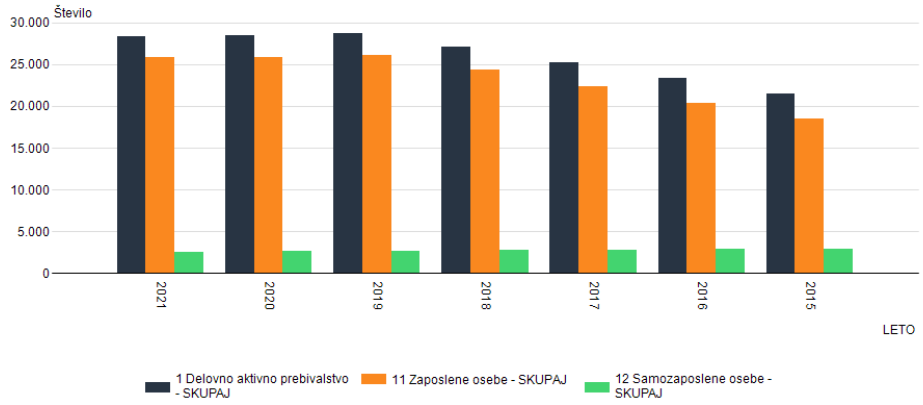

Figure 2: Working population - road freight transport.
Source: SURS, 2022g.

Due to the emptying of the pool of available labor, structural disparities in the labor market are becoming more pronounced, and short-term problems are also caused by the deteriorating epidemiological situation. With rapid economic growth, the outflow of registered unemployed persons into employment increased markedly, while inflows of persons into unemployment also decreased markedly. As a result, the number of unemployed is approaching historically the lowest levels, which, in addition to unfavorable demographic trends, reduces the pool of available labor force on the Slovenian labor market and causes an increasing shortage of suitable

staff. According to a survey by the ESS, in the second half of last year more than half of companies encountered a shortage of adequate manpower, which is more than before the outbreak of the pandemic (Bank of Slovenia, 2022).

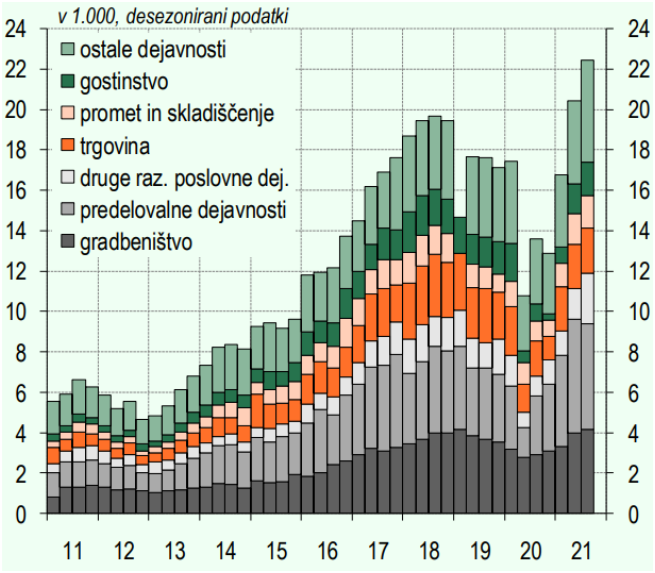

Figure 3: Vacancies, 2022 - by industry.
Source: Banka Slovenije, 2022.

	TOTAL	ROAD freight transport	ROAD passenger transport (**)	Railways	Pipelines	Inland water transport	Sea transport	Air transport	Warehousing and support activities	Postal and courier activities
EU-27	**10297.3**	**3205.5**	**1939.8**	**571.4**	**24.4**	**44.5**	**173.5**	**295.9**	**2450.0**	**1592.3**
EU-28	**11675.8**	**3496.4**	**2187.0**	**636.8**	**26.0**	**45.7**	**186.9**	**376.6**	**2872.4**	**1847.8**
BE	**214.9**	62.3	19.1	32.6	1.0	0.7	1.3	5.8	55.8	36.4
BG	**173.9**	73.9	30.6	11.2	0.2	0.6	0.8	2.3	34.1	20.2
CZ	**293.5**	131.3	41.2	26.7	0.2	0.6	0.0	2.6	52.7	38.1
DK	**150.7**	32.1	28.5	5.9	0.4	0.2	17.2	5.2	30.8	30.5
DE	**2375.4**	452.8	495.2	46.4	2.0	10.2	22.6	64.8	735.8	545.6
EE	**41.7**	16.3	3.8	1.3	0.0	1.1	1.9	0.8	13.1	3.5
IE	**102.1**	24.1	29.0	3.2	0.2	0.3	0.8	8.5	18.2	17.6
EL	**182.4**	36.5	61.4	0.7	0.03	0.1	18.8	4.0	45.5	15.4
ES	**919.4**	342.2	192.8	15.7	0.7	0.5	8.2	32.6	235.1	91.6
FR	**1387.4**	372.7	267.3	204.8	3.3	4.3	13.9	66.5	210.7	243.9
HR	**81.0**	23.0	15.4	3.7	0.7	0.1	4.4	1.1	21.9	10.8
IT	**1132.5**	347.2	166.4	45.4	2.3	3.2	48.7	20.3	348.9	150.2
CY	**19.7**	2.1	3.5	0.0	0.0	0.0	0.3	0.4	11.5	1.9
LV	**81.9**	27.1	13.5	0.8	0.5	0.3	0.9	2.1	31.3	5.5
LT	**140.8**	82.4	17.2	10.2	0.1	0.1	1.1	0.9	21.8	7.0
LU	**22.3**	7.8	1.9	3.4	0.0	0.4	0.0	1.9	4.6	2.3
HU	**255.1**	81.2	52.8	19.0	0.5	0.9	0.0	1.4	63.5	35.7
MT	**13.5**	1.3	4.0	0.0	0.0	0.0	0.4	1.9	4.7	1.1
NL	**426.6**	128.8	59.3	17.1	0.1	13.4	7.8	26.4	103.1	70.5
AT	**211.8**	61.9	55.9	18.7	0.8	0.6	0.0	9.0	39.1	25.8
PL	**909.4**	458.4	141.3	50.2	5.0	1.0	2.1	4.8	148.6	98.0
PT	**175.6**	73.5	36.9	0.6	0.1	0.4	1.7	12.9	33.6	15.9
RO	**390.1**	160.8	80.4	26.9	5.9	2.1	0.3	4.6	67.9	41.1
SI	**52.4**	27.6	5.8	1.3	0.2	0.1	0.2	0.7	9.7	6.8
SK	**117.5**	50.9	16.0	7.0	0.2	0.4	0.0	0.6	25.4	17.0
FI	**142.1**	45.2	25.4	9.5	0.1	0.2	8.7	6.1	25.2	21.7
SE	**283.8**	82.2	75.2	8.9	0.0	2.7	11.5	7.6	57.3	38.4
UK	**1378.4**	290.9	247.2	65.3	1.7	1.2	13.4	80.7	422.4	255.6

Figure 4: Employment in transport sectors, EU 2018.
Source: Evropska komisija, 2021.

The shortage is greatest in large companies, and among the most important activities it is greatest in construction, catering, health and social work, and transport and storage. As many as two thirds of companies cite staff shortages as reasons for employment problems, which are mostly solved by extending employment procedures, hiring foreign nationals and changing job conditions, while less than a tenth of employers offered higher wages or other bonuses. Survey data from SORS and ESS show that employment will continue to strengthen in all activities in the first half of this year, with construction and other miscellaneous business activities leading the way. Among the occupations, the most sought after will be bricklayers, drivers of heavy trucks and tractors, workers for simple jobs in manufacturing, welders and salesmen. These occupations are already among those for which employers find it most difficult to find suitable workers (ibidem).

Slovenian carriers also have the same problems as we described at the beginning of this chapter for countries in Europe. In the last year, we have witnessed many "calls for help", as due to the lack of drivers, carriers are afraid that their vehicles will remain in parking lots.

As reported by etransport (2022), Slovenia has not been a significant source of staff for the employment of new truck drivers for a long time. In recent years, however, the (Western) Balkans have also emptied considerably. In the last 30 years, it has been a fairly reliable, stable source of recruitment for Slovenian carriers, but now this possibility no longer seems to be relied on. Obviously, different solutions will be needed, but the question is what and how they will be feasible. The trucking companies believe that similar agreements with Slovenia and Bosnia and Herzegovina on the employment of foreigners, which were a formal framework that encouraged the movement of labor, should be concluded with a third country. However, they also see some possibilities for "technical" improvements in the current regulation of employment of foreigners.

In 2020, 2,360 applications for consent to the single work permit for residence and work in Slovenia were submitted for road freight transport (SKD 2008: 49,410 road freight transport). In the period from January to December 2021, only 1,314 such applications were issued.
Etransport (2022) states that the downside of the current system is that carriers do not know what kind of candidate for the job of driver they will hire. The condition for employment is (purely) of an administrative nature; the candidate may be employed after submitting the required documentation, which must meet all legal requirements. "It often happens that a candidate does not meet the employer's expectations because he simply does not have the right" genes "for the driver, and then the job turns out to be unsuccessful. Instead of a rather complicated administrative procedure for obtaining a single permit (work and residence permit), on the basis of which a foreign worker is then obliged to serve one year with a Slovenian employer, they are proposing a simpler solution. Namely, for a foreigner

to enter work in Slovenia, it is sufficient that he does not have any criminal reservations and the like, and he would be temporarily employed by a Slovenian employer for a period of six months. During this time, the Slovenian employer would find out whether the employee with his knowledge and attitude towards work meets his expectations or not. In the case of a positive assessment, of course, I would apply for a work permit for a worker (the procedure could be opened two or three months before the end of the six-month period), while in the case of a low-quality worker this procedure would not start at all. This could relieve the workload of administrative units and units of the Employment Service that manage these procedures, and it would also save him fruitless work. ”While 1,445 applications for work permits were submitted in Slovenia in 2020, they were in 2021, by December, as many as 2142 were given (ibidem)

The problem of Slovenian carriers is also the regulations governing family reunification. According to the current legislation, such family reunification is possible only after two years of foreign work in Slovenia. A more stable employment of foreign workers would be brought about by a change in regulations, which would enable a foreigner's family partner to be employed in Slovenia and not just live there. "Families where a family partner can only live with us but cannot work, namely puts these families in a relatively less favorable social position, which increases the pressure on social transfers. However, social transfers are known to be a great burden on the state budget ”(etransport, 2022).

It is worrying that Slovenian carriers, in their tendencies to fill the gap in the employment of truck drivers, are focusing only on foreigners and on easing legal and administrative rules. If we add to this the belief that "a good salary is not a motivator" and that "drivers have an extremely friendly working environment" (thus etransport 2022), it is clear that we are very far from solving the problem. Slovenia's pool of staff may be really empty, in the classic sense of finding drivers, but there are many possibilities for introducing new, more modern and more encouraging methods for hiring domestic staff. We described some of these strategies at the beginning of the chapter.

Imports of foreign workers, mostly from countries with a much lower standard than Slovenia, cannot be a long-term solution. Especially given the fact that there are countries in Europe that have a better standard than Slovenia and also urgently need drivers. The fact is that people who do not have a financially, socially and value-friendly environment for their career and personal development will use employment in Slovenia / Europe only as a springboard for the path to the environment where they will get it. Coercion such as two years of compulsory work with a Slovenian carrier after receiving a work visa is also not a solution. A worker who works merely because he is forced into it cannot and will not do his work with pleasure or efficiency. In this t.i. legal barriers are not the factor that causes problems for carriers due to a lack of drivers.

3 STRATEGIES FOR ADDRESSING DRIVERS' DEFICIENCIES

The situation described in the previous chapter has led Europe to a number of debates on how to overcome the problem of driver shortages. From short-term solutions such as: making truck driving attractive by increasing salaries, introducing bonuses and the possibility of buying stakes in the company and flexible working hours that can start with road hauliers. Towards long-term solutions that sometimes require the intervention of government and other institutions, such as employment programs for women and ex-military personnel, awareness-raising in schools, additional training and education programs, redefining existing and new regulations and providing more rest, building modern car parks etc.

However, the following emerged as the most effective in many strategies (Ti, 2021):
a) Use of apprenticeships and training programs to attract young people
The most popular strategies to alleviate deprivation are apprenticeships and training programs. The offer of apprenticeships to promote young people in the profession has been accepted by many companies. These schemes often include training and pay, which can be attractive to young people living in areas with high unemployment. Businesses have also set up "academies" and training schools to give people the opportunity to train, while covering or contributing to training costs, such as the usually expensive entry requirement.

The legal age for driving a heavy goods vehicle varies across Europe, which can be a barrier to entering the profession. The Nagel Group in Germany recognized this problem and created an apprenticeship scheme that employs young people and gives them experience in the industry before they turn 21 years old.

A further initiative aimed at attracting young drivers is the FTA's partnership with the Think Logistics branch of the educational charity Career Ready. Its aim is to establish links between schools, colleges and employers to communicate to young people the opportunities offered by a career in logistics.

An example of an online driving academy is JMHC Logistics' HH Drive Right initiative. The company launched its online learning academy HH Drive Right with a special focus on attracting young potentials to the transportation industry. The emphasis was on increasing the number of drivers working in the company and providing teenagers with an alternative to retail work.

Further examples include Eddie Stobart's driving school in the UK. It offers funding, courses, and driving experience with a guaranteed job, provided you complete it at the end of the program. Aldi offers a driver apprenticeship scheme for people over the age of 18, with an attractive salary, mentoring and a decent holiday and allowance. The apprenticeship is 13 months long and drivers would strive to obtain a Cat C + E license.

b) Seasonal rental

During peak times, the shortage is more noticeable and noticeable throughout the region. The idea to include the scheme is to attract drivers that can be used at peak times and then used in other ways, which is perhaps a more attractive option than a full-time driver.

One company that researched this approach is DHL Freight, which tested a new scheme to get more people behind the wheel to keep goods flowing across Europe, especially at peak times (such as Christmas). DHL Freight's recruitment was initially focused on European operations and a pilot scheme is already in place at branches in Erfurt, Koblenz, Maintal, Malsfeld and Sehlem.

The pilot program recruits new employees in a "rotating deployment" facility, where they serve as peak drivers and work in warehouses in quieter times. The company reported that 30 new jobs had been created in each branch of the pilot program, and if the initiative proved successful, another 500 staff would be recruited across Europe.

c) Recruitment of former military personnel as drivers

Some companies in Europe have launched campaigns to encourage former military personnel to take up the profession.

There have been around 50,000 unemployed veterans in the UK since 2019, representing a large pool of potential truck drivers. To take advantage of this, Wimbledon-based logistics company ELB Partners turned to XMR, a specialized agency to recruit former military drivers, to find qualified and reliable drivers. Many carriers have to rely heavily on agency drivers at this time, but this short-term solution inflates supply chain costs that are difficult to pass on to customers in a sector that is still sensitive to margins, the company commented.

In Germany, too, more and more companies want to hire military truck drivers.

The organization of carriers, Logistik Netzwerk Thüringen, recently announced that they are going to tender with the logistics command of the German army. The aim of the cooperation between Logistik Netzwerk Thüringen and the German army is to support the professional development of employees through their recruitment and training on both sides. For example, members of the army from a logistics unit could work in a logistics company during a break during their service and then return to serve in the army.

Drivers in the military are not just looking for German and British organizations. In April 2018, the DSV concluded an agreement with the Dutch army. If necessary, the company hires its trucks to military drivers to support the logistics operator during the busiest periods. As part of the “Logistics and personnel” pilot project, the

operator benefits from military peak military assistance (eg before Christmas). DSV, on the other hand, sends its trucks to the army for major international exercises.

d) Reducing the minimum age of professional truck drivers

Special attention is paid to the lack of young people who are trained as drivers of heavy goods vehicles. In the second quarter of 2020, the share of drivers under the age of 24 driving heavy goods vehicles decreased by 57% compared to the second quarter of 2019. According to the IRU, 11% of the workforce in Poland is under the age of 25, while in Romania, the average age of drivers is 41 years. The European average for drivers under 25 is 7%.

To address this issue, the industry is urging governments to lower the minimum age of professional truck drivers to include younger ones. The International Road Transport Union has called on countries to agree on a minimum age of 18 for professional truck drivers. One of the consequences of the pandemic is the increased number of unemployed young people, which they estimate as a potential partial solution to the problem of driver shortages.

There are a variety of age requirements around the world. In the Middle East and some European countries, the minimum age is already 18 years. In many other countries, the minimum age is 21, but in countries such as China and Turkey it can rise to 26. There are also different age requirements and rules within the EU, which may even differ depending on whether the transport is domestic or international. Such restrictive rules on the minimum age are a serious obstacle to young people's entry into employment at a time when youth unemployment exceeds 30% in some countries.

e) Attracting female truck drivers

According to the IRU, women make up 2-3% of drivers in Europe. The unattractiveness of the job means that only half of the staff is used, which is an acute problem. Therefore, campaigns to promote the employment of women in this profession should be supported. The European Commission has set up the "Women in Transport - EU Platform for Change" program, which aims to promote transport as an attractive area for women's work.

f) Attracting foreign drivers

Another way to alleviate the shortage is to hire non-resident drivers. Opening borders to employees from Eastern European countries has helped, but only temporarily and as a result have carriers started looking for drivers farther and farther east. In Poland, for example, there are agencies that offer employment to drivers from Asian countries such as Bangladesh, India, the Philippines and Vietnam. It can take about four to six months from the start of the recruitment process to arrival. Hiring foreign drivers from Central Asian and Caucasian

countries such as Kazakhstan, Uzbekistan, Georgia and Armenia can only take about one to three months.

Although this method can help increase the number of drivers, it is often linked to trafficking and exploitation concerns, mainly due to poor knowledge of European law and regulations.

g) Use of financial incentives

Using financial rewards is, of course, a strategy to invite new drivers and retain existing drivers. This is probably the most realistic short-term solution. Some carriers encourage their own drivers to "catch" employees in competition in motorway service areas. As an incentive, there are various cash prizes. Some companies were also known for offering shares to employed drivers as an incentive to join, while others offered a flexible schedule and additional leave to compensate for long absences from home.

h) Institutions and government contributions

The contribution of institutions or organizations and governments is essential to address the causes of driver shortages. The lack of comfortable and safe rest areas has become one of the key problems for truck drivers and a major factor discouraging women and young people from joining the industry. In response to this problem, the European Commission has decided to make funds available to increase the number of available secure car parks across Europe. It is estimated that companies that decide to create safe parking spaces for trucks according to uniform European standards will be able to raise a total of 178 million euros. However, EU funding is not fully guaranteed, but only 30%, and 70% should be covered by investors, with additional support from Member States.

4 USE OF TECHNOLOGY

The use of different technologies can help with the problem of lack of drivers by enabling or. facilitates the visibility of the supply and demand schedules needed to address the idling issues of lorries. According to Espace, the best estimates show that 20% of lorries are empty across Europe. Equipping trucks with localization technology and sensors is a step towards visibility and more efficient use of resources.

The introduction of digitized platforms and the use of artificial intelligence and forecasting could also be very useful, as they can address structural inefficiencies such as empty runs and inefficient use of resources. Using this type of platform can help reduce driver shortages by reducing the number of trucks needed to move the same load. This would also help reduce emissions and costs. However, the reality is much more complicated in reality. Although there is an average of 40% of imaginary spare capacity on the market, this 'waste' cannot be fully addressed using road

platforms. The use of digital platform road freight transport undoubtedly affects efficiency and thus reduces driver shortages, but it is important to note that this is not a miracle solution for the entire industry.

According to a survey conducted by the IRU, 71% of European transport companies believe that autonomous vehicles are a reality in the next decade. Autonomous trucks can reduce labor costs and continue driving 24 hours a day, 7 days a week without being limited by the driver's rest time and driving distance restrictions. However, in reality the technology is not yet commercially feasible on a large scale and usually works well indoors. When the technology is mature enough, it will certainly make it easier for carriers to work (Ti, 2021).

In addition to the above, the use of new technology is also extremely important in the education and practical training of truck drivers. Currently, formal driver training lasts three years and is valued at 180 credit points. It is about IV. level of education with the acquired title of driver of motor vehicles. However, those who have successfully completed primary education or lower vocational education or equivalent education according to previous regulations may enroll in the educational program. Additional conditions for enrollment stipulate that anyone who has, in addition to the general conditions, also relevant work experience, which is proven by:

- with a valid driving license for motor vehicles of category C or C1 or D or D1, or
- with a valid driving license for category B motor vehicles and a medical certificate in accordance with the Drivers Act, Official Gazette no. 109/2010, issued by an occupational medicine specialist for the driver of the second group of motor vehicles.

Completed education according to the program enables the acquisition of the Basic Vocational Qualification (code "95").

Candidates who have not completed vocational school IV. degrees can pursue a national professional qualification and thus meet one of the conditions for pursuing a driver in the transport of goods. In accordance with the provisions of Article 11 of the Road Transport Act (Official Gazette of the Republic of Slovenia No. 6/16 et seq.), The National Professional Qualification of Drivers (NPK) must be passed by drivers engaged in transport with vehicles with a total weight exceeding 3,500 kg and those engaged in bus transportation. NPK is a condition for the driver to be entered in the register of drivers. A professional qualification is a professional or professional qualification required for the performance of a profession. The professional standard prepared by the state, however, is much more comprehensive than one might expect for candidates who complete a three-year vocational school. Even less can it be fulfilled only by the usual truncated implementation of "courses" for obtaining a national professional qualification

We would also like to highlight the issue of practical education, which could effectively replace "practical lessons on the roads" with appropriate modern technology. Just as pilots are trained in simulators in aviation, it would be extremely important to introduce simulators in road training. Both in the beginning when obtaining a driver's license and later, when applying various changes, either technological or changes in legal regulations.

5 CONCLUSIONS

The most serious problem of the whole road freight industry is undoubtedly the lack of drivers. There is a shortage of around 400,000 drivers in Europe, of which 100,000 in the UK, 65,000 in Germany and 40,000 to 50,000 in France. The unattractiveness of the profession, the aging population of drivers (average age 44) and the high level of qualifications required to pursue the profession are some of the reasons that explain the shortage. Despite a number of strategies (which will only mitigate the consequences to some extent) being implemented, the shortage of drivers in Europe will be exacerbated if transport companies do not improve working and pay conditions for drivers. Strategies (such as apprenticeships, seasonal hiring, recruitment of former military personnel, use of technology, institutional and government contributions, lowering the age of drivers, attracting females to the profession, financial incentives, etc.) will help to improve some bad practices of employers in transport , which will not only help carriers to retain existing drivers, but also in hiring new drivers.

The consequences of a shortage of drivers for road freight are numerous. Several European professional associations point to the risk of weakening the sector, which showed its strategic character during the pandemic. At the same time, transport companies will have to focus on their own, i.e. national pool of staff, and to inspire and gain them in the profession with fair conditions and modern technology, from training to upgrading knowledge.

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