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, crosscultural studies, as well as supply chain and operations management.

> Vol. IV May 2023





AREMA – ACADEMY FOR LOGISTICS AND MANAGEMENT

INTERNATIONAL JOURNAL DEVELOPMENT

FOR

REGIONAL

International Journal for Regional Development (IJRD - Print) ISSN 2463-7920 (IJRD - Online) ISSN 2463-7939

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The published articles express authors' viewpoints. All articles have been triple blind peer reviewed.

CONTENT

EDITORIAL COMENTARY

Patricija Jankovič, Marko Hrženjak	
Crucial role of contracts in tourism industry	1
Patricija Jankovič, Ivana Tadić The impact of the pandemic on the transport sector	24
Jovana Kisin, Azemina Mashalović, Jelena Ignjatović Energy crisis as an opportunity to accelerate the green transition and sustainable economic development: evidence from the western balkans	48
Sašo Murtič, Ingrid Franko Uhernik, ŠejlaMurtič Vpliv mednarodnih sprememb na menedžment proizvodnih in storitvenih sistemov v sodobnem industrijskem razvoju industrijske generacije 4.0	69
Jelena Jesić, Simonida Vukadinović, Andrea Andrejević Panič, Bo	rut
Vojinović Circular economy and eco-innovation indicatrs as imputs for EU sustainable development strategies	92
Ksenija Babanić, Tihana Rogač, Viktoria Laza, Milica Miškov Circular economy as a pathway to sustainable economic growth and development	104
Matej Trapečar Forensic examination and factors of trafic accidents	113
Ružica Zelenović Towards a circular economy: trends, opportunities, challenges and perspective	124
Tilen MedeotArtificialintelligenceandsustainability:how AL can improve sustainable decisionmaking in modern examinations	132
now AI can improve sustainable accision-making in modern organizations	

Natali Grujić

Sustainability as pillar of competitive businesses: Evidence from Comtrade Group

147

Robert Mašera, Lovro Stojnšek		
Future of transport technology	156	
Damjan Plut		
Automation of internal flows car production	166	
Robert Mašera		
Discrimination and diversity of human resources	179	

EDITORIAL COMENTARY

Dear colleagues and readers,

Vol. IV of the IJRD is presenting the latest thinking and research of the international scientific conference, which was held in may 2023 at AREMA, under the title Sustanable economy in modern organisations.

We are particularly pleased by the fact that not only AREMA students, but also students from our partner academic organization Educons from Novi Sad, Serbia, actively participated in the conference. This kind of cooperation between professors and students and joint participation in international conferences are a decisive building block in creating a successful future for our young colleagues.

As always, we 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 ARTICLES¹

 $^{^{\}scriptscriptstyle 1}$ original scientific articles; sicris / cobiss methodology 1.01

Patricija Jankovič² Marko Hrženjak³

CRUCIAL ROLE OF CONTRACTS IN TOURISM INDUSTRY

Abstract:

In this article, we present different kinds of contracts in tourism. Contracts are crucial in the tourism industry, as they provide a legal framework for transactions between tourism businesses and their clients. There are different types of contracts in tourism, including accommodation contracts, transportation contracts, tour operator contracts, and contracts between tourism businesses and their suppliers. Contracts establish the rights and obligations of both parties and provide clarity in case of disputes, ensuring that the tourism industry operates smoothly and efficiently.

Special emphasis is placed on the presentation of various tipes of contracts and their impact on relations in tourism.

Key words: tourism, contracts, travel, transport, obligations. 1 INTRODUCTION

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Tourism is an essential aspect of many economies worldwide. It is an industry that has grown significantly over the years, providing a source of income and employment to many individuals. However, planning and organizing tourist trips can be a daunting task. Therefore, it is crucial to have a structured approach to ensure that everything runs smoothly. This essay discusses the organization of tourist trips and provides sources to support the ideas presented.

To begin with, the first step in organizing a tourist trip is to decide on the destination. The destination chosen should be based on various factors such as the interests of the tourists, the season, and the budget. Research can be conducted to gather information about the different destinations and their attractions. The internet is a valuable source of information, with numerous websites and travel blogs providing insights into various tourist destinations. For instance, websites such as TripAdvisor provide reviews of different tourist destinations, helping tourists make informed decisions (Tripadvisor, n.d.).

After choosing the destination, the next step is to plan the itinerary. The itinerary should include the places to visit, the activities to engage in, and the duration of the trip. A well-planned itinerary ensures that the tourists get the most out of their trip. The itinerary should also consider the interests and preferences of the tourists. For instance, if the tourists are interested in cultural activities, the itinerary should include visits to museums, historical sites, and cultural festivals. The Lonely Planet is an excellent source of information for planning itineraries. It provides comprehensive travel guides that cater to different interests and budgets (Lonely Planet, n.d.).

The third step is to make travel arrangements. This includes booking flights, accommodation, and transportation. Travel agencies can be of great help in making these arrangements. They have established relationships with airlines, hotels, and transportation companies, enabling them to offer competitive rates. However, it is essential to conduct research to ensure that the travel agency chosen is reputable and reliable. The Better Business Bureau (BBB) is a good source of information on the reputation of travel agencies (Better Business Bureau, n.d.).

The fourth step is to ensure that the necessary travel documents are obtained. These may include passports, visas, and travel insurance. The process of obtaining these documents can be time-consuming and stressful, but it is essential to ensure that the trip runs smoothly. The U.S. Department of State website provides information on passport requirements and visa regulations for different countries.

In conclusion, organizing tourist trips requires a structured approach to ensure that everything runs smoothly. The steps involved include choosing the destination, planning the itinerary, making travel arrangements, and obtaining the necessary travel documents. The internet provides a wealth of information to assist with each step, with websites such as TripAdvisor, Lonely Planet, and the U.S. Department of State website providing valuable insights and guidance. By following these steps, tourists can have an enjoyable and stress-free trip.

Contracts play a crucial role in the tourism industry, as they provide a legal framework for transactions between tourism businesses and their clients. Contracts establish the rights and obligations of both parties and provide clarity in case of disputes. In this article, we will explore the different types of contracts in tourism and their importance.

The first type of contract in tourism is the accommodation contract. Accommodation contracts define the terms and conditions of a guest's stay at a hotel or other accommodation establishment. The contract typically includes the price, the duration of the stay, the type of room, and the cancellation policy. Accommodation contracts are essential for both the guest and the establishment, as they provide legal protection in case of disputes or misunderstandings. Examples of accommodation contracts include hotel registration cards and Airbnb rental agreements (EU Travel Commission, 2023, Chron, 2023, World tourism Organizatin, 2023).

The second type of contract is the transportation contract. Transportation contracts are agreements between transportation providers, such as airlines or tour operators, and their clients. These contracts define the terms and conditions of the transportation service, including the price, the itinerary, and the cancellation policy. Transportation contracts are essential in the tourism industry, as they provide legal protection for both parties and ensure that the transportation service is provided as agreed. Examples of transportation contracts include airline tickets and tour packages (EU Travel Commission, 2023, Chron, 2023, World tourism Organizatin, 2023).

The third type of contract is the tour operator contract. Tour operator contracts are agreements between tour operators and their clients. These contracts define the terms and conditions of the tour, including the price, the itinerary, and the cancellation policy. Tour operator contracts are essential in the tourism industry, as they provide legal protection for both parties and ensure that the tour is provided as agreed. Examples of tour operator contracts include guided tours and adventure travel packages(EU Travel Commission, 2023, Chron, 2023, World tourism Organizatin, 2023).

In addition to the above contracts, there are also contracts between tourism businesses and their suppliers, such as food and beverage providers, activity operators, and transportation companies. These contracts define the terms and conditions of the business relationship and ensure that both parties meet their obligations.

In conclusion, contracts are essential in the tourism industry, as they provide a legal framework for transactions between tourism businesses and their clients. Accommodation contracts, transportation contracts, and tour operator contracts are some of the most common types of contracts in the industry. By establishing the rights and obligations of both parties, contracts provide clarity and legal protection in case of disputes, ensuring that the tourism industry operates smoothly and efficiently.

2. LEGAL REGULATION OF TOURISM ACTIVITIES

Tourism is a legally regulated activity and an important part of the economy that has become an increasingly attractive sector despite the turbulent times of pandemics, wars, and recessions. It provides employment for a large number of people. In this industry, there are numerous relationships between individual entities that require legal regulation and categorization of individual relations into areas that are easier to regulate legally. This finding suggests that tourism is such an important sector of the economy that we need rules to regulate relationships between tourists, tourism agencies, and providers of individual services.

A tourism contract is also required in the industry-related economic activity, as numerous relationships are intertwined that are related to the industry or indirectly affect industrial movements. The industry is increasingly looking for opportunities to produce products used in tourism and thus trying to meet certain market needs. We know that a tourism contract involves a contractual relationship, but the Slovenian legislator regulated three tourism contracts in the Obligations Code, namely the travel organization contract, the intermediary contract (together called travel contracts), and the tourist accommodation contract. The first two are typically consumer contracts (on one side the passenger as a consumer and on the other the travel organizer or intermediary), and the latter, tourist accommodation contract, is a commercial contract (two economic entities, a travel agency and a host, conclude it with each other).

We shall not forget that in recent years, the European Commission has adopted numerous acts aimed at protecting the traveler in relation to travel agencies. The following must be considered at a minimum:

- Council Directive 93/13/EEC on unfair terms in consumer contracts,
- Directive 2005/29/EC of the European Parliament and of the Council concerning unfair business-to-consumer commercial practices in the internal market,
- Regulation (EC) No 2006/2004 of the European Parliament and of the Council on cooperation between national authorities responsible for the enforcement of consumer protection laws,
- Directive 2011/83/EU of the European Parliament and of the Council on consumer rights,
- Directive 90/314/EEC on package travel, package holidays and package tours,
- Provisions of Regulation (EC) No 2006/2004 and Directive 2011/83/EU,
- Directive (EU) 2015/2302 of 25 November 2015,
- Consumer Protection Act of the Republic of Slovenia.

In addition to regulating services in tourism, the valid Law on the Provision of Tourism Services also regulates two contracts: the package travel contract and the related travel organization contract, as well as the rights and obligations of merchants and passengers in connection with these contracts.

The first contract, which simplistically includes the first two: the travel contract and the travel organization contract, is the package travel contract. »A package is a combination of at least two different types of travel services for the purposes of the same trip or vacation if:

a) These services are combined by one merchant, among other things at the request or choice of the passenger, before a single contract for all services is concluded; orb) regardless of whether separate contracts for individual providers of tourist services are concluded, if these services:

- are purchased at one point of sale and if they were selected before the passenger agreed to pay;
- offered, sold, or charged at a flat rate;
- advertised or sold under the name "package arrangement" or a similar name;
- are combined after a contract has been concluded, in which the merchant gives the passenger the opportunity to choose between different types of services; or
- shopping with individual merchants through related online booking procedures, when the merchant with whom the first contract was concluded forwards the passenger's name, payment information, and email address to another merchant or merchants and the contract with the other merchant or merchants is concluded no later than 24 hours after the confirmation of the reservation of the first travel service« (Consumer Protection Act of the Republic of Slovenia).

The second contract is the related travel arrangement contract, which »means at least two different types of travel services purchased for the purposes of the same trip or vacation, which do not constitute a tourist package and result in separate contracts with individual providers of travel services if the merchant: a) allows the traveler to choose and pay for each travel service separately during one visit to his sales point or one contact with him, or

b) enables the target purchase of at least one additional tourism service from another merchant if the contract with this other merchant was concluded no later than 24 hours after the confirmation of the reservation of the first tourism service.« (Consumer Protection Act of the Republic of Slovenia)

The current Law on the Provision of Tourism Services regulates not only tourism services and the methods and conditions for providing such services, but also two contracts: the contract for a package travel and linked travel arrangement and the rights and obligations of traders and travellers in relation to these contracts.

The Consumer Protection Act (which we have already mentioned) also includes another contract, namely the contract for the time-sharing of residential properties (also known as time-share contract).

In the field of tourism, many customs have developed in practice, and therefore an important source of law in this area are the Special Customs in the Hospitality Industry (PUG). They regulate the contract for hotel services, the agency contract for hotel services, the holiday accommodation contract, and the contract for the provision of food and beverages.

2.1 A travel organization contract

In legal terms, a travel organization contract has all the features of a classic contract, as the travel organizer and the passenger are co-contractors with their own obligations and rights. The organizer undertakes to provide the passenger with certain services, and the passenger undertakes to pay the agreed price to the organizer. The contract is concluded between the travel organizer and the individual, but travel is typically organized for a group that is formed based on interest in a pre-prepared program.

The law (OZ, 2004) requires the organizer to issue a travel confirmation at the time of contract conclusion, which contains certain elements that provide legal protection to the passenger. The essential elements include the place and date of issuance, the

identification and address of the travel organizer, the name of the passenger, the place and date of the start and end of the trip, the days of stay, the necessary information on the timetable, prices, and conditions of transportation and the quality of transport, the conditions under which the passenger can cancel the trip, etc. If a program of travel with essential information was provided to the passenger before the confirmation was issued, the travel confirmation only proves that everything is organized according to that program.

In summary, a travel organization contract is an important legal document that regulates the relationship between the travel organizer and the passenger and protects the rights of the tourist. The travel confirmation is an essential document that provides legal protection to the passenger and ensures that all services are organized in accordance with the agreed program.

The law (ZGD) has expanded the possibilities of organization and defined that the travel organizer can be a natural or legal person who has certain obligations and related responsibilities towards the persons who have participated in the travel. Natural or legal persons must be properly registered for the activity and have appropriate licenses for it. The obligations that bind the organizer are:

- protecting the rights and interests of the passenger during their travel. Therefore, the organizer must provide the passenger with services that have the content and characteristics as announced in the contract, certificate or travel program. They must ensure the rights and interests of the passenger in accordance with good business practices,
- informing the passenger of any impacts and changes related to the travel. The organizer must inform the passenger, before the conclusion of the contract, of border and sanitary formalities that apply to travel abroad, within the EU, and especially regarding travel to third world countries. Similarly, they must provide information about the timetable, the address and telephone number of the local representative of the organizer, information on optional travel insurance to cover the costs of contract cancellation, etc.,
- protecting confidential information about passengers and their movements,
- being responsible for the implementation and organization of the travel. The law stipulates that the organizer is liable for the damage caused to the

passenger because they did not fulfill or only partially fulfilled the obligations under the contract and the law relating to the organization of the travel,

- being responsible for the travel organizer if they themselves perform individual services, and
- being responsible for the travel organizer if they entrusted individual services to third parties.

It should be understood that the travel organizer is liable for the damage caused by the fact that these services were not provided at all or were only partially performed in accordance with the regulations that apply to them (we provide an example of damage during transportation under the carrier's liability rules).

If the services under the contract were performed incompletely or poorly (superficially), the passenger may request a proportional reduction in the price, but only if they objected to the travel organizer or made a request within 8 days after the end of the travel. However, such a request does not affect their right to compensation for any damage that may have occurred to their belongings, the arrangement, or certain services that they paid for under the contract. It should be noted that the law expressly states that the provisions of the contract that exclude or reduce the liability of the organizer are null and void.

2.1.1 Obligations of the passanger

When we talk about the passenger, we always mean a person. Therefore, the passenger can only be a natural person, while the order and other obligations related to travel, such as payment, can also be made by a legal person who ordered the travel. The mutual obligations in this case are not established by this contract because it is a completely different relationship or another contract that may have been realized through payment.

In addition to the obligations of the travel organizer, we also define the obligations of the passenger, which determine what the passenger is obliged to do, namely:

 To pay the travel prices as agreed. The travel organizer determines what is included in each travel or the travel price, and the passenger agrees with the contract or the price.

- To provide the organizer with the necessary information for the organization and implementation of the trip,
- To meet the prescribed travel conditions required by our or the legal regulations of the country to which the passenger is traveling. Therefore, the passenger must ensure that he personally, his personal documents, and his luggage meet the prescribed conditions (customs, sanitary, administrative). The organizer must warn him about this; otherwise, he is jointly responsible if the trip fails.
- To reimburse the damage caused to the organizer by not fulfilling contractual and legal obligations.

2.1.2 Termination of the rights and obligations

The law (OZ) generally states that parties enter into legal relationships only voluntarily, so no one can force them; otherwise, the legal effect of nullity or invalidity of the legal contract would occur. Therefore, even in the contractual relationship of travel organizations, the law provides for the possibility of terminating the rights and obligations agreed in the contract. Termination may occur due to various factors on the side of the passenger or the organizer. Termination may occur due to:

- The replacement of the passenger with another if not agreed. The passenger may appoint another person to use the agreed services instead of him, provided that the substitute person meets the special travel conditions and that the passenger reimburses the travel organizer for the replacement costs.
- The increase or decrease of the agreed price between the organizer and the passenger. The organizer can only request an increase in the agreed price if there have been changes in the currency exchange rate or changes in carrier tariffs affecting the travel price. In the case of a decrease in the price, the organizer must refund the difference to the passenger. If the increase in the agreed price exceeds ten percent (8% in Croatia), the passenger can terminate the contract without compensation (in this part of the contractual relationship, guarantees do not apply unless the co-contractors have agreed otherwise).

The right of the passenger to terminate the contract for various personal reasons. The passenger may completely or partially terminate the contract at any time (before the start of the package in Croatia). Legal cancellation deadlines are given, so if the passenger cancels the contract on time (within a reasonable period, depending on the arrangement), he only has to reimburse the organizer for administrative costs incurred by the organization of that part related to the contract between them. The law also allows the travel organizer (physical or legal person) to demand a certain percentage of the agreed price as compensation for loss of costs or loss of profit in case of untimely termination. The organizer has the right to reimbursement of its costs only if the passenger cancels due to circumstances that he could not avoid or deter and which would be a justifiable reason for not concluding the contract if they were known at the time of the contract conclusion.

The law (OZ) also gives the travel organizer the right to terminate the contract if there are justified circumstances for doing so. Complete or partial termination of the contract by the organizer without compensation is possible if extraordinary circumstances occur before or during the performance of the contract, which could not have been foreseen, avoided, or prevented and would be a valid reason for the organizer not to conclude the contract if they had known about them at the time of conclusion. In the event of an insufficient number of passengers as stated in the confirmation, the organizer may terminate the contract, but must inform the passenger in a timely manner.

If the organizer terminates the contract before its fulfillment, they must refund everything they received from the passenger. They are not entitled to any administrative costs because there is no legal basis for them.

2.2 Intermediary travel contract

The law (OZ) states that in an intermediary contract, the intermediary (which can be a natural or legal person) undertakes to conclude, on behalf and at the expense of the traveler, a contract for the organization of travel or a contract for one or more specific services that enable such travel or accommodation, and the traveler undertakes to pay the agreed amount as compensation for the travel. In the travel certificate, the intermediary must expressly state that they act as an intermediary, otherwise they are considered to be the person responsible for organizing the trip or are considered the organizer of the trip. The provisions relating to the contract for the organization of travel apply mutatis mutandis to the intermediary contract, unless otherwise provided.

The intermediary is obliged to act in accordance with the instructions given to them by the traveler in a timely manner. If the traveler has not given any specific instructions, it means that they agree with the organizer's organization. In this case, the intermediary must act in the most favorable way for the traveler. The intermediary is not responsible for the work of third parties, but only for their careful selection.

2.3 Contract for the rental of catering facilities or an Alotment contract

This is a form of contract where the owner of a catering facility or a natural or legal person who manages a catering facility gives the organizer, a tourist or other agency, the right to use certain facilities, spaces or beds. Therefore, in a contract for the rental of catering facilities or an Alotment contract, the caterer undertakes to:

- provide a certain number of beds in a certain facility, in a certain place, and under certain conditions to the tourist agency within a specified time frame,
- offer catering services to persons sent by the agency as their guests, and
- pay the agency a certain commission.

Under the same contract, the tourism agency or other natural or legal person engaged in tourism undertakes to:

- endeavor to obtain guests or tourists who will fully use the agreed facilities or spaces,
- inform the caterer within certain deadlines of any changes or risks that may prevent the full use of the spaces, and
- pay the price of the services provided, as much as they have utilized the rented hotel facilities.

In this case, the law determines the essential content of the contract, which is reflected in the fact that the contract must be concluded in writing and is usually concluded for one year (unless otherwise specified in the contract).

2.3.1 Obligations of tourist agency

Tourism is a very variable economic sector, which means that it is a very weak industry influenced by numerous factors such as wars, health conditions, natural disasters, fires, etc. Tourist agencies have an important role in the expansion, organization, and implementation of tourism activities. In Slovenia, they are organized in local communities, with tourist information centers linking to tourist organizations and ultimately to tourist agencies. The Republic of Slovenia adopts a tourism development strategy every year and adapts to the new circumstances. Through the strategy and based on the law, the obligations of the tourist agency are determined, which are:

- informing the host about the development and changes of the tourism development strategy in Slovenia. The agency is obliged to inform the host about the occupancy of the accommodation facilities. If the tourist agency cannot occupy all the rented accommodation facilities, it must inform the host within the agreed or customary deadlines and send him/her a list of guests, specifying a deadline by which the host can freely dispose of the rented facilities.
- respecting the agreed prices. The tourist agency cannot charge higher prices for hospitality services to the persons it sends to the hospitality establishment than those agreed upon in the allotment contract or listed in the hospitality price list.
- paying for hospitality services. If not otherwise specified in the contract, the tourist agency pays for the hospitality services to the host after the services are provided.
- issuing a special written document. The tourist agency must issue a special written document (voucher) to persons sent to the host according to the allotment contract. The document is issued in the name or for a specific group and is non-transferable. The meaning of this document is that it contains an order to the host to provide the services specified therein; it is proof that the

person is a client of the tourist agency who has entered into an allotment contract with the host; it serves as a basis for settling mutual claims between the host and the tourist agency, and

 occupying the rented facilities. The contract may specify that the agency must occupy the rented hospitality facilities. If the agency fails to occupy the rented hospitality facilities in such a case, it must pay the host for the unused bed per day.

2.3.1 Obligations of the host

Hosts associated with the tourism industry organization, connected with tourist agencies, and other activities in the field of tourism, negotiate and provide services that are agreed upon between them at the national level. Their obligation is especially:

- to provide the agreed accommodation facilities. The host assumes the final and irrevocable obligation to provide the agreed number of beds at the agreed time and to provide the services specified in the special written document to the persons sent by the tourist agency. The host may not conclude a contract with another tourist agency that would rent facilities already rented out by the first allotment contract.
- to treat all tourists equally. The host is obliged to provide services to persons sent by tourist agencies under the same conditions as to other guests.
- In case of failure to perform agreed obligations, the travel agency has the right to terminate the contract, either temporarily or completely. The agency may temporarily terminate the use of the rented accommodation without fully terminating the contract and without having to compensate the landlord, if the agency sends a notice of termination within the agreed period. If the notice of termination is sent within the agreed period, the travel agency may terminate the contract completely without having to compensate for any damages."

3 CONCLUSION

A good knowledge of contracts in tourism is essential for all customers because it

helps them understand their rights and responsibilities when they enter into an agreement with a travel agency or any other tourism service provider. Contracts outline the terms and conditions of the agreement, including the price, payment terms, cancellation policies, and other important details.

Having a good understanding of the contract can help customers avoid potential misunderstandings or disputes with the travel agency or service provider. It can also help customers make informed decisions about their travel plans and ensure that they receive the services they paid for.

Furthermore, understanding contracts can help customers identify any hidden costs or clauses that may impact their travel experience or increase their expenses. By having a clear understanding of the contract, customers can protect themselves from fraud or deceptive practices and ensure that they are treated fairly and equitably.

In summary, a good knowledge of contracts in tourism is essential for all customers to protect their rights, make informed decisions, and avoid any potential problems or disputes when dealing with travel agencies or service providers.

Having a good knowledge of contracts in tourism is essential for service providers for several reasons:

- I. Protecting their interests: Service providers need to protect their interests by ensuring that the contract clearly outlines the terms and conditions of the services they are providing, including the payment terms, cancellation policies, and liability provisions. This ensures that they are fairly compensated for the services they provide and that their business is protected from potential legal disputes.
- II. Building trust and credibility: Clear and well-drafted contracts help to build trust and credibility with customers. By having transparent terms and conditions, service providers can demonstrate that they are committed to delivering quality services and that they value their customers' trust and loyalty.
- III. Meeting legal requirements: Service providers in the tourism industry are subject to various legal requirements and regulations, such as consumer protection laws and data protection regulations. A good knowledge of

contracts can help service providers ensure that their contracts are in compliance with these legal requirements and that they avoid any legal liabilities or penalties.

IV. Minimizing misunderstandings and disputes: By clearly outlining the terms and conditions of their services, service providers can minimize misunderstandings and disputes with customers. This can help to improve customer satisfaction and retention, as well as save time and resources that might otherwise be spent resolving disputes.

So, a good knowledge of contracts in tourism is essential for both customers and service providers for several reasons:

- I. Protection of rights and obligations: Contracts outline the rights and obligations of both parties involved in the tourism transaction. A good understanding of the terms and conditions of a contract can protect both the customer and the service provider from any potential misunderstandings or disputes that may arise.
- II. Avoidance of fraud: A thorough knowledge of contracts can help customers and service providers identify fraudulent activities or misrepresentations that might occur in the tourism industry. It can also help to prevent any fraudulent behavior or malpractices that might occur during the transaction.
- III. Financial protection: Contracts in tourism transactions usually involve a significant amount of money, and understanding the terms and conditions can help customers make informed decisions about their financial commitments. It can also help service providers to ensure they receive payment for their services as per the agreed-upon terms.
- IV. Compliance with legal requirements: Tourism transactions are governed by laws and regulations, and contracts often include terms that ensure compliance with these legal requirements. A good understanding of contracts can help both customers and service providers to comply with relevant laws and regulations, avoiding potential legal issues.

In summary, a good knowledge of contracts in tourism is essential for both customers and service providers as it helps to protect their rights and obligations,

avoid fraud, provide financial protection, and ensure compliance with legal requirements.

Sources:

- 1. Better Business Bureau. (n.d.). Retrieved from <u>https://www.bbb.org/</u>
- 1. Chron "Types of Contracts in the Hospitality Industry,", <u>https://smallbusiness.chron.com/types-contracts-hospitality-industry-</u> <u>30849.html</u>
- 2. Consumer Protection Act of the Republic of Slovenia, Zakon o varstvu potrošnikov (Uradni list RS, št. 130/22).
- 3. European Travel Commission, "Tourism Contract Law," <u>https://www.etc-</u> <u>corporate.org/research/tourism-contract-law/</u>
- 2. Lonely Planet. (n.d.). Retrieved from <u>https://www.lonelyplanet.com/</u>
- Obligacijski zakonik (OZ): s komentarjem / redaktorja Miha Juhart, Nina Plavšak. – 1. natis. – Ljubljana: GV Založba, 2004, Zbirka Nova slovenska zakonodaja. ISBN: 86-7061-323-9
- 5. TripAdvisor. (n.d.). Retrieved from https://www.tripadvisor.com/
- ZGD, Zakon o gospodarskih družbah (Uradni list RS, št. 65/09 uradno prečiščeno besedilo, 33/11, 91/11, 32/12, 57/12, 44/13 odl. US, 82/13, 55/15, 15/17, 22/19 ZPosS, 158/20 ZIntPK-C in 18/21).
- 7. World Tourism Organization, "Legal Issues in Tourism," <u>https://www.unwto.org/legal-issues-tourism</u>.

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THE IMPACT OF THE PANDEMIC ON THE TRANSPORT SECTOR

Abstract:

In this article, we present the impact of COVID 19 pandemic on the economy, tourist travel and the transport sector, which is strongly linked to travel, especially in three key industries: the airline industry, public transport and cruises.

Special emphasis is placed on the presentation of solutions of the crises, particularly in management of travel industry.

Key words: tourism, COVID 19, transport, airline industry, public transport, cruises

1 INTRODUCTION

With the COVID-19 pandemic, movement of people was restricted in many places, either through national, regional, or neighborhood borders, to limit the transmission of the SARS-CoV-2 virus. In the context of restricted movement, some places people visit, modes of travel, and travel patterns have changed. These changes have wider implications for the future of transportation and how we can address current issues related to mobility behavior (Conrow et al., 2021).

The profitability of the entire sector significantly decreased in 2020, especially when comparing the second quarter of 2020 to the second quarter of the previous year,

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2019. In the previous period, companies in the transportation sector generated the most profit in the spring months, which was associated with population mobility - school trips, commuting, etc. In the second quarter of 2020, the "transportation and storage" sector did report a profit, but it was very modest. Companies with 50-250 employees (medium-sized companies) recorded a significant loss, but they also experienced losses in the previous period. Therefore, it cannot be conclusively argued that the reason for these losses was due solely to mobility restrictions. On the contrary, the biggest decline in profits in the second quarter of 2020 was observed in large companies with more than 250 employees. However, they significantly recovered in the third quarter (Ponisciakova & Kicova, 2021).

The COVID-19 pandemic has had unprecedented consequences around the world, negatively impacting the transportation sector, which experienced a drastic decrease in passenger traffic in all modes of transportation. Since physical interaction is a key medium for maintaining the spread of the virus, government decisions were focused on either separate decisions or combinations of decisions to limit or block mobility. Therefore, countries around the world, including the United States, Canada, Italy, and China, introduced various types of travel bans and restrictions and all types of mobility options that likely include physical contact and implemented domestic emergency plans for medical response. According to the World Health Organization, the virus is respiratory and spreads mainly by contact with an infected person. In particular, contact with droplets produced by infected subjects after sneezing or coughing is a key medium for the spread of the virus. Modes of transportation are among the most critical platforms for the rapid spread of infection in high-density urban environments with mixed use. This aspect has been shown in the modern context when people move every day (an average of 2.5 trips per day), covering an average distance of around 30 km for various reasons (such as work, study, shopping, entertainment) using various modes of transportation, including walking, cycling, public transport, and private vehicles (Moslem et al., 2020).

In the second phase of restrictions, many countries took on the challenge of conventional travel and required the requalification of road infrastructure and the acquisition of electric micro-mobility with political will and support, while promoting walking and cycling. Planning road infrastructure and improving pedestrian and bicycle paths are very encouraging ways to increase mobility after the pandemic, promoting integrated infrastructure design and control with intelligent transport system technologies, information modeling of infrastructure construction, and planning and concept of mobility as a service (Canale et al., 2019).

COVID-19 has further endangered oil suppliers who were already facing falling oil prices. Due to the continuation of people's daily lives at home, the number of people using transportation has decreased, and energy consumption in the manufacturing industry has decreased. Approximately 2% of vehicles in the world used electric power, and the remaining vehicles used gasoline in 2016. A decreasing trend was also observed in this area, as road traffic was limited, freight traffic decreased, and there was almost no air and rail traffic (Priya et al., 2021).

To contain the spread of COVID-19 and in anticipation of the gradual resumption of economic activities, mobility was limited by local and domestic restrictions in various areas of mobility, such as the suspension of domestic and international flights, prohibition of movement between communities, and isolation at home. Production systems and work environments were adapted to the necessary safety conditions, including intelligent work environments or increased social distance (Moslem et al., 2020).

The COVID-19 pandemic had an extraordinary impact on shipping markets in 2020. According to estimates by Clarksons Shipping Intelligence Network, world seaborne trade is projected to have decreased by 4.4% in 2020, a comparable reduction to that of the international financial crisis (2009: 4.1%) (Gavalas et al., 2022).

Arellana et al. (2020) studied the short-term effects on transportation systems caused by various government measures in Colombia. Using official and secondary data from the seven largest Colombian cities, the authors analyzed the impact on three components of the transportation sector – freight transportation, air transportation, and urban public transportation. The results showed that the measures significantly reduced the demand for travel in the transportation system, decreased the number of passengers, and also reduced negative impacts on the environment. In the first three months of the measures in the country, freight transportation decreased by 38%, affecting the supply chain of non-essential

products for citizens' lives. According to many other experts, public passenger transportation is one of the sectors most affected by the COVID-19 pandemic.

The pandemic has had a significant impact on the transportation sector in China. The decrease in the number of passengers caused by COVID-19 can be divided into two parts: a spontaneous decrease in people and a decrease limited by the government. For the spontaneous decrease, it is natural for people to stay at home during vacation and avoid infection. Infected patients were strictly monitored. On the other hand, the Chinese government quickly implemented responsive policies (i.e., city closures, extending holidays) to control the epidemic, which also reduced transportation and halted some economic production (Wang et al., 2021).

Changes in the share of transportation modes were initially seen as an opportunity and a threat at the beginning of the pandemic. Increased use of active transportation and a decrease in the number of trips by private vehicles positively affect health and reduce emissions (opportunity). However, reduced patronage of public transport, if replaced by vehicle trips, may result in reduced physical activity and increased greenhouse gas emissions (threat). One year after alert levels were introduced, the majority of people in New Zealand felt that their travel routines had not changed compared to how they travelled before the pandemic, and the increased use of active transportation that occurred during lockdown periods appears to have been temporary. The only lasting effect seems to be a decrease in patronage of public transport, which presents a range of challenges, particularly those related to transport equity, as any reduction in services would be disproportionately felt by people who are already disadvantaged by transport (Conrow et al., 2021).

Transport is a critical sector of any economy, contributing significantly to gross domestic product, e.g., 3.8% in the UK in 2016, 2.9% in the US in 2014, and 6.7% in India in 2013. Additionally, transport accounts for approximately 20% of global energy consumption, with significant harmful environmental impacts attributed to road freight transport in particular. This highlights the need for sustainable development in the sector, which addresses issues from various perspectives (e.g., infrastructure, regulations, and policies). Although the share of freight may be small when measured as flows in transportation networks, it is critical to the efficiency of transport and the costs of transportation-related infrastructure. Freight transport directly and indirectly impacts economic development, with its role increasing with the globalization of economies, particularly due to the diversity and scale of services provided by transportation companies. Evidence emphasizes that transport costs are a significant part of supply chain costs that affect procurement and procurement costs (Strauss et al., 2020).

2. IMPACT OF COVID-19 ON TOURIST TRANSPORTATION

Numerous researchers have studied possible changes in travel behavior during and after the COVID-19 pandemic. Zhang and Hayashi (2020) examined the impacts of COVID-19 on the transportation sector. Their study was based on a global expert survey with a sample size of 357 professionals. The study shows that a large proportion of modal shift from public transport to other modes of transport was observed worldwide. The largest possible shift was to cars (64.8%), followed by walking (42.3%), bicycles (35.6%), and motorcycles (19.7%).

Next, we present the three most exposed types of tourist transportation during the COVID-19 pandemic. 2.1 Impact of COVID-19 on air transportation The market for passenger air transport services consists of the sale of passenger air transportation services and related goods by entities (organizations, sole proprietors, and partnerships) using aircraft such as airplanes and helicopters to provide air transportation services to passengers. It includes services offered by both scheduled and non-scheduled air carriers. The passenger air transport market is divided into domestic and international air passengers (NASDAQ OMX's News Release Distribution Channel, 2021).

The COVID-19 pandemic has caused immense damage to many industries, but the airline industry has been hit the hardest. According to the International Air Transport Association, passenger air traffic, measured by revenue passenger kilometers, decreased by 90% in April 2020 compared to the previous year, and still by 70% in August 2020 (Li et al., 2021). The COVID-19 pandemic was an exceptional case of supply chain disruption in sectors worldwide. The pandemic particularly severely disrupted the commercial aviation industry. Due to travel restrictions, government orders, quarantine, social distancing, and fear, international aviation organizations estimated a 40% decrease in global passenger traffic and a 47-58% decrease in the number of planned airline seats worldwide. In addition, new cleaning and safety procedures have caused greater strain on airlines, affecting flight schedules (Strauss et al., 2020).

Lee and others (Lee et al., 2020) reported that 194 countries had implemented some form of cross-border surveillance measure in response to the coronavirus pandemic, including travel and visa restrictions as well as complete border closures. As a result of these restrictions, in April 2020, the International Air Transport Association (IATA) predicted that airlines would lose \$314 billion in passenger revenue due to the outbreak of the coronavirus, while the CEO of IATA described the 50% loss of business in the sector as catastrophic. National "stay-at-home" restrictions combined with the shutdown of large parts of the global economy (including the manufacturing and service sectors) and individual consumer concerns about infection have caused passenger demand to evaporate. Airlines have responded to the sudden reduction in reservations, revenue, and excess capacity by rationalizing their networks, reducing services, laying off staff and/or furloughing them, placing aircraft in temporary storage, and lobbying national governments for financial support (Adrienne et al., 2020).

Transportation is a major contributor to the tourism industry. The branch of transportation that has undoubtedly been most affected by the pandemic is air transportation. Two years ago, forecasts for the development of the air market in Poland indicated a dynamic increase in the number of passengers at domestic airports, especially regional ones. Meanwhile, the pandemic that broke out in March 2020 caused a 90% reduction in passenger traffic from March 2020 to May 2020, which dramatically affected the revenues of all participants in the sector and their employees in the aviation value chain. In April 2020, most countries with which Poland had direct land or sea passenger connections had introduced restrictions on international travel (Roman et al., 2022).

"The aviation industry remains very fragile and is one of the biggest victims of the global COVID-19 pandemic. Air traffic has declined due to social isolation, and travel restrictions grounded two-thirds of commercial airlines at the outbreak's beginning and worsened the aviation industry's revenues. It is the most severe type of crisis, as 7.5 million flights were canceled, and customers demanded refunds. This is unprecedented in the history of aviation and the biggest challenge when more planes are on the ground than in the air. The pandemic affected the economy and hit tourism, leading to a decrease in aviation industry revenues because passenger demand closely follows the gross domestic product's progress. COVID-19 is estimated to have cost airlines \$320 billion in lost global revenue, which directly or indirectly poses a risk to 25 million jobs. Member states of the International Air Transport Association (IATA) lost an average of \$230 million per day, halving annual revenues from \$838 million to \$419 million in 2020, the biggest decline in recent aviation history. According to the International Civil Aviation Organization, the pandemic caused an overall 80% reduction in passenger numbers in 2020 compared to 2019. The decline in gross domestic product in most countries has affected trade and tourism and reduced people's incomes by 48%. Air traffic is expected to return to pre-COVID-19 levels in 2023 (Xuan et al., 2021).

Greater public awareness of the contribution of air travel to global greenhouse gas emissions, together with a loud movement to shame flying, inflationary pressures, and recent conflicts causing increases in fossil fuel energy prices, have further slowed the recovery of international travel. The closure of Russian and Ukrainian airspace since February 2022 has affected travel within Europe and increased longdistance travel costs between Europe and the Middle East and Asia-Pacific due to flight diversions. The lifting of travel restrictions was the main factor in the revival of international travel. Despite the negative impact of further waves of COVID-19 caused by the more infectious Omicron variant in the first quarter of 2022, the World Tourism Organization's modeling predicts a gradual increase in international tourist arrivals to 78% in 2022 compared to 2021 (Flaherty et al., 2022).

The COVID-19 pandemic has caused an unprecedented crisis for global airlines. Governments worldwide have introduced travel bans, lockdowns, and stoppages to enforce social distancing measures in their efforts to prevent further rapid spread of the disease and protect the effectiveness of national healthcare systems. The travel and hospitality industry in general, and particularly airlines, have been severely impacted, with over 60% of the world's commercial aircraft grounded. An extraordinary crisis like the COVID-19 pandemic likely means not only little time for organizing and planning a response, but also that traditional response strategies are insufficient (Albers & Rundshagen, 2020).

Demand for air travel is derived from the state of the global economy. Although consumer demand for flying is cyclical, the long-term trend of steady and accelerating growth has been present since the 1950s. While commercial aviation has experienced many external shocks, including the September 11 terrorist attacks, the 2003 SARS virus, and major volcanic eruptions that temporarily disrupted normal traffic flows and reduced demand for air passengers, they have always returned, and in increasing numbers. Indications regarding the current state of COVID-19 are varied, with forecasts suggesting it could take several years for traffic to return to pre-crisis levels, during which time the airline industry will undergo dramatic changes, which we are already observing (Adrienne et al., 2020).

Early academic analyses of the impact of the pandemic on air travel included considerations of the dramatic consequences for global passenger traffic and ways in which it could affect future demand for air travel among certain consumer groups. Indeed, the COVID-19 pandemic in 2020 and the restrictions on international travel and the dramatic decline in consumer demand that resulted from it have already had a significant impact on passenger aviation around the world (Suau-Sanchez et al., 2020).

Lau et al. (2020) explore the extent of air traffic and COVID-19 and confirm a strong correlation between the situation in the home country and the number of passengers. Similarly, there is an important relationship between international COVID-19 cases and the number of passengers. Rahman et al. (2020) found that global airline revenues are expected to decrease due to reduced demand for flights in Europe due to COVID-19. Due to government border closures, passengers have disappeared, which has changed airline operations and reduced staff by \$113 billion.

In addition, the pandemic has also affected air cargo traffic due to flight cancellations.

Li et al. (2021) analyze the effect of COVID-19 on China's civil aviation and conclude that the prospects for air cargo traffic are optimistic. The air cargo sector can easily recover compared to passenger traffic. The pandemic has limited travel, which has greatly affected aviation, and airlines have suspended flights. However, recovery is expected to be slower, as the shape of the recovery curve (V or U-shaped) depends on economic prospects. The findings show that the pandemic has far-reaching consequences for the economy, disrupting production, and limited transportation has further slowed economic activities (Xuan et al., 2021).

Suau-Sanchez and others (2020) state that the airline industry is one of the most affected industries by the pandemic, which will transform the aviation sector. This unexpected crisis has put a tremendous burden on airline companies. COVID-19 has not only negatively affected the aviation industry but has also impacted economic activities that strongly influence the demand for air travel and the revenues of the airline industry.

In the context of passenger air transport, although the damage caused by the pandemic is straightforward, i.e., a drastic drop in demand, two forces influence demand. Firstly, COVID-19 limits supply. Passengers cannot travel due to restrictions imposed by governments. Secondly, COVID-19 reduces demand. The desire or need of passengers to travel naturally decreases during the pandemic (De Vos, 2020).

The impacts of both forces on demand can vary. Additionally, due to the same force, the impact can differ among passengers and flight destinations. For example, COVID-19 has affected passengers in Europe more than passengers in the United States because passenger flights in Europe are mostly international, and most travel restrictions are also international. If COVID-19 only has a little impact on the willingness of passengers to fly on certain routes, airlines could expect a V-shaped recovery when they resume operations on these routes. In this situation, airlines should shift their resources to other critical areas of operation instead of launching marketing campaigns for these routes. If there is an impact on the willingness of passengers to fly, and the impact varies among passengers, airlines should identify passenger segments that are most affected and implement targeted promotions (Li et al., 2021).

Mass groundings of passenger planes occurred in the second and third weeks of March, and by Friday, April 17, 2020, nearly 5000 passenger planes were grounded in 39 countries in the Eurocontrol area. Nearly one-fifth of these (948) were in the United Kingdom, and a significant number were also stored in Germany (709), France (525), and Turkey (470). Quarterly figures were also reported in Norway, Sweden, Switzerland, Belgium, Spain, Italy, the Netherlands, Austria, Portugal, Denmark, and the Republic of Ireland. Interestingly, the location of these planes was not static and changed almost daily as airlines moved their assets between countries during the crisis (Adrienne et al., 2020). The decline in the number of passengers in air transport is presented in Figure 1.



Figure 1: The decline in the number of passengers in air transport in relation to the number of confirmed cases of COVID-19. Source:(Forsyth et al., 2020)

The data on the number of passengers (see Figure 1) shows that the COVID crisis has caused an exceptional decrease in the number of passengers, resulting in a dramatic decrease in revenue not only for airlines but also for airports. The length and impact of the crisis on airports have depended and will continue to depend on the containment of the virus and the effectiveness of monetary and fiscal stimulus programs (Forsyth et al., 2020).

The COVID-19 pandemic is therefore changing the fate of European aviation. Due to the suspension of cross-border travel caused by the pandemic in the spring of 2020, all airlines began to implement extensive measures to reduce employees. Due to the increasing prolongation and widespread realization that the return to pre-COVID-19 operations will be months if not years away, European airlines have resorted to different responses, persistence, as well as innovative and exceptional strategies, in which governments are mainly involved as providers of much-needed liquidity (Albers & Rundshagen, 2020).

By the end of March 2020, it was estimated that global airlines collectively required \$300 billion in financial support in addition to the \$200 billion demanded by IATA. By mid-April 2020, it was reported that 17,000 aircraft worldwide (which represents approximately 64% of the total global passenger fleet) had been inactive for at least one week and were parked in temporary storage. By the beginning of May, airlines and original equipment manufacturers were announcing significant job losses. Virgin Atlantic announced it was laying off almost a third of its UK workforce, while General Electric was reportedly considering reducing its global aviation workforce by a third (or 13,000 jobs) (Adrienne et al., 2020).

In Europe, when the virus peaked and passenger demand disappeared, airlines quickly responded to the surplus capacity by canceling flights. However, since parking fees for airplanes at major European airports often exceed 200 pounds per hour for the largest planes, cheaper parking spaces were needed. Some planes were sent to long-established desert parking lots in the United States, while others were parked in a more ad hoc manner, where space allowed or "smart parking" on runways, taxiways, and airport ramps around the world (Kotoky et al., 2020).

Extended periods of inactivity may also require windshields, brakes, and landing gear to be covered and protected in accordance with the aircraft manufacturer's recommendations and maintenance procedures typical of the airline. Despite being parked, airplanes still require a basic level of care and maintenance. This can include towing the plane to turn the tires to prevent flat spots, occasional ground engine starts, and inspections of climate units, controls, and electrical systems. KLM has described in detail the level of support required in its Active Parking Program, while Virgin Atlantic has reported inspecting each grounded plane every 7, 14, and 30 days. The process of putting an aircraft into a parked state is time-consuming. It is estimated that it can take up to 60 hours to park an A320 aircraft, and a similar amount of time to return it to active use (Adrienne et al., 2020).

Since most well-documented cases of SARS-CoV-2 transmission on flights involved people sitting in the same row or two rows in front or behind, reducing seating density can also help reduce the risk of transmission on flights. In addition to mask use, there is evidence from community and hospital studies that maintaining distance between individuals reduces the risk of transmission by increasing protective efficacy at distances of 1, 2, and 3 meters. The potential protective effect of eliminating the occupancy of the middle seat on flights was evaluated in an experimental model, which showed that this approach could lead to a 57% reduction in transmission risk. Unfortunately, airlines need to use all seats to increase profit, so this approach is no longer used (Flaherty et al., 2022).

2.2 Impact of COVID-19 on public transportation

City travel has decreased worldwide during the COVID-19 pandemic, but not equally for all modes; public transportation has taken the hardest hit, as shown by research data. In some cases, this has been accompanied by reduced service offerings and further worsened the perception of public transportation as more risky than personal transportation due to closer contact with other people, which is possible, and sometimes unavoidable, in public transportation vehicles and stations (Tirachini & Cats, 2020).

The fact that a person infected with the novel coronavirus COVID-19 is contagious before showing any symptoms is particularly concerning for exposure to the virus in public places. Several factors contribute to making public transportation stations and vehicle environments highly risky for COVID-19 infection for the following reasons (Tirachini & Cats, 2020):

- People are enclosed in a confined space. The risk of infection increases with the level of passenger occupancy in vehicles and stations. The discomfort associated with traveling on overcrowded buses or trains has increased since the COVID-19 pandemic due to the additional danger of infection with a potentially deadly virus.
- 2. Access control to identify passengers or workers who may be sick may be limited.
- 3. The existence of multiple surfaces such as seats, railings, doors, and ticket machines that can easily transmit microbes.
- 4. Public transportation, such as railways, subways, airlines, taxis, and buses, act as carriers and distributors of diseases and involve facing endless social distancing rules. Due to the limited operation of the public transportation system during lockdown periods, there were severe losses across all modes of public transport. Below are some examples that explain the impact on public transport from different countries (Nayak et al., 2022):
 - Indian railways have suffered significant losses from passenger and freight trains. Similarly, the Indian airline industry is estimated to have lost about 3-3.6 billion US dollars due to the grounding of all international and domestic flights during these COVID-19 outbreaks.
 - From March 16, 2020, to May 8, 2020, there was a significant drop in public transportation activity in the United States and Canada compared to data from February 1, 2020, to March 15, 2020.
 - Similar statistics were found regarding the impact of COVID-19 on the transport sector in Europe. Spain experienced the largest decrease in transport activity, taking into account social distancing guidelines, from March 16, 2020. The UK's public transport activity started decreasing much later. The Netherlands had the smallest impact during the COVID-19 pandemic, and the industry's activity began to

increase from April 29. In 2019, the tourism and transport industry in the Lazio region of Italy generated 30.2 billion euros in revenue. In the best-case scenario, this figure was estimated to decrease to 25 billion euros in 2020, and in the worst-case scenario, to 19 billion euros.

On percent of people using various types of transport were also affected by national lockdown/restrictions in New Zealand. The general use of public transport significantly decreased during quarantine periods, more so than the use of private vehicles and active modes of travel (e.g. walking, cycling), and took longer to return to pre-pandemic levels. Although during a public health crisis it is possible to expect concerns regarding the use of public transport as people can be in close contact with others outside their household bubble, the two most common reasons in a New Zealand survey for decreased use of public transport among regular riders since the beginning of the pandemic were "traveling less" and "not needing to travel". Therefore, the decline in public passenger transport can largely be attributed to work from home arrangements and no other significant changes; regular users of public transport were more likely to continue working from home even as restrictions became less strict. Social distancing requirements have caused public transport operators to operate with reduced passenger capacity, and service frequency has been reduced on some routes, which likely resulted in public transport users choosing to continue working from home until normal service levels are restored (Conrow et al., 2021).

The economic and social effects of the COVID-19 outbreak on public transport are as follows (Tirachini & Cats, 2020):

- Financial difficulties. Within a few weeks, the COVID-19 pandemic became the biggest economic crisis for public transport services in decades. The sharp decrease in demand for public transport due to COVID-19 has been combined with increased costs due to new hygiene and cleaning standards. In these conditions, many public transport agencies are struggling financially and putting pressure on governments.
- Social justice. In this context, the vision of public transport as a driver of social integration rather than segregation seems more distant than ever before. With the COVID-19 pandemic, people have abandoned public

transport, but not equally: groups with higher incomes have left public transport in greater numbers. A recent study comparing travel in Santiago in the last week before the coronavirus outbreak with the first week of national measures to contain the virus in March 2020 showed that people from households with higher incomes were the largest group of people who stopped traveling by public transport. While public transport trips decreased by between 30% and 40% for people in households with the lowest incomes, the decrease in public transport use was over 70% for households with the highest incomes.

Sustainable mobility. If buses and trains are running almost empty during COVID-19, the argument for the economic and environmental efficiency of promoting public transport is seriously challenged, and the only remaining argument would be to provide mobility to those who need to travel because public transport is their only option. The goal should be to ensure that public transport is as safe as possible and can accommodate and attract more people, not just those who have no feasible alternative.

Advice on the use of public transportation in response to the COVID-19 pandemic has been quite diverse around the world. At one end of the spectrum, official guidelines explicitly discourage the use of public transportation. The United Kingdom clearly advises, "Avoid using public transport where possible" and "Consider all other forms of transport before using public transport." Similarly, the Dutch national government advises the use of public transport only if absolutely necessary and if no other means of transportation are available, and to travel outside of peak hours as much as possible. In the United States, it is suggested that employers offer incentives for using forms of transportation that reduce close contact with others (e.g. cycling, walking, driving alone or with household members). Such situations can be accompanied by strict rules of physical distancing. For example, in May 2020, in New South Wales, Australia, the capacity of a standard 12-meter bus and train carriage was reduced to 12 and 32 passengers, respectively (Tirachini & Cats, 2020).

At the other end of the spectrum are countries, especially in Asia, that have not imposed strict restrictions or warnings. In some cities in China, bus capacity was
reduced to only 50%, allowing for the occupancy of all bus seats, while built-in cameras verify compliance with capacity. Subway trains in Taiwan and South Korea operated with high occupancy during rush hours, far exceeding the usual COVID-19 physical distancing recommendations (one or two meters of distance between people) in countries where wearing masks in public places is mandatory. Furthermore, as the economy reopens after a lockdown in Singapore, the government's COVID-19 task force explicitly stated that social gatherings are still prohibited as of June 8, but physical distancing in public transport will not be enforced as long as passengers wear masks and do not talk to each other to reduce the risk of infection. Differences in recommendations and regulations regarding public transportation between countries could be explained by differences in the prevalence of COVID-19 in their communities, but there are likely more factors at play (How & Thiagarajan, 2020).

As in other countries around the world, public mobility in China has also decreased rapidly, especially in the area of public passenger transport, which has largely been replaced by individual car traffic. As a result, some service providers have completely halted their services, for example in Wuhan, China, or have only allowed the use of public passenger transport for basic travel, as some states in the United States and some countries in Asia and Europe. Although public passenger transport services in some countries have been performed without restrictions, passengers have limited use of public passenger transport because they are afraid of getting infected with the virus (Konečný et al., 2021).

In a pandemic, changes in people's behavior driven by risk perception and resulting responses can affect the spread of infections. While two online surveys of 1000 South Koreans in late February and late March showed that 75.4% and 88.7% of respondents, respectively, refrained from using public transportation, it is unclear whether such high levels of risk perception are representative of the extent to which the wider public is actually practicing social distancing. It is also important to be aware of how certain population groups have changed their behavior in response to COVID-19, as susceptible groups such as the elderly are more likely to progress to severe cases of COVID-19, and because other groups such as those working in companies may have less autonomy in implementing social distancing.

Understanding people's behavior is crucial in responding to COVID-19, as it forms the basis for changing behavior (Park, 2020).

Jenelius and Cebecauer (2020) examined how COVID-19 affected passenger mobility in the regions of Sweden (Skåne, Västra Götaland, and Stockholm) using data from carrier management systems. Stockholm was the most affected region by COVID-19 cases between March and May 2020. At the same time, the decrease in the number of passengers was the largest in this region (about 60%) and the smallest in Västra Götaland (about 40%). As conditions improved, passenger mobility gradually increased but remained lower than the previous year. Ultimately, public transit was the most affected mode of transportation. The decrease in the number of passengers was primarily due to a decrease in the number of active transit users, while the average daily number of trips per active transit user remained relatively stable. There was also a noticeable change in the types of tickets purchased. Data showed increased demand for one-time and electronic tickets, while monthly passes sales decreased. Short-term ticket sales declined sharply as they are primarily used by tourists. The study's results are not clear on whether demographic factors influence the use of different types of public transportation. However, it was found that these differences affect the financing of public transportation. In summary, passengers significantly changed their mobility and decision-making by exiting the public transit system, and those who remained switched to more flexible types of tickets. Part of the slight recovery in passenger numbers in the latter half of the period was due to the return of public transit users.

Wielechowski and others (2020) aimed to evaluate the changes in public transport mobility in Poland as a result of the COVID-19 pandemic. The authors analyzed the traffic situation at the national and regional level from March 2nd to July 19th, 2020, during the first wave of the pandemic. Based on research, there is an indirect, insignificant correlation between people's mobility in public transportation and the number of new cases in Poland. The strength and statistical significance of the correlation vary considerably from one voivodeship to another. On the other hand, a statistically significant but strong indirect correlation was observed between the changes in public transportation mobility and the measures taken by the Polish government, with the strength and statistical significance of the correlation varying considerably from one region to another. The results indicate that the antipandemic measures taken by the Polish government reduced public transportation mobility more than it would have been limited by the development of the epidemic itself.

Tarkowskii and others' (2020) study attempted to explain societal responses to mobility restrictions. The difference in mobility regarding visits to parks, shops, and pharmacies varies considerably. One way to explain these differences is through long-term habits of social life, possibly influenced by historical and cultural factors. The reduction in mobility and changes in mobility patterns are evident effects of social distancing. Regarding the regional dimension, mobility is persistently decreasing in most analyzed areas. In the local context, as illustrated by the analysis of changes in travel time from residential areas in Gdansk, Gdynia, and Sopot to the business and scientific center of Gdańsk-Oliwa, a noticeable but spatially diverse reduction in travel time (by private car) was observed. The most significant reduction in travel time was recorded in peripheral areas accessible via highways that are typically congested during peak hours. Mobility restrictions caused a significant reduction in traffic jams, resulting in shorter travel times.

2.3 The impact of COVID-19 on cruises

Cruise ships transport a large number of people in enclosed spaces for a longer period than any other mode of transportation. Therefore, cruise ships are a unique environment for the transmission of human-to-human infections. The incidence of acute respiratory infections in passengers is statistically significant depending on the season, destination, and duration of travel (Rocklöv et al., 2020).

A lot of attention has been given to the crisis in the cruise industry due to its potential serious impact on human health. Health is one of the most important concerns when it comes to cruise travel. Health issues endanger the personal health and well-being of passengers, crew members, and even local residents of cruise ports. The transmission of infectious diseases from human to human is increased on cruise ships due to the high population density in enclosed spaces (Pan et al., 2021).

Cruise companies have had major problems with outbreaks, which forced them to carefully consider strategies to reduce the transmission of SARS-CoV-2. Many outbreaks on cruise ships occurred at the beginning of the pandemic, before companies on cruise ships introduced stricter protocols. An extensive analysis by the CDC of 89 trips on 70 cruises in US waters or with US citizens between January and April 2020 identified longer travel duration (14-day trips compared to 7-day trips) as a risk factor for outbreaks. In contrast, the risk was lower for cruises with a reduced total number of passengers and crew members, testing on day 0 and 4, daily symptom checks, isolating anyone who tested positive or had compatible symptoms, and limiting the cruise to a single port call.

A series of measures, including advising on full vaccination before embarking on a cruise (ideally mandatory and not just recommended), pre-boarding screening, daily symptom monitoring, testing at two time points soon after departure, and effective isolation and quarantine protocols, can help reduce the spread of SARS-CoV-2 on ships. Data on the effectiveness of masking in this context is limited (Flaherty et al., 2022).

The occurrence of multiple outbreaks on cruise ships during the COVID-19 pandemic illustrates the vulnerability and weakness of limited cruising. Passengers are confined to the cruise ship for days and weeks with poor ventilation in cabins, which enhances person-to-person transmission of disease. Because of this increased transmission, the Centers for Disease Control and Prevention issued an order in 2020 prohibiting sailing and advising travelers from the United States to defer all cruise travel. All of this public information, as well as discussions on social and traditional media about cruises, have negatively impacted potential future cruises (Rocklöv et al., 2020).

3. CONCLUSION

The COVID-19 pandemic has had a strong impact on the travel industry and the experiences of travelers, who have been exposed to requirements for COVID-19 vaccine certification, diagnostic testing before and after departure, rapid antigen testing, mask wearing, and the critical importance of comprehensive travel insurance. Although new vaccines and antiviral agents have greatly reduced the risk of severe hospitalization and death, the risk of further variants that evade the vaccine or immune system is high and makes efforts to return to a completely

normal travel environment difficult. Travel medicine providers have shown resilience in adapting to the pandemic. Travel medicine should use the technological and behavioral progress of the pandemic to protect itself from future global shocks. Future research should assess the long-term impact of the pandemic on travelers' health behavior and travel practice.

The nature and extent of changes in movement and transportation resulting from the COVID-19 pandemic have shown that determined policy measures can change travel habits and rethink the use of space. The experiences gained from changes in traffic behavior during the pandemic should be used to shape innovative policies that recognize that climate change requires as bold and interventionist a political response as that implemented during the COVID-19 pandemic.

The discussion of the impact of COVID-19 has become extremely important for policy makers. The pandemic has a high price: it brings death, economic devastation, and changes all aspects of society. It halts the global economy, leading to layoffs, a tourism crisis, consumer spending, and oil price drops. Similarly, the pandemic has altered consumer spending, unemployment, and cost of living. In addition, lockdowns and other measures have weakened consumer confidence. The extent of the effects is unknown, and the severity varies from country to country, as it affects some areas more than others. Through a review of the literature, we confirm the thesis of the task that the COVID-19 pandemic has strongly marked the tourism industry and the transport sector associated with it.

The global economic contraction that began in the first quarter of 2020 (and later) can be described as the first deliberate "lockdown recession" in history. Widespread lockdowns to prevent the spread of the virus, particularly in the largest world economies, have stopped economic activity ranging from transportation, trade, and production to services, causing a significant contraction of economic activity and increasing unemployment. The policy measures used to deal with the crisis are those usually used in economic downturns or recessions, including creating liquidity in the economy with low interest rates and quantitative easing to reduce the risk of financial system collapse, giving money to people in financial distress, and providing tax cuts for businesses and households, etc. However, unlike other economic and financial crises, the current crisis also requires measures to manage public health and prevent the spread of the virus, which has complicated the economic response.

Despite the negative impact of the COVID-19 pandemic, this global health crisis has offered opportunities for the travel and tourism industry to become more agile and resilient by redefining and reshaping operational practices. Our task is to contribute to understanding the consequences that have arisen from the risks affecting international travel and the uncertainty caused by the COVID-19 pandemic.

Findings show that it is important to be aware that when making decisions about international travel, tourists often rely on available information or hints and COVID-19 safety etiquette to reduce travel risk and uncertainty caused by the pandemic. Maximum engagement of tourists in the destination and behavior approach can be achieved by obtaining information or hints about destinations and implementing health preventive measures.

Passengers can make various behavioral adaptations in response to the COVID-19 pandemic situation and related closure strategies. The main motivation is to avoid exposure to the virus. In the absence of better information, this often means adhering to the principle of avoiding crowds. This can affect all travel choices, from changing routes to less busy ones, changing departure times to avoid peaks, switching to private (and preferably owned) modes, changing travel destinations, or refraining from travel altogether. The willingness and ability of the population to adapt to such changes vary considerably, depending on personal preferences, as well as income and household composition, logistics, flexibility of work schedules, working from home, digital knowledge, and vehicle availability. All of this means that there is a considerable inequality in people's ability to avoid crowds if they wish to do so.

The absolute risk of infection strongly depends on the prevalence of the disease in the community at any given time, so all restrictions or regulations on the use of public transport should be adjusted differently depending on the phase of the outbreak. A detailed analysis is needed on this issue, which determines the levels of infection that make the use of public transport increasingly risky from a public health perspective. Nevertheless, there are some promising indications of how to make public transport safe or at least significantly reduce the risk of infection, with consequences especially for the post-closure phase. It is still too early for definitive conclusions; more research is needed to assess the actual level of safety in public transport when appropriate measures to contain the virus are taken in different phases of the pandemic.

This is extremely important because if a large part of the population perceives public transportation as unsafe and unhealthy, it will not be able to fulfill the social role it is meant to serve, including accessibility, sustainability, and fairness. Certain developments, such as the lifting of restrictions, are beyond the control of the public transportation sector, but many of the measures discussed above are the main responsibility of service providers. This will also help reassure the public that appropriate measures are being taken. During this period, communication, public relations, and enforcement of safety measures are particularly important.

The extended crisis surrounding the COVID-19 pandemic reveals the fragility and unsustainability of the current global economic system, in which travel and tourism play a crucial role. We must not forget that this coronavirus spread so quickly around the world primarily because of international tourism and business travel. It is not surprising that tourism is also one of the economic sectors that have been most affected by the blockades and travel restrictions that countries have imposed to keep their citizens inside and foreign travelers outside.

A more important question is what kind of world we envision for ourselves and future generations. The crisis gives us a unique opportunity to seriously consider this. Although it is essential to dream of promising future scenarios, we must not forget that our social world is strongly marked by various types of inequality. These inequalities existed before the crisis, intensified during the crisis, and will certainly not disappear after the crisis. In this general context, we must rethink the future of travel and tourism and the future of travel and tourism.

Sources

- Adrienne, N., Budd, L., & Ison, S. (2020). Grounded aircraft: An airfield operations perspective of the challenges of resuming flights post COVID. *Journal of Air Transport Management*, 89, 101921. <u>https://doi.org/10.1016/j.jairtraman.2020.101921</u>
- 2. Albers, S., & Rundshagen, V. (2020). European airlines' strategic responses to the COVID-19 pandemic (January-May, 2020). *Journal of Air Transport*

3. Arellana, J., Márquez, L., & Cantillo, V. (2020). COVID-19 outbreak in Colombia: An analysis of its impacts on transport systems. *Journal of Advanced Transportation*, 2020.

- Canale, A., Tesoriere, G., & Campisi, T. (2019). The MAAS development as a mobility solution based on the individual needs of transport users. 2186(1), 160005.
- Conrow, L., Campbell, M., & Kingham, S. (2021). Transport changes and COVID-19: From present impacts to future possibilities. *New Zealand Geographer*, 77(3), 185–190. https://doi.org/10.1111/nzg.12315
- De Vos, J. (2020). The effect of COVID-19 and subsequent social distancing on travel behavior. *Transportation Research Interdisciplinary Perspectives*, 5, 100121.
- Flaherty, G. T., Hamer, D. H., & Chen, L. H. (2022). Travel in the Time of COVID: A Review of International Travel Health in a Global Pandemic. *Current Infectious Disease Reports*, 24(10), 129–145. https://doi.org/10.1007/s11908-022-00784-3
- Forsyth, P., Guiomard, C., & Niemeier, H.-M. (2020). Covid –19, the collapse in passenger demand and airport charges11The authors wish to thank Brian Pearce of IATA and Michael Stanton-Geddes of ACI for helpful discussions and data, and also two anonymous referees for their comments. *Journal of Air Transport Management*, 89, 101932. https://doi.org/10.1016/j.jairtraman.2020.101932
- Gavalas, D., Syriopoulos, T., & Tsatsaronis, M. (2022). COVID–19 impact on the shipping industry: An event study approach. *Transport Policy*, *116*, 157– 164. <u>https://doi.org/10.1016/j.tranpol.2021.11.016</u>
- 10. How, M., & Thiagarajan, S. (2020). Why you can board a crowded MRT train but cannot meet your friends: Lawrence Wong explains.
- Jenelius, E., & Cebecauer, M. (2020). Impacts of COVID-19 on public transport ridership in Sweden: Analysis of ticket validations, sales and passenger counts. *Transportation Research Interdisciplinary Perspectives*, 8, 100242.

- Kotoky, A., Stringer, D., & Saxena, R. (2020). Here's what you do with twothirds of the World's Jets When They Can't Fly. *Bloomberg*. https://www. bloomberg. com/news/features/2020-04-16/coronavirus-travel-whathappens-to-planes-grounded-by-covid-19
- Lau, H., Khosrawipour, V., Kocbach, P., Mikolajczyk, A., Ichii, H., Zacharski, M., Bania, J., & Khosrawipour, T. (2020). The association between international and domestic air traffic and the coronavirus (COVID-19) outbreak. *Journal of Microbiology, Immunology and Infection*, 53(3), 467– 472.
- Lee, K., Worsnop, C. Z., Grépin, K. A., & Kamradt-Scott, A. (2020). Global coordination on cross-border travel and trade measures crucial to COVID-19 response. *The Lancet*, *395*(10237), 1593–1595.
- Li, X., de Groot, M., & Bäck, T. (2021). Using forecasting to evaluate the impact of COVID-19 on passenger air transport demand. *Decision Sciences*, *n/a*(n/a), 1–6. <u>https://doi.org/10.1111/deci.12549</u>
- Moslem, S., Campisi, T., Szmelter-Jarosz, A., Duleba, S., Nahiduzzaman, K. M., & Tesoriere, G. (2020). Best–Worst Method for Modelling Mobility Choice after COVID-19: Evidence from Italy. *Sustainability*, *12*(17). https://doi.org/10.3390/su12176824
- 17. NASDAQ OMX's News Release Distribution Channel. (2021, februar 17). Passenger Air Transport Global Market Report 2021: COVID 19 Impact and Recovery to 2030: Major companies in the passenger air transport market include American Airlines; Delta Airlines; UnitedContinental; Deutsche Lufthansa and Air France KLM. The global passenger air transport market is expected to grow from \$460. *NASDAQ OMX's News Release Distribution Channel.* ProQuest One Business. http://nukweb.nuk.unilj.si/login?url=https://www.proquest.com/wire-feeds/passenger-airtransport-global-market-report-2021/docview/2489982645/se-2?accountid=28926
- Pan, T., Shu, F., Kitterlin-Lynch, M., & Beckman, E. (2021). Perceptions of cruise travel during the COVID-19 pandemic: Market recovery strategies for cruise businesses in North America. *Tourism Management*, 85, 104275.
- 19. Park, J. (2020). Changes in subway ridership in response to COVID-19 in Seoul, South Korea: Implications for social distancing. *Cureus*, *12*(4).

- 20.Ponisciakova, O., & Kicova, E. (2021). The impact of the Covid pandemic on transport companies and the possibilities of improving their management in the conditions of Slovak republic. 129, 01025.
- 21. Priya, S. S., Cuce, E., & Sudhakar, K. (2021). A perspective of COVID 19 impact on global economy, energy and environment. *International Journal of Sustainable Engineering*, 14(6), 1290–1305. https://doi.org/10.1080/19397038.2021.1964634
- 22. Rahman, N. A. A., Rahim, S. A., Ahmad, M. F., & Hafizuddin-Syah, B. (2020). Exploring COVID-19 pandemic: Its impact to global aviation industry and the key strategy. *International Journal of Advanced Science and Technology*, 1829–1836.
- 23. Rocklöv, J., Sjödin, H., & Wilder-Smith, A. (2020). COVID-19 outbreak on the Diamond Princess cruise ship: Estimating the epidemic potential and effectiveness of public health countermeasures. *Journal of travel medicine*, *27*(3), taaa030.
- 24. Roman, M., Kosiński, R., Bhatta, K., Niedziółka, A., & Krasnodębski, A. (2022). Virtual and Space Tourism as New Trends in Travelling at the Time of the COVID-19 Pandemic. *Sustainability*, 14(2). https://doi.org/10.3390/su14020628
- 25. Strauss, A. T., Cartier, D., Gunning, B. A., Boyarsky, B. J., Snyder, J., Segev, D. L., Roush, M., & Massie, A. B. (2020). Impact of the COVID-19 pandemic on commercial airlines in the United States and implications for the kidney transplant community. *American Journal of Transplantation*, *20*(11), 3123–3130. https://doi.org/10.1111/ajt.16284
- 26.Suau-Sanchez, P., Voltes-Dorta, A., & Cugueró-Escofet, N. (2020). An early assessment of the impact of COVID-19 on air transport: Just another crisis or the end of aviation as we know it? *Journal of Transport Geography*, 86, 102749.
- 27. Tarkowski, M., Puzdrakiewicz, K., Jaczewska, J., & Połom, M. (2020). COVID-19 lockdown in Poland–changes in regional and local mobility patterns based on Google Maps data. *Prace Komisji Geografii Komunikacji PTG*, *23*(2), 46–55.

- 28. Tirachini, A., & Cats, O. (2020). COVID-19 and public transportation: Current assessment, prospects, and research needs. *Journal of Public Transportation*, 22(1), 1.
- 29. Wang, Y., Fang, Z., & Gao, W. (2021). Covid-19's impact on China's economy: A prediction model based on railway transportation statistics. *Disasters*, *45*(1), 76–96. https://doi.org/10.1111/disa.12476
- 30. Wielechowski, M., Czech, K., & Grzęda, Ł. (2020). Decline in Mobility: Public Transport in Poland in the time of the COVID-19 Pandemic. *Economies*, 8(4), 78.
- 31. Xuan, X., Khan, K., Su, C.-W., & Khurshid, A. (2021). Will COVID-19 Threaten the Survival of the Airline Industry? *Sustainability*, 13(21). https://doi.org/10.3390/su132111666
- 32. Zhang, J., & Hayashi, Y. (2020). Impacts of COVID-19 on the transport sector and measures as well as recommendations of policies and future research: Analyses based on a world-wide expert survey. *SSRN*. https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3611806

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ENERGY CRISIS AS AN OPPORTUNITY TO ACCELERATE THE GREEN TRANSITION AND SUSTAINABLE ECONOMIC DEVELOPMENT: EVIDENCE FROM THE WESTERN BALKANS

Abstract: War in Ukraine caused unusual disruptions to the energy market in Europe. Energy prices, primarily natural gas and coal have reached historic highs caused by post-pandemic economic development, insufficient natural gas supplies, and a lack of wind power generation. The governments of the Western Balkans (WB) region countries agreed that energy should be given a central role as a driver of development in the establishment of a stronger, more persistent, and more integrated region. That is why the European Union's proposal is to continue efforts to mitigate climate change, especially by introducing energy production from renewable sources. This will

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certainly require strong and coordinated action by the governments in the region, with the strong support of the European Union. The aim of the paper is to analyze the implications of the energy crisis in the countries of the Western Balkans, with a special focus on the opportunities arising from the acceleration of the green transition. Consequently, the paper is divided into three separate parts. The first part analyzes the energy crisis in the countries of the WB, the second part focuses on government response and fiscal measures in WB region, while the third part is about how the Western Balkan region can benefit from this crisis and accelerate the green transition and sustainable economic development. The methodology used in the paper consists of several qualitative research techniques, such as analysis, synthesis, and comparative analyses.

Keywords: energy crisis, Western Balkans, green transition, sustainable development

Introduction

Although the ongoing crisis caused by Russia's invasion of Ukraine should have characteristics of regional conflict, the scope and consequences of these calamitous events have become a global concern and threat. One of the many outturns of this war is the energy crisis, which is having far-reaching effects on the energy sector and energy security for households, businesses, and economies, prompting government short-term responses and long-term policy change. Russia's invasion of Ukraine has had a profound effect on global energy markets and reshaped the energy world. According to International Energy Agency (IEA), minimum 6 key changes affected the global energy sector (World Economic Forum, 2022b):

- Higher energy prices brought shock to the system with extraordinary turbulence in energy markets, particularly for natural gas.
- Russia's gas exports to the EU were drastically cut, causing a rapid shift in trade flows and supply shortages.
- The change in traditional energy trade routes created new energy policies that prioritize long-term energy security and short-term energy demand.
- Negative economic impacts of the energy crisis, which is reflected in inflation, higher energy cost caused by rising prices of goods and services, higher interest rates, falling income, debt growth, recession, rising poverty, etc.
- Annual change in CO₂ emissions from global fossil fuel combustion and impact on plans to reach net-zero emissions by 2050.
- A push towards renewables because many countries, especially advanced, in the last two years increased investments in clean energy.

Considering all these changes, effects, complexity, and experience with previous energy crises, it is totally expected that the process of adjustment is unlikely to be a smooth one, as IEA warns. Besides the war in Ukraine and the weakened global economy with the COVID-19 pandemic, today's global energy crisis is strongly driven by geopolitical factors and Europe and natural gas have key roles. Also, by its characteristics, this crisis is very complex, specific, broad, and deep because it is made up of an existential mix - natural gas, oil, coal, electricity, food security, and climate. These multiple dimensions are reflected in weaknesses and questionable reliance on the energy system, rise in energy prices, energy insecurity, high inflation, economic damage, etc. Today, it is not only an open question about energy prices but also about their availability and whether there will be enough for all needs. As food and energy prices rise, incomes fall, so one of the extremely important facets of this crisis is the fact that we are also facing the global cost-of-living crisis across the world, which quickly limits household budgets. Besides significant global implications, coupled with the impact of the global pandemic, energy prices, availability, and affordability have a particularly strong impact on the economy in developing countries, such as countries in the Western Balkan region. It will be especially important for these countries to quickly adapt to the changes happening in the energy sector and respond to the challenges of the green transition and move on the path of sustainable economic development as economic growth and development that takes care of environmental protection by linking sustainable economic growth with improving people's health, social justice, employment, and environmental protection (Đorić, 2021).

1. Characteristic of energy crisis in the Western Balkan region

Before the beginning of the practically connected periods of different crises, the global pandemic, the war in Ukraine and the energy crisis, which jointly brought about major economic, security, health, social, ecological, technological, and other changes and challenges, the initial macroeconomic situation in the Western Balkans region was good. In the years before the outbreak of the pandemic, there was a good trend of economic growth and favorable macroeconomic indicators in almost all countries of the Western Balkans region. Observing the 2017-2021 period, economic growth ranged from 2.1% (2017) in Serbia to 12.4% (2021) in Montenegro. Due to the escalation of the pandemic crisis, the biggest recession in 2021 was recorded in 2020 by Montenegro (15.3%), followed by North Macedonia (6.1%), Bosnia and

Herzegovina (3.4%), Albania (3.1%), while Serbia recorded the lowest recession level (0.9%) (Chart 1).





Source: Authors based on World Bank, 2023.

After the strong post-COVID recovery in 2021, growth momentum was sustained across the region as the consumption, investment, and export rebound was sustained into the following year. Economies and sectors most exposed to either Russian or Ukrainian demand, such as Montenegro's tourism sector and investment flows into Serbia, held up well. But, as some analysis point out that it is almost certain that it is now clear that the Western Balkan region is "heading into a perfect storm" (World Bank, 2022). This will be caused with economic slowdown in the Eurozone which is a main trade partner and export market for Western Balkans goods and services, and a source of foreign direct investment and remittances. As a result, growth in the Western Balkans has been further revised downward for 2023 (by 0.3 percentage points) to 2.8 percent, which is in line with revisions to global growth as well as with projected recession in the Eurozone in 2023 (World Bank, 2022).

In the context of the energy crisis, the region of the Western Balkans generally has common characteristics, potentials, and problems, but again each of the individual countries has its own specificities. The countries of the region are dependent on the Russian Federation for oil and gas supplies, apart from Albania, while Kosovo and Montenegro do not have a developed gas infrastructure. All three external actors in the region's energy geopolitics, the EU, Russia, and China, participate in various forms of financing and building energy infrastructure in the countries of the Western Balkans, while their focus in the energy sector is significantly different (Turčalo, 2020). As a direct consequence of the current energy crisis for the entire region of the Western Balkans, there is an increase in energy and an even greater increase in food prices, which is pushing inflation upward to levels unseen for many years. Crisis circumstances at the global and European level have brought about the growth of interest rates and weaker external demand, which has brought even more problems that characterize the situation in the region.

As mentioned, energy prices have surged in the Western Balkan region. In July 2022 the average annual increase in the price of energy for the region was 13.1 percent. The increases in energy prices have ranged from 4.5 percent in Albania to 18.2 percent in Bosnia and Herzegovina. The share of the household budget spent on energy is smaller and more evenly distributed than the share of the budget spent on food (World Bank, 2022). However, this percents does not reflect the full effect of energy price increases because all governments have mitigated the impact of these increases on their citizens with strong fiscal spending. The effects of the increase in energy prices are manifold. In addition to the increase in food prices, the impact of energy price increases on poverty can be expected, but it is going to be smaller and less regressive. Yet, higher energy prices could contribute to increases in poverty by more than a half percentage point in some of the Western Balkan countries (World Bank, 2022). The main problem in Western Balkan countries is a very low level of energy efficiency, caused by outdated energy infrastructure, poor connectivity, insufficient maintenance, and investments in the energy sector in the last several decades. Compared to the EU average, the energy intensity of the economy, an important measure that indicates the amount of energy consumed per unit of GDP, is several times higher in the countries of the Western Balkan region. The data show that the average consumption of coal is 2-3 times higher, the share of gas consumption is 50% lower, and the CO₂ emission is 3 times higher in Western Balkan countries compared to the EU (Turčalo, 2020). All the contrary to these bad indicators, the Western Balkans region is in paradox reality between energy dependence on the supply of oil and gas from Russia, and the potential to become an energy center, due to its geographical location and 3 EU energy corridors passing through it. According to (Knez et al, 2022) Western Balkans can play an important role in maximizing the impact of the Europe green transition because this region has a large renewable energy and hydro-energy capacity. Until then, the real, current position of the region from the perspective of the location of the required primary

energy resources, transport routes, etc. it differs significantly in relation to the mentioned potential of the Western Balkans to transform into an energy center (Turčalo, 2020).

2. Energy-related measures and policy in Western Balkan countries The Russian invasion of Ukraine contributed to huge changes in the global energy markets, which were reflected in a permanent reshaping of the energy world and a complete reorientation of the European energy policy. The Russian invasion of Ukraine contributed to huge changes in the global energy markets, which were reflected in a permanent reshaping of the energy world and a complete reorientation of the European energy policy. Countries in the Western Balkans have received significant support in the form of an Energy Support Package of \pounds 1 billion for the Western Balkans, proposed by the European Commission in November 2022 as part of the Berlin Process Summit. The purpose of this package is for aid and support to the Western Balkans in reducing their dependence on Russian fossil fuels, improving the energy security of the region, and accelerating decarbonization. The proposed package is intended to meet the immediate needs, as well as the shortterm and medium-term needs of the countries of the Western Balkans to overcome the current energy crisis (European Commission, 2022).

The \mathfrak{E}_1 billion package is divided into two equal parts, one-half of the package is for taking immediate measures, and the other half is for short and medium-term measures. The first half of the package should provide direct funds to the economies of the Western Balkan region through budget support measures that should include: 1) to balance the increase of energy prices for d the energy sector and businesses, 2) support policy measures to accelerate the energy transition, and 3) to keep energy prices affordable level. Chart 2 shows the distribution of the first part of the package by individual countries from the Western Balkans intended for the category of immediate measures in the form of budget support for tackling the effects of the energy crisis. From the chart, it can be concluded that \mathfrak{E}_{165} million of the first part of the package is provided for Serbia, \mathfrak{E}_{80} million each for Albania and North Macedonia, \mathfrak{E}_{75} million for Kosovo, \mathfrak{E}_{70} million for Bosnia and Herzegovina and \mathfrak{E}_{30} million for Montenegro.

Chart 2. EU immediate measures for WB6



Source: Authors based on European Commission (2022a).

The remaining \in 500 million of the package, provided through the Western Balkans Investment Framework (WBIF), are intended to supply the necessary energy, energy efficiency, and strengthening of renewable energy sources (European Commission, 2022a). Chart 3 presents the short- and medium-term measures provided through WBIF. From the chart, it can be concluded that 46% of the second part of the package is provided for Guarantees (€230 million), 34% for New Flagship Investments (€170 million), and 20% for Regional Energy Efficiency Programme (€100 million).



Chart 3. Sort- and medium-term measures provided through WBIF

Source: Authors based on European Commission (2022a).

The economic and investment plan for the Western Balkans envisages the mobilization of up to 9 billion euros in grant funds till 2030 and 20 billion euros in loans, with the help of a new guarantee fund for the Western Balkans. It focuses on leading projects in green and digital transition, smart mobility, sustainable energy and support to the private sector and human capital development to bridge the socio-economic gap between the Western Balkans and the EU. Through the economic investment plan and its Green Agenda for the Western Balkans, the EU supports energy efficiency and the production of renewable energy, as well as the strengthening of energy connectivity infrastructure (European Commission, 2022a).

In response to the energy crisis, EU countries have implemented several measures that are classified into seven types of responses to cushion and overcome the negative effects of the energy crisis. Each of the EU countries adopted specific measures including retail price regulation, reduced energy tax/VAT, transfers to vulnerable groups, wholesale price regulation, windfall profits tax/regulation, the mandate to state-owned firms, business support, and other measures (see Table 1).

Country / Policy	Reduced energy tax / VAT	Retail price regulatio	Wholesal e price regulatio	Transfers to vulnerabl	Mandat e to State-	Windfall profits tax /	Business support	Other
	,	n	n	e groups	owned firms	regulatio n		
Austria	~	\checkmark		~		~	\checkmark	~
Belgium	~	\checkmark		~		~	\checkmark	~
Bulgaria	~	\checkmark		~		~	\checkmark	
Croatia	~	\checkmark		\checkmark		\checkmark	\checkmark	\checkmark
Cyprus	~	~		~	~	~	~	
Czechia	~	\checkmark		\checkmark	\checkmark	\checkmark	\checkmark	\checkmark
Denmark	~	~		~		~	~	\checkmark
Estonia	~	~		~		~	~	
Finland	~			\checkmark		~	\checkmark	~
France	~	\checkmark	~	~	~	~	\checkmark	~
Germany	~	\checkmark		\checkmark		\checkmark	\checkmark	
Greece	~	\checkmark		\checkmark	~	\checkmark	\checkmark	
Hungary	~	\checkmark				~	\checkmark	\checkmark
Ireland	~	\checkmark		~		~	\checkmark	~
Italy	~	\checkmark		~		~	\checkmark	
Latvia	~	\checkmark		~		~	\checkmark	
Lithuania	~	\checkmark		~		~	\checkmark	~
Luxembourg	~	\checkmark		~		~	\checkmark	
Malta		\checkmark	~		~	~	\checkmark	~
Netherlands	~	\checkmark		~		~	\checkmark	
Poland	~	\checkmark		~		~	\checkmark	
Portugal	~	\checkmark	~	~	~	~	\checkmark	
Romania	\checkmark	\checkmark		\checkmark		\checkmark	\checkmark	
Slovakia		\checkmark		\checkmark	~	~	\checkmark	
Slovenia	~	\checkmark	\checkmark	\checkmark		\checkmark	\checkmark	
Spain	~	\checkmark	\checkmark	\checkmark		~	\checkmark	
Sweden	~	~		~		~	~	\checkmark

Table 1. of measures for the energy crisis in EU countries

'proposed' (☑) refer to measure that have been publicly announced but have not yet implemented.
'enacted' (☑) are all those measures already in implemented.
Source: Scarevatti C. S. Taclionistre C. Traci and C. Zachmann (2001)

Source: Sgaravatti, G., S. Tagliapietra, C. Trasi and G. Zachmann (2021)

Identical to the countries of the EU, the countries of the Western Balkans introduce a variety of measures to overcome the consequences of the energy crisis. Table 2 shows the various measures that have been taken or are in the process of being taken in the next period by each individual country in the Western Balkans.

Country /	Measures for the energy crisis
Policy	
Albania	- 200 million euros were allocated to cushion the effect of the
	energy crisis for 2021-2022.
	- Price tariffs increases for consumers that consume more
	than 700kW/h are under consideration.
Bosnia and	- In 2021, BiH adopted an amendment to the Law on
Herzegovina	Electricity that limits the price increase of electricity to a
	maximum of 20% for eligible customers.
	- In 2022, RS adopted a conclusion that enables electricity
	supply to all schools.
	- An increase in network tariffs.
	- Market-supplied consumers are exposed to the price
	increase.
Kosovo ⁹	- Introduction of a subsidy of 120 million EUR for energy.
	- Change in the tariff structure.
	- Increased revenues for USS (nearly 20% considering the
	subsidy).
	- Daily two-hour electricity outages.
	- 20 million EUR to import electricity.
Montenegro	- An increase in network tariffs is expected to take place.
	- As of March 2022, no specific measures were taken. Market
	consumers are directly exposed to the rise in prices.
North	- Amendments to the VAT Law, reducing the tax on electricity
Macedonia	supply for households from 18% to 5%.
	- Prices of commodities were frozen, and then the government
	introduced a margin cap.
	- One-off support of 50 EUR for those receiving a below-the-
	average pension and a 20% reduction of excise duties on the
	flue.

Table 2. Measures for the energy crisis in WB countries

⁹ All references to Kosovo in this document should be understood to be in the context of United Security Council resolution 1244 (1999).

	-	Support of 255 million EUR for producers and Transmission	
		System Operator, and around 10 million EUR for additional	
		flue supply from TPP Negotino.	
Serbia	-	The import gas price is set at the level it was in 2019.	
	-	Network tariff increases are expected.	
	-	The government introduced a decree on Energy Vulnerable	
		Customers to support 200,000 households in paying	
		electricity bills. 1,500 homes can apply for subsidies for gas	
		and 50,000 to get support with heating costs.	
	-	The installation of solar panels and replacing carpentry are	
		announced. The state has allocated 230 million euros to	
		increase energy efficiency in 2022.	
	-	Measures to freeze the price of flour, sugar, sunflower oil,	
		pork, and milk were also introduced.	

Source: Balkan Green Foundation (2022).

The implementation of all the above-mentioned measures to tackle and overcome the adverse effects of the energy crisis implies an increase in the public expenditures of individual countries. Chart 4 shows the level of public expenditure in 2022 and the forecast for 2023 and 2024 by WB6.



Chart 4. Public expenditures (percent of GDP) of WB6

Source: Authors based on World Bank (2022)

According to the data of the World Bank shown in graph 3, it can be concluded that of all analyzed countries from the Western Balkans, the highest public expenditure in 2022 was registered by Serbia in the amount of 47.1% of the gross domestic product, followed by Montenegro with 44.9% (of GDP), Bosnia and Herzegovina with 42.3% (of GDP), North Macedonia with 37.2% (of GDP), Albania with 30.7% (of GDP) and KM with 30.1% (of GDP). In 2022, public expenditures in all Western Balkan countries are lower during the energy crisis compared to those during the pandemic crisis, especially in Montenegro, which was the most affected country during the pandemic crisis due to its dependence on tourism. Projections for the current and next year show that public expenditures in the countries of the Western Balkans will stabilize and remain at the same level, even with a slight tendency to decrease in some countries.

3. Energy transition for sustainable economic development and growth in the Western Balkan region

Energy transition, as part of the green agenda, is a topic that has been wellknown for around 10 years, but over the past year, it has received the greatest attention, with features of the energy revolution. It is a global process and reality, for which can no longer talk about whether someone likes it or not. An effective energy transition definition, proposed by the World Economic Forum, is "a timely transition towards a more inclusive, sustainable, affordable and secure energy system that provides solutions to global energy-related challenges, while creating value for business and society, without compromising the balance of the energy triangle" (World Economic Forum, 2020), that include energy access and security, economic development and growth, and environmental sustainability. Imperatives for the energy transition include regulations and political commitment, capital and investment, innovation and infrastructure, economic structure, and consumer (society) engagement (World Economic Forum, 2020). Energy transition, as an inevitable process, should have six dimensions (World Economic Forum, 2022a):

- Accelerating energy access
- Navigating future energy supply and demand
- Building energy system resilience
- Remapping energy geopolitics
- Unlocking energy finance

- Strengthening energy policy and governance
- Designing the future of power systems
- Driving energy technology innovation

According to the latest data, wind and solar energy represented a record 12% of global electricity generation last year, up from 10% compared to 2021. Renewable energy sources and nuclear power combined represented a 39% share of global generation last year, with solar's share rising by 24% and wind by 17% from the previous year. Overall, the growth in wind and solar in 2022 met 80% of the rise in global electricity demand. Additionally, forecasts show that an era of fossil decline is about to begin in 2023 (World Economic Forum, 2023).

These trends are well familiar, especially in Europe, where policy and actions are strongly focused on energy transition, now more than ever. Russia and its EU energy customers have broken their relationships and brought rapid and deep changes in EU energy policy, above all for supplier diversification, and a strong focus on maintaining energy security. Europe's strong dedication growth of renewable energy production so is not something new and unforeseen. Energy security policies have diverse energy mix with clean energy as an important part for a long time. But the war in Ukraine and hence energy geopolitical changes will clearly speed up this process and accelerate the move to more sustainable energy sources. Approved in 2020, the European Green Deal is a growth strategy with 50 actions striving for Europe to be the first climate-neutral continent by 2050. This EU broad roadmap has a set of proposals to make the EU's climate, energy, transport, and taxation policies fit for reducing net greenhouse gas emissions by at least 55% by 2030, compared to 1990 levels. Also, cleaner energy and cutting-edge clean technological innovation are one important part of this plan (European Commission, 2020). By signing the Sofia Declaration, the Western Balkans

fully supported the goals of the Green Agenda for (Mashovic et al, 2022). Shortly after the outbreak of Russia's aggression on Ukraine and global and European energy market disruption, the EU Commission response was the new REPowerEU, a plan for saving energy, producing clean energy, diversifying energy supplies, rapidly reducing dependence on Russian fossil fuels and fast forward the green transition. These goals will require a massive scale-up of renewables as well as faster electrification and replacement of fossil-based heat and fuel in industry, buildings, and the transport sector. REPowerEU plan is backed by financial and legal measures to build the new energy system that Europe needs. Besides new EU legislation to speed up permitting procedures for clean energy projects and more regulatory incentives created for innovative technologies, the EU will allocate 210 billion EUR till 2027 to fund investments in energy infrastructure. Mostly investments will be for strengthening energy grid and renewable energy production - wind, water, and solar energy. Also, this plan facilitates renewable gases production - hydrogen and bio-methane (European Commission, 2022b).

In this context of the clearly defined long-term EU energy policy, the Western Balkans region cannot and should not be left out, which has been officially confirmed. The current energy crisis of the economies of the Western Balkan countries is hitting particularly hard due to the high dependence of those economies on fossil fuels, but at the same time it is a good incentive to diversify the energy sector and for investments in renewable energy sources in the Western Balkans. The position, determination, and interest of the countries of the Western Balkans is accelerated and complete inclusion in these flows, and not to miss this opportunity and lose time again. All the inevitable changes that are taking place should be seen as a moment for the Western Balkans, which has opened the possibility to implement energy transformation, as it could respond to all the future demands and strengthened the region's competitiveness. Activities for supply diversification and green transition are also planned for countries that are not members of the European Union, which require complex changes in the field of legislation, strategic planning, implementation, and monitoring. The energy crisis gave new momentum to the process of realizing the European Union's green agenda in the Western Balkans and the goal of building a resilient common regional market. In 2021, the European Union accepted the action plan for the green agenda for the Western Balkans region, which contains the goals of reducing carbon dioxide emissions, increasing the share of obtaining energy from renewable sources, and preserving biodiversity. When it comes to renewable energy sources, the Western Balkans region has a lot of untapped potential for solar, hydro, wind energy and bioenergy. As good natural prerequisites for the successful development of the renewable energy sector, the region has many sunny days, windy coasts, mountain ranges, rivers, the sea, as well as large sources of biomass. Switching to clean, cheaper, and renewable energy would bring huge benefits. First, these are long-term savings, cleaner air, contribution to the achievement of climate goals, etc. A modern and resilient regional energy system would greatly improve the safety and security of energy supply, which is one of the region's problems. Over the last few years, key changes have been made in terms of legislation, which is the starting point for energy transformation in the region. Also, exchanges for the exchange of electricity are being opened in some countries. Fundamental reshaping EU energy policy and environmental pressures are changing the foundations of economic activity, consumer choices, and investor behaviour everywhere. However, so far, the Western Balkans is very slowly to moving away from legacy "brown" industries, established value chains and market infrastructure. Furthermore, while the change to a sustainable growth is not easy and fast, the green transition offers investment opportunities for the Western Balkans countries. High-level estimations suggest that supporting a green economic recovery after COVID-19 will generate more than \$10 trillion in investment opportunities (World Bank, 2021), and considering this fact, this the "window" that Western Balkans shall not close and miss chance to step forward in this direction.

Although there are beliefs that this crisis is an opportunity for the Western Balkans, it is necessary to be realistic and consider numerous obstacles. A survey of the energy sectors of all WB countries revealed similar barriers to the use of renewable forms of energy and the green transition. Western Balkans countries are in the process of adopting the necessary regulations and strategies towards climate change mitigation, but the implementation still is at a low level. There are numerous reasons for this reality, such as lower level of economic development, absence of investment, social peace protection, deficient commitment of decision-makers, etc. (Knez et al, 2022). Without strong political determination, and with too much bureaucracy and corruption, outdated networks and underdeveloped markets, progress is hindered. The process of energy transition is slow and unstable, without many concrete actions. There is also some inconsistency in the implementation of decisions - leaving coal means no new coal-based projects, no excuses. In this sense, companies should meet the set environmental standards, which should be stricter (Deutsche Welle, 2022).

In addition to the above, the WB region is facing challenges of another kind, so that the green agenda is still not at the top of the list of interests and is not fully understood by citizens. One illustrative example is the behavioural diagnostic survey carried out in 2022 in Bosnia and Herzegovina, Kosovo, North Macedonia, and

Serbia about attitudes towards transition from traditional heating sources relying on inefficient and heavily polluting solid fuels to more sustainable and efficient heating in the Western Balkans. The survey results suggest that attitudes among respondents are quite progressive, but intentions for behavioural change to upgrade heating remain low. Among traditional heating user respondents, 41 percent are unwilling to upgrade their heating technology, while 21 percent are unsure about upgrades. Among 38 percent willing to upgrade, only half of these would do so in the next two years. Low intentions appear to be driven mainly by affordability concerns, other priorities for the home budget and by low trust in the institutions that should support transition. Attitudes about sustainable heating practices are progressive and most respondents are aware of the costs and benefits of upgrades. From the results of this research, we conclude that in the region of the Western Balkans, energy transition will require holistic engagement strategies and solutions that address perceptions and knowledge about its costs and benefits. Support programs provided by governments in the Western Balkans should be designed and implemented in such a way to include non-financial barriers, and to have influence on the attitudes, beliefs, and preferences towards investments in cleaner more efficient technologies (World Bank, 2022). In context of this example, it is necessary to make efforts to achieve growing enthusiasm, which will be one of the key factors for progress.

The energy intensity of countries, as highlighted before is an indicator with very bad values in Western Balkan region and depends on income levels, industrial structure, efficiency standards, urbanization, etc., so overall economic, and social development will be very important. Reducing energy intensity is key in a country's decarbonization strategy because it shows that economic growth is achieved with less energy-intensive activities which, in turn, results in less emissions (World Economic Forum, 2020). Potentially positive aspect of higher fossil fuel prices is they provide strong reasons to accelerate towards sustainable alternatives, but from the other side the negative economic outlook and short-term measures to ensure energy for today's needs could slow momentum in the push towards renewables and long terms plans (World Economic Forum, 2022b). Some trends are having more and more significance now and future ahead of us. Some experts underline three development directions in the energy sector - democratisation, decarbonisation and digitalisation of energy (World Economic Forum, 2022c). This means that it is

expected to have less of a dependence on a few suppliers for many, many consumers, which requires more and more diversification and opportunities for new energy sources to develop. Furthermore, encouraging production of energy that has low carbon or zero carbon effect and application of digital tools in energy use, production, management, and maintenance. These trends should be taken into consideration for future energy sector development in Western Balkans. Also, significant EU investments over the remainder of the decade can provide an anchor for structural reforms in the Western Balkans. Deeper regional integration with the EU, including with digital, investment, innovation, energy, and industrial policy, could boost economy, investment and trade prospects, the regulatory environment, competition, and productivity. The EU investments will include sizable funding for the green and digital transition in the Western Balkans, as is key priority given these economies that are farthest from the green transition frontier (World Bank, 2022). The impact of the implementation of the green transition process and changes in the energy portfolio in the countries of the Western Balkans, in accordance with EU policies, should contribute to further encouraging the acceleration of sustainable economic development.

Conclusion

Although the global economy was deteriorated and lot of money was printed during the pandemic, the economic consequences could have been annulled in a couple of years and the crisis would not have gotten so bad if Russia's aggression against Ukraine had not happened. As a direct consequence of the war in Ukraine and all the geopolitical tensions, the reduced supply of energy sources and the increase in their prices created the essence of today's global crisis, and that is high inflation. Inflation, or price rise, is currently the major economic problem, and as many economists point out, inflation is the worst thing that can happen to the economy. Energy sources and food are the most important for people, and that's where is the greatest inflationary pressure, so today we have an energy crisis but also a cost-ofliving crisis. The fact is that difficult problems do not have easy solutions. The most effective solution to this problem is to raise the reference interest rates, which will reduce economic activity due to less investments and new projects. Consequently, this will further reduce employment and demand, which will ultimately reduce prices and restrain inflation. By increasing the price of money, employment and economic growth will be sacrificed, but that would bring a faster solution to the problem of inflation. Another aspect of solving the current crisis is a political decision and strong leadership, but the current situation is just the opposite. We are witnessing a crisis of leadership, pronounced populism, and solving the problems that have arisen requires very politically unpopular actions. Also, the reality is that today's leaders have no experience with crises like this because such situation at this level world did not have for over four decades.

Politics and the economy are very closely related, especially in crises. The geopolitical situation and the conflict that exists in different relations led to inflation becoming a weapon of geopolitical and economic struggle. In addition, the war in Ukraine is the biggest global problem now, it is omnipresent, the cause of everything and which created numerous problems in logistics and with energy that will not disappear until the conflict in Ukraine is resolved. Logistics is incredibly important in the modern economy because most production today operates on the principle of just in time, everything arrives at the last moment, in order to save money and not create warehouses. When the world is global and united, it all works, otherwise, as it is today, the consequences are very serious. Forecasts of reduced global economic growth for this year are very certain and several developed economies almost certainly will be in recession. This energy crisis has shown us what big, unforeseeable, turbulent, and radical changes are possible. Each of the countries of the Western Balkan region has its own characteristics and specificities, but at the regional level, it can be concluded that the crisis showed the importance of developed energy infrastructure, the importance of energy diversification and accelerating the green transition process. The Western Balkan region has reality not harmonized, between energy dependency and perspective to become an energy hub but it will take a lot of time and work to use and have all benefits of this potential. Investing in long-term infrastructure during economic crises can be a powerful vehicle to drive further economic development and generate employment.

References

 Balkan Green Foundation (2022). Energy Crisis in the Western Balkans: Measures Undertaken Amid Energy Price Shocks. Heinrich Boll Stiftung. Available at <u>https://www.balkangreenfoundation.org/en-us/publications/?year=2022 (accessed on 14 April 2023).</u>

- 2. Deutsche Welle, 2022 <u>https://www.dw.com/sr/zemlje-balkana-na-putu-ka-%C4%8Distoj-energiji/a-63385842 (accessed on 24 April 2023).</u>
- Đorić, Ž. (2021). Zelena ekonomija i održivi razvoj u zemljama Zapadnog Balkana, Ekonomske ideje i praksa, Faculty of Economics and Business, University of Belgrade, issue 41, pages 67-91. Available at <u>https://ideas.repec.org/a/beo/ekidpr/y2021i41p67-91.html (accessed on 24 April 2023).</u>
- European Commission (2022). Energy Support Package for the Western Balkans. https://neighbourhoodenlargement.ec.europa.eu/system/files/2022-12/WBIF%20Energy%20support%20pack%20221202.pdf (accessed on 22 April 2023).
- <u>European Commission (2022a)</u>. Western Balkans Focus on energy. <u>https://neighbourhood-enlargement.ec.europa.eu/system/files/2022-</u> <u>12/Factsheet%20focus%20on%20energy.pdf (accessed on 22 April 2023)</u>.
- European Commission, 2022b. <u>https://commission.europa.eu/strategy-and-policy/priorities-2019-2024/european-green-deal/repowereu-affordable-secure-and-sustainable-energy-europe_en (accessed on 26 April 2023).</u>
- European Commission, 2020. <u>https://commission.europa.eu/strategy-and-policy/priorities-2019-2024/european-green-deal_en. (accessed on 20 April 2023).</u>
- 8. EU in Serbia, 2022 <u>https://europa.rs/energetska-bezbednost-i-bolja-povezanost-za-zapadni-balkan/ (accessed on 20 April 2023).</u>
- 9. <u>International Energy Agency IEA. (2022)</u>. World Energy Outlook 2022, Paris, France. Available at www.iea.org/weo (accessed on 30 March 2023).
- 10. Knez, S., Štrbac, S. & Podbregar, I. (2022). Climate change in the Western Balkans and EU Green Deal: status, mitigation, and challenges. Energy Sustain Soc 12, 1. Available at <u>https://doi.org/10.1186/s13705-021-00328-y</u> (accessed on 28 March 2023).
- Mashovic, A., Ignjatovic, J., Kisin, J. (2022) Circular economy as an imperative of sustainable development in North Macedonia and Serbia, ECOLOGICA, Vol. 29, No. 106 (2022), str. 169-177. https://doi.org/10.18485/ecologica.2022.29.106.5

- 12. <u>Sgaravatti, G., Simone Tagliapietra, S., Trasi, C. (2022)</u>. <u>National energy</u> policy responses to the energy crisis, Bruegel Datasets. <u>Available at</u> <u>https://www.bruegel.org/dataset/national-energy-policy-responses-</u> <u>energy-crisis (accessed on 28 March 2023)</u>.
- 13. <u>Sgaravatti, G., Tagliapietra, S., Trasi, C., Zachmann, G. (2021). National</u> policies to shield consumers from rising energy prices, Bruegel Datasets. <u>Available at https://www.bruegel.org/dataset/national-policies-shield-</u> <u>consumers-rising-energy-prices (accessed on 28 March 2023).</u>
- 14. <u>Turčalo, S. (2020). Energetska geopolitika na Balkanu: geopolitika i</u> <u>evropske integracije Zapadnog Balkana: globalni i regionalni poredak,</u> <u>Friedrich-Ebert-Stiftung, Sarajevo. Available at https://vpi.ba/wp-</u> <u>content/uploads/2020/06/16147.pdf (accessed on 28 March 2023)</u>
- <u>United Nation. (2022). Global impact of war in Ukraine: Energy crisis, UN</u> <u>Global crisis response group on food, energy and finance, brief no. 3.</u> <u>Available at https://unsdg.un.org/sites/default/files/2022-08/GCRG_3rd-</u> <u>Brief Aug3_2022_.pdf (accessed on 28 March 2023).</u>
- 16. World Bank (2023). <u>https://data.worldbank.org/indicator/NY.GDP.MKTP.KD.ZG</u> (accessed on 28 March 2023).
- 17. World Bank (2022). Beyond the Crises. Western Balkans Economic Report, No.22. Washington. Available at https://documents1.worldbank.org/curated/en/099010110192229651/pdf/ P17947808ec26c001094ac004a1b5d70a2a.pdf <u>(accessed on 30 March</u> <u>2023).</u>
- 18. World Bank (2021): Toolkit for Policymakers to green the financial system. . Available at:

https://documents1.worldbank.org/curated/en/374051622653965991/pdf/ Toolkits-for-Policymakers-to-Green-the-Financial-System.pdf (accessed on 16 April 2023).

- 19. World Economic Forum, 2023 <u>https://www.weforum.org/agenda/2023/04/wind-solar-record-global-</u> <u>energy-transition-17-april/ (accessed on 19 April 2023).</u>
- 20.World Economic Forum, 2022a

https://intelligence.weforum.org/topics/a1Gb000000380N6EAI/keyissues/a1G0X000006DQC4UAOž (accessed on 19 April 2023).

- 21. <u>World Economic Forum. (2022b). 6 ways Russia's invasion of Ukraine has</u> <u>reshaped the energy world.</u> Available at https://www.weforum.org/agenda/2022/11/russia-ukraine-invasionglobal-energy-crisis/<u>(accessed on 30 March 2023).</u>
- 22. <u>World Economic Forum. (2022c)</u> <u>https://www.weforum.org/agenda/2022/05/energy-transition-2022</u> (accessed on 19 April 2023).
- 23. World Economic Forum, 2020, Fostering Effective Energy Transition 2020 edition. Available at

https://www3.weforum.org/docs/WEF_Fostering_Effective_Energy_Tran sition_2020_Edition.pdf. (accessed on 20 April 2023).

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VPLIV MEDNARODNIH SPREMEMB NA MENEDŽMENT PROIZVODNIH IN STORITVENIH SISTEMOV V SODOBNEM INDUSTRIJSKEM RAZVOJU INDUSTRIJSKE GENERACIJE 4.0

Abstract:

Changes in the economy and in industry are a constant, so logistics and logistics processes are also part of these changes, because they have to follow the development and technological modernization of industrial production and, consequently, the development of individual logistics procedures, which connects industry with procedures for the preparation and implementation of industrial production. Management is the area that, through the search for new solutions, enables the introduction of new models, new systems, new paradigms that are supposed to improve production and also the necessary product flows that enable production and circular economy. Some forms of management with the introduction of "Just in Time" and "Ji joka" models of soft production have lost their relevance in the period of the Covid 19 pandemic and the economic crisis caused by wars, so the need to return the industry a few steps back with the introduction of large stocks, with which

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the industry would maintain production and, consequently, the market. The review of collected information in industry, in production, in service and other organizations, gave new needs for changes in the supply of raw materials, semi-finished products or products for further production, which changes the development models. Problems with commodity, financial and capital flows also cause problems in production, in supplying the market and does not satisfy the necessary form of consumption, so we searched for possible solutions through the research.

Key words: management, logistics, processes, changes, solutions.

1. Uvod

V razvojnem obdobju industrije smo se zadnje čase posvečali iskanju novih rešitev, novih modelov ter proizvodnjo kakor tudi oskrbo proizvodnje skušali skozi čas vezati na menedžment logistike, logistiko in logistične procese, kjer smo logistiko opredelili kot ključni del storitvenih dejavnosti vsake organizacije. Pri tem smo prepoznavali spremembe v cilju iskanja novih rešitev glede na obliko industrijske proizvodnje, iskali možnosti posodabljanja postopkov, zmanjševanje potrate časa, prostora in delovne sile, z uporabo tehnologije, ustrezne organizacije in menedžmenta. Pri tem smo spoznavali, da v menedžmentu gre za več, med seboj povezanih metod, sistemov, načinov ali oblik upravljanja, od katerih je zelo pogosto časovno odvisna industrijska proizvodnja, oskrba trga in ljudi, tudi distribucija, izmenjava blagovnih trendov in predvsem mednarodna trgovina. Spoznamo, da je element obvladovanja menedžmenta v bistvu pomemben obvladovanie mednarodne konkurence, kar omogoča širitev proizvodnje, uvajanje novih oblik menedžmenta storitvenih dejavnosti, kaj ustrezna oskrbi, nadzoru proizvodnih procesov, uporabi sodobnih tehnologij, spremljanju trga in pridobivanju uporabnikov ali potrošnikov.

Spoznamo, da je menedžment oblika uravnavanja poslov, ki omogočajo pravočasno izvajanje logističnih storitev za potrebe industrijske proizvodnje, pri čemer je industrija, kakor tudi storitvena dejavnost, težila k uporabi sodobnih modelov in napredne tehnologije. Industrija je spoznala pomen logistike in logističnih procesov (so sestavni del cene polizdelka ali izdelka in tudi cene blagovnih tokov), ki v svojem razvoju spreminjajo industrijsko proizvodnjo in zahtevajo uvajanje digitaliziranih oblik upravljanja novih tehnologij. Tako so se začeli spreminjati tudi načini življenja ljudi, rojevajo se potrebe po novih in iskanih produktih, kar industrijo in logistični menedžment usmerja v iskanje tehničnih, tehnoloških in strokovnih rešitev, ki bodo zadovoljile najvišje potrebe človeka.

Različni avtorji skozi svoja pisanja ponazarjajo zgodovinski razvoj industrije ter pri tem navajajo razvoj začetek organizirane proizvodnje z industrijo 1.0 v koncu 18. stoletja, kjer so prepoznali uvajanje mehanske proizvodnje, ki jo je tedaj gnala moč vode in kasne moč vodne pare. Sočasno se je razvija menedžment proizvodnje in menedžment logistike, ki je skozi trajnostni razvoj omogočila hiter razvoj industrije, pri čemer pomembno vlogo ima znanost, ki skozi svoja dognanja nudi razvojne možnosti, kar je posledično pogojevalo razvoj nove dobe industrije 2.0, ki se je nadaljevalo v 20. stoletju. Prepoznanje in uvajanja električne energije proizvodnjo korenito spremeni, kajti omogoči uvajati nove oblike proizvodnje, spoznajo proizvodnjo v obliki tekočega proizvodnega traku, delavci v zaporedju proizvodnje opravljajo tiste naloge, ki omogočijo proizvodnjo istega produkta.

Skozi proučevanje ugotovimo, da je močan vpliv na razvoj industrijske ali druge proizvodnje vplivala II. svetovna vojna, ki je povzročila velika uničenje in ravno potrebe po obnavljanju so pogojevale razvoj industrije 3.0. Gospodarski učinek je bil viden v zgodnjih šestdesetih letih 20. stoletja, kjer so s pojavom prvih oblik informacijskih sistemov, z uvajanjem prvih na pol avtomatiziranih strojev v posamezne proizvodne procese, pospešili razvoj gospodarskih sistemov v širšem območju celotnega planeta. Tedaj govorijo o prvih oblikah strojne in avtomatizirane opreme, ki zmore zahtevnejša fizična dela dviganja težjih surovin, stiskanje s prešami, prenosi blaga, potiskanje blaga in podobno. Znanost priznava velik gospodarski napredek v industrijski in drugi proizvodnji, transportu, skladiščenju in v logističnih procesih, ki so bili tedaj in so tudi danes nujni za pripravo industrijske proizvodnje ter jih razlagamo kot nalaganje, nakladanje, dviganje, prenosi, notranji transport, ipd. V tem času se pojavijo prve oblike informacijsko logističnih sistemov, ki s pomočjo informacijske tehnologije služi za med organizacijsko povezovanje [1]. Iskanje mehkih sistemov pretoka blaga ter spremljanje blagovnih tokov v proizvodnjo in storitveni dejavnosti so pogojevali uvajanje vzhodnih sistemov organizacije dobave surovin v proizvodnjo »Just in Time« ter »Dži Džoka«, kar se je pokazalo zelo uspešno. Nove oblike razvoja blagovnih in proizvodnih tokov so narekovale prepoznavanje novih oblik menedžmenta, predvsem v logistiki in storitveni dejavnosti, kjer je tudi znanost iskala razvojne možnosti industrije 4.0, kajti je bil narejen velik preskok v gospodarskem razvoju, industrijskem in proizvodnem razmišljanju, tehnologiji in vlogi človeka pri nastajanju novih produktov.

Treba je razumeti, da je znanost, spoznavanje, razvoj in uporaba inteligentne industrije 4.0 v mnogočem v popolnosti zasenčil in spremenila vsa dotedanja razvojna industrijska obdobja, kar se nadaljuje in predstavlja tehnološko najvišjo obliko organizacije industrijske ali druge proizvodnje in storitvenih dejavnosti, kar vpliva na trg, tržne razmere, na potrošnika.

Najnovejša oblika industrije uporablja inteligentna mreženja strojev, človeka in procesov, povezanih z industrijsko in drugo proizvodnjo, z logistiko in storitveno dejavnostjo, ki s pomočjo informacijske in komunikacijske tehnologije obvladujejo neposredno povezovanje pravnih ali fizičnih subjektov [2]. Nova industrijska generacija je razvita sodobno informacijsko infrastrukturo, kar je pogojevalo uvajanje novih oblik transporta, razvite so različne oblike prometa, kar počasi spodbuja razvoj nove dobe v industrijskem razvoju [3]. Posledično je znanost omogočila, da je nova inteligentna revolucija prevzela nadzor nad njenimi dosežki, kar neposredno uporablja v proizvodnih ali storitveni dejavnosti in širše. Znanost omogoči, da strojno mehanizacijo, avtomatsko vodene stroje, opremo in vodila v industrijski ali drugi proizvodnji, v logistiki in širši storitveni dejavnosti prevzame v upravljanje računalnik s svojo programsko opremo in poveže širši krog organizacij (fizičnih ali pravnih oseb), kar poimenujejo internetno industrijsko povezovanje. Sto tehnologijo znanost prepozna mehko obliko menedžmenta, kar poimenuje

trajnostni razvoj industrije in logistike, katere cilj naj bi bil s čim manjšimi posegi v naravo in naravne vire, dosegati učinkovite rezultate in zadovoljevanje trg. Ta narejen predstavlja preskok z analognega sistema vođenja tehnoloških procesov v projekcijo digitalnega sveta, ki omogoča mnogo večje povezovalne zmožnosti med različnimi dejavniki. S pomočjo znanosti dotedanji stroji postanejo avtomatizirani, s pomočjo programske opreme sami mislijo, vodijo jih programski sistemi, ki jih poimenujejo z roboti.

Danes v znanosti in praksi govorimo o razvojnem obdobju, ki ustvarja pametne tovarne, ki omogoča virtualna razmišljanja, virtualno načrtovanje, virtualno proizvodnjo in posledično virtualno procesiranje[4]. Znanost je ozko vezana na različne oblike menedžmenta, ki z uporabo znanstvenih dosežkov nujno sledi trajnostnemu razvoj in ta se ne ustavi ter poskuša zagotoviti racionalno rabo naravnih in drugih dobrin, ki v industrijo, gospodarstvo in splošno rabo vnaša nove paradigme.

Spreminjanje je neustavljivo, znanost raziskuje, spremlja, izboljšuje, vsled česar so na poti nova prelomna obdobja industrije, ki se kaže v smernicah in ciljih industrije 5.0, v kateri znanost, industrija in praksa pričakujejo sodelovanje ali poosebljanje (personalizacijo) industrijske ali druge proizvodnje, logistike ali druge storitvena dejavnosti, oziroma se teži k popolnem sodelovanje človeka z novodobnimi pametnimi stroji, roboti, sistemi ipd., iz česar je mogoče sklepati, da bosta človek in stroj popolnoma sodelovala s sistemom. Pričakovati je popolno sodelovanje naravne in umetne inteligence, kar znanost prepoznava kot smisel razvoja bodoče industrije z osebno povezavo človeka s strojem, z robotom in inteligentnimi sistemi in vse v potrebi učinkovitosti in ustvarjalnosti nove generacije industrije.

Ravno je menedžment pogojeval, da je industrija s pomočjo znanosti, s pomočjo tehnoloških dosežkov razvila sisteme, nove postopke in procese v industrijski ali drugi proizvodnji, v logistiki ali drugi storitveni dejavnosti, s čemer naj bi v cilj trajnostnega razvoja ohranili energijo, zdravje ljudi in potrebe po novem razvoju. Pri vsem je treba razumeti, da je industrija, ob podpori znanosti, v praksi in skozi tehnološki razvoj, skozi razvoj interneta, informatike, informacijskih sistemov, računalništva, digitalizacijo vodenje postopkov, uvajanje sodobnejših načinov proizvodnje, uvajanje robotov in pametne tehnologije, dosegla največje gospodarske učinke. Gre za čas, kjer se menedžment zaveda hitrega gospodarskega razvoja, tehnološkega napredka, gospodarske in trgovske konkurence, hitre spremembe proizvodnje, vse večje digitalizacije proizvodnih in drugih procesov ter robotizacije posameznih postopkov, zato je za potrebe industrijske ali druge proizvodnje, logistike in druge storitvene dejavnosti ustvaril potrebo po vlaganjih v razvoj tehnologije za potrebe upravljanja in vodenja logistike in logističnih procesov v industriji in širše [5].

1.2 Vloga menedžmenta v pametni industriji (področje raziskave)

Spremembe so se kazale skozi industrijski razvoj, v našem raziskovalnem primeru smo iskali razloge za uvajanje posameznih modelov, postopkov in aktivnosti, za katere smo ugotovili, da so zelo uporabni in odpravljajo potrato časa, prostora in
delovne sile, obenem pa ugotavljamo, da gre za modele, ki so hitro ranljivi, saj povzročajo odvisnost. Znanost in praksa sta ugotovili, da je v fazi globalizacije v industrijski in drugi proizvodnji prišlo do izločitve logistike, predvsem nekaterih logističnih postopkov in logističnih procesov, s čemer se je industrija in druge oblike proizvodnje iz proizvodnje posvetila k proizvodu. Šlo je za zgodovinsko spremembo, kjer so v menedžmentu spoznali, da je vsakršna dejavnost v industrijski ali drugi proizvodnji, ki ni neposredno vezana na proizvodnjo, sicer dejavnost, ki jo štejejo v breme in je treba te postopke obravnavati ločeno. Pri vsem menedžment ugotavlja kaj industrija 4.0 sploh pomeni v logistiki in storitveni dejavnosti in kako je logistika udeležena v trajnostnem razvoju industrije. Znanost opozarja na spremembe, ki so vezane na nove paradigme tehnološkega napredna generacije industrije 5.0. pri čemer jasno pove, da v novi industriji 5.0 vijaki komunicirajo z roboti za montažo, avtonomni sistemi viličarji sami skladiščijo blago na visokih policah, inteligentni stroji sami usklajujejo proizvodne procese, zaposleni so povezani s stroji v obliki komuniciranja naravne in umetne inteligence. Nova paradigma predstavi trajajoči razvoj in usklajen menedžment in pokažeta proizvodno prilagodljivost in povezanost proizvodnje znotraj industrije ali med več različnimi industrijami. Povezani so in delujejo skozi digitalno omrežje, s pomočjo interneta, povezuje jih mednarodni splet medijev, kar daje možnost boljšega izkoriščanja pametnih strojev. Ob spoznavanju znanosti in prakse v raziskovalnem področju lahko dojemamo, da gre za pozni del industrije 4.0 z uvajanjem novih sprememb, novih parametrov in nove paradigme pametne industrije 5.0, kar počasi pelje do prepoznave potrebe po večjem sodelovanju proizvodnega dela industrije z menedžmentom in storitvenim delom logistike. Potreben je spremenjen menedžment v logistiki, ki z uporabo določene tehnologije, z avtomatizacijo in sistemskim vodenjem, omogoča manjšanje stroškov logistike v pripravi, predpripravi in po koncu proizvodnje [6].

Znanost je pokazala, da bi sodobne oblike blagovnih tokov zagotavljale uvajanje in razvoj nove paradigme industrije 5.0, s čemer bi industrija, z uporabo inteligentnih sistemov zagotovila zanesljivo proizvodnjo, kjer bi proizvodne linije bile zgrajene v proizvodnih modulih, ki bi omogočili hitro menjavo ogrodij, hitro sestavo novih modelov, tipov ali produktov, izboljšanje proizvodnje ter zmanjšanje stroškov, glede na količine in obseg trga. Pri vsem je mogoče prepoznati, da menedžment logistike, skozi trajnostni razvoj industrije in njenih sestavnih komponent stremi k osredotočanju na naročnike in porabnike, pri čemer se potrošniki in proizvajalci v interesnem področju zbližajo.

Zanimivost menedžmenta je mogoče prepoznati tudi v modularnem sistemu, ki se kaže v potrošniškem dizajnu, kjer kupci v sodelovanju z industrijo, lahko sami oblikujejo izdelke v skladu z njihovimi potrebami, njihovimi željami ter jih predlagajo v proizvodnjo. Znanost in praksa sta pokazali, da je cilj industrije izdelati izdelke, ki bodo sporočali podatke o delovanju, gre za potrebo po odzivanju tehnologije, s katerim bi lahko odpravili napake ali izboljšali posamezne sisteme. Odzivne podatke industrija uporabi za izboljšanje produktov ter na podlagi dognanj tržišču ponudi sodobne in izboljšane izdelke, logistika pa nove storitve. Menedžment logistike ob proizvodnji sledi trajnostnem razvoju, sledil algoritmom in izračunom idealne infrastrukture, najbližje in najbolj ustrezajoče poti blagovnih tokov, ker pametni stroji neodvisno modulom pošiljajo potrebo po novih materialih ali po novih izdelkih. Znanost na ta način opredeljuje pametna omrežja, ki omogočajo optimalen pretok blaga, izdelkov, naročil in ki obenem omogoča nenehno med organizacijsko povezovanje.

V obdobju industrije 4.0 in predvsem v obdobju med 2019 in 2023 se je industrija močno povezala z dobavitelji surovin, kar je povzročilo soodvisnost predvsem od določenih surovin ali komponent, ki omogočajo proizvodnjo in oskrbo trga. Gre za modularno obliko proizvodnje, kjer se podatki nizajo in so vezani za proizvodnjo ali vezani za stanje v proizvodnji, v logistiki ali v drugih procesih, se med seboj kombinirajo in vrednotijo po smernicah industrije 4.0 in z usmeritvami industrije 5.0, v čemer se kaže nenehen in trajen razvoj. Posledično temu se je zgradil določen menedžment, ki v logistiki omogoča, da se podatki sproti pošiljajo in so na voljo dobavitelju, proizvajalcu, naročniku in kupcu hkrati, kar v idealnih pogojih zagotavlja krožno gospodarjenje. Gre za popolno uporabo logističnih in procesnih sistemov, ki zagotavljajo nenehen dotok surovin, polizdelkov ali izdelkov na proizvodni trak, v skladišča ali na trg. Tako pridobljene podatke je mogoče sproti analizirati ter uporabiti za nova dognanja, ki omogočijo prepoznavanje novih postopkov, za proizvodnjo izdelkov, ki jih trg želi.

Vpliv mednarodnih sprememb na menedžment proizvodnih in storitvenih sistemov v sodobnem industrijskem razvoju industrijske generacije 4.0 predstavlja uvajanje sodobnih tehnologij, obenem pa se kaže velika soodvisnost širšega kroga dobaviteljev ali različnih oblik industrije, kar lahko povzroči nelojalno konkurenco in obvladovanje mednarodnih trgov. Gre sicer za trajnostni razvoj pa vendar so geopolitične, strateške, gospodarske in tudi trgovske zahteve spremenile svet, razvija se gospodarska dvopolnost, ki na zahodu vodi politiko in usmerja njene razvojne možnosti, na vzhodu pa se počasi gradi pol surovin in koncentracija oblasti v eni osebi, kjer želijo gospodariti z rudami in surovinami, od katerih so moderne industrije popolnoma odvisne. Posledično tej ugotovitvi, menedžment logistike skozi trajnostni razvoj zahteva od industrije, nosilcev storitvenih procesov in uporabnikov, da ravnajo s proizvodi ali z izdelki tako, da bodo čim dlje uporabni, s čemer naj bi bila zagotovljena njihova odzivnost in sledljivost. Cilj nove paradigme je, da se izdelkom zagotovi podatkovna usmerjenost v času njihove rabe, z ekološkega pogleda pa je treba že v osnovi zagotoviti recikliranje izrabljenih materialov, s čemer se zagotavlja materialni ciklus, krožno gospodarjenje in trajnostni razvoj [7].

1.3 Hipoteza raziskave

Izhajali smo iz predpostavke, da menedžment logistike v pametni industriji skozi trajnostni razvoj industrije in trajnostni razvoj logistike ter njeni logističnih procesov, med prehodom industrije 4.0 in v uvajanju nove paradigme industrije 5.0, zahteva spoznavanje sodobni tehnologij in informacijskih sistemov, ki omogočajo izvedbo posameznih postopkov in procesov v fazah predpriprave proizvodnje in kasneje v postopku skrbi za končne izdelke. Skozi proučevanje sprememb in številnih vplivov, ki ves čas spreminjajo blagovne, finančne in kapitalske tokove smo

spoznali, da sodobne oblike logistike, predvsem tiste, ki jih je svet, po vzoru Japonske uvedel v svoje tokove, močno spreminjajo proizvodnjo in oskrbo trga. V razcvetu mešanih sistemov in iskanja najbolj optimalnih oblik proizvodnje in skrbi za proizvodnjo, smo spoznavali pomembnost logistike in menedžmenta pa je kljub temu, zardi geopolitičnih, tržnih in kapitalskih interesov, prišlo do popolne zrušitve znanstvenih in strokovnih predpostavk. Za izravnavo vseh procesov v proizvodnji, kjer je logistika tako pomembna, kolikor je pomembna proizvodnja, je do končnega izdelka, treba vrednosti menedžmenta vključevati v pametno tehnologijo z računalniško programirano opremo, ki omogoča hitro, natančno in strokovno podporo industriji [8]. Ravno ta nihanja v blagovnih tokovih in soodvisnost blagovnih, proizvodnih, finančnih in kapitalskih tokov od geopolitičnih interesov zahtevajo iskanje nove paradigme menedžmenta. V ta namen smo hipotezo »Menedžment v proizvodnji in storitveni dejavnosti v pametni industriji zahteva stalno prilagajanje in iskanje novih rešitev« ter odprli vprašanje, ali blagovni, finančni in kapitalski tokovi zahtevajo reorganizacijo industrijske proizvodnje, logistike in postopkov mednarodnega povezovanja ali pa je mogoče z ustreznim menedžmentom postopke regulirati.

Znanost in praksa sta pokazali, da s primerjanjem opazljivih, empiričnih in merljivih podatkov, podvrženih določenim merilom je mogoče smernice industrije 4.0 (FoF Factories of the Future) prilagoditi zahtevam po hitrem odzivu na razvojne zahteve in geopolitične interese. Gre za prepoznavo implementacijo sodobne paradigme dostavne, nosilne, razdeljevalne, skenirane, tehtalne in druge opreme, s katero je mogoče eliminirati geopolitične interese, časovne in storitvene napake v med organizacijskega posameznih fazah poslovanja. Skozi opazovanje, eksperimentiranje in oblikovanje možnosti, smo prepoznali rezultate uspešnega raziskovalnega dela, obenem pa smo vsaj teoretično raziskavo usmerili v nove virtualne spremembe industrijske proizvodnje.

1.4 Metode in vizija raziskave

Proučevati menedžment in za njegovo poslanstvo iskati metode raziskave je lahko preprosto in enostavno, obenem lahko predstavlja dokaj zahtevno nalogo, glede na podlago h kateri želimo menedžment umestiti. Preprosto zato, ker o menedžmentu v proizvodnji, v logistike ali drugje govorimo in pišemo ves čas industrijskega generacijskega razvoja, skozi katere je ob razvoju proizvodnje mogoče pojasniti, da je logistika, kot storitvena industrija, že v prejšnjem stoletju uporabljala tedaj obstoječo tehnologijo, informacijske sisteme in novo tehnologijo, s katero opravljala naloge za industrijske procese. Menedžment je posebna veja znanosti, v gospodarskem področju, kjer ves čas iščejo nov e oblike, nove modele ter v ta namen znanost proučuje blagovne, finančne in kapitalske spremembe.

Menedžment v industriji zasleduje tehnološki napredek ter skozi njega uravnava različne oblike dela v proizvodnji in za potrebe proizvodnje ter v logistiki, kjer skladno z novo tehnologijo uporablja metode in dosežke, ki omogočajo uporabo modelov, oblik ali načina vodenja tehnologije tudi v izvedbi logistike in logističnih procesov. V ta namen je menedžment spremljal spremembe na svetovnem trgu, spoznal dobavo materialov po sistemu »Ob prav času, na prave mestu« ali »Just in Time«, v proizvodnih procesi pa model »dela brez emocij« ali »Džid žoka«, kar je dalo določene prednosti in bilo prepoznano, kod mehke oblike proizvodnje. Znanost in praksa sta pokazali, da je pot je vodila k zagotovitvi logističnih postopkov in procesov, ki bodo zagotavljali hiter in nemoten potek industrijske proizvodnje. Skozi novi model menedžment so iskali skladnosti uporabe naprednih tehnologij in tehnoloških sistemov, ki omogočajo hitro dobavo proizvodnih materialov. Danes lahko ugotovimo, da gre za zahtevne modele (gospodarska disciplina), ki jih je znanost spoznala za uspešne pa vendar, da bi to dosegli njihovo uporabo, so skozi menedžment logistike, zaradi časovnih usklajenosti, morali uporabiti sodobno in avtomatizirano tehnologijo (robote), s katerimi so, ob upoštevanju prostora, časa in delovne sile, poskušali zagotoviti zagotavljanje procesov v predpripravi, transportu, pakiranju, skeniranju, pakiranju, skladiščenju in nalaganju. V smislu raziskave smo preverili delovanje in uporabnost novih modelov ob prepoznavi, da je soodvisnost, geopolitične težnje, delitev sveta in vojne prevelika, prevelike so spremembe, zato je naša vizija bila usmerjena v iskanje prilagodljiv načinov, kako izvajati logistiko v industrijski proizvodnji, kako uporabiti strojno opremo za izboljšanje procesov logistike in kako industriji omogočiti, da njena proizvodnja teče nemoteno. Skozi postopke menedžmenta je bilo treba skozi uvajanja tehnologije v logistične procese, uporabiti IT tehnologije in digitalno omrežje z različnimi vmesniki, med različnimi uporabniki in med različnimi dobavitelji, kar je zahtevalo nenehno iskanje ustreznih rešitev in spremljanje industrijske proizvodnje. Skozi menedžment logistike smo s pomočjo proučevanja pojavov, z zbiranjem opazljivih, empiričnih in merljivih podatkov, podvrženih merljivemu razmišljanju, pridobiti nova znanja, ki so zaradi geopolitičnih interesov, delitve sveta, velikih sprememb ipd. zahtevali nekaj korakov nazaj, zaradi česar so velike organizacije pričele ponovno uvajati velika skladišča, ustvarjati zaloge in se zanašati na lastne vire.

V procesu smo uporabili komparativno metodo, s pomočjo katere smo naredili hiter pregled nekaterih sistemov in modelov menedžmenta v industriji 4.0. Z deduktivno metodo smo s z dejanji in dokazili poskušali pridobiti odgovore na odločitve in modele menedžmenta. Z metodo analize smo podkrepili ali ovrgli nekatere, do sedaj sicer potrjene postopke in oblike menedžmenta v logistiki in proizvodnji ter s statistično metodo izoblikovali naše kreiranje bodočih modelov.

1.5 Potek raziskave

Raziskava je iz vseh pogledov zanimiva in zahtevna, saj smo skozi smernice menedžmenta logistike v pametni tovarni iskali prednosti in slabosti, ki jih povzročajo geopolitične, gospodarske, tržne in druge spremembe v svetu. Primerno temu je raziskava šla v prepoznavanje obstoječih modelov, njihovo uporabnost v oskrbi industrije, težave industrije in logistike, soodvisnost in med organizacijske povezave. Nujno je bilo treba za menedžment proučiti organizacijsko strukturo in procesno organizacijo oblik posameznih organizacij ter poiskati vzroke za spremembe in spreminjanje [9].

Če bi med organizacijsko povezovanje, iskanje cenejših oblik dela ali cenejših materialov povezali s smernicami trajnostnega razvoja industrijske ali druge

proizvodnje, storitveni ali drugi dejavnosti, bi zlahka razumeli spremembe v področju menedžmenta, ki sledi razvoju industrije generacije 4.0 in ki v razvoj umeščajo vse novosti, ki omogočajo hitrejše in enostavnejše upravljanje ali vodenje zahtevanih procesov. Poglabljanje v tehnološki napredek, kjer znanost, strokovnjaki in teoretiki predstavljamo digitalizacijo kot fenomen in orodje za upravljanje pametnih strojev pomeni, obvladovanje sprememb in dojemanje, da je digitalizacija že zdavnaj prispela v srž industrije, gospodarstva, storitvenih dejavnosti, izobraževanje in v vso družbo. Šlo je za prepoznavanje novih sistemov, prilagajanje novim modelom, oblikam in načinom proizvodnje ali storitev in obenem je šlo za uvajanje novih oblik menedžmenta, ki sledi tem spremembam. V industrijskem smislu prepoznamo, da tehnologija ni le primat za vodilni in vodstveni sloj menedžmenta v industriji, storitveni ali drugi dejavnosti, temveč je tehnologija vključena v procese proizvodnje, kar nedvomno vodi v k spremembi poslovnih modelov, spreminja oblike in dizajn izdelkov, obenem tudi organizacijskih procesov ter spreminja zahteve po fizičnem delu in oblikah menedžmenta. Temu lahko pojasnimo, da gre za smernice, ki so naravnane v poučevanje zaposlenih, v njihovo prepoznavanje in osvajanje različnih veščin, s katerimi morajo slediti digitalizaciji [10]. Torej smernice zajemajo digitalno produkcijo industrije 4.0 ter zahtevajo uvajanje novih delovnih procesov, kjer so avtomatizirani sistemi (stroji) nosilci opravljenega dela in kjer delavec nadzira delo sistemov. V razvoju menedžment vidi primat sporazumevanja naravne in umetne inteligence, tem spremembam se prilagaja in uvaja nove oblike delovanje [11]. Smernice razvoja generacije industrije 4.0 menedžment prepoznava kot pobudo in je v tem moderator različnih interesov in ambasadorjev kjer s svojimi modeli in oblikami zagotavlja varnost pred konkurenčno izmenjavo vseh pomembnih deležnikov iz politike, gospodarstva, znanosti, sindikatov in združenj. Te smernice v obliki sprememb navajamo kot platformo, ki predstavlja vodilno svetovno generacijo industrije 4.0, ki skozi nove oblike menedžmenta in omrežij, razvija osnovne koncepte priznavanja izzivov obvladovanja prihodne generacije industrije 5.0, obenem proizvodnji, storitvam in menedžmentu daje konkretna priporočila znanosti, gospodarstvu in razvojni politiki, kako se prilagoditi spremembam. Skozi spoznavanje razvojnih smernic vidimo konkretne nacionalne in mednarodne izmenjave s številnimi dvostranskimi in večstranskimi sodelovanji, zlasti na področju varnosti in standardizacije informacijske tehnologije [12]. Gre za spremembe, ki vplivajo na menedžment in razumevanje vsega kar nas obkroža, zato hočemo vedeti vse, ča prav se zavedamo, da so spremembe številne in je njihov proces v stalnem nihanju k boljšemu ali k zmožnemu.

Torej je specifika menedžmenta logistike v trajnostnem razvoju industrije v njenem nenehnem tehnološkem, strukturnem in organizacijskem razvoju ter v njenem nenehnem iskanju naprednih tehnoloških, informacijskih, digitalnih in drugih elementov, ki naj bi z ustreznim menedžmentom omogočili nemoteno industrijsko proizvodnjo, zmanjševali stroške in zagotovile trg. Znanost nas uči, da so smernice sinonim za uvajanje sprememb in menedžmenta, ki omogočajo uvajanje popolnoma avtonomnih procesov predpriprave, proizvodnje in posebno postopkov v proizvodnji, ki naj bi omogočili boljšo pripravo blaga za kupca [13]. Razumemo, da gre za menedžment proizvodnje in logistike, ki se odraža skozi uvajanje avtonomnega pakiranja, paletiziranja, skladiščenja, dobave itd., pri čemer dosledno uporablja smernice industrije 4.0 [14]. To je razvojni čas, kjer si industrija, ob uporabi številnih mednarodnih modelov menedžmenta, tehnike in tehnologije želi v svojo proizvodnjo in tudi v storitveno dejavnost zagotoviti popolnoma avtonomne sisteme obdelave podatkov, naročil, priprave plana in proizvodnje. Gre za združevanje matematične optimizacije z podatkovno inteligenco, ki predstavlja podlago za razvoj orodij IT za načrtovanje in delovanje v industrijskih proizvodnih sistemih [15]. Tehnološkim spremembam sledijo spremembe vođenja in upravljanja oziroma menedžmenta različnih postopkov, kar procesom in modelom daje posebno modrost.

Menedžment proizvodnje in logistike v pametni tovarni predstavlja spremljanje sprememb, saj je raziskava je pokazala, da je delitev posameznih procesov industrijske proizvodnje v notranje (čista proizvodnja) in zunanje (logistika) v prvotni fazi pomenilo skrb menedžmenta v industrije za njen proizvod ter usmerjanje vseh tehničnih in tehnoloških procesov v dizajn proizvoda ter v izboljšanje in privlačnost posameznega produkta. Naša proučevanja so pokazala, da matematična in finančna opažanja pokazala, da bi zapostavljanje tehnološkega razvoja logistike časovno pomenilo oviranje proizvodnje, zato je bilo nujno sprejeti odločitev, da je logistika za industrijo ključnega pomena, kjer gre za vrsto pripravljalnih in izvedbenih postopkov in opravil, brez katerih procesi industrije ne morejo zagotavljati svojega poslanstva. Skozi ta razvoj je industrija prepoznala nujne spremembe, kjer v procesu razvoja generacije industrije 4.0 mora logistiki nameni možnosti tehnološkega razvoja, ki bo sledil njeni proizvodnji. V fazi pregleda vloge menedžmenta v industrijski ali drugi proizvodnji in posebej v logistiki, je bilo treba iskati izhodišča za uporabo sodobnih tehnologij in sistemov, ki so jih zajele spremembe in jih že nudijo smernice razvoja generacije industrije 4.0.

Spremembe so vodile k uporabi mehkih pristopov, kjer so poskušali po vzoru vzhodnih sistemov Japonske ali Kitajske, z uporabo sistema »kan ban«, ki pomeni razdeljevanje nalog z oskrbo delovnih mest [16] ter deluje po načelu vlečenja (»pull«), brez napovedi, na odpoklic količin v sami proizvodnji pospešiti proizvodnjo. Skozi spremembe sistem pojasni, da sta zaznavanje potreb in pravočasna oskrba potekali s pomočjo signala na magnetni kartici ali očitanju praznega zaboja ali očitanju praznega prostora. Torej so menedžment ali vodenje in upravljanje uravnavali po tipu proizvoda in število kosov, ki jih je potrebno iz skladišča pripeljati v proizvodnjo ali proizvesti zapisani na kan ban magnetni kartici. V delovanju sistema porabniku (robotu ali stroju) kan ban magnetna kartica pove, kaj mora v nekem trenutku pripeljati iz priročnega skladišča, proizvajati v procesu proizvodnje, odpeljati iz proizvodnje ali skladišč in koliko. Sistemsko delovanje pojasni, da pametni stroj vedno vzame le toliko blaga, surovin, polizdelkov ali izdelkov, kolikor v procesu potrebuje, proizvajalec pa mora v zaporedju procesov to količino zopet dopolniti. Sistem modela kan ban pojasni, da je primeren za veliko industrijsko ali serijsko proizvodnjo, kjer je manj nihanj po potrebah po

spremembah in kjer so zagotovljeni enakomerni in uravnoteženi proizvodni procesi [17]. Skozi sistem se kažejo spremembe in oblike menedžmenta, ki usmerjajo pomembnost razvoja posameznih sklopov in celote.

Spremembe zaznamo tudi v menedžmentu logistike, ki predstavlja ekskluzivno podporo avtonomnim sistemom in opremi uporabljeni v pametnih tovarnah in mehki obliki proizvodnje. Pri vsem lahko razumemo, da menedžment pametne tovarne temelji na simultanem razvoju uporabnih komponent, ki skozi zaznavanje spremljajo komuniciranje opreme in ljudi (naravne in umetne inteligence), omogočajo vodenje in upravljanje, posredujejo informacije o potekih komunikacije med vsem faktorji vključenimi v proizvodnji, pri čemer prepoznava spremembe ter omogoča racionalno delo, racionalno porabo energije ter ustrezen menedžment. Skozi prepoznavanje sprememb v simultanem smislu uporabljamo pojem avtonomne naprave v industriji (sistem delovanja pametne tovarne), kjer lahko iščemo ekskluzivna izhodišča za podporo menedžmentu v trajnostnemu razvoju proizvodnih in logističnih procesov, ki naj bi v prihodnosti posodobili opravljanje posameznih opravil. Znanost in praksa nam v raziskavi omogočita, da v konkretnem raziskovalnem področju prepoznamo ekskluzivno podporo logistike v industrijski proizvodnji, kjer za opravljanje logističnih nalog uporabljajo AGV SMARTCART 100TT (Automated guided vehicle). Gre za pametni viličar ali avtonomno napravo, ki v procesih svojega dela uporablja spremembe in inteligentne sisteme, ki jim omogočajo samostojno delovanja v različnih kombinacijah logistike. Tu prepoznamo avtonomne naprave, ki jih v pametni tovarni ali drugi industriji uporabljajo za prevoz blaga in materialov iz priročnih skladišč v proizvodnjo [18]. Gre za sisteme ali pametne naprave nove generacije, ki imajo komponente za odločanje ter same izvajajo številne procese, se energetsko obnavljajo (polnijo baterije) in prilagajajo spremembam. Njihovo delovanje je vezano na sisteme sledenja po metodi fiksnih sledi po začrtani poti, ki so v programu natančno kodirane, pri čemer avtonomni AGV robot sledi magnetnemu traku (ali drugi obliki), ki je njegova infrastruktura, pri tem uporablja RFID tehnologijo in je povezan v proizvodni sistem, ki nadzoruje poti več enakih ali različnih robotov.

Menedžment prepozna prve avtonomne naprave, ki jih je mogoče uporabiti tudi za izvajanje logistike oziroma jih opredelijo kot naprave, ki opravljajo logistiko in logistične procese v neposredni povezavi v industrijski proizvodnji. V procesih približevanja pomena storitvene dejavnosti k proizvodni, so prepoznavne so še druge oblike avtonomnih sistemov ali naprav, ki izvajajo prenos materialov na določenih točkah, kot so roboti v obliki roke, ki izvajajo določene gibe v fazah proizvodnje, kjer človek tega ne more, v razvoju pa so še druge oblike, ki jih preverjajo in testirajo v virtualnih postopkih. Njihova raba je zanimiva, pomeni spremembe in spreminjanje v proizvodnji in storitveni dejavnosti, obenem predstavlja potrebo po spreminjanju sistemov pretoka blagovnih, finančnih in kapitalskih tokov, pri vsem pa niso jasne posledice ali pravne odločitve, ki morajo zagotavljati varnost vseh deležnikov tako z gospodarskega [19] kakor pogodbenega [20] in varnostnega pogleda.

2. Vpliv sprememb na menedžment

Velikokrat smo ugotovili, da so spremembe gonilo tehnološkega, gospodarskega, industrijskega in vsega družbenega razvoja. Tem spremembam sledi tudi menedžment, kar vidimo skozi razvoj menedžmenta v industriji, v gospodarstvu, v storitveni ali drugi dejavnosti, kjer se menedžment prilagaja spremembam in je vezan na rast in trajnostni razvoj. V praksi vidimo, da spreminja tudi menedžment v logistiki, kar je mogoče opredeliti matematično, časovno, ekonomsko ali s pojmom gospodarske rasti in gospodarskega razvoja. Navadno gospodarska rast vključuje rast ustvarjenih dobrin in storitev, kar industrija dosega z večjim obsegom dela, večjim vlaganjem kapitala, večjo rabo energije ali pa s kakovostno produktivnostjo in učinkovitostjo, kar je posledica uporabe znanja in ustreznega usposabljanja. Kadar ocene rasti, spremi njanj in razvoja vežemo na subjekte, lahko gospodarsko rast vežemo na ustrezne oblike menedžmenta v proizvodnji, v storitvi ali drugi dejavnosti. V obdobju razvoja generacije industrije 4.0 je svetovna industrija vseskozi v razvoju in iskanju najboljših razvojnih rešitev in ni pričakovati, da bi se kdaj ustavila. V prvotni obliki je vzročni faktor za spremembe bila svetovna globalizacija, ki je na trgu povzročila hudo gospodarsko konkurenco, zato so bile nujne hitre spremembe, tako na tehnološkem, kot na organizacijskem področju, kar neposredno vpliva na spremembe in organizacijo menedžmenta. Proces se tudi v geopolitičnih spremembah nadaljuje, spreminja in išče nove izzive ter prostor za svojo ekspanzijo, kar na trgu ustvarja hude konkurence, ekonomske in trgovske vojne.

Razvite države zahoda in države vzhoda, kjer je največ surovin, ves čas iščejo možnosti in priložnosti, znane so nam tudi oblike blagovnih kvot, velikokrat je prišlo so povezav zahoda na vzhod zaradi poceni delovne sile ali zaradi stroškov logistike za transport surovin, kar je pogojevalo ovajanje vzhodnih metod menedžmenta. Skozi te podatke pridemo do spoznanja, da se industrija razvija, spreminja in inteligentno izpopolnjuje samo in zgolj zaradi spreminjanja potrošnikovih želja, potreb, navad, statusa, pomembnosti, populizma in podobno. Gre za navade potrošnikov, ki želijo nov e produkte ali nove storitve, zahtevajo spremembe in izpopolnjevanja, zaradi česar se jim mora proizvodnja prilagajati. Pridemo do spoznanja, da je industrijski menedžment oziroma oblike vodenja in upravljanja znotraj industrije in storitvene dejavnosti, posledica sočasnih in med seboj prepletenih procesov na strani proizvodnje in potrošnje. Pri vsem pa sta avtonomna tehnologija in avtonomna oprema dejavnika, ki lahko in ki bo trajno vplivala na razvoj, zaradi česar je industrija, proizvodnja, storitvena in druga dejavnost nenehno usmerjena v iskanje novih in novih rešitev, novih spoznanj, novih sprememb. Pri vsem je logistika neločljiv del tako industrijske, kot druge proizvodnje v globalu, kar je mogoče razumeti, da logistika in logistični menedžment morata slediti spremembam in tehnološkim dosežkom.

V raziskavi iščemo oporne točke, ki nas vodijo k uvajanju sistemov in tehnoloških dosežkov generacije industrije 4.0, pri čemer govorimo o pametnih tovarnah, kjer posamezne industrije v proizvodnji in tudi v področju logistike poskušajo uvajati avtonomne sisteme, ki delujejo po novi organizacijski strukturi vodenja in upravljanja [9]. Če pogledam spremembe in iskanje novih rešitev v področju logistike in storitvene dejavnosti splošno ugotovimo, da je tehnologija v logistike prisotna že od začetka razvoja industrije in industrijske proizvodnje, pri čemer je prvotna oblika logistike uporabljal oblike naprav, ki so lahko izvajale težja dela, kot so dviganje, shranjevanje, razvrščanje in podobno. Temu primerno so bili pripravljeni in oblikovani sistemi menedžmenta, ki so stopnjo tehnološkega razvoja razlagale po tedanjem znanju.

Uporaba sodobnih avtonomnih sistemov (naprave ali robota) AGV SMARTCART 100TT (ali drugih uporabnih avtonomnih naprav, strojev, robotov) v predpripravi za proizvodnjo in v sami proizvodnji, predstavljala novost za industrijo, pri čemer se je prilagodil tudi menedžment. Nove oblike, nove sisteme ali naprave so pričeli uporabljati v avtomobilski industriji, industriji bele tehnike, v farmaciji, v industriji prehrane in kasneje mnogo širše ter na več področjih. Sodoben menedžment v logistiki in za potrebe logistike predlaga uporabo inteligentnih avtonomnih naprav v obliki robotov, ki samostojno in po določenem vzorcu pripeljejo surovine (materiale) v proizvodnjo, oskrbujejo proizvodno linijo ali opravijo druga dela, za katera menedžment meni, da ni treba, da jih opravlja človek. Menedžment je prepoznal, da inteligentni sistemi ali naprave lahko opravlja dela med fazami proizvodnje ali odvažajo končne izdelke v procese priprave za skladiščenje ali transport [21]. Pri tem menedžment v logistiki ukazuje na podatek, da je uvedba avtonomnih sistemov ali naprav ali opreme šele v začetni in razvojni fazi, kar pomeni da se je začel proces zmanjševanje števila delovnih mest, zmanjšanje operaterjev z uvedbo računalniškega nadzora, kar spreminja tudi oblike menedžmenta. Pri vsem menedžment in vodstvo industrije, proizvodnih ali storitvenih organizacij spozna, da tehnološka podpora v področju logistike pomenila cenejšo proizvodnjo, manj zaposlenih in več prihranka [22]. Na ta način menedžment uravnava blagovne tokove, pri čemer logistični procesi v nekem grobem kontekstu pomenijo potek materialov od dobavitelja, preko proizvodnih procesov do porabnikov, kjer se kažejo transportni stroški in ekonomija transporta [23]. Kako to poteka je odvisno od menedžmenta ali organizacije postopkov, uporabe znanosti in znanstvenih metod ter funkcionalnih metod, ki menedžmentu neposredno omogočajo izvedbo posameznih procesov. Prepoznamo kompleksen menedžment, ki je prisoten v industrijski in drugi proizvodnji, v logistiki in drugih dejavnostih, kar logistiki omogoča da so postopki ali procesi usklajeni, vitki, da ne povzročajo izgub, da je vzpostavljeno primerno upravljanje, da ima ustrezen informacijski sistem in tehnološko podporo. Gre za spoznanje, da menedžment in logistika spremljata spremembe, pri čemer učinkovita logistika predstavlja ključne dejavnike industrijske proizvodnje, ki se kažejo v skupnem strošku produkta ali proizvoda.

3. Prepoznavanje konkretnega menedžmenta v logistiki in logističnih procesih

Medsebojne stične točke menedžmenta v industrijski ali drugi proizvodnji in stične točke v logistiki ali drugi storitveni dejavnosti, smo opisali skozi prikazovanje

posameznih oblik posodabljanja proizvodnih ali logističnih procesov, kjer vodenje in upravljanje ima svoj smisel. Zato je med rezultati konkretnega menedžmenta treba omeniti stalno prilagajanje spremembam, tehnološkim in znanstvenim potrebam ter praksi, pri čemu je treba zelo poudariti, da industrija, proizvodne in druge organizacije in celotno gospodarstvo stremijo k uvajanju inteligentnih sistemov ali pametne tehnologije, pri čemer je menedžment ključnega pomena in ves čas spremlja razmere na svetovnem trgu. Menedžment skozi svoje smernice in vođenje posameznih sistemov v industriji, proizvodnih ali drugih organizacijah, v logistiki in drugih storitvenih dejavnostih, dojema smernice in industrijski razvoj industrijske generacije 5.0. Pri raziskavi prepoznavo konkretnega menedžmenta posebej vidimo v Slovenski in Evropski avtomobilski industriji, pri čemer v svoje raziskave uvajajo virtualne sisteme raziskav in preizkušanj materialov. Na teh raziskavah temelji nov sodobni in tehnološko izboljšan način proizvodnje, zmanjšajo se čas raziskave ter potrata časa, prostora in materialov.

Znanost ugotavlja, da industrije, proizvodne in storitvene organizacije s pomočjo digitalizacije, s pomočjo računalniške opreme in simultanih programov, v razvojno raziskovalni oddelkih v avtomobilski industriji razvijajo virtualne programe, ki omogočajo nastajanje namišljenih orodij za izdelavo nekaterih delov motornih, hibridnih ali električnih vozil. Iz vsega lahko razumemo, da se sočasno z razvojem novih tehnologij in sistemov, razvijajo tudi trendi posodabljanja menedžmenta v logistiki, ki se kažejo v upravljanju blagovnih tokov, oskrbe industrije z materiali, ravnanje z materialih v skladiščih in širše, kjer dela opravljajo robotizirani viličarji in ostala robotizirana transportna sredstva. Znanost prepoznava uporabo sodobnih sistemov menedžmenta, kjer uporabljajo glasovne oblike vodenja operaterjev ali delavcev, Gre za organizacijo, kjer so na ustreznih mestih nameščeni sistemi za natančno lociranje pozicije delavca ali transportnega sredstva, nameščeno je vizualno usmerjanje delavcev za vodenje procesov, za vodenje avtonomnih naprav uporabljajo umetne inteligence. Skozi raziskavo ugotavljamo, da je podobno tudi na področju organizacije transporta, kjer planiranje in optimizacija transportnih procesov potekata v okviru interaktivnega sodelovanja različnih informacijskih sistemov. Pri vsem pa gre za logistično industrijo ali storitveno področje, kjer se že uporabljajo robotizirana avtonomna vozila, ki opravljajo tista težja in zahtevnejša dela, ki so za človeka nevarna ali pa predstavljajo izgubo časa.

Raziskava nam pokaže, da se skozi novi menedžment kaže močna tendenca uporabe alternativnih virov energije za opravljanje različnih logističnih procesov in postopkov. V uporabi je sodoben in s proizvodnjo povezan logistični informacijski sistem, ki je v podporo pri pridobivanju ustreznih informacij o skladišču ali transportu in obenem podpora v med organizacijskem povezovanju različnih organizacij, različne proizvodnje ali različnih industrij. Pri vsem menedžment omogoča povezave vseh oblik blagovnih tokov, skladiščnih in transportnih zmogljivosti, nadzira in usmerja vključevanje v vse infrastrukture (cesta, železnica, voda in zrak), omogoča tudi vključevanje vseh transportnih sredstev (tvorno vozilo, vlakovna kompozicija, ladja ali letalo). Za potrebe blagovnih tokov, skladiščenja in transporta prirejeni tako, da jih v transportu lahko uporabljajo vse oblike transportnih vozil. V interesu iskanja rešitev zelene energije v novodobnem transportu vse bolj uporabljajo hibridna ali električna vozila, s čemer poskušajo podati konkreten način podpore razvoju in varstvu okolja. Skozi menedžment blagovnih tokov je prepoznati velik napredek pri razvoju mobilnih terminalov in komunikacijskih tehnologij, ki omogočajo stalno povezanost v medmrežja interneta, ki zagotavljajo stalen nadzor nad blagom in njihovimi tokovi, pri čemer naprave z vozili na poti, ves čas sporočajo podatke v skladišča ali naročnikom. Tudi menedžment pojasni, da je nemogoče konkurenčno nastopati na trgu, če ni ustrezne podpore informacijskih sistemov, če ni ustrezne uporabe sodobne tehnologije, če ni informacijske podpore, če ni črtnih kod in GPS sistema navigacije logistike. Skozi sisteme blagovnih tokov je zaznati uvajanje novih tehnologij, upoštevanje smernic prihajajoče industrije 5.0, uporabo RFID kod in robotiziranih manipulatorjev, kar predstavlja tehnološke dosežke nove dobe. V industriji, v proizvodnji in storitvi se konkretna podpora vidi v razvoju robotiziranega in inteligentnega transporta, popolni sledljivosti blaga na poti, v uvajanju novih načinov identifikacije z enodimenzionalnimi, dvodimenzionalnimi in več dimenzionalnimi črtnimi kodami, radio frekvenčno identifikacijo in širše. S konkretno podporo tehnologije industrije na dolgi rok znižujejo stroške, povečuje svojo ponudbo, širi proizvodnjo[24].



Vir: Murtič, Uhernik Franko, Murtić, 2023

4. Organizacija menedžment z uporabo inteligentnih sistemov in tehnologije

Blagovni tokovi, industrijska in druga proizvodnja, logistika in druge spremljajoče storitve, so ozko vezane na menedžment industrije, pri čemer je menedžment naravnan tako, da skozi svoje delovanje uporablja sodobno opremo in sisteme, ki mu omogočajo vodenje blagovnih tokov, vodenje v proizvodnji, spremljanje logistike, obvladovanje konkurence ter pregled trga. Menedžment uporablja številne

inteligentne tehnologije in informacijske sisteme, s pomočjo katerih zbira, shranjuje, obdeluje in posreduje potrebne podatke, ki omogočajo krožno gospodarjenje. V vsem tem je logistika, s svojimi logističnimi procesi, všteta v skupno ceno prodanega proizvoda posamezne industrije ali druge proizvodnje, zato morata menedžment industrije in logistike skrbeti, da so v blagovne tokove, postopke in procese pripravi in izvedbe proizvodnje vključeni poslovni informacijski sistemi (Enterprise Resource Planning), ki predstavljajo celovite programske rešitve za industrijo in njene razpoložljivih kapacitete. V sistemu menedžmenta smo prepoznali blagovne tokove, kjer menedžment spremlja logistične procese skladiščenja in manipulacije blaga pred, v proizvodnjo in iz proizvodnje na trg pri čemer uporabljajo WMS (Warehouse Management Systems) sistem, ki omogočajo vodenje in upravljanje blagovnih tokov (surovin in končnih izdelkov), upravljanje skladišč ter posredovanje informacijski podpor industriji in logističnim procesom v skladišču, v smislu prevzema izdelkov, odlagalnega mesta, komisioniranja, izdajo blaga, kontrolo stanja, potrebo po dobavi. S pomočjo menedžmenta sistemi popolnoma nadzirajo, kontrolirajo ter posodabljajo posamezne procese in so ves čas in neposredno vezani na sistem poslovanja industrije, ali druge oblike proizvodnje. V naravi in v praksi vsi postopki potekajo s pomočjo brezžičnih mobilnih terminalov, brez uporabe papirja in s takojšnim posredovanjem podatkov nazaj v poslovni informacijski sistem. Pri tem sistem uporablja identifikacijske tehnologije v obliki radio frekvenčne identifikacije, črtne kode, pri čemer tehnologija omogoča glasovno vodenje in vodenje s pomočjo lučk. Znanost sicer ugotavlja, da je podpora s strani menedžmenta sistemsko dovršena in sledi smernicam industrijskega razvoja 4.0 [25], ni pa povsem jasno, če sledi spremembam. Za prepoznavanje sprememb smo v kontekstu naše raziskave uporabili določeno inteligentno ali pametno opremo ali tehnologijo, ki uravnava in izvaja logistične procese od vstopa materialov v proizvodnjo, skozi izvajanje notranjega transporta za povezovanje procesov vezanih v proizvodnji ter izvajanje nalog in procesov, kateri imajo cilj pregled končnih izdelkov za transport.



Vir: Murtič, Uhernik Franko, Murtić

Skozi proučevanje sprememb smo s pomočjo tehnologije in računalniške opreme proučevali napredne postopke izvedbe logističnih procesov ter odpravljali napake in težave. Cilj je bil z novodobno inteligentno tehnologijo prepoznati prednosti sistemov ter pospešiti logistično delo, odpraviti nastajajoče napake ter preprečiti reklamacije, kar smernice industrije 5.0 prepoznavajo kot zahtevo po uporabi preizkušenih metod. V procesu smo spoznali številne tehnike in postopke menedžmenta in razvoja logističnih procesov, ki se kažejo v zaporedju ter procesno omogočajo hitrejšo proizvodnjo, natančne postopke, skrajšanje časa posameznih storitev in manjše stroške.

Spremembe so stalnica in jih ni mogoče ustaviti, zato je v očeh menedžmenta vitka ali bolj prožna proizvodnja splošna filozofija upravljanja procesov v industriji ali drugi proizvodnji, oziroma v storitveni dejavnosti, ki pomaga izboljšati celotne vrednosti ključnih kazalnikov (KPI Key Performance Indicator). V spoznavanju ugotovimo, da gre za niz orodij, za odkrivanje in stalno odpravljanje izgub ter izboljševanje kakovosti, pri čemer je cilj skrajševanje proizvodnih časov in zmanjševanje proizvodnih ali logističnih stroškov. Dostopni podatki nam povedo, da je sistem bil razvit v TPS – Toyota Production System, kjer so skozi spremljanje tehnoloških procesov vzpostavili sprememb menedžmenta in filozofiio organiziranja proizvodnje in logistike, vključno z medsebojnim vplivanjem dobaviteljev in kupcev. Zato je proizvodnja podprta z različnimi logističnimi orodji, med katerimi menedžment izpostavlja znane procese stalnega izboljševanja »kaizen« in »poka-yoke«. Cilj menedžmenta mehke ali vitke proizvodnje je doseči enakomeren tok dela v celotni proizvodnji, ki bi sama zaznavala napake, zastoje in jih nadomestil z novimi, naprednimi tokovi. Skozi pregled učinkov znanja in znanosti spoznamo, da je uporaba japonske metode kaizen v industriji in v logističnih procesih pomenilo nenehno izboljševanje, zasnovano na dolgoročnem razvoju procesov, integriranih v industriji. Osnovna namen menedžmenta za

uporabo novodobnih sistemov ali metod se je kazal skozi nenehno izboljševanje procesov, uporaba novih znanj ter pridobivanje izkušenj in veščin vseh zaposlenih v podjetju. Če vse pogledamo skozi trajnostni razvoj pa ugotovimo, da menedžment industrije, v izboljšanju kakovosti, produktivnosti in učinkovitosti proizvodnje, uporablja še druga nova orodja, metode, tehnike in strategije (6 sigma, 5S, 20 ključev, celovito upravljanje produktivnosti, Total Productive Maintainmenc, SMED, Just in Time in Just in Sequence).





Vir: Murtič, Uhernik Franko, Murtić

Spremembe so povzročile potrebo po iskanju ustreznega menedžmenta, ki bo industrijski ali drugi proizvodnji, logistiki ali drugi storitveni dejavnosti omogočilo sodobno delovanje. Zato menedžment v pametnih tovarnah predlaga uporabo metode Total Productive Maintenance, ki se odraža v celovitem produktivnem vzdrževanju sistemov, kar prepoznamo kot novo metodo za izboljšanje učinkovitosti inteligentnih sistemov v vseh okoljih. Gre za univerzalno obliko, ki jo je mogoče uporabiti v vsakem industrijskem ali drugem proizvodnem ali logističnem sistemu, ne glede na razvojno strukturo in stopnjo delovanja organizacije. Gre za sicer zelo občutljiv sistem delovanja, ki v ospredje postavlja vzdrževanje, kot potreben in zelo pomemben del industrije, druge proizvodnje ali logistike, ne odraža pa se kot neprofitna dejavnost ali strošek, čeprav je prisotna v vseh oblikah industrije, druge proizvodnje ali logistike. Cilj metode je ob spoštovanju naprednih sprememb odpraviti izgube v predpripravi in proizvodnji, s čemer naj bi dosegali večje proizvodne učinkovitosti, pri tema pa vključuje vse zaposlene, pred vsem se opira na skupinsko delo pri uresničevanju idej za izboljšanje sistemov. Spoznamo da krepi občutek delavca za lastništvo, za njihovo opremo in delovni prostor, vzpostavlja sisteme za vzdrževanje opreme in proizvodnjo ter podaljšanje življenjske dobe strojev in omogoča vsem zaposlenim, da stalno pridobivajo dodatne sposobnosti in znanja. V nadaljevanju spoznavanja sprememb prepoznamo metodo SMED (Single Minute Exchange of Dies), ki ima pomemben vpliv na trajnostni razvoj. Določan

minimalne čase nastavitve ogrodij, orodij ali priprav pametne tehnologije, proizvodne linije za funkcioniranje za drug proizvod. Nastavitev opreme, stroja, proizvodne linije za drug proizvodni proces traja le določen čas, ki ga metoda SMED poskuša še skrajšati s ciljem čim hitreje usposobiti in prilagoditi stroje za proizvodnjo drugega proizvoda, novejšega proizvoda.

5. Spremembe in učinki menedžmenta

Prepoznavne metode so posledica spremljanja sprememb v smeri iskanja izboljšav ali v smeri posodabljanja sistemov vodenja in upravljanja ali menedžmenta v industrijski, drugi proizvodnji ali v storitveni dejavnosti. Skozi prepoznavanje sofisticiranih metod in sistemov menedžmenta so šli v iskanje rešitev k izboljšanju logistike (storitvene dejavnosti) v pametnih tovarnah, vzpostavljali so avtomatska generiranja posameznih procesov, spreminjali proizvodnjo, spreminjali plane naročil ter pripravljali sisteme za boljše delovanje. Šlo je za uvajanje sodobnejših sistemov menedžmenta v logističnih postopkih, ki so jih podprli s tehnologijo, logističnih informacijskih sistemov, poslovnih informacijskih sistemov in podpornih tehnologij. Če pogledamo razvojne spremembe in težnjo kapitala po doseganju čim večji poslovnih učinkov, s čim manjšimi stroki, lahko ugotovimo, Pričakovanja so bila dosežena na različnih področjih že z uvedbo AGV (transportni robot), uvedbo pametnih linij, pametnih viličarjev in druge opreme, ki je prinesla merljive. S spremembami so popravil potratne sisteme in procese, ki so pomenili fizično prenašanje materialov, stalno zapisovanje in matematično obdelavo podatkov, odpravljene so naloge, ki so pomenile potrato časa in prostora in uvedeni novi postopki, nove operacije, ki pomenijo napredek celotne industrijske proizvodnje in ki pomenijo trajnostni razvoj logističnih procesov v smislu razvoja industrije 4.0. Inteligentni sistemi v logistiki se razvija kot produkt vseh metod v poglavju, s čemer je dosežen avtonomen sistem poosebljanja človeka in stroja. Tako je skozi menedžment dosežen spoj znanja in pametnega stroja, kar skupaj tvori intelektualni kapital industrije. Vse je vezano na spremembe, pri čemer je kapital dosegel maksimum uspeha, vendar se je pokazala ranljivost sistemov, kar je pokazala že svetovna pandemija Covid 19, ko so bili ustavljeni dobavni tokovi. Delitev sveta po politični, gospodarski, tržni ali drugi metodi, negativno deluje na razvoj sistemov, posebej geopolitično delovanje in povzročanje gospodarskih, tržnih ali dejansko uničevalnih vojn, v mnogo čem spremeni delovanje obstoječih metod in sistemov, zaradi česar trpi proizvodnja, ustavljeni so ali celo prekinjeni blagovni tokovi, ustavijo se finančni tokovi in kapitalni tokovi zavzamejo bipolarne položaje, kar negativno vpliva na svetovni razvoj.

6. Konstruktivna razprava

Skozi raziskavo smo proučevali gospodarske, politične, blagovne, finančne, kapitalske in druge spremembe, predvsem pa smo iskali napredne tehnologije in sisteme, ki ob svoji rabi omogočajo razvoj menedžmenta in sistemov, ki so vključeni v njem. V konkretnem primeru smo s primerjavo različnih modelov iskali podatke in rezultate uporabe avtomatizirane opreme, inteligentnih naprav in logističnih

sistemov, ki bi podprli menedžment logistike v pametni tovarni in okrepili industrijsko proizvodnjo. Končni cilj je bil skozi menedžment v logistiki, trajnostni razvoj in konkretne naloge avtomatizirati in izpopolniti nekatere procese in postopke v industrijski ali drugi proizvodnji, v logistiki ali drugi storitveni dejavnosti ter poiskati inštrumente kako industriji zagotoviti prihranek v času, prostoru, v sredstvih in porabljenih materialih. Številne ugotovitve so nam pojasnile, da je v razvoju in spremljanju sprememb sodelovalo veliko stroke in znanja, zato nedvomno gre za rezultate skupinskega dela, veliko izkušenj, podkrepljenih z metodami iskanja rešitev za izboljšanje sistemov ter zmanjševanja izgub v procesih priprave in proizvodnje ter v zaključnem delu shranjevanja izdelkov in za izboljševanje pretočnosti ter produktivnosti v avtomobilski industriji. Pri vsem smo se zavedali, da je v znanosti (v praksi veliko manj) vse mogoče, vse je relativno in je vse mogoče nadgraditi, dopolniti, dodelati, spremeniti, inovirati ipd., smo vztrajno še iskali tiste elemente, tiste modele in prednosti, ki bi dali odgovor kaj vse se da storiti, da bi industrijski ali drugi proizvodnji, logistiki ali drugi storitveni dejavnosti zagotovili ustrezen menedžment, konkurenčno prednost, izboljšanje proizvodov, zagotavljanje trga. Spoznali smo, da razvoj menedžmenta v logistiki, v pametnih tovarnah ali drugih dejavnostih še zdaleč ni zaključen in bo sledil tehnološkemu, materialnemu, sistemskemu in raziskovalnemu področju. Intelektualni kapital industrije se krepi, razvija in osvaja vesoljne širine, zato je v prihodnosti pričakovati nove spremembe, nove tehnologije, nove metode in nov razvoj.

Pri vsem pa smo prav tako spoznali, kako so sodobna tehnologija, inteligentni sistemi, blagovni tokovi, finančni tokovi, kapitalski interesi in mnogo širše lahko krhko področje, kjer lahko manjše spremembe vplivajo. Soodvisnost dobave surovin ali blagovnih tokov, soodvisnost tehnologij ali inteligentnih sistemov, soodvisnost produkcije in mnogo širše na povedo, da so spremembe v nadaljevanju in da niso vedno v razvojnem smislu. Minula pandemija Covid 19, stalno medsebojno obtoževanje velikih sil ZDA, Kitajske, Rusije in širše povzročajo nove spremembe v geopolitičnem, trgovskem, industrijskem, varnostnem, človeškem okolju, kar zopet onemogoča blagovne in finančne tokove, zaradi česar kapital išče nove možnosti. Prepoznali smo težave pri oskrbi proizvodnje s posameznimi komponentami, zaradi česar trpi avtomobilska industrija, trpi trg, trpi mobilnost in širšo krog človeškega napredka.

Industrija in predvsem avtomobilska industrija je prisiljena narediti nekaj korakov nazaj in ponovno graditi velika skladišča, kjer bo za daljše proizvodno obdobje zagotavljala surovine, repro material ali polizdelke za dokončanje lastnih proizvodov. Avtomobilska industrija zaradi pomanjkanja določenih komponent ima na 1000 delovnih mesta cca. 20.000,00 Evrov dnevne izgube, kar jo sili v iskanje novih rešitev. To nam pove, da raziskava ni zaključena, da se nadaljuje v cilju iskanja novih možnosti, boljših rešitev in konkurenčne prednosti.

7. Zaključno mnenje avtorjev

Avtorji smo skozi iskanje razlogov za spremembe in uspešno delovanje različnih sistemov v industrijski in drugi proizvodnji, v logistiki in drugi storitveni dejavnosti,

sledili menedžmentu ter iskali ustrezne odgovore na nastajajoče težave v industrijskem razvoju. Pri tem smo ugotovili, da menedžment logistike v pametnih tovarnah predstavlja postopke, informacije, opremo, sisteme, avtomatizacijo, vizualizacijo, digitalizacijo in številne druge postopke, ki opredeljujejo informacije, povezovanje in sodelovanje kot ključni faktor za pomoč industriji pri njenem obvladovanju proizvodnje in doseganju razvoja. Iz povedanega sledi, da je naloga menedžmenta preobraziti industrijo, človeka in potrebe ter vzpostaviti proizvodnjo in storitev, ki bo naravnana v varovanje človekovega okolja. Spoznali smo, da je naloga menedžmenta nuditi široko podporo razvoju intelektualnega kapitala industrije v širitvi industrijskih programov, zato ga je treba razumeti kot podporo v področij industrijske ali druge proizvodnje, in sicer v cilju obvladovanja konkurence, zagotavljanja človeških potreb, kakovosti okolja in socialne pravičnosti kot tri dimenzije (triple bottom line) pri kateri je osnovni vektor tehnologija, zato je to nenehno razvijajoči se proces. Uvedba pametne tehnologije in razvoj pametnih tovarn je glavni modul menedžmenta v trajnostnem razvoju in posodabljanju industrije, zato je vsako posodabljanje proizvodnje, logistike in logističnih procesov sistemsko izboljšanje. Postavili smo si hipotezo, ki smo jo skozi pregled pojasnili in strokovno potrdili. Praktični izsledki in proučevanje literature so nam dali teoretično podlago za potrditev naše predpostavke, kar se je pokazalo za potrebno. Področje raziskave globoko sega v razvoj industrije 4.0 in z uporabo avtomatizirane opreme in inteligentnih sistemov presega meje dosedanjega razvoja, kar nam pove, da se počasi razvijajo smernice industrije 5.0, ki bo popolnoma digitalizirala svet in vse okoli njega.

Pri vsem pa smo spoznali kako je sodobna in napredna tehnologija lahko krhka, glede na geopolitične, trgovske, kapitalne, finančne in kapitalske interese. Industrija je prisiljena v iskanje novih rešitev, skozi katere bi zagotovila ustrezen dotok surovin, oskrbo trga in stalno prodajo svojih izdelkov. Naše delo še zdaleč ni končano in se veselimo novih raziskav in novih ugotovitev.

Reference

- 1. Zelenika. R., Pupovac, D., Menemdžmen logističkih sustava, podpoglavje 2.4.11 Informacijskologistički sustavi, ISBN 978-953-6148-66-0, 88-97., Ekonomska fakulteta u Rijeci, 2008.
- Kaj je industrija 4.0, kako jo uporabljamo, kakšna je njena funcija, najdeno na (<u>http://www.plattformi40.de/I40/Navigation/DE/Industrie40/WasIndustr</u> ie40/was-istindustrie-40.html
- 3. Zelenika R., Ekonomika prometne industrije, poglavje Važnije odrednice prometne industrije, ISBN 978-953-6148-69-1, 227-247, Ekonomski fakultet u Rijeci, 2010.
- 4. (Westkämper, Spath, Constantinescu in Lentes, 2013).
- 5. Wildemann H., Entwicklungstrends in der Automobil- und Zulieferindustrie. znanstveni članek Razvojni trendi v avtomobilski in oskrbovalni industriji, Empirische Studie, TCW Transfer-Centrum, München, 2009.

- 6. Wiendahl H.-P., Erfolgsfaktor Logistikqualität. Vorgehen, Methoden und Werkzeuge zur Verbesserung der Logistikleistung, znanstveni članek Logistika kakovosti faktorja uspeha, 2.Auflage, Springer Verlag, Berlin, Heidelberg, New York, 2002.
- 7. Zelenika R., Upravljanje logističnim mrežama, poglavje Informacijske tehnologije čimbenik upravljanja logističkim mrežama, IBN 978-953-6148-59-2, 233–263, Ekonomski fakultet u Rijeci, 2007.
- 8. Nyhuis P., Wiendahl H.-P., Fundamentals of Productiom Logistics, Theory, Tools and Applications, znanstveni članek Osnove proizvodne logistike, teorija, orodja in aplikacije. Springer Verlag, Berlin, Heidelberg, 2009.
- Raspor, A., (2021), Od teorije organizacije do sistemizacije in organizacije dela, Perfectus, Svetovanje in izobraževanje, dr. Andrej Raspor s.p., Dolga Poljana, 2021, Pregledna monografija kot učbenik za dodiplomski in podiplomski študij, str. 33 – 60.
- 10. Bergmann, B., Samopodoba strokovne usposobljenosti. V J. Erpenbeck & L. von Rosenstiel (ur.), Handbuch der Kompetenzmessung,194-224, Stuttgart: Schaeffer-Poeschel, 2007.
- 11. Hartmann, E., Oblikovanje dela za industrijo 4.0: stare resnice, novi izzivi. V A. Botthoff in E. Hartmann. Prihodnost dela v industriji 4.0, str. 9-20, Berlin: Springer, 2015.
- 12. Schäfers-Hansch, C., Pogled v prihodnost nadaljnjega izobraževanja -Industrija 4.0 z vidika razvoja kadrov. V S. Franken (ur.), Industrie 4.0 in njeni učinki na svet dela,154-172, Aachen: stresalniki, 2015.
- Seitza, KF, Nyhuisa. P, Cyber-Physical Production Systems Combined with Logistic Models – A Learning Factory Concept for an Improved Production Planning and Control, The 5th Conference on Learning Factories, CIRP 32, 92-97. Gre za Učenje koncepta tovarne za izboljšano načrtovanje proizvodnje, 2015.
- 14. Mayer. A., Weigelt. M., Grimm.S., Erll. A., Potzel. M., Franke. J., methodology to analyze the functional and physical architectu, Lean 4.0 - A conceptual conjunction of lean management and Industry 4.0, 51st CIRP Conference on Manufacturing Systems, CIRP 72, 622-628. Gre za konceptualno povezavo vitkega upravljanja in industrije 4.0, 2018.
- 15. BMWi. (2016a). Mittelstand 4.0 Digitalni produkcijski in delovni procesi. http://www.mittelstand-digital.de/DE/Foerderinitiativen/mittelstand-4-0.html . Dostopno: 1. marec 2018.
- 16. Črešnjak. V., Bašič. M., Metode optimizacije proizvodnje »Kanban kot gradnik vitke proizvodnje«, diplomska naloga EPF, povzeta vsebina iz naloge, UNI Maribor, 2012.
- 17. De Lestrange, G., Ali HR oddelek upočasni digitalno preobrazbo? Upravljanje znanja, revija za menedžerje, 6/7, 34-36, 2017.
- 18. Murtič S., Franko Uhernik I., 3. mednarodna znanstvena konferenca razvoja industrijskega inženiringa, Priložnosti, potenciali in izzivi, Fakultete za

industijski inežniring Otočec, Roboti v funciji izvajanja logistike, Zbornik člankov, 17, 2018.

- 19. Murtič, S., Jankovič, P. (2018), Osnove gospodarskega prava v logistiki, Arema, Visoka šola za regionalni menedžment, Rogaška Slatina, Učbenika za dodiplomski in podiplomski študij, uporabno v celoti.
- 20.Jankovič, P., Murtič, S., (2019), Osnove pogodbenega prava v logistiki, Arema, Visoka šola za regionalni menedžment, Rogaška Slatina, Učbenik za dodiplomski in podiplomski študij, uporabno v celoti.
- 21. Zelenika. R., Ekonomski fakultet u Rijeci, Prometni sustavi, tehnologija, organizacija, ekonomika, logistika i menedžment, poglavje Važnije značajke suvrmenih tehnologija transporta, ISBN 953-614-823-4, 407 491, 2001.
- 22. Božičnik, S., (2020), Transportna ekonomija, Univerza v Mariboru, Univerzitetna založba, Slomškov trg 15, 2000 Maribor, Slovenija, http://press.um.si, zalozba@um.si, znanstvena monografija, str. 69 -100.
- 23. Mehami. J., Nawi. M., Zhong. Y Z., Smart automated guided vehicles for manufacturing in the context of Industy 4.0, 46th SME North American Manufacturing Research Conference, NAMRC 46, Texas, USA, Manufacturing 26, 1077-1086. Gre za avtomatizirana vodena vozila za proizvodnjo, 2018.
- 24. (roboti v skladišču: http://www.bbc.com/news/technology-36702758).
- 25. Nieto, AM., Goop. V., From Factory of the Future to Future of the Factory: Integration Approaches, IFAC PapersOnLine 50-1 11695–11700. Razvoj tovarne prihodnosti Westkämper, D. Spath, C. Constantinescu and J. Lentes (ed.), Digitale Produktion. Berlin/Heidelberg, Germany: Springer Berlin Heidelberg,, znanstveni članek digitalna produkcija, 2013

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CIRCULAR ECONOMY AND ECO-INNOVATION INDICATORS AS INPUTS FOR EU SUSTAINABLE DEVELOPMENT STRATEGIES

Abstract:

The overall aim of the EU Sustainable Development Strategy was to identify and develop actions to enable the EU to achieve a continuous long-term improvement of quality of life through the creation of sustainable communities able to manage and use resources efficiently. Based on ecological and social innovations, circular economy, as an economic model that aims to keep resources in use for as long as possible by reducing waste, reusing products and materials, and recycling them at the end of their life, has substantial potential to improve policy strategies in the future. Major environmental challenges faced by many countries around the world could be

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mitigated with key benefits of a circular economy, helping to reduce waste and pollution. The European Union has recognized the importance of eco-innovations as a key driver of sustainable development and has implemented various policies and initiatives to implement the principles of circular economy in practice. Eco-innovation refers to the development and implementation of new technologies, products, and services that have a positive environmental impact while also contributing to economic growth. The subject of this paper is the analysis of the impact of measuring circular economy indicators on sustainable development goals for easier definition of sustainable development strategies and policies in developing countries. The goal of this work is to support the initiative of joint synergistic action of all actors based on the principle of the quintuple helix concept and to make contribution for initiating those actions at the local and regional levels.

Introduction

Measuring the impact of circular economy and eco-innovation on EU sustainable development strategies includes indicators which should identify areas where further action is needed for promoting and operationalizing sustainable development. In present time, we could form several groups of indicators:

- Environmental performance indicators: These indicators measure the environmental impact of eco-innovation, such as reductions in greenhouse gas emissions, water use, and waste generation.
- Economic indicators: These indicators measure the economic benefits of ecoinnovation, such as job creation, increased productivity, and reduced costs.
- Innovation indicators: These indicators measure the level of eco-innovation activity in the EU, such as the number of patents filed, research and development expenditures, and collaboration between businesses and research institutions.
- Policy indicators: These indicators measure the effectiveness of EU policies and initiatives in promoting eco-innovation, such as the number of projects funded, the uptake of eco-innovation by businesses, and the level of public awareness.

With the respect of the main purpose of our conference and its practical nature, aim of this paper will be to create a brief overview of impacts of circular economy on sustainable development strategies as a foundation for discussion arising from different perspectives: social impact of eco-innovations, economic impact of ecoinnovations, technology impact of eco-innovations, the impact of eco-innovations on the natural environment. The impact of eco-innovations on natural environment is one of the leading points of the reasons for criticism, by authors and individuals who are restrained or even opposed. The concept of circular economy (CE) is increasingly attracting the attention of companies and the academic community and policy makers as a practical approach to solving current sustainability challenges, transforming the linear model of production and consumption, which takes place according to the "take-use-discard", into a circular form of resource management¹⁷. In the continuation of the work, we will also, briefly refer to the criticisms of this way of understanding the necessary concept for enabling improvements in the functioning of human civilization that will not endanger nature on the planet Earth. This paper brings evidence and foundation on the impact for the promotion and actualization of Circular Economy and its measurement tools. Inspired by the quintuple helix logic on local and regional levels we could have brighter picture for analysis of sustainable development strategies and its formation in the future. The structure of the paper supports a reasonable discussion on the following sub-topics: Innovation ecosystems based on the quintuple helix model, circular economy, quintuple helix model and eco-innovation indicators as important inputs for EU sustainable development strategies, possibilities and availability of measurements according to CE definition and CE strategies, conclusions and implications for further research.

1. Innovation ecosystems based on the quintuple helix model

Eco-innovation in companies leads to reduced costs, improves capacity to capture new growth opportunities and enhances their reputation among customers. Ecoinnovation is therefore a powerful instrument to protect the environment with a positive impact on the economy and society. The Eco-innovation Scoreboard gathers data on eco-innovation performance across the EU and beyond, thus helping to monitor and evaluate progress made since 2010.¹⁸

Eco-innovation, by reducing impacts on the environment, increasing resilience against external pressures and using resources more efficiently, is vital in supporting this transition to a circular economy and achieving the objectives of the European Green Deal. The EU's 8th Environment Action Programme supports the

¹⁷ Vukadinovic, S. (2022), Circular economy and employment in the European Union, monograph, University Educons.

¹⁸ https://green-business.ec.europa.eu/eco-innovation_en

environment and climate action objectives of the European Green Deal by accelerating the transition to a regenerative economy that gives back to the planet more than it takes, in particular "through continuous innovation, adaptation to new challenges and co-creation". The <u>biennial thematic report</u> presents good practices, drivers and challenges for eco-innovation to support a circular industrial transformation. This approach is in contrast to the traditional linear economy, where resources are extracted, used, and then discarded.

As highlighted in the author's work Del Vecchio et al.,¹⁹ the environmental sustainability dimension is well recognized in the innovation ecosystems debate,²⁰ such as in the quintuple helix model through the helix of natural and environmental transitions, ²¹ ²² ²³ the research in this field has failed to understand how innovation ecosystems can support the development of value creation processes in line with the Circular Economy principles.

The shift towards a circular perspective in the debate on the innovation ecosystem is coherent with the nonlinear innovation model depicted by author <u>Leydesdorff</u>²⁴ in the analysis of society as a knowledge-based context in continuous transformation originating from the advancement of technology and science. By focusing on the Circular Economy, the eco-innovation ecosystems can offer an important contribution to the operationalization and implementation of sustainable development strategies, based on relevant eco-indicators and inspired by

¹⁹ Pasquale Del Vecchio, Giuseppina Passiante, Grazia Barberio, Carolina Innella, Digital Innovation Ecosystems for Circular Economy: the Case of ICESP, the Italian Circular Economy Stakeholder Platform, International Journal of Innovation and Technology Management, Vol. 18, No. 01, (2021). <u>https://doi.org/10.1142/S0219877020500534</u>

²⁰ Etzkowitz, H. and Ranga, M. [2015] Triple helix systems: An analytical framework for innovation policy and practice in the knowledge society. Entrepreneurship and Knowledge Exchange. Routledge, London, pp. 117–158.

²¹ Grundel, I. and Dahlström, M. [2016] A quadruple and quintuple helix approach to regional innovation systems in the transformation to a forestry-based bioeconomy. Journal of the Knowledge Economy, 7, 4, 963–983.

²² Romano, A., Passiante, G., Del Vecchio, P. and Secundo, G. [2014] The innovation ecosystem as booster for the innovative entrepreneurship in the smart specialization strategy. International Journal of Knowledge-Based Development, 5, 3, 271–288.

²³ Carayannis, E. G. and Campbell, D. F. [2009] Mode 3 and quadruple helix: Toward a 21st century fractal innovation ecosystem. International Journal of Technology Management, 46, 3–4: 201–234

²⁴ Leydesdorff, L. [2012] The triple helix, quadruple helix,, and an N-tuple of helices: Explanatory models for analyzing the knowledge-based economy? Journal of the Knowledge Economy, 3, 1: 25–35., Leydesdorff, L. [2013] N-Tuple of Helices. Encyclopedia of Creativity, Innovation, and Entrepreneurship. Springer, New York, pp. 1400–1402.

sustainability principles required by the Circular Economy and quintuple helix model.

The quintuple helix model promotes environmental sustainability that presents interesting points of contact with other well-debated issues such as ecosystem services. This approach to ecological economics is focused on understanding nature and the environment's value in the decision-making process²⁵. It also allows identifying innovative ideas and solutions for environmental management and sustainability²⁶. Despite the topic of innovation being intrinsically linked to the Circular Economy paradigm, the comprehension of its meaning and dynamics in innovation systems is marginally explored.

Supported by the author Gemma Durán – Romero et al.²⁷ the concept of Circular Economy (CE) emerged aiming to increase the resource use efficiency and minimize resource inputs, waste and emissions generation. However, the contribution of CE eco-innovations to climate change mitigation goals, pushed by the Quintuple Helix Model (QHM) actors, is still unknown. Climate change represents an increasing threat to society and demands collaborative actions for changing technologies, production methods, and consumption. This analytical review intends to fulfil this gap by investigating the main elements of the QHM that contribute to CE ecoinnovations, namely companies, government, society, academia, and the natural environment. An analytical framework and theoretical propositions for future research are proposed. Eco-innovation technologies from energy, waste, transportation, construction and manufacturing sectors are discussed. Practical recommendations and implications for policymakers associated with CE and climate change policies and their interrelationship in terms of eco-innovations are also provided. Also in different perspectives of social, economic and environmental impacts, we must investigate the main characteristics and ways that a eco-

²⁶ Evans, N. M. [2019] Ecosystem services: On idealization and understanding complexity. Ecological Economics, 156, 427–430

https://doi.org/10.1016/j.techfore.2020.120246

²⁵ Rau, A. L., von Wehrden, H. and Abson, D. J. [2018] Temporal dynamics of ecosystem services. Ecological Economics, 151, 122–130.

²⁷ Gemma Durán - Romero, Ana M. Lopez, Tatiana Beliaeva, Marcos Ferasso, Christophe Garonne, Paul Jones, Technological Forecasting and Social Change, <u>vol. 160</u>. Bridging the gap between circular economy and climate change mitigation policies through eco-innovations and Quintuple Helix Model.

innovations as a basics of future industry, way of living and human communities in general can support the creation of sustainable development strategies for the achievement of goals related to the circular economy. Environmental, economical and social implications of circular economy concept highlight the need for active involvement of users and their encouragement of more sustainable and responsible behaviors ²⁸.

2. Circular economy, quintuple helix model and eco-innovation indicators as important inputs for EU sustainable development strategies

Circular economy and eco-innovation indicators can be important inputs for EU Development strategies as they provide valuable information on the progress and impact of policies and initiatives related to sustainable development.

Some examples of circular economy indicators that can be used include:

- Resource productivity: This indicator measures the amount of economic output generated per unit of material input. A higher resource productivity indicates that the economy is using resources more efficiently.
- Recycling rates: This indicator measures the percentage of waste that is recycled. Increasing recycling rates can reduce the amount of waste sent to landfill and promote the reuse of resources.
- Circular design: This indicator measures the proportion of products and services designed with circularity in mind, such as the use of recyclable materials and the ease of disassembly for repair or recycling.
- Circular business models: This indicator measures the adoption of circular business models, such as product-as-a-service, remanufacturing, and sharing platforms.
- Some examples of eco-innovation indicators that can be used include:
- Green patent applications: This indicator measures the number of patent applications related to environmental technologies and innovations.
- Eco-innovation investments: This indicator measures the level of investment in eco-innovation activities, such as research and development and the adoption of new technologies.

²⁸ Urbinati, A., Chiaroni, D. and Chiesa, V. [2017] Towards a new taxonomy of circular economy business models. Journal of Cleaner Production, 168, 487–498.

- Eco-innovation performance: This indicator measures the environmental and economic benefits of eco-innovation, such as reductions in greenhouse gas emissions and improvements in resource efficiency.

By monitoring these indicators, policymakers can assess the effectiveness of their policies and initiatives and identify areas where further action is needed to promote sustainable development. This information can then be used to inform the development of EU Development strategies and ensure that they are aligned with the goals of a circular and sustainable economy.

As mentioned in paper signed by authors Arsova et al.²⁹ an important but unexplored research issue is understanding how digital innovation ecosystem and a quintuple helix model can support the promotion of Circular Economy. They presented the evidence of a single and extreme case study related to the Italian Circular Economy Stakeholder Platform (ICESP). This is shown as good practice of a digital platform for stakeholders' engagement, supporting the creation of a digital innovation ecosystem focused on the Circular Economy.

3. Possibilities and availability of measurements according to CE definition and CE strategies

Assessment of direct and indirect effects of the circular economy can rely on direct and indirect indicators when data is unavailable. However, it is difficult to define what direct or indirect mean. For further addressing the problem authors Moraga et al., proposed that "indicators may be direct or indirect in relation to the definition in sensu stricto or latu". Circular economy indicators can be classified into three measurement types:³⁰

• a) Direct CE with Specific Strategies: indicators can focus on one or more identifiable CE strategies, *e.g.* Recycling Rate³¹ is specific to materials.

²⁹ Sanja Arsova, Andrea Genovese, Panayiotis H. Ketikidis, Josep Pinyol Alberich, Adrian Solomon, Implementing Regional Circular Economy Policies: A Proposed Living Constellation of Stakeholders

Sustainability 2021, 13(9), 4916; https://doi.org/10.3390/su13094916

³⁰ Gustavo Moraga, Sophie Huysveld, Fabrice Mathieux, Gian

Andrea Blengini, Luc Alaerts, Karel Van Acker, Steven de Meester, <u>Jo Dewulf</u>, Circular economy indicators: What do they measure?, <u>Resources, Conservation and Recycling</u>, <u>vol. 146</u>, 2019, p. 452-461.

³¹ <u>Graedel et al., 2011</u> T.E. Graedel, J. Allwood, J.

P. Birat, M. Buchert, C. Hagelüken, B.K. Reck, S.F. Sibley, G. Sonnemann, What do we know

- b) Direct CE with Non-specific Strategies: indicators always focus on more than one strategy, and it is not possible to recognise the explicit strategies, *e.g.* water withdrawal³².
- c) Indirect CE: indicators may evaluate aspects of CE strategies but with the use of <u>ancillary</u> approaches to assess CE, *e.g.* the indicator 'Eco-innovation index' form the Resource Efficiency Scoreboard³³ (EC, 2016) rank European countries in relation to eco-innovation factors; the indicator may provide information on CE, but it is not direct to a CE definition.

By designing products and materials with reuse and recycling in mind, policymakers can help to reduce the amount of waste generated and minimize the environmental impact of consumption. In addition, a circular economy can also create new economic opportunities and jobs in areas such as repair, remanufacturing, and recycling. This can help to drive economic growth while also reducing the strain on natural resources.

Overall, by incorporating circular economy principles into policy strategies, policymakers can help to address a range of environmental and economic challenges while also promoting sustainable development.

Although there are numerous critiques³⁴ addressed to the circular economy and circular business models, claiming that the circular economy has diffused limits, unclear theoretical grounds, and that its implementation faces structural obstacles. Circular economy is based on an ideological agenda dominated by technical and economic accounts, which brings uncertain contributions to sustainability and depoliticizes sustainable growth.

Critics of the circular economy concept have raised several concerns regarding its implementation in practice. Some of the common criticisms include (Table 1): Table 1: Points of critics of the circular economy concept

about metal recycling rates? J. Ind. Ecol., 15 (2011), pp. 355-366, <u>10.1111/j.1530-</u> <u>9290.2011.00342.x</u>

³² <u>Geng et al., 2012</u> Y. Geng, J. Fu, J. Sarkis, B. Xue Towards a national circular economy indicator system in China: an evaluation and critical analysis J. Clean. Prod., 23 (2012), pp. 216-224, <u>10.1016/j.jclepro.2011.07.005</u>

 ³³ <u>EC, 2016</u>, EU Resource Efficiency Scoreboard 2015 European Commission (2016)
 ³⁴ Hervé Corvellec, Alison F. Stowell, Nils Johansson (2021), Critiques of the circular economy, Journal of Industrial Ecology, Wiley. https://doi.org/10.1111/jiec.13187

Lack of concrete action	Circular economy is often discussed in theory, but there
	is a lack of concrete action to implement it. They argue
	that many of the policies and initiatives are not
	enforced, and there is a lack of accountability for
	businesses that do not follow circular principles.
Limited scope	Circular economy only focuses on the end-of-life stage
	of products and materials and does not address the full
	lifecycle. Circular economy should also consider the
	extraction, production, and distribution stages to
	ensure that resources are used sustainably from the
	beginning.
Technical challenges	Implementing a circular economy requires significant
	technical expertise and investment, which may be
	difficult for small businesses and developing countries.
	There is a need for more research and development to
	develop new technologies and solutions that can enable
	a circular economy
Limited impact	Circular economy may have limited impact on the
	overall economy and environment. Circular economy
	may only address a small portion of the environmental
	challenges faced by society, and that broader systemic
	changes may be needed to achieve with more practical
	sustainable development strategies

Source: Authors consideration

Despite these criticisms, proponents of the circular economy argue that it is a necessary shift towards a more sustainable and resilient economy. The circular economy has the potential to create new economic opportunities and jobs, reduce waste and pollution, and promote sustainable consumption and production patterns.

Under a circular economy, materials from products at the end of their lifecycle are recovered through dismantling and recycling and consequently re-injected into the beginning of the product lifecycle, thereby reducing environmental impacts and production costs. Recycling is therefore a necessary precondition for a circular economy – resources and materials are recycled, returned back to the economy and used again. However, to maximise the effectiveness of recycling and the economic potential of secondary raw materials, eco-innovation is key. Eco-innovation allows for the possibility to transform waste into a valuable resource through the development of new technologies, processes, services and business models. SMEs, including a qualified workforce working in eco-industry sectors related to recycling, repair, and reuse are therefore a necessary contribution to the circular economy and act as vectors for boosting the recycling and reuse market.³⁵ By analyzing these indicators, policymakers can assess the impact of eco-innovation on EU development strategies and identify areas where further action is needed to promote and operationalize sustainable development.

Conclusion

By the Sofia Declaration on the Green Agenda for the Western Balkans from 2020, the countries of the Western Balkans have undertook to implement measures in the field of climate 4 change and pollution prevention, energy development, transport and circular economy, as well as biodiversity development, sustainable agriculture and food production.³⁶

Capacities are insufficiently developed at the local level, but there are also large differences in economic power in different regions in Serbia. The time frame and respect for the time frame by the executive authority and agility in the creation of public policies can greatly contribute to the acceleration of the transition and the stimulation of the economy towards new investments. The infrastructure and economic justification for business connections between companies is insufficiently developed. Insufficient industry knowledge of new business models and sources of industry financing to change the way of doing business in the context of the circular economy. It is necessary to change the resource policy in such a way that the state will influence the preservation of natural resources through various measures and

³⁵ Asel Doranova, Laura Roman (Technopolis Group, Belgium) Bettina Bahn-Walkowiak, Henning Wilts, Meghan O'Brien (Wuppertal Institute for Climate, Environment, Energy, Germany) Stefan Giljum (Vienna University of Economics and Business, Austria) Mary Ann Kong, Mathieu Hestin (BIO by Deloitte, France), Policies and Practices for Eco-Innovation Uptake and Circular Economy Transition EIO bi-annual report November 2016

³⁶ Simonida Vukadinović, 2022, Circular economy in the Western Balkans countries, Proceedings International Conference "The circular economy: "the number one priority" for the European Green Deal", September 19-21, Sremska Kamenica, Novi Sad, Republic of Serbia.

emphasize through public policies the sustainable reuse of already used resources and materials.³⁷

In order to overcome the debates about the economic profitability and justification of the circular economy and what science teaches us that the output of these energy sources is questionably small in relation to energy needs, measuring the results as precisely as possible and recording the good and bad sides implemented in practice can only help with people's awareness. As it is extremely difficult to change human consciousness, even if it is obvious that the individual or group is doing something to the detriment of himself and his environment, we are left with - measurement and precise information about the effect of the circular economy.

Literature:

- Gemma Durán Romero, Ana M. Lopez, Tatiana Beliaeva, Marcos Ferasso, Christophe Garonne, Paul Jones, Technological Forecasting and Social Change, <u>vol. 160</u>. Bridging the gap between circular economy and climate change mitigation policies through eco-innovations and Quintuple Helix Model. <u>https://doi.org/10.1016/j.techfore.2020.120246</u>
- Pasquale Del Vecchio, Giuseppina Passiante, Grazia Barberio, Carolina Innella, Digital Innovation Ecosystems for Circular Economy: the Case of ICESP, the Italian Circular Economy Stakeholder Platform, International Journal of Innovation and Technology Management, Vol. 18, No. 01, (2021). <u>https://doi.org/10.1142/S0219877020500534</u>
- Sanja Arsova, Andrea Genovese, Panayiotis H. Ketikidis, Josep Pinyol Alberich, Adrian Solomon, Implementing Regional Circular Economy Policies: A Proposed Living Constellation of Stakeholders, Sustainability 2021, 13(9), 4916; <u>https://doi.org/10.3390/su13094916</u>
- 4. Asel Doranova, Laura Roman (Technopolis Group, Belgium) Bettina Bahn-Walkowiak, Henning Wilts, Meghan O'Brien (Wuppertal Institute for

³⁷ Circular economy course in University Educons new curriculum with best practice case study firm Biofor System in eco-innovations, Jelena Jesic, Simonida Vukadinović, Proceedings International Conference "The circular economy: "the number one priority" for the European Green Deal", September 19-21, 2022, Sremska Kamenica, Novi Sad, Republic of Serbia.

Climate, Environment, Energy, Germany) Stefan Giljum (Vienna University of Economics and Business, Austria) Mary Ann Kong, Mathieu Hestin (BIO by Deloitte, France), Policies and Practices for Eco-Innovation Uptake and Circular Economy Transition EIO bi-annual report November 2016

- Gustavo Moraga, Sophie Huysveld, Fabrice Mathieux, Gian Andrea Blengini, Luc Alaerts, Karel Van Acker, Steven de Meester, <u>Jo Dewulf</u>, Circular economy indicators: What do they measure?, <u>Resources, Conservation and Recycling</u>, <u>vol. 146</u>, 2019, p. 452-461.
- 6. <u>Graedel et al., 2011</u> T.E. Graedel, J. Allwood, J.
 P. Birat, M. Buchert, C. Hagelüken, B.K. Reck, S.F. Sibley, G. Sonnemann, What do we know about metal recycling rates? J. Ind. Ecol., 15 (2011), pp. 355-366, <u>10.1111/j.1530-9290.2011.00342.x</u>
- <u>Geng et al., 2012</u> Y. Geng, J. Fu, J. Sarkis, B. Xue Towards a national circular economy indicator system in China: an evaluation and critical analysis J. Clean. Prod., 23 (2012), pp. 216-224, <u>10.1016/j.jclepro.2011.07.005</u>
- 8. <u>EC, 2016</u>, EU Resource Efficiency Scoreboard 2015 European Commission (2016)
- 9. Vukadinovic, S. (2022), Circular economy and employment in the European Union, monograph, University Educons.
- 10. Jelena Jesic, Simonida Vukadinović, 2022, Circular economy course in University Educons new curriculum with best practice case study firm Biofor System in eco-innovations, Proceedings International Conference "The circular economy: "the number one priority" for the European Green Deal", September 19-21, Sremska Kamenica, Novi Sad, Republic of Serbia.
- 11. Simonida Vukadinović, 2022, Circular economy in the Western Balkans countries, Proceedings International Conference "The circular economy: "the number one priority" for the European Green Deal", September 19-21, Sremska Kamenica, Novi Sad, Republic of Serbia.
- Hervé Corvellec, Alison F. Stowell, Nils Johansson (2021), Critiques of the circular economy, Journal of Industrial Ecology, Wiley. https://doi.org/10.1111/jiec.13187

Acknowledgement:

[&]quot;The research was supported by the Science Fund of the Republic of Serbia, Grant No. 303, Circular economy as a model of development that forms a new identity of the Republic of Serbia - EDUCIRC2022".

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CIRCULAR ECONOMY AS A PATHWAY TO SUSTAINABLE ECONOMIC GROWTH AND DEVELOPMENT

Abstract:

Circular economy (CE), as a concept of sustainable development, is a topic that is gaining more and more importance, especially in the last few years, that is, since the beginning of the war in Ukraine and the energy crisis, when the concept of green transition is gaining momentum. There is a great need for a circular economy in the world, with recycling being considered the leading instrument of this model of economy. As one of the newer economic paradigms, the circular economy is becoming imperative for achieving sustainable economic growth and development. Respecting the importance of this topic, the aim of our student work will explore the concept of the circular economy, its advantages, and how it can be applied, with special emphasis on Serbia. The paper is conceived in three parts. The first part is based on the analysis of the essence, principles, and advantages of the circular economy. The second part presents the application of the circular economy concept in various branches of the economy and business. The third part focuses on the circular economy in the Republic of Serbia and roadmap for its implementation. **Keywords**: circular economy, sustainable development, Serbia

Introduction

In the 21st century, global economic growth and technological advancement have led to the rapid depletion of natural resources, environmental pollution, and climate change. This unsustainable way of life has led to a call for a more sustainable and circular economy that seeks to reduce waste, conserve resources, and minimize pollution. In modern business, which is characterized by major economic,

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technological and environmental changes, the circular economy (CE) plays a significant role. The concept of circular economy as a paradigm of sustainable development takes into account the issue of waste management, its further recycling and the real new value that multiplies the company's further continuation of the product's life cycle. By actors in the circular economy, that are companies, consumers, citizens and representatives of non-governmental organizations. Also, states are considered a critical supporter of CE implementation.

The circular economy is an economic model that seeks to retain the value of products and materials in the economy for as long as possible, while reducing waste and pollution. The circular economy seeks to keep resources in use for as long as possible. This is achieved by designing products and services with durability, reuse, and recycling in mind. The circular economy means a departure from the traditional linear economic model, which is based on the principle of take-make-use-dispose. This model relies on large quantities of cheap, readily available materials and energy. In contrast, the circular economy model is based on a closed-loop system that aims to create economic, social, and environmental benefits.

The circular economy model is based on three principles: design out waste and pollution, keep products and materials in use, and regenerate natural systems. The first principle seeks to eliminate waste and pollution by designing products and processes that minimize waste and pollution. The second principle aims to keep products and materials in use for as long as possible by promoting reuse, repair, and recycling. The third principle seeks to regenerate natural systems by promoting ecosystem restoration and the use of renewable resources.

1. Advantages and challenges of the circular economy

The circular economy offers several advantages compared to the linear economic model. The first benefit is the reduction of waste and pollution. The circular economy aims to design out waste and pollution, resulting in a cleaner environment and reducing the negative impact of waste on human health. The second advantage is the preservation of resources. The circular economy seeks to keep products and materials in use for as long as possible, reducing the demand for natural resources and preserving them for future generations. The third benefit is the creation of new economic opportunities. The circular economy creates new jobs in the recycling, repair, and refurbishment industries. Additionally, the circular economy can help promote innovation and collaboration. By working together to develop new solutions and sharing resources, businesses can overcome challenges and find new ways to reduce waste and preserve resources. This can help drive innovation and promote a more sustainable future.

The development of the circular economy plays a significant role in the fight against climate change, and it has numerous benefits. This form of economy in which materials and resources circulate, aiming for zero waste, has many advantages over the linear model, including:

- 1. Protection of resources and the environment
- 2. Energy savings
- 3. Reduction of unemployment
- 4. Promotion of innovation and increased competitiveness

These benefits have been recognized by the European Commission, which adopted the "zero waste" program three years ago. This program aims to increase recycling and prevent the loss of important resources, create jobs, drive economic growth and new business models, as well as reduce greenhouse gas emissions. Specifically, the goal of this program is to achieve 70% recycling of municipal waste and 80% recycling of packaging waste by 2030. The Commission estimates that the circular economy could save businesses in the European Union a total of 600 billion euros.

Strategic management is a field of management that helps companies carefully evaluate circular economy-inspired ideas and firmly separate and explore where circularity seeds can be found or integrated. Previous research has identified that strategic development for circularity can be a challenging process for companies, requiring multiple repeated strategic cycles. The book Strategic Management and the Circular Economy defined circular economy for the first time as a strategic decision-making process that covers the phases of analysis, formulation, and planning. Each phase is supported by frameworks and concepts popular in management consulting - such as the idea tree, value chain, VRIE, Porter's five forces, PEST, SWOT, strategic clock or internationalization matrix - all adapted through a circular economic lens. Although still to be tested, it is claimed that all standard tools for strategic management can and should be calibrated and applied to the circular economy. Although the circular economy offers many advantages, there are also challenges for the implementation of this system on a large scale. One of the biggest challenges is changing consumer behaviour. Consumers are accustomed to traditional linear economies, where products are used and then discarded, and it can be difficult to convince them to accept a new way of thinking. This is particularly true in countries where consumerism is deeply rooted in the culture. Another challenge is the lack of infrastructure and support systems for the circular economy. In many cases, companies need to invest in new technology and infrastructure to enable reuse, repair, and recycling of products. This can be expensive and timeconsuming, and it may take some time before these investments pay off. Finally, there is the challenge of coordination and collaboration across different industries and sectors. The circular economy requires a high degree of collaboration and coordination between companies, governments, and other stakeholders, and this can be difficult to achieve in practice.

2. Adoption and implementation of the circular economy concept by industries

Sustainability in business, which can be achieved through the application of a circular economy, is becoming an imperative today, a matter of competitiveness, social and environmental responsibility, and ultimately perhaps survival. As the concept of circular economy gains importance, more and more sectors in the economy have modalities in which they apply it. Some examples are as follows:

• Textile Industry

Circular economy within the textile industry refers to the practice of constantly recycling clothes and fibers, reintroducing them into the economy as much as possible, rather than ending up as waste. Circular textile economy is a response to the current linear model of the fashion industry, "where raw materials are extracted, turned into commercial goods, then bought, used and ultimately discarded by consumers." The documentary film about the fashion world, The True Cost (2015), explained that in fast fashion "unsafe conditions and factory disasters are justified by the necessary jobs they create for people with no alternative." It is argued that by adopting circular economy practices, the textile industry can transform into a sustainable business.

• Construction industry

The construction sector is one of the largest generators of waste in the world. Circular economy emerges as a useful solution for reducing the industry's impact on the environment. Construction is very important for the economy of the European Union and its member states. It provides 18 million direct jobs and contributes about 9% of the EU's GDP. The main causes of the impact of construction on the environment are found in the consumption of non-renewable resources and the production of pollutants, which are increasing at an accelerated pace.

• Furniture industry

When it comes to the furniture industry, most products are passive durable products, and therefore implementing strategies and business models that extend the lifespan of products would typically have lower environmental impacts and lower costs. The EU has identified huge potential for implementing a circular economy in the furniture sector. Currently, out of 10 million tons of annual discarded furniture in the EU, most ends up in landfills or is incinerated. There is a potential increase of 4.9 billion euros in gross value added by transitioning to a circular model by 2030.

• The oil and gas industry

The rise of the circular economy within the oil and gas industry is very poor, the opportunity for circularity has never been more apparent, or possible, than when equipment is being decommissioned. Hundreds of thousands of tons of waste are returned to shore for recycling. Unfortunately, this equates to equipment that is perfectly fit for continuous use being disposed of. Over the next 30-40 years, the oil and gas sector will need to decommission 600 installations in the UK alone.

• Renewable energy industry

The energy resources of oil and gas are not in line with the idea of a circular economy, given that they are defined as "development that meets the needs of the present without compromising the ability of future generations to meet their own needs." A circular economy can only be powered by renewable energies such as wind, solar, hydro, and geothermal.

Today, a large number of international companies and successful brands have introduced into their operations some of the principles and practices of the circular economy, which achieves sustainability in business. Representative example of a brand that uses circular economy system is **o**ne of the world's largest
brands "Adidas". They are committed to recycling their shoes and strive to reduce any form of pollution that affects the planet. On their website, various information can be found about what they plan to do and what they are already doing to improve the quality of life. Some of the steps they plan to take are:

• By 2024, they plan to replace raw polyester with recycled materials

• By 2025, they are committed to reducing carbon dioxide emissions by an average of 15% per product

• By 2030, they plan to reduce combined greenhouse gas emissions from retail, operations, and suppliers by 30%

The main factors that contribute to the creation of increasing amounts of waste are two phenomena: frequent innovations and poor product quality. Waste is also generated when there is a mismatch between the lifespan of a product and its useful life, or when the useful life is shorter than the lifespan. Frequent innovations are precisely the reason why some products are not used for a long period. The best example of this is the mobile phone. The world's largest manufacturers introduce new models almost every year, even though the old ones are still more than functional. By creating demand, discarded devices pile up. To avoid waste, waste prevention is essential in the circular economy. Prevention is achieved by designing products to have a longer lifespan, while containing eco-friendly materials that are not harmful and parts that can be easily repaired, replaced, or recycled.

3. Serbia in transition towards circular economy

The Roadmap for the Circular Economy in Serbia is a process that aims to familiarize, promote, and connect recognized actors who, with their knowledge, innovation, and creativity, can contribute to a faster transition to a circular economy. This document is a guide to transitioning to a circular economy model that focuses not only on profit but also on environmental protection and resource preservation. The economic, social, and environmental dimensions are equally important.

The goal of the Roadmap is to stimulate production through the application of circular business models, motivate industry to create new jobs, and improve business performance by finding innovative sustainable solutions for markets. This document aims to encourage society towards systemic changes in thinking, culture, and resource relationships, as well as to encourage decision-makers to commit to changes in public policies and dialogue in the context of a circular economy. This document guides a process that provides an opportunity for all stakeholders to engage in open dialogue and joint solution creation for a more efficient and faster transition.

In Serbia, there are currently more than 3,000 illegal landfills. Currently, less than 10% of waste is recycled, and the current goal is to increase this percentage to a minimum of 50% by 2030 through laws and bylaws, which would provide an opportunity for 30,000 new jobs. The circular economy would give Serbia a great chance for a second chance. Circular economy is a regenerative economic model that positively impacts all types of capital: financial, human, social, and natural. Its goal is to regenerate devastated natural resources, retain materials in use, and extend the life cycle of products by applying appropriate design that allows products to not become waste and contribute to pollution at the end of their life cycle. Global trends are moving towards replacing deeply embedded linear economy and waste management with circular economy. Circular economy also implies protection of human rights through sustainable development, global natural resource security, combating climate change, energy security, ensuring sufficient food quantities, reducing inequalities, more transparent public finances and social security of citizens, preserving health and cleaner environment, and the rights of future generations to resources.

In today's world, we are faced with numerous global challenges such as fighting climate change, extinction of plant and animal species, endangered ecosystems, continuous growth of waste, pollution, and depletion of natural resources as a result of climate change and pollution. The circular economy can play a significant role in addressing the climate crisis and achieving UN climate goals, but a fundamental change in the global approach to fighting climate change is necessary.

The European Commission has prioritized cleaner technologies, innovation, and research to reduce harmful gas emissions and achieve the ambition for Europe to become a global leader in the circular economy. The "European Green Deal" introduced a new Circular Economy Action Plan in March 2020, with a focus on sustainable resource use, particularly in the textile and construction sectors. Within the framework of the "European Green Deal," the European Commission will supplement the macroeconomic coordination process with a focus on economic and sustainable development to achieve citizens' well-being.

Member states of the European Union are required to align their national policies with new development strategies and public policies. Between 2014 and December 2018, 14 out of 28 countries developed either a strategy, a roadmap or action plans for the transition to a circular economy. Some countries are even in the process of revising their initial strategic documents.

Improving business models and aligning business operations with the principles of circular economy in Serbia can greatly contribute to improving the competitiveness of national companies and addressing socio-economic issues. The Government of the Republic of Serbia's program for environmental protection development since 2017 has stated that environmental protection programs will be developed in accordance with circular economy principles that apply to infrastructure projects. The roadmap aims to:

• Provide information on the importance of transitioning to a circular economy, i.e. a new business model and conditions of competitiveness, opportunities for faster development of Serbia, and solving the problem of managing secondary raw materials, including waste, the need for resource and energy independence, and environmental safety.

• Identify sectors in which there is already a basis for the application of circular economy tools, without underestimating less developed sectors and traditional industries that will require more investment to transition to new production models.

• Identify key agents of change who can contribute to a faster transition to a circular economy through synchronized and joint activities.

The roadmap for Serbia presents different approaches to the reasons for transitioning to a circular economy, as well as economic models and possible ways to increase national productivity through new global trends in economic growth that lead to a reduction in the use of natural resources and negative impact on the environment.

Conclusion

In conclusion, the circular economy offers a promising vision for a more sustainable future. By keeping resources in use for as long as possible and minimizing waste, businesses can reduce their impact on the environment and create new economic opportunities. While there are challenges to implementing this system on a large scale, there is significant potential for the circular economy to become a more widespread and influential system in the future. As consumers, businesses, and governments work together to promote a more sustainable future, the circular economy is likely to play an increasingly important role in achieving this goal.

Circular economy is an approach used in economics to reduce the negative impacts of human activities on the environment and to ensure sustainable development. Circular economy processes involve reusing, renewing, and recycling products and materials, which means reducing the consumption of resources, energy, emissions, and waste. This reduces environmental pollution and improves people's quality of life.

In this paper, we have become familiar with the fact that circular economy is of great importance for sustainable development and environmental protection. We have studied various aspects of circular economy, such as product reuse, renewable energy sources, resource usage, and recycling. We have also analyzed the positive effects of implementing circular economy, which are directly related to environmental preservation and improvement of people's quality of life.

Literature and internet sources

- Ministry of Environmental Protection of the Republic of Serbia Circular Economy <u>https://www.ekologija.gov.rs/dokumenta/cirkularna-ekonomija/cirkularna-ekonomija</u>
- Časopis Industrija :: Cirkularna ekonomija priča o otpadu kao resursu
- <u>Šta je cirkularna ekonomija? | Žuti Okvir 2023 (nationalgeographic.rs)</u>
- <u>https://srda.rs/wp-content/uploads/2021/12/Program-razvoja-cirkularne-</u> <u>ekonomije-u-RS-za-period-2022-2024.-godine.pdf</u>
- <u>https://circulareconomy-serbia.com/stanje-cirkularne-ekonomije-u-srbiji-</u>
 <u>2021-2022</u>
- <u>https://balkangreenenergynews.com/rs/srbija-usvojila-program-razvoja-</u> <u>cirkularne-ekonomije-crna-gora-razmatra-nacrt-strategije/</u>
- <u>https://cirkularnaekonomija.org/</u>

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FORENSIC EXAMINATION AND FACTORS OF TRAFFIC ACCIDENTS

Abstract:

In the paper, we first described the definitions, categories and factors for the occurrence of road traffic accidents. Based on statistical information, we analysed the causes of traffic accidents. Most accidents occur because of excessive speed of vehicles. Traffic police officers generally investigate accident investigation in our region. In the most demanding cases, forensic experts or criminalists technicians provide professional assistance.

We focused on traffic accidents where participants died. It has been found that in traffic accidents with fatalities, many of the perpetrators are under the influence of alcohol. We also provided the results of the survey on the types of feelings of security of persons and suggested proposals.

Key words: traffic safety, traffic accidents, examination, alcohol.

1. Introduction

Drivers most often violate road traffic regulations with an unadjusted speed, the wrong side and direction of driving, alcoholism, inappropriate overruns and noncompliance with priority rules. Nakao and Tatara (2019) examined autopsy cases related to traffic accidents in Japan. The traffic accidents involving drug or alcohol use have emerged. They proposed the need to act against drivers who drive drunk, pedestrian who drive and drive under the influence of drugs. They also found that traffic accidents are not just caused by drunk drivers, but also by the careless behaviour of drunk pedestrians.

A traffic accident is one that occurs on a traffic surface, i.e. on a public road or an uncategorized (unclassified) road used for public road traffic ZPrCP (2021). At least

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Assoc. Prof. Dr. Matej Trapecar completed his PhD in 2010. In his doctoral thesis, he studied the usefulness of the biometric data for identity check of persons in traffic accident analysis and for improvement of traffic safety, and biometric identification. His fields of research include biometrics, forensics, logistics, traffic safety, work safety at work and ergonomics. He is an active member of international organisations ENFSI (European Network of Forensic Science Institutes and IAI (International Association for Identification).

one vehicle should be involved in the accident, causing property damage, injury to the participant or death. Traffic accidents can be divided by the location of the event, the time of the event, the consequences, the mode, the cause and the characteristics. According to the consequences, accidents fall into four categories:

- Category I; only property damage occurs, participants do not have to inform about the traffic accident. As well, a police officer who present an insignificant risk, which means that the cause of the accident is a misdemeanour punishable only by a fine, is not required to establish the facts and gather evidence.
- Category II; where at least one individual has suffered a minor injury.
- Category III; where at least one person has sustained serious personal injury.
- Category IV: when a person has died or died due to accident within 30 days of the accident.

In order to improve traffic safety, it is necessary to activate factors whose main impact is to reduce the danger. The danger of traffic accidents arising from the movement of vehicles and pedestrians can be shown as a state of factors that occur. Road traffic may be viewed from three perspectives if the potential reasons are examined: the person, the vehicle, and the road (Rotim, 1990, Tollazzi, 2001) (Figure 1). Three different systems are observed in the structure of road traffic: mechanical (vehicle - road; VR) and two biochemical (man - vehicle; DV) and (man - road; DR). The connection between the individual elements of the system is represented by either the driver, the vehicle, and the surroundings or the road. Within this context, there exists a feedback connection between the environment vehicle and driver - vehicle, while the connection between the two blocks environment - driver is irreversible (one-sided). The road is the most important within the surrounding system. The driver, as the first factor, operates the vehicle (the second factor) based on road information and their subjective assessment of external influences. In addition to the driver and the vehicle, the third factor is the road, and as a fourth, road traffic. In addition to these four factors, there are certain elements that occur suddenly in traffic, e.g. rocks on the road, oil and mud on the road. Because of this, another factor is needed for the final analysis, which is called the incident factor. This approach allows for the division of accident risk into five

factors: man (the human element), vehicle, road, road traffic and incident factor (Luburić, 2021).



Figure 1: Venn diagram Source: own.

2. Impact technical factors for road safety

Safety on the road can be affected by different traffic-related factors. The assessment and classification of these factors may differ among professionals, as stated by Rotim (1990) and Tollazzi (2001). All factors that have an impact on traffic safety are included, such as the driver's personality and physical abilities, the vehicle's stopping distance, stability in curves, speed, and the condition of the road. Additionally, the width of the driver's field of view is also a significant factor. The human being is the most crucial factor in road safety. When studying a driver's behavior and actions on the road, it's important to consider that the driver is part of a system that relies on information to make decisions and control the vehicle. Man also acts indirectly through the construction and upkeep of roads, the building of vehicles, the implementation of traffic laws, the education and guidance of road users, and other means. The main factors that affect individuals in road traffic are the driver's personal characteristics (as a pedestrian), their psychophysical characteristics, and their level of education and culture.

Human participation has a direct impact on road safety. Factors such as fatigue, alcohol, drugs, medication, illness, and permanent psychophysical abilities of the

driver can arise occasionally and affect safety. These factors are demonstrated before and during the driving test. Operating a vehicle requires significant demands on an individual's psychophysical abilities, particularly since the advancement of human psychophysical abilities lags behind the technological progress of road traffic. One of the fundamental issues is subjecting an individual to high velocity, considering the weight of the motor vehicle, also to high energy. Man can technically perfect the vehicle and build better road infrastructure, but he cannot go beyond a certain limit set by nature. The fact is that the demands of modern traffic often exceed human capabilities. Participation, especially driving a motor vehicle, must be subject to the maximum control consciousness of a person. Every moment of inattention can lead to minor or major danger. Human imperfections as a factor in traffic safety can be counteracted by adapting the vehicle and the traffic route and by creating other suitable conditions for safe traffic, but at the same time, it is necessary to adapt the person to the vehicle and traffic through education and raising awareness. It follows that in order to increase the safety of road traffic; the work must be aimed at adapting objective factors to the psychophysical abilities of people and adapting people to the requirements of modern road traffic. Certain rules need to be followed while participating in road traffic, which necessitates appropriate social behaviour. The behaviour of an individual is greatly influenced by their personality structure, which consists of various factors such as temperament, character, abilities, biological and sociological motives, attitudes, interests, adaptability, self-confidence, and decision-making skills.

3. Investigated scene of the traffic accident

Jackson, Jones, Booth, Champod, and Evett (2006) focused on the issues raised during the forensic examination and criminal investigation. The paper talks about the implementation of such questions based on expert opinions and about a model that provides the definition of the various rules in the light of helping forensic investigators both at the scene of the crime and other users of forensic science.

Investigation of a traffic accident in our region: ZPrCP (2021) requires police to arrive on the scene of accidents II, III, and IV. category, including any tasks to secure the location and to carry out the scene. The participants in the category one can

accept and complete the European road accident report form themselves and manage questions from the insurance company.

In the event that the police are informed of a traffic accident, or find out or come across it during their work, they must do everything necessary in the investigation process. Police officers must gather information in advance of the inspection, prepare for the crime scene, secure the scene, interview witnesses, and document the accident scene in writing and with pictures, search and secure mark tracks. Officers must complete the work with a final product, such as official notes, payment orders issued, reports to the prosecutor's office etc.

3.1. Traffic accident analysis

The number of deaths in road accidents today in most countries is a major factor in the total number of deaths. Statistics (Ministrstvo za notranje zadeve, Policija, 2022) show that in 2021, 424.445 violations occurred during road traffic control. 112 people died in traffic accidents, 5.218 people were injured physically. There were 11.720 traffic accidents with property damage.



Graph 1: Traffic accidents that result in fatalities in Slovenia Source: Ministrstvo za notranje zadeve, Policija, 2022.

The safety culture does not align with the expected standards of road traffic safety for the years 2012 to 2021. Although there has been a decrease in the number of people killed in traffic accidents from 2019 to 2020, the overall number remains high. Specifically, there were 87 fatalities in 2018, 91 in 2019, and 73 in 2020. In 2021, there was a surge in the number of accidents resulting in 112 fatalities (Graph 1). It is imperative to focus on enhancing awareness among road users through diverse media platforms to encourage responsible behaviour and greater accountability while driving.

Inappropriate speed and driving on the wrong side and in the wrong direction were identified as the most frequent causes of fatal traffic accidents. This is followed by violations of the right-of-way rules, improper overtaking, incorrect vehicle movements, insufficient safety distance, and irregularities regarding pedestrians.

In accidents involving injuries, the most common factors are improper speed and failure to follow right-of-way rules. Car drivers made up the majority of people who died in traffic accidents. Most fatal traffic accidents in 2021 took place on regional roads and in areas without a proper street network. The police officers ordered approximately 400.000 breathalysers (Alco testers) and conducted 1.071 professional examinations through their work. They detained 475 drivers until they became sober and temporarily revoked nearly 5.000 driving licenses.

The average level of alcohol intoxication among those who caused traffic accidents in 2021 was similar to that of previous years. In the last ten years, the percentage of fatal traffic accidents caused by alcohol is 33.3%, which ranks as the third highest share. The years 2020 and 2012 had higher shares of 37% and 34.4%, respectively. However, the year 2014 had the lowest share at 23.2%.



Graph 2: The proportion of alcohol-related drivers resulting in a fatal accident



3.2. Forensic examination or criminal technical investigation of the crime scene

Forensic examination or criminal technical investigation of the crime scene is the starting point for the successful use of physical or material evidence. The forensic laboratory and forensic technical investigators provide this examinations and investigations (James, Nordby, 2009, Chisum, Turvey, 2007). In court proceedings, where defense attorneys work to advocate for the defendants, there is a significant emphasis on effective management and thorough investigation. Each crime scene is unique (Dragač, 2000). By utilizing a logical and systematic approach alongside skilled and trained investigators, even the most challenging cases can be thoroughly investigated and successfully resolved.

In the field of forensic and criminal technical activities, it is necessary to ensure that the evidence is properly secured (ZNPPol, 2019). It is important to handle evidence properly and maintain its integrity at crime scenes, during house searches, during transport, and in laboratory work. In Slovenia, traffic police officers receive training in investigating traffic accidents. Forensic technicians only attend tours in rare cases, such as when there are multiple fatalities. The information in the paper is intended solely for forensic evidence purposes. The use of different methods in forensic investigations to examine secured evidence plays a crucial role in the investigation of criminal activities. The laboratory infrastructure allows for safe and skilled work and the utilization of accredited and globally recognized techniques. The National Forensic Laboratory received 5.639 inquiries and reports in 2021.

The National Forensic Laboratory conducts the following investigations or examinations: physical, chemical, biological and fingerprint examinations, as well as examinations of documents and money. Over the past few years, approximately 35,000 distinct samples have undergone analysis. Traffic accident forensic inquiries involve examining items such as paint, varnish, light bulbs, and, in the event of identifying the driver, fingerprints, biological evidence, etc. (Ministrstvo za notranje zadeve, Policija, 2022).

A road safety analysis survey was conducted (Ninamedia, 2021). There were 1,514 respondents in the sample. There were two questions regarding the well-being of road users on Slovenian roads and the approval of suggestions to enhance road safety. The respondents were asked to indicate, on a scale ranging from 1 to 5, their level of safety perception as a traffic participant on roads in Slovenia. Among those who use Slovenian roads, the majority of respondents (46.0%) rated their safety level as average (rating 3). Table 1 shows that 37.3% of respondents scored 4 and feel safe as a traffic participant. However, significant portions of respondents, accounting for 13.1%, do not feel safe or feel unsafe. Additionally, 3.1% of respondents feel completely safe.

Different categories of	Year	Year
safety emotions	2014	2021
I don't feel safe at all	3.6%	3.0%
I don't feel safe	8.1%	10.1%
I feel medium-safe	44.5%	46.0%

I feel safe	37.3%	37.3%
I feel completely safe	6.4%	3.1%
I don't know	0.1%	0.5%

Table 1: Frequency distribution of responses (compared to previous research – 2014)

Source: Ninamedia, 2021.

The respondents had access to multiple suggestions. (Table 2The proposals are expected to have an impact on improving road safety in the future. Overall, it can be observed that the proposed suggestions are highly favoured by the respondents. A proposal has been suggested to limit the highest speed permitted in towns and villages to 30 km/h. The majority of respondents (74.1%) were against this proposal. The majority of respondents (88.6%) are in favour of implementing alcohol locks for professional drivers.

Proposal		%		
		No	I don't	
			know	
Continuous sectional speed measurement on	56.9	35.0	8.1	
motorways and high-speed roads				
Lowering the permitted blood alcohol level to 0.0	54.0	39.3	6.7	
%0				
General speed limit in cities at 30 km/h	21.7	74.1	4.2	
Total ban on using the phone while driving (also	46.4	46.8	6.8	
hands-free)				
Installation of alcohol locks as a measure for	75.8	17.2	6.9	
drivers who have already driven under the				
influence of alcohol				
Installation of alcohol locks for professional drivers	88.6	7.7	3.7	
(transport of passengers, children)				
Mandatory cycling helmet for adults (bikes and e-	61.2	30.3	8.5	
scooters)				

No smoking while driving	58.3	31.4	10.3

Table 2: Proposals for respondents

Source: Ninamedia, 2021.

4. Conclusion

The movement of traffic from one point to another, known as point A to point B, has never been entirely safe and even today it remains unsafe. Akinori, Wang, and Kitano (2022) emphasized the emergency response system when comparing various road safety strategies. A shared conceptual framework was suggested for the advancement of road safety in the future. The framework encompasses a united vision, safety measures, secure systems, and a traffic safety culture.

The factors that contribute to road traffic accidents include human behavior, vehicle conditions, road conditions, traffic volume, and unexpected events. Inappropriate speed is the primary reason for traffic accidents. We have a significant number of drivers who are drunk and cause traffic accidents. Despite the existence of these facts, only 50% of individuals are in favour of a driver having a blood alcohol concentration of 0,0 ‰. The driver's culture and behaviour while driving are causing significant issues in our area. In contrast, promoting traffic safety and educating young individuals is more effective than implementing punishment-based strategies.

References

Akinori, M., Wang, A., Kitano, N. (2022). A conceptual framework for road traffic safety considering differences in traffic culture through international comparison. International Association of Traffic and Safety Sciences, Volume 46, Issue 1, 2022, pp. 3-13.

Chisum, W., Turvey, B., 2007. *Crime reconstruction*. USA: Academic press title. Dragač, R., 2000. *Tipični primeri ekspertiza saobračajnih nezgoda*. Beograd: Saobračajni fakultet. Jackson, G., Jones, S., Booth, G., Champod, C., Evett, I., 2006. The nature of forensic opinion – a possible framework to quide thinking and practice in investigation and in court proceedings. Science & justice, Volume 46, 2006, pp. 33-44.

James, S., Nordby, J., 2009. *Forensic science – an introduction to scientific and investigative techniques, 3rd ed.* Boca Raton: CRC Press.

Luburić, G. Sigurnost cestovnog i gradskog prometa I. URL: <u>https://files.fpz.hr/Djelatnici/gluburic/Luburic-predavanja-v3.pdf</u>. 13.4.2021.

Ministrstvo za notranje zadeve, Policija, 2022. Letno poročilo o delu policije 2021. URL: <u>https://www.policija.si/o-slovenski-policiji/statistika</u>

Nakao, K., Tatara, Y. (2019). An analysis of alcohol and drug intake in forensic autopsy of traffic fatalities. International Association of Traffic and Safety Sciences. Volume 43, Issue 2, 2019, pp. 75-78.

Ninamedia, 2021. *Varnost cestnega prometa v Sloveniji*. [Online]: <u>https://www.avp-</u> <u>rs.si/wp-content/uploads/2021/12/javnomnenjska-raziskava_varnost-cp-</u>

2021 december finalna.pdf [12.4.2023].

Rotim, F., 1990. *Elementi sigurnosti cestovnog prometa: Ekspertize prometnih nezgoda*. Zagreb: Znanstveni savjet za promet JAZU.

Tollazzi, T., 2001. *Varnost v cestnem prometu, verzija 2.0, zbrano gradivo*. Maribor: Fakulteta za gradbeništvo.

ZNPPol, Zakon o nalogah in pooblastilih policije. Uradni list RS, št. <u>15/13</u>, <u>23/15 –</u> <u>popr.</u>, <u>10/17</u>, <u>46/19</u> – odl. US, <u>47/19</u> in <u>153/21</u> – odl. US)

ZPrCP, Zakon o pravilih cestnega prometa. Uradni list RS, št. 156/21 – u.p.b. in 161/21 – popr.

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TOWARDS A CIRCULAR ECONOMY: TRENDS, OPPORTUNITIES, CHALLENGES AND PERSPECTIVE

Abstract:

Circular economy is a concept of sustainable economic development in 21 st century. Circular economy is a development strategy that implies that economic growth can be achieved without excessive use of resources, and considers waste as a resource, as objects of work in the subsequent production process. The circular economy is the antithesis of the current linear model of an economy based on uncontrolled exploitation of natural resources and flow of materials (factory user - landfill). The principle of the linear economy has a take-do-throw base, while the circular economy has a wider take-do-fix-reuse-recycle base. The aim of this work to explore the concept of the circular economy, its trends, opportunities, challenges and perspective, with evidence from Serbia. The paper have three parts. The first part is the analysis trends in the circular economy. The second part is about opportunities and challenges the circular economy. The third part focuses on development of the circular economy in Serbia, with some examples of circular economy implementation. In conclusion, final remarks about perspective of the circular economy are given.

Keywords: circular economy, sustainable development, Serbia

Introduction

The circular economy is recognized as an important tool for the green transition of the Republic of Serbia, which in recent years has been placed high on the list of priorities for the development of our society. The circular economy is an economic model that focuses on reducing waste and using resources in a sustainable way. Unlike the linear model of the economy, in which resources are used, waste is produced, and energy is used, and then these products are thrown away, the circular economy focuses on using resources more efficiently, reducing waste, and saving energy. used in a sustainable way. A circular economy uses the concept of a circular flow of resources, which means that materials, products, and components are used in a way that contributes to their reuse, repair, renewal, and recycling. This includes designing products that can be easily disassembled and recycled, as well as using renewable energy sources. The circular economy has the potential to create new market opportunities and business models and contributes to sustainable

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development and environmental protection. It is often considered one of the key responses to global challenges such as climate change, poverty reduction and biodiversity conservation. In the circular economy, companies focus on creating value in a way that uses fewer resources, produces less waste, and contributes to sustainability. This model also encourages collaboration between different sectors and actors, including government, businesses, non-governmental organizations, and the community at large. The circular economy is increasingly recognized as a key business model in the future, in many countries and companies that adopt circular economy strategies and introduce an innovative approach to their business.

1. Trends in Circular Economy

Production-consumer relations that are dominant in today's economic systems, imply unsustainable use of resources and energy. In the coming decades, the need for resources will be greater than at any time in human history so far and it is becoming obvious that linear economic model (take-produce-use-dispose) which is based on the assumption that natural resources are unlimited and easily available, must undergo a serious transformation. It is expected that in the next 40 years the global consumption of materials such as which is biomass, fossil fuels, metals and minerals doubled, and annual production increase waste by 70% by 2050. There are several trends in the circular economy that are developing in the world:

- Extending the life cycle of products: This trend involves extending the use of products to reduce the need to produce new products. For example, repairing, refurbishing, or reselling products instead of buying new ones.
- Resource sharing: This trend refers to sharing products, services, or resources with others to reduce the need to produce new products. For example, sharing bicycles, cars, apartments, or tools.
- Product design: Product design is a key factor in the circular economy. Products are designed to be easily recycled, repaired or refurbished, and materials are chosen to minimize environmental impact.
- Use of renewable energy sources: The use of renewable energy sources, such as solar and wind farms, is also a trend in the circular economy. This helps reduce greenhouse gas emissions and air pollution.

- Digitization: Digitization can help track the movement of materials and products through the supply chain, which can help better manage resources and reduce waste.
- Circular startups: The emergence of new businesses dealing with innovative and creative solutions to reduce waste, such as recycling, refurbishing, repairing, sharing and reusing materials and products.

These trends show that there is a growing interest in the circular economy in the world, and that there are many opportunities for innovation and improvement of the environment through the application of the circular economy.

2. Circular economy: Possibilities and Challenges

There are many existing opportunities in the circular economy that can be applied in different sectors and industries. Some of them are:

- Recycling: Recycling is one of the key methods in the circular economy that enables the reuse of materials that would otherwise end up as waste. Materials such as glass, plastic, paper and metal can be recycled and reused in the production of new products.
- Refurbishment: Refurbishment is a process in which damaged products are repaired to extend their life. For example, cars, home appliances, furniture and other items can be refurbished to reduce the need to produce new products.
- Sharing: Sharing resources like apartments, bikes and cars is also a possibility in the circular economy. Sharing resources reduces the need to produce new products and reduces the amount of waste.
- Product design: Designing products so that they can be recycled, repaired or renewed can reduce the amount of waste generated and increase resource efficiency.
- Reuse: Products that are in good condition but have ceased to be used in one context can be used in another. For example, old furniture or electronics can be donated to organizations that collect items for those in need.
- Composting: Composting is the process of turning organic waste into highquality fertilizer for plants. In this way, the waste is used instead of being thrown away.

These opportunities can be applied in different sectors and industries, and the application of the circular economy can bring numerous benefits for the environment and the economy.

Although there are many opportunities in the circular economy, there are also challenges that hinder its wider success and application in various industries. Some of the most common challenges are:

1. Lack of awareness of the importance of the circular economy: Many people are not aware of the importance of switching to a circular economy and how it can positively affect the environment and the economy.

2. Lack of infrastructure: The circular economy requires a different infrastructure than the linear model currently used, which can be a challenge in many countries.

3. Insufficient involvement of all stakeholders: Inclusion of all stakeholders, including producers, governments, environmental organizations, and consumers, is critical to the success of the circular economy.

4. High initial costs: Transitioning to a circular economy may require high initial costs that can be challenging for some companies and countries.

5. Lack of legal regulation: The lack of legal regulation that would support the circular economy can make it difficult to implement this economic strategy.

6. Complexity of supply chains: The circular economy requires complex supply chains, which can be challenging for some industries.

7. Technical challenges: Technical challenges, such as the lack of technology to recycle certain materials, can make it difficult to apply the circular economy in some industries.

Considering these challenges, the transition to a circular economy can be a longterm process that requires the engagement and cooperation of all stakeholders to overcome the aforementioned challenges.

3. Circular economy in Serbia

In 2019, the National Plan for the transition to a circular economy was adopted in Serbia, which includes measures to reduce waste, increase recycling, improve resource management, support green industry and encourage innovation. Also, there are some initiatives that promote the circular economy, such as "Circular Serbia" launched by the organization Smart collective, which aims to support companies that apply the principles of the circular economy. However, there are still many challenges in implementing the circular economy in Serbia, such as the lack of recycling infrastructure and insufficient government support for sustainable production and consumption. More investment and support is needed in order for the circular economy to develop in Serbia and become a key factor in the fight against climate change and environmental protection.

For the fulfillment of the general goal provided are five specific goals, with measures and activities that will be implemented in the period 2022-2024. years. One of the priorities is to support business entities in order to improve efficiency of production and removal of waste from supply chains, retention of components and materials in a closed cycle through reprocessing and recycling, application of new one's technology and replacement of old materials with advanced and renewable ones, transition to use renewable sources of energy and materials, extending the life of products through design

and maintenance and virtual delivery of goods and services. Local support is also necessary for self-governments in creating local road maps for the circular economy to contribute to the formation of sustainable communities. It is also necessary to educate relevant stakeholders parties (media, schools, universities, consumers), strengthen cooperation between business and academic sector for innovations that contribute to the circular economy and encourage implementation green public procurement and voluntary instruments in the field of environmental protection. The circular economy should benefit citizens, regions, and cities, to contribute sustainable development and climate neutrality, as well as preserving people's health and well-being. The state of pollution in Serbia is worrying, with serious consequences for human health and the environment. Air, water, and land pollution are the main problems, and there is also a problem with hazardous waste and noise. The air is most polluted in cities, especially in the winter months when solid fuel heating is used. Air pollution has serious consequences for human health, especially for children and the elderly, and is associated with an increased risk of cardiovascular and respiratory diseases.

Water pollution is also a big problem in Serbia, especially in industrial and agricultural areas. Many rivers and lakes are polluted, and the quality of drinking water in many parts of the country is not adequate. Water pollution has serious consequences for the health of people and animal species that live in these ecosystems. Soil is also polluted, especially in industrial areas, which can lead to food contamination and increased risk of disease. Hazardous waste is another big problem in Serbia, with many illegal landfills and inadequate waste treatment. This can lead to soil and water pollution, as well as health risks for people living near these landfills. Noise is also a significant problem in urban areas, especially with traffic and industrial activities. Serbia has great challenges in the fight against pollution, but there are efforts and initiatives being undertaken to improve the state of the environment. Further investments and actions are needed to reduce the impact of pollution on the environment and human health.

In Serbia, there are numerous examples of the application of the circular economy in various sectors. Some of these examples include:

- "Green Net" e-waste collection project: This project enables free collection of e-waste by citizens and businesses, after which the waste is processed into new products.
- "Eco-Save" program for saving energy in households: This program encourages citizens to install energy-efficient devices and carry out energy rehabilitation of their homes, thereby reducing energy consumption and reducing costs.
- "Recycling Center" in Belgrade: This center allows citizens to recycle waste, such as paper, cardboard, plastic, and glass. The recycling center also has a shop where products made from recycled materials are sold.
- "Novi Sad Circular Economy Platform": This platform brings together companies, organizations, and experts with the aim of developing a circular economy in Novi Sad. The platform organizes workshops, events, and other activities to raise awareness of the importance of the circular economy and encourage cooperation between different sectors.
- "Campaign to reduce plastic packaging" in supermarkets: Some supermarkets in Serbia have started a campaign to reduce the use of plastic packaging. This includes replacing plastic shopping bags with paper or cloth bags, as well as reducing the use of plastic packaging for fruit and vegetables.

These are just some examples of the application of the circular economy in Serbia, and there are many other initiatives and projects in different sectors, such as construction, food production and the textile industry.

Conclusion

The perspective of the circular economy is positive because this is a model that has the potential to solve many problems that are characteristic of linear models of the economy. The circular economy focuses on reducing waste and using resources in a sustainable way, which has a positive impact on the economy, society, and the environment. Its application can lead to the creation of new markets and business models, cost reduction, increased resource efficiency, improved quality of life and environmental protection. The circular economy also contributes to the achievement of global sustainable development goals, such as reducing poverty, combating climate change, and preserving biodiversity.

The world economy is increasingly shifting to circular business models, and many countries have already adopted circular economy strategies. There are more and more companies that are switching to circular business models and offering products and services that are sustainable. Accordingly, the perspective of the circular economy is positive, and it is expected that this economic strategy will become even more important in the future, as efforts are made to reduce waste and increase the efficiency of resource use.

Literature and internet sources

- Brnjas, Z., Drašković, B., & Grbić, V. (2016). Cirkularna ekonomija: Savremeni koncept efikasne i održive ekonomije. Ecologica: nauka, privreda, iskustva, 23(84), 685-689.
- doc. dr Simonida Vukadinović "Cirkularna ekonomija i zapošljavanje u Evropskoj uniji", Fakultet poslovne ekonomije, Univerzitet Educons, Sremska Kamenica, Srbija
- Mashovic, A., Ignjatovic, J., Kisin, J. (2022) Circular economy as an imperative of sustainable development in North Macedonia and Serbia, ECOLOGICA, Vol. 29, No. 106 (2022), str. 169-177. https://doi.org/10.18485/ecologica.2022.29.106.5
- Radoičić, J., & Arsić, L. (2020). Cirkularna ekonomija putokaz ka zelenim radnim mestima. Ecologica, 27(98), 332-339.
- Radivojević, A. (2018). Cirkularna ekonomija implementacija i primena tehnologije u njenoj funkciji (Circular Economy Implementation and

Technology Application in Its Function). Ekonomske ideje i praksa, (28), 33-46.

- Ministry of Environmental Protection of the Republic of Serbia Circular Economy <u>https://www.ekologija.gov.rs/dokumenta/cirkularna-</u> <u>ekonomija/cirkularna-ekonomija</u>
- <u>https://circulareconomy-serbia.com/stanje-cirkularne-ekonomije-u-srbiji-</u> 2021-2022
- The circular economy: "the number one priority" for the European Green Deal, Proceedings from the conference CIRECON 2022

Tilen Medeot

ARTIFICIAL INTELLIGENCE AND SUSTAINABILITY: HOW AI CAN IMPROVE SUSTAINABLE DECISION-MAKING IN MODERN ORGANIZATIONS

Abstract:

In this paper it is explored how artificial intelligence can improve activities of many modern organizations in achieving higher levels of sustainability. Today modern challenges are facing many challenges and decisions in which artificial intelligence cand provide valuable insights which can help organizations make informed decisions that are environmentally and socially responsible and also financially beneficial.

Keywords: artificial Intelligence, sustainability, sustainable decision-making, modern organizations, environmental impact, carbon footprint, energy efficiency, waste reduction, social responsibility

Introduction

As the environmental challenges are growing, sustainability is becoming a bigger issue for modern organizations in different sectors. To reduce the impact on the environment, to improve the image and reputation of and to meet the expectations of stakeholders, organizations are adopting many sustainable practices. The emergence of artificial intelligence has enabled organizations to expand the possibilities for sustainable decision-making, what is a goal of any modern organization.

What is sustainability?

The concept of sustainability was initially introduced by the United Nations Brundtland Commission in 1987 as "meeting the needs of the present without compromising the ability of future generations to meet their own needs". An integrated approach that considers environmental concerns together with economic development is essential for achieving sustainable development (United Nations, 2023).

UCLAs' sustainability committee defines sustainability as "the integration of environmental health, social equity and economic vitality in order to create thriving, healthy, diverse and resilient communities for this generation and generations to come. The practice of sustainability recognizes how these issues are interconnected and requires a systems approach and an acknowledgement of complexity" (UCLA, 2023).

We can find many different definitions regarding sustainability but in its broadest meaning sustainability, refers to the capacity to sustain or support a process continually over time. Within the business and policy spheres, the concept of sustainability aims to prevent the exhaustion of natural or physical resources, ensuring their availability for the long run (Mollenkamp, 2023).

Currently we consider three sustainability pillars must developed and managed in order to meet sustainability principles (Emerick, 2023):

- Economic: The economic pillar of sustainability concentrates on guaranteeing that economic growth is feasible and sustainable over time. This encompasses responsible resource management, the development of policies that incentivize investment in renewable energy, and the promotion of fair-trade practices to ensure equitable access to resources and benefits.
- Social: The social aspect of sustainability centers on improving quality of life for everyone. This entails protecting human rights, advancing gender equality and diversity, granting access to fundamental services such as healthcare, sanitation, and education, and committing to social protection initiatives that strengthen the resilience of communities.
- Environmental: Thu element aims to protect and preserve natural resources while utilizing them responsibly. This includes minimizing carbon emissions, investing in sustainable energy sources, preserving water and land resources, protecting biodiversity and ecosystems, as well as adopting waste management practices that mitigate the impact on air quality.



Figure 1: Three pillars of sustainability (SNC Lavalin, 2023)

Why is sustainability important for modern organizations?

Modern organizational should consider sustainability for various reasons. Firstly, organizations have a significant impact on the environment through their regular operations, production activities and through their supply chains. If companies successfully implement sustainable practices, they can reduce their carbon footprint, conserve natural resources, and minimize pollution (Mota, 2019).

Sustainable practices can have beneficial effect in cost savings for organizations, such as reducing energy and water consumption, minimizing waste, and optimizing supply chain efficiency. The positive impact on reducing costs can result in increased profitability and competitiveness (Garnet et al, 2016).

More people are becoming environmentally conscious and seeking out sustainable products and services and if companies adapt to changing market demands and consumer preferences with implementation of sustainable practices, they can significantly improve company's reputation and brand image (Garnet et al, 2016).

Finally, by implementing sustainable practices, organizations can stay compliant with regulations and avoid legal or financial penalties. Governments around the world are introducing regulations and policies to promote sustainability, and organizations that fail to comply may face fines or reputational damage (Jagannathan, 2018)

Implementation of sustainable practices can contribute to a more sustainable future, improving a company's long-term viability and success, increasing resilience in the face of changing market conditions and societal expectations.

Sustainable Decision-Making in Modern Organizations

What is sustainable decision-making?

Sustainable decision-making is the process of making decisions that consider the on the environment, society, and economy. Such decision-making considers the potential consequences of a decision and choosing an option that minimizes negative impacts while maximizing positive impact. It is a very complex interdisciplinary process that requires usage of different methodologies to address sustainability issues. (Toman, 1998).

It often involves collaboration and ideation processes among employees to support each other in making sustainable choices. Sustainable decision-making involves plenty of complex choices, and employees need to come together, go through ideation processes, and support each other in overcoming their biases. It can be simplified by involving sustainability in everyday decision-making, which can change the way people conduct their lives and envision their work and purpose (Negru, 2020).

Why is sustainable decision-making important for modern organizations?

In today's world, sustainability has become a critical factor for organizations to remain relevant and competitive. Similar to digital transformation, achieving sustainability requires organizations to transform every division of their business. As a result, sustainability should be an essential component of corporate strategy development. For organizations, sustainability is manifested in three key areas, commonly known as Environment, Social, and Governance (ESG) (Rafi, 2022) Sustainable decision-making is crucial for modern organizations for several reasons. It satisfies investor expectations, consumer preferences and demands, and regulatory mandates.

Investor pressure is one of the most powerful factors for implementing sustainable practices: 85% of investors considered ESG factors in their investments in 2020 while 91% of banks monitor ESG performance of investment (Gartner, 2021).

Consumer preferences and demands should also not be overlooked. Different studies show that increasing numbers of millennials and Gen-Z customers there is a great pressure on providing sustainable products and services: 73% of Gen-Z are prone to spend more money on a sustainable product (FirstInsight, 2023). Another study shows, a significant portion of consumers have altered their consumption behaviors in favor of sustainable practices. Specifically, 61% of respondents reported reducing their use of single-use plastic, while 39% stated that they are purchasing fewer new goods compared to the previous year. These changes are particularly pronounced among younger generations, namely Gen-Z and younger Millennials. These findings suggest a growing awareness and adoption of sustainable consumption practices among consumers (Deloitte, 2021).

There are many regulatory commitments and obligations related to sustainability. The Paris Climate Agreement has highlighted the need for stricter government policies to achieve sustainability goals, with several countries establishing legally binding targets of reaching net zero emissions. The EU's sustainability taxonomy evaluates the environmental impact of businesses and applies to global firms operating in the region. Organizations must proactively transform their operations to become more sustainable, improving compliance and relationships with regulatory bodies (Rafi, 2021).

The importance of sustainability extends beyond regulatory compliance and environmental impact. It also has implications for talent acquisition and retention. Recent surveys have shown that a significant portion of Gen-Z and millennial workers base their career choices on personal ethics, with 49% and 44%, respectively, reporting such behavior. In addition, over half of US business students surveyed indicated that they would accept lower pay to work for a company that is environmentally responsible. If organizations do not prioritize sustainability, they may lose crucial talent to competitors who have established themselves as sustainability leaders (Deloitte, 2021).

Sustainability can also contribute to increased employee motivation and productivity. McKinsey & Company reports that sustainability measures can reduce costs and boost operating profits by up to 60% (Mckinsey, 2020). An inclusive culture that values sustainability has been linked to 27% higher profitability and 22% greater productivity (Deloitte, 2023).

The challenges of sustainable decision-making in modern organizations

A lot of modern organizations face different challenges when they try to execute sustainable decision making. One of biggest obstacles is finding the right balance between short-term effort and long-term benefits. Sustainability initiatives require investments at the beginning that do not show immediate benefits, which can be challenging for some companies to justify such decisions. Additionally, it is also challenging to measure the impact of sustainability initiatives which may cause organizations to struggle to determine the effectiveness of strategies to achieve sustainability goals (Gassmann, Jackson-Moore, 2022).

Achieving sustainability in modern organizations is hindered by the requirement for cooperation and cohesion across various departments. This cross-functional collaboration is critical, as sustainable decision-making involves numerous divisions, including operations, finance, marketing, and supply chain. Nonetheless, guaranteeing that each department is moving towards the same sustainability objectives may pose a challenge, particularly in larger organizations (Negru, 2023). Organizations do not necessarily have all the resources or expertise needed to start sustainability initiatives and develop effective sustainability strategies. This can be due to a lack of tools, insights, and knowledge, or a lack of incentives from government policies. Management needs to align the company's strategy with sustainability efforts. Investing in sustainability can lead to long-term benefits, such as attracting and retaining talent, motivating employees, and reducing risks (Rafi, 2021).

Artificial Intelligence and Sustainability

What is artificial intelligence?

Artificial intelligence (AI) is the ability of computers to perform tasks that are associated with intelligent beings. The term is commonly used when referring to the project of creating systems that possess intellectual processes like humans (reason, discover meaning, generalize, learn from experience). Intelligence by its definition (human or machine), can change and adapt methods of behavior according to the situation (Golabs, 2023).

From the 1940s, when digital computers were first introduced, it has been demonstrated that they can execute complex tasks: discovering proof for mathematical theorems or even playing chess with outstanding abilities.

Today, certain programs have achieved the performance standards of human specialists in performing specific tasks, resulting in artificial intelligence being used in a variety of applications such as medical diagnosis, computerized search engines, and voice or handwriting recognition (Britannica, 2023).

Artificial intelligence refers to machines capable of learning, reasoning, and acting for themselves. Like humans and animals, they can make independent decisions when presented with new situations (Hao, 2018).

Short history of artificial intelligence

The idea of artificial intelligence is not new. In the mid-1950s there were many intellectuals who were discussing the concept of artificial intelligence. One of most known scientists was Alan Turing – an English mathematician, logician, computer scientist... Turing laid the foundation for the development of artificial intelligence

in his famous paper - Computing Machinery and Intelligence. In this paper he proposed the idea of a test which would determine if a machine is capable of demonstrating intelligent behavior, which is equivalent to human behavior. According to Turing, a machine that could converse with humans without the humans knowing that it is a machine would win the "imitation game" and could be said to be "intelligent". (Anyoha, 2017).

The first artificial intelligence proof of concept was introduced in 1955 when Allen Newell, Cliff Chaw and Herbert Simon developed "Logic Theorist" - a program designed to mimic the problem-solving skills of a human. The term artificial intelligence was first used by John McCarthy at the Dartmouth Summer Research Project on Artificial Intelligence. McCarthy organized a groundbreaking conference where he united prominent researchers from different fields to talk about artificial intelligence, a term he coined during the event. (Anyoha, 2017).



Figure 2: AI timeline (Anyoha, 2017)

Artificial intelligence made significant progress from 1957 to 1974 with the development of better machine learning algorithms, natural language processing, and problem-solving solutions. However, the lack of computational power slowed down further progress. In the 1980s, Artificial intelligence was reignited with the introduction of "deep learning" techniques and expert systems, which mimicked the decision-making process of a human expert. In the 1990s and 2000s many landmark goals of AI were achieved (including IBM's Deep Blue defeating chess champion Gary Kasparov; speech recognition software being implemented on personal computers). Even human emotion was tackled with the development of Kismet, a robot that could recognize and display emotions (Anyoha, 2017). Different types of artificial intelligence

Artificial intelligence can be divided into two categories: AI types based on capabilities and AI based on functionalities.

First category – AI types based on capabilities can be further divided into three groups (Kanade, 2022):

- Narrow AI: Another name for this group is weak AI. These are AI systems designed to perform specific tasks and are limited to the domain they were programmed for. Examples of narrow AI include image and speech recognition, chatbots, and recommendation engines used in e-commerce. These systems are not capable of generalizing or adapting to new tasks outside their programmed domain.
- General AI: systems included in this group can perform any intellectual task that a human can do. Solutions can learn and adapt to different situations, reason about complex problems, and perform multiple tasks across various domains. However, such an AI system has not yet been developed.
- Super AI: these solutions that can outperform humans in any task. It has the ability to think, reason, solve problems, make judgments, learn and communicate autonomously. Although currently only a theoretical concept, super AI represents the potential future of AI technology.



Figure 3: Types of artificial intelligence (Kanade, 2022)

Second category – AI based on functionalities are composed of the following groups (Kanade, 2022):

- Reactive Machines: Reactive AI machines are a fundamental type of AI that do not retain past experiences or memories for future use. These systems focus solely on the present situation and react to it based on the most optimal action.

- Limited Memory Machines: Limited memory machines, also known as reactive machines with limited memory, can store and use past experiences or data for a short period of time. For example, a self-driving car can store the speeds of vehicles in its vicinity, their respective distances, speed limits, and other relevant information for it to navigate through the traffic. However, they do not store memories for future use like other AI machines.
- Theory of Mind: Theory of mind AI is a hypothetical type of AI that can understand human emotions and beliefs and socially interact like humans. It represents an advanced level of AI beyond current capabilities and is currently not yet developed but is considered a possibility for the future.
- Self-aware AI: in this group are included systems that have a level of consciousness, emotions, beliefs, and the ability to understand their own existence. It is a hypothetical concept of AI that is more advanced than any other AI type, as it would have the capability to outperform humans in almost every intellectual task.

How does artificial intelligence work?

Artificial intelligence works by combining large data sets in various forms (speech, text, image, etc.) with intuitive processing algorithms. After data is collected the system processes the data by applying various rules and algorithms in order to interpret, predict, and act on the input. After the system has processed the data, it provides an outcome - this step determines if the data and its given predictions are a failure or a success. If the outcome is a failure the system learns from the mistake and repeats the process differently. The final step is the assessment phase where the technology analyzes the data and makes conclusions and predictions. It can also provide necessary, helpful feedback before running the algorithms again. It is crucial to understand that artificial intelligence is not only one algorithm, but is combined from many algorithms (Wilson, 2023).



Figure 4: How artificial intelligence works (Kanade, 2022)

on data input, which is assessed through analysis, discovery, and feedback. Based on the assessments, the system adjusts input data, rules and algorithms, and target outcomes in a loop until the desired result is achievedHow can artificial intelligence help with sustainable decision-making?

How can artificial intelligence help with sustainable decision-making?

The pursuit of sustainability goals while balancing business demands poses complex challenges for companies. The Paris Agreement, which has been ratified by 197 governments, has set the target of achieving a net-zero emissions economy by 2050, requiring radical transformations across all economic sectors. Artificial intelligence can offer valuable contributions to sustainable decision-making. It has the potential to provide valuable insights and facilitating better-informed choices. An undeniable area where artificial intelligence can provide support to business leaders is by analyzing vast amounts of data and enabling informed and sustainable decisionmaking. Artificial intelligence can expedite an organization's progress towards sustainability goals through the automation of decision-making processes while considering environmental, social, and governance (ESG) constraints, elimination of human error, and acceleration of processes that may impede an organization's progress. Artificial intelligence can be leveraged to facilitate decisions concerning machine usage, electricity consumption, and grid balancing in the energy management field while concurrently conserving resources (Naismith, 2023).

Examples of how AI can be used in sustainable decision-making

Artificial Intelligence can improve sustainable decision-making in various sectors and areas of business: environmental planning, corporate sustainability, and public policy. Such technology can help us improve sustainable decision in many ways:

- Enhancing decision-making processes by analyzing historical data against current market trends, enabling organizations to become more environmentally sustainable and comply with regulations (Pahulje, 2021)
- Artificial intelligence can drive automation processes that eliminate human error and reduces time of execution, which can accelerate progress towards environmental, social and governance (ESG) goals (Naismith, 2023).
- In the field of energy management artificial intelligence can help organizations in many ways: The application of AI's predictive capabilities and intelligent grid systems in managing renewable energy supply and demand can optimize efficiency, reduce costs, and lower carbon pollution generation. Through dynamic management of the renewable energy supply and demand, AI can enable more precise energy forecasting and enhance system flexibility, minimizing the need for energy storage. AI applications can balance electricity supply and demand needs in real-time, which can help reduce energy waste and improve sustainability (Tehrani, 2023)
- The integration of AI in agriculture is gaining momentum and presents numerous opportunities for industry. Modern agribusinesses can efficiently analyze farm data to predict crop yields and monitor climate conditions what can improve agricultural sustainability. Given the labor-intensive nature of agriculture, AI can enable the maximization of resources, leading to the production of greater yields with less effort. By analyzing data on soil moisture levels, weather patterns and crop growth it can optimize crop yields, reduce water consumption and minimize the use of pesticides and fertilizers, helping farmers to make more sustainable decisions (Soon&Hui, 2022).
- In the field of waste reduction artificial intelligence can help in various ways. When garbage is being collected artificial intelligence can optimize waste collection routes, which reduces fuel consumption and emissions (Tsai, 2021). Artificial intelligence can also be used to identify and sort recyclable materials more efficiently. Efficiency in such operations can increase recycling rates and reduce the amount of waste sent to landfills and increase

the number of materials that are recycled (Muhamad et al, 2020). With AI solutions organizations are capable of monitoring where waste is being generated and identifying which areas should apply effort in reduction waste generation (Enegbuma, 2020).

In today's business environment organizations are constantly trying to improve their supply chain management. Artificial Intelligence can help in various segments of supply chain management. Accurate inventory management is crucial for companies to ensure that the right items are stocked at the right time. AI tools are highly effective in analyzing large datasets and providing timely guidance on forecasting supply and demand. With these tools organizations can predict consumer habits and forecast seasonal demand, helping to anticipate future demand trends while minimizing the costs of overstocking inventory. Another big hype in supply chain management is automated warehouses. Automated warehouses can, with usage of artificial intelligence, achieve minimal cost for warehouse staff and much higher processing speed compared to conventional warehouses. Automated systems can simplify procedures and speed up work, saving time and reducing the number of human errors and workplace accidents. Warehouse robots can provide faster and more accurate procedures what leads to higher productivity with reduced cost. Improvement in supply chain can lead to increased customer satisfaction – AI system help reduce manual effort which speeds up the process and removes bottleneck and reduces errors what means that the customer is getting their product faster and without any damages (Jacobs, 2023).

Conclusion

In order to increase the possibilities for organizations to improve their sustainable decision-making, implementation of artificial intelligence technology is a promising approach. Artificial intelligence can analyze vast amounts of data and can provide insights that can lead to informed and more sustainable decisions. It is important to understand that artificial intelligence is a complementary tool to human decisions. With future evolution of artificial intelligence, it is likely that it will become an even more valuable tool in the process of achieving high levels of sustainability therefore organizations should embrace this technology even more.

REFERENCES

- Anyoha, R. (2017, August 28). The History of Artificial Intelligence. Harvard University – Science in the News. https://sitn.hms.harvard.edu/flash/2017/history-artificial-intelligence/
- 2. Britannica. (2023). Artificial Intelligence. https://www.britannica.com/technology/artificial-intelligence#ref219078
- 3. da Mota, V. F. (2019, September 30). The implementation of an environmental management system and its contributions to today's organizations. Journal of Engineering and Technology for Industrial Applications (Edition 19, Vol. 5).
- Deloitte. (2021). A call for accountability and action The Deloitte global 2021 millennial and Gen Z survey. Retrieved from https://www2.deloitte.com/content/dam/Deloitte/mk/Documents/aboutdeloitte/2021-deloitte-global-millennial-survey-report.pdf
- 5. Deloitte. (2021). Inclusive Mobility: How Mobilizing a Diverse Workforce Can Drive Business Performance. Retrieved from https://www2.deloitte.com/us/en/pages/tax/articles/inclusive-mobilitydiverse-workforce-drive-business-

performance.html?msclkid=7coca27bd05c11ecbcadf788134febc7

- Deloitte. (2021, April 22). Four out of five UK consumers adopt more sustainable lifestyle choices during COVID-19 pandemic. Retrieved from https://www2.deloitte.com/uk/en/pages/press-releases/articles/four-outof-five-uk-consumers-adopt-more-sustainable-lifestyle-choices-duringcovid-19-pandemic.html
- 7. Emerick, D. (2023, March 14). What are the Three Pillars of Sustainability? ESG the Report. https://www.esgthereport.com/what-is-esg/the-g-inesg/what-are-the-three-pillars-of-sustainability/
- 8. FirstInsight. (2023, April 25). The state of consumer spending: gen z shoppers demand sustainable retail. Retrieved from https://www.firstinsight.com/white-papers-posts/gen-z-shoppers-demandsustainability
- 9. Garnett, S. T., Lawes, M. J., James, R., Bigland, K., & Zander, K. K. (2016, April). Portrayal of sustainability principles in the mission statements and on
home pages of the world's largest organizations. Conservation Biology (Vol. 30, No. 2).

- 10. Gartner. (2021, June 10). The ESG Imperative: 7 Factors for Finance Leaders to Consider. Smarter With Gartner. Retrieved from https://www.gartner.com/smarterwithgartner/the-esg-imperative-7factors-for-finance-leaders-to-consider
- 11. Gassmann, P., & Jackson-Moore, W. (2022, December 6). The CEO's ESG dilemma.
 PWC. Retrieved from https://www.pwc.com/gx/en/issues/esg/ceo-esg-dilemma.html
- 12. GolabsTech. (2023, January 9). AI: Welcome to the Future. https://golabstech.com/ai-welcome-to-the-future/
- 13. Hao, K. (2018, November 10). What is AI? We drew you a flowchart to work it out. MIT Technology Review. https://www.technologyreview.com/2018/11/10/139137/is-this-ai-wedrew-you-a-flowchart-to-work-it-out/
- Jagannathan, M., Kamma, R. C., Renganaidu, V., & Ramalingam, S. (2018, July 18). Enablers for Sustainable Lean Construction in India. 26th Annual Conference of the International Group for Lean Construction.
- 15. Koller, T., & Nuttall, R. (2020, June 9). How the E in ESG creates business value. McKinsey & Company. Retrieved from https://www.mckinsey.com/capabilities/sustainability/our-insights/sustainability-blog/how-the-e-in-esg-creates-business-value
- 16. Malpani Naismith, A. (2023, February 10). AI Can Propel Corporate Sustainability Ambitions Into Action. TriplePundit. Retrieved from https://www.triplepundit.com/story/2023/ai-artificial-intelligencesustainability/766026
- 17. Mollenkamp, D. T. (2023, March 8). What is Sustainability? How Sustainability Work, Benefits, and Example. Investopedia. https://www.investopedia.com/terms/s/sustainability.asp
- Negru, M. (2020, October 13). Sustainable Decision-Making Experience. Retrieved from https://2030.builders/sustainable-decision-making
- 19. Pahulje, M. (2021, June 17). AI decision-making and sustainability. Flexis.
 Retrieved from https://blog.flexis.com/ai-decision-making-and-sustainability

- 20.Rafi, T. (2021, February 10). Why Corporate Strategies Should Be Focused On Sustainability. Forbes. Retrieved from https://www.forbes.com/sites/forbesbusinesscouncil/2021/02/10/whycorporate-strategies-should-be-focused-on-sustainability/
- 21. Rafi, T. (2022, June 9). Why sustainability is crucial for corporate strategy. World Economic Forum. Retrieved from https://www.weforum.org/agenda/2022/06/why-sustainability-is-crucialfor-corporate-strategy/
- 22. SNC Lavalin. (2023, March 20). What do the three pillars of sustainability mean for the built environment? https://careers.snclavalin.com/blogs/2022-3/three-pillars-ofsustainability-and-the-built-environment
- 23. Spiceworks. (2022, March 14). What Is Artificial Intelligence (AI)? Definition, Types, Goals, Challenges, and Trends in 2022. https://www.spiceworks.com/tech/artificial-intelligence/articles/what-isai/#_002
- 24. Tehrani, K. (2023, March 21). 5 Ways AI can Improve Environmental Sustainability. AI Time Journal.
- 25. Toman, M. (1998, June 1). Sustainable Decisionmaking: The State of the Art from an Economics Perspective.
- 26.United Nations. (2023, April 21). Sustainable Development goals. https://www.un.org/en/academic-impact/sustainability
- 27. University of California, Los Angeles. (2023, March 23). What is sustainability? https://www.sustain.ucla.edu/what-is-sustainability/
- 28.Wilson, C. (2023, April 5). How AI Works: The Basics You Need to Know. HubSpot. https://blog.hubspot.com/marketing/how-does-ai-work

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SUSTAINABILITY AS PILLAR OF COMPETITIVE BUSINESSES: EVIDENCE FROM COMTRADE GROUP

Abstract: In the last few decades, the connection between respect for human rights, well-being, environmental protection, and climate change has been increasingly linked to business operations. The concept of sustainable business, which has become recognizable at the global level, is in a constant process of development. The concepts of corporate responsibility and sustainability are an inseparable part of the corporate culture of modern companies, and they are guided by this in making business decisions to create lasting value. Sustainable business requires continuous efforts to integrate corporate responsibility and sustainability into every aspect of business. This research paper is a case study of the Serbian IT company ComTrade as an example of a successful business that implemented the principles of sustainability. The paper is divided into three thematic sections. The first part presents the theoretical framework of sustainable development and legal framework in Serbia. The second part is about the IT company ComTrade Group, as the subject of research in this case study. The third part focuses on sustainable business practices implemented in ComTrade. In conclusion, final remarks are given.

Keywords: sustainable development, sustainability, modern business, IT company

Introduction

Sustainable development and socially responsible business are increasingly becoming the focus of the companies, not only in the world, but also in Serbia and the region. This type ofbusiness is also in the interest of the users themselves. Such a trend among users is led by generation Z and millennials, who expect from companies not only a reduction in carbon dioxide emissions, but also other activities related to sustainable business. This paper examines the operations of the ComTrade company from the aspect of sustainabledevelopment. The ComTrade company is a leader in its field of activity, not only in Serbia, but also inSoutheast Europe. The paper used the method of analyzing both official documents and concrete actions of the company from the point of view of sustainable development. The ComTrade Group's attitude towards the basic principles of sustainable development: social, economic, and environmental is also analyzed. Using the method of comparison, the paper determined whether there is a disproportion between documents and practical action, that is, whether ComTrade only

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declaratively stands for the principles of sustainable development or has firmly incorporated them into its operations.

1. Sustainable development: Definition and Application

There are numerous definitions of sustainable development which, depending on the perspective, can be interpreted in different ways. The definition of the World Commission on Environment and Development (WCED), known as the Brundtland Commission and founded in 1983, is the most frequently cited. In the commission's document "Our Common Future" (the Brundtland Report) from 1987, sustainable development is defined as "development that meets the needs of the present without compromising the ability of future generations to meet their own needs." Today's understanding of sustainable development is based on the understanding of the interconnectedness and interactions of its three basic pillars: society, environment, and economy (economy).

The social component includes fostering communities while encouraging cultural diversity and preserving cultural heritage, ensuring equal access to education and health care, achieving equality for all members of society, improving social rights. The next component includes the development of strategies and plans for environmental protection, reducing and stopping pollution, care for climate stability, reasonable and efficient exploitation of natural resources and care for their capacities, protection of biodiversity and nature. The economic segment of sustainable development should enable an increase in people's well-being, maintenance of price stability and employment with satisfactory incomes, cost savings and economic efficiency. The biggest progress in the international affirmation of the concept of sustainable development was achieved in August 2015. The UN, as the main body that provides guidelines for sustainable development, presented the Agenda 2030 document, which was adopted by 193 countries. It defines 17 basic and 169 subgoals of sustainable development. There are 17 main goals of sustainable development, and they are all interconnected, so success in achieving one affects the achievement of the others:

1) A world without poverty infrastructure

9) Industry, innovation and

10) Reducing inequality

- 2) A world without hunger
- 3) Good health

11) Sustainable cities and communities

- 4) Quality education production
- 5) Gender equality
- 6) Clean water and sanitation
- 7) Affordable and renewable energy
- 8) Decent work and economic growth

12) Responsible consumption and

- 13) Climate action
- 14) life under water
- 15) life on Earth
- 16) Peace, justice and strong institutions
- 17) Partnership for goals

1.1. Legal framework of sustainable development in Serbia

Serbia, like other countries of the Western Balkans, faces numerous problems. The high rate of unemployment, problems of poverty and social exclusion, economic and political instability, problems with corruption and unfinished reforms, in many areas indicate the necessity of leading a better policy of sustainable development. In 2008, the Republic of Serbia adopted the National Sustainable Development Strategy for the period until 2017, which accepted sustainable development as a permanent priority, representing at the same time a condition for accession to the EU, which advocates economic development based on social equality and a high level of environmental protection. In addition to EU membership, the importance of (NSOR, 2008) is emphasized: the development of a competitive market economy, balanced economic growth, development of human resources, reduction of unemployment, improvement, balanced regional development, rational use of resources and environmental protection. In doing so, the goals that the global community has in the field of sustainable development are respected, and the basic dimensions of sustainable development are observed through their functional connections. The Republic of Serbia also adopted the National Strategy for the Sustainable Use of Natural Resources and Goods (2012), with the aim of stimulating the restructuring of the Serbian economy on the way to sustainable development. It was created to shift the focus of investment from "business as usual" to an economy that approaches development in a balanced way. An inadequate system of financing and management stands out as a basicobstacle for the sustainable use of resources. A series of specific principles that should be guided in the process of sustainable development include respect for the capacity of the environment; preservation of natural values; limited use and substitution of resources; use of "green" technologies; the principle of prevention; precautionary principle; principle of market correction...

2. Company profile: ComTrade Group

The international IT company ComTrade Group began its path to success in 1991. Company is based in Belgrade, Serbia but it has divisional head offices in Boston, Dublin, Amsterdam, and Ljubljana. Veselin Jevrosimović, the owner and president of the Group, founded the first company from the system. Today, the group is directly present in 13 countries of the world, including the countries of Western Europe and the United States of America, and it has over 20 companies connected in an organized whole. With more than 1,600 employees, 1,000 of whom are software engineers, ComTrade is thelargest IT company in the entire Southeast Europe.

Founded as a software engineering and services company, today it is positioned as an IT leader operating on three continents, offering high-quality software solutions, innovative technologies, as well as outstanding system integration services. Through established partnerships with the world's leading technology companies, such as Microsoft, HP, IBM, Oracle and others, Comtrade focuses on providing each user with high-quality IT solutions inorder to improve efficiency and modernize business. Recognizing the quality of the technological solutions, the European Organization for Nuclear Research (CERN) chose ComTrade to take care of the huge amounts of data generated by the largest scientific projectin the world (The Large Hadron Collider). ComTrade Group covers a wide range of activities within the IT industry with a special emphasis on designing and implementing solutions for clients from the public and private sectors and providing RD services. Their specialty is the integration of software solutions -Data protection, DevOps services, CRM solutions and Cloud. A significant role in the group's portfolio is also played by the distribution of IT equipment and consumer electronics with over 4,000 products on offer and cooperation with the 50 largest manufacturers. Due to constant opportunities in the dynamic IT market, Comtrade is always open to providing opportunities to young and ambitious IT students. In order for the youngest colleagues to have adequate first work experience and knowledge acquisition, the company also offers internship tutoring programs that include several different modules with the aim of adequate preparation for working on real business projects. The company is also known to the public for its socially responsible activities, as a large number of computers and other equipment are donated to charity every year, and numerous young talents are among the ComTrade Group's scholarship recipients.

3. Sustainable business in the ComTrade Group

The ComTrade company points out that since its foundation, they have based their businesson the principles of sustainable development. This is manifested in the attitude towards employees and their families, environmental protection, commitment to the education anddevelopment of children and young people, as well as the overall well-being of the community in which they operate. The management of the company believes that social responsibility is primarily reflected in the attitude towards employees, and they advocate for a sustainable balance between businessand private life. They motivate each team member to achieve their full potential, regardless ofgender identity, nationality, religion, origin, marital status, disability, age, sexual orientation...The code of conduct of the ComTrade Group (2022, page 8) states that: *"discrimination against anyone based on any of the listed characteristics, as well as harassment or offensive behavior, whether sexual or personal on any other basis, is not tolerated. The mentioned principles are applied as within the company, as well as on behavior towards Business Partners".*

ComTrade Group has over 3,000 employees and is committed to constantly improving relations with employees, clients, suppliers and the entire environment. Employees are supported in relation to business, legal, financial or emotional issues, as well as the right to free psychological counseling. The company financially supports employees who become parents. Article 1.5 of the code of conduct defines that the company (2022, page 8) : "contributes to national and social development through creating new jobs, paying taxes and promoting cultural and social programs". In the same document, it is also stated that ComTrade, as a responsible member of society, provides financial or production donations for education and science, art and culture, sports, social and humanitarian projects. The company's activities are permanently focused on one of the most socially significant, but also the most sensitive topics, the inclusion of especially children with disabilities. The social sensibility of ComTrade is also reflected in the projects intended for the parents of those children. Free retraining and professional training for software testing and quality control are organized, which is especially beneficial for parents who want to work from home. For 27 years, the company has been organizing EDIT, a free summer programming school. In this way, young people are offered the opportunity to participate in IT projects, gain knowledge and permanent employment. In cooperation with Center Alfa, ComTrade presented the project of Education of young people about risks and dangers on the Internet. Ten employees are educated through numerous free IT workshops and courses.

ComTrade has concluded agreements with faculties on business and technical cooperation (example of the University of Economics in Kragujevac) which, among other things, provide for free professional practice and student scholarships, joint work on projects with the economy, as well as professional development of professors and teaching staff. The company's donations intended for the education of children and young people arenumerous, and only a few of them are listed: 40 Tesla tablets to the "Novi Beograd" elementary school, which is attended by children with developmental disabilities; 16 notebook computers to the secondary medical school in Gračanica; in cooperation with partners, 48 notebook computers for children in Bosnia and Herzegovina so that they can follow online classes in the age of corona; also in cooperation with partners, smartphones, tablets and mobile cards for about 2,800 eighth-grade students for online self-assessment ofknowledge in the age of the pandemic... The company points out that they are extremely proud of their project "My Tesla EDU Classroom" which, in the most difficult time of the Covid19 pandemic, helped eighth gradersto overcome challenges and uncertainty, to prepare as well as possible for the final exam and enroll in the desired high school. With the help of an online self-assessed knowledge test, more than 65,000 students who had a high school graduation exam were successfully tested with the support of the LMS platform that ComTrade created and adapted. In the same period, when compassion was crucial, the company showed digital solidarity. She used her resources and long-term expertise in the IT industry in the fight to help the most vulnerable. In cooperation with the Office for IT and Administration of the eGovernment of the Republicof Serbia, she participated in the establishment of

a national platform for volunteer applications, at the address budivolonter.gov.rs The ComTrade company pays special attention to this aspect of the environment. The code of conduct (2022, page 16) states: "Environmental protection is important to ComTrade because it enables the creation of social, environmental and economic value for long-term business success and responsible global development. ComTrade is focused on identifying all aspects of its business that may have impact on the environment and the implementation of these aspects such as the reduction of resource consumption, waste and the company's work as well as the promotion of energy and resource conservation. ComTrade strives to preserve natural resources and reduce the environmental burden of waste generation and emissions into air, water and soil." Through their actions, they strive to minimize the company's plastic waste. The consumption of more than 220,000 plastic cups per year prompted them to replace them with paper ones. They also put plastic straws out of use, changed the way food is served in cafeterias, installed numerous waste disposal boxes, use energy-saving light bulbs, heat with electricity, and recycle all used office supplies. In the central campus in New Belgrade, they installed solar panels as well as a charger for electric and hybrid cars. In mid-March, ComTrade employees planted 100 saplings on the territory of Belgrade, and in April they participated in the cleaning of the banks of the Sava. The company says that their goal is to expand their knowledge of how each of them can reduce the negative impact on the environment outside of the company, and not just that their awareness is determined by legal regulations. In the middle of 2011, the environmental protection initiative "Life is Green" was launchedwithin the company, with the aim of establishing and implementing an environmental protection management system (EMS) according to the specified standard. In the document ComTrade Environmental policy (2018, page 1) the main goals of the company aimed at preserving the environment are defined:" Goals of our company are: Reduction of wastes and improvement of recycling rate; Promotion of energy and resource conservation; Purchasing and development of environmentally friendly products and materials; Improvement of employee's awareness. We are focused to prevent pollution, reduce waste and ensure that, wherever practical measures are implemented to protect environment."

Conclusion

ComTrade Group is a good example of business from the aspect of sustainable development. The method of analysis and the method of comparison, which were used in thework, showed that the company not only implemented the basic principles of sustainable development in its official acts, but also applies and nurtures them in practical action. Attention is equally focused on all three pillars of sustainable development. Analyzing the working environment that ComTrade creates for its employees, one gets the impression thatthe company has reached the standards of the social model of the welfare state, i.e. the Scandinavian countries. The company operates on an international level, which gave it the opportunity to emulate, butalso to adopt examples of the best practices of socially responsible and sustainable business. He insists on these principles in cooperation with clients and partners. In this sphere, ComTrade is becoming a model for other companies in the country and region. It is recommended that ComTrade permanently improve the practice of sustainable business, follow current trends, adapt, and apply them.

Literature and internet sources

1. Environmental policy, 2018, ComTrade System Integration, Belgrade

2. Klarin T, "The Concept of Sustainable Development: From its Beginning to the Contemporary Issues", Zagreb International Review of Economics & Business, Vol. 21, No. 1, pp 67-94, 2018

3. ComTrade Group Code of Conduct, 2022, ComTrade Group Compliance Monitoring Committee, Belgrade

4. United Nations, "Transforming our World: The 2030 Agenda for Sustainable Development", A/RES/70/1,2015

5. <u>https://biznis.telegraf.rs/it-biz/3171270-digitalna-solidarnost-comtrade-</u> <u>system-i ntegration-pruza-podrsku-u-borbi-protiv-korona-virusa</u>

6. <u>https://www.telegraf.rs/vesti/beograd/2025646-kompanija-comtrade-</u> <u>donirala-40-tesla-tableta-ucenici-sa-smetnjama-u-razvoju-sada-ce-mnogo-lakse-</u> <u>uciti-foto</u> 7. <u>https://pcpress.rs/comtrade-donirao-16-notebook-racunara-</u> <u>srednjoj-medicinskoj -skoli-u-gracanici/</u>

8. <u>https://poslovnenovine.ba/2020/04/24/comtrade-distribution-sa-poslovnim-</u> <u>partn erima-donirao-48-notebook-racunara/</u> 9. <u>https://www.ite.gov.rs/vest/sr/4949/kompanije-telekom-srbija-telenor-srbija-vip-comtrade-i-huawei-obezbedile-donaciju-pametnih-telefona-tableta-i-mobilnih-kartica-za-oko-2800-ucenika-osmog-razreda-za-onlajn-samoprocenu-znanja-.php</u>

10. <u>https://www.infokg.rs/info/ekonomski-fakultet-uspostavio-saradnju-sa-kompanijom-comtrade.html</u>

11 .<u>https://www.novosti.rs/ekonomija/preduzetnik/1221300/drustvena-odgovornost-svim-segmentima-komtrejd-poslovanja</u>

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FUTURE OF TRANSPORT TECHNOLOGY

Abstract:

In the project task, we are addressing the issue of new technology for heavy transport vehicles, which would be mass-implemented into road freight transport, with the aim of reducing the environmental impact, increasing road safety and improving efficiency, in a way so that this is economically justified.

We compare promising and meaningful alternatives that would suit different situations and find out where new technology needs to be further developed to be safe and efficient.

Key words: alternative fuels, autonomous driving, infrastructure, technology, visions

1. INTRODUCTION

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.

As the demand for transport services rises globally every year, and it rises the demand for heavy transport trucks, and with higher demand comes grater pollution. Main cause for increased transport demand is mostly strong purchasing power, low item costs, online shopping and good communication.

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Manufactures and transport companies are trying to implement sustainable technologies and materials to their products and services. Some of those are ecofriendly packaging, low emissions vehicles and bater transport planning. Problem arises with fact that new alternative solutions are not competitive with diesel powered vehicles. We tried to find out the current state of alternatives.

This short paper tries to identify some 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.

2. Alternative fuels

We believe that the future for the next 10 - 20 years is in CO2 neutral fuels. The fact is that CO2 pollution is smaller and such alternatives are very welcome in the right form. A sudden ban on all internal combustion engines would be a major economic disadvantage and therefore the switch to other energy sources, such as electricity, must be mild and. 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 for 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) Currently, natural gas lorries are only used on relations that allow such vehicles to be charged, because we need special infrastructure, in cities and on shorter trips. So, these are mainly urban routes, close distribution, internal transportation, and possible routine transport lines that are well recalculated. (TRUCKER, 2020)

Hydrogen fuel cells, which produce electricity through the chemical process, also have great potential. The only side product in this is water, but it is worth noting that hydrogen production is energy wasteful. Ecologically correct is the production of hydrogen from renewable sources. The hydrogen vehicle is eco-friendly and efficient therefore this technology is already used in cars and is being tested intensively on lorries and rail. According to current prototypes, hydrogen vehicles are also expected to be competitive with lorries that drive longer routes of more than +800km per week. The advantage of hydrogen is also the shorter charging time of the container compared to charging the battery. (Ficko, 2020) Mercedes also promises a high life of hydrogen-powered trucks, which would be equivalent in quality to the diesel version with 1,200,000km of life spand and 25,000 working hours. The total mass of the composition will be 40tons at the test, which means that the load mass is 25 tones. The only discharge into the environment is the water and steam produced by the production of electricity. Many of the developments are also 100,000 vehicles, which, due to the nature of the work, are the first candidate for the complete transfer of the entire fleet to electricity. This approach allows the majority of lorries operating shorter distances, especially in cities, as well as long-distance lorries, to be electrified, provided that the charging infrastructure so permits. (Jurgele, M., 2022, p.40)

It is necessary to create an equal plan which provides guides to countries and businesses so that they know how to invest in infrastructure, and 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 this planning. (Evans, et al., 2020)

However, it is also necessary to provide for 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.

Our study and conclusions are, that forced changes could disrupt the efficiency of our transport and cause massive increase in prices, that would lower the quality of life in Europe and also make mobility a luxury. Only options are expensive vehicles and almost free energy or expensive energy and cheap vehicles.

According to forecasts, alternative vehicles are not expected to be cost-justified until around 2030. If motor energy was are affordable, there will also be an increased interest, and in mass production, and the prices of new vehicles are expected to fall 20-50% compared to current purchase prices of the new vehicle.

3. 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. (Maurer, et al., 2016) So far, we have researched some proposals and methods of controlling autonomous vehicles, which did not cover any weaknesses. After that we asked truck divers some strategic questions about autonomous driving. Drivers whose trucks are equipped with assistive systems with automation conditions 2.0 (active cruise, warning of

distance...) were asked: What are the potential weaknesses of the current technology that might be passed on and what are the potential weaknesses of autonomous vehicles 3.0 and 4.0.

Most of them had concerns about whether this would be safe at all, especially on Slovenian roads, which are inappropriately narrow for lorries. They were concerned about dangerous banks and collisions with rear-view mirrors, as well as narrow bridges and unwanted objects on the road.

However, given our experience with active pace and lane assistance, we have come to the question of whether tire wear will be worse or better, and what fuel consumption will be like. The high weakness of the active cruise is superficial anticipation and too often braking, which means that wear and tear of the brakes and tires is high and, as a result, fuel consumption is increasing.

The price of the vehicle will be high in the early stages, which may be a major problem as prices on the market will not be adjusted to the type of vehicle unless legally required, but such vehicles will be avoided in such a case. We'll get an answer when the first cases arrive on the market. (Kesse, 2018)

The question also raised whether fully autonomous vehicles would be able to be refueled without human intervention. However, we have not found an answer to this, as this is currently only possible for autonomous industrial electric vehicles that connect themselves to special charging stations.

An important role in our research is the identification of the link between the upcoming automation of the vehicles and the quality of the working process of the professional driver. We have linked our findings from our survey here and combined them with the opinions of the professional of drivers who commented on our findings. We have also included a debate about alternative propulsion, as we believe

that most autonomous vehicles will be powered by alternative fuels, especially electric propulsion. (Kesse, 2018)

The greatest advantage would be additional driving assistance as many drivers make phone calls while driving, which causes distraction and increases the risk of an accident. Today, additional safety is provided by crash warning systems, which also automatically brake in the event of a bump, lane keeping system, ABS, TSC..., but additional assistance would increase safety. (Maurer, et al., 2016)

During assisted autonomous driving, the driver would have more time and options for more efficient monitoring of traffic information, which would help to bypass traffic jams. The driver can also monitor the navigation and predicted route while, thus directing the vehicle along shorter routes, avoiding the road that is closed to lorries, or finding a better alternative route. Many drivers drink water or eat a simple snack while driving, which causes short moments of weak focus on the road, that could be improved with assistance of autonomous truck.

With the help of autonomous driving, the driver could perform this activity more safely and less stressfully, as most driving times account for motorway driving at higher speeds. Under these conditions, it is important that the driver is always 100% focused on driving as the consequences of high-speed accidents often end up with severe consequences.

In fully autonomous driving, the driver could read books or perform other activities, which opens the way for new business opportunities, assuming that most of the time autonomous driving is the one controlling the vehicle. Autonomous vehicles are supposed to communicate with each other, thus helping to make transport more efficient. During this period, the driver can assess and improve the performance of the autonomous vehicle, thus helping to increase efficiency and to obtain data to help manufacturers upgrade the operation of the system.

We have concluded that drivers are open to semi-autonomous and fully autonomous driving, because of improving safety and improving the working environment, particularly in the area of safety at work and driving efficiency.

5. Future concept



Figure 5: Futuristic transportation Source: Personal collection

We have opened a research/concept about remote controlled transportation vehicles, that could change the transportation in many ways.

Our concept is to drive trucks remotely, with remote control, in which the driver is present behind the wheel via analog and digital devices. The driver can remotely operate a vehicle with equipment that benefits simulators, but we believe that such equipment could be further upgraded for maximum and reliable data transmission, which is key to reliable and safe operation.

This way, we could provide drivers with a safe and healthy environment, with same work principle that they have managed until now. It would be necessary to put together powerful vehicle management tools and to upgrade lorries for this type of operation.

General drivers' opinion that were asked about this topic was mixed as some like the physical presence in the vehicle, but others were amazed as this could make their life much different.

In this short paper we tried to present some of our research results, of our project. More can be found in our main paper.

5. LITERATURE

Ambrald, M., 2020.The Future of Trucking. Accessible on :https://medium.com/swlh/the-future-of-trucking-7b8208e7a29f (15.12.2020)

AuroraTeam,2021.ScalingSimulation.Accessibleon:https://aurora.tech/blog/scaling-simulation (1.3.2022)

Einride, 2023. Insights. Accessible on : <u>https://www.einride.tech/insights</u> (15.1.2023)

Evans, D., Evans, D., in Williamson, A., 2020. The Road to Zero Emissions : The Future of Trucks, Transport and Automotive Industry Supply Chains. GB., US. : Kogan Page, Limited.

Ficko, T., 2020. Hyundai Xcient Fuel Cell: Tovornjaki na vodik že na poti v Evropo. TRUCKER, (novinarski članek e-revije iz baze podatkov) 2020, 1. Accessible on : <u>https://www.trucker.si/hyundai-xcient-fuel-cell-tovornjaki-na-vodikze-na-poti-v-evropo</u> (14.1.2021).

Gašperič, P., 2017. Strategija razvoja prometa v Republiki Sloveniji do leta 2030. Dosotpno na :

<u>https://www.gov.si/assets/ministrstva/MzI/Dokumenti/Strategija-razvoja-</u> prometa-v-Republiki-Sloveniji-do-leta-2030.pdf (10.12.2020)

Gornjak, L., 2020. Zelena Slovenija. Kakšna je prihodnost prometa v Sloveniji?. Accessible on :

<u>https://www.zelenaslovenija.si/EOL/Clanek/2963/embalaza-okolje-</u> logistika-st-81/kaksna-je-prihodnost-prometa-v-sloveniji-eol-81 (15.1.2021).

- Gruden, T., Jakus, G., 2020. Raznolikost voznikovih odzivov na zahtevo za prevzem vodenja pogojno avtomatiziranega vozila. V : Žemva, A., Trost, A. ur. Zbornik devetindvajsete mednarodne Elektrotehniške in računalniške konference ERK 2020. Portorož : Slovenska sekcija IEEE Fakulteta za elektrotehniko v Ljubljani. (pp. 95-98).
- Jervis, T., 2022. What is the Euro 7 emissions standard?. Accessible on: <u>https://www.carbuyer.co.uk/car-ownership/303931/what-is-the-euro-7-</u> <u>emissions-standard</u> (20.3.2022)

Jović, M., 2021. Gorivo 2.0. kamion & BUS, 3 / 2021, pp.50-53.

Jurgele, M., 2022. Dizlu še ni odklenkalo. Transport & Logistika, 22 / 1-2, pp.40.

Jurgele, M., 2022. Evolucija namesto revolucije. Transport & Logistika, 22 / 3, pp.20-23.

Kalauz, Z., 2022. Pametni tahograf – kaj nas čaka v naslednjih nekaj letih?. Accessible on : <u>https://prevozi.finance.si/8986906/Pametni-tahograf-kaj-nas-</u> <u>caka-v-naslednjih-nekaj-letih</u> (18.1.2023)

Kesse, S., 2018. THE FUTURE OF TRUCKING: CHALLENGES FOR THETRANSPORTATIONSECTOR.Accessibleon:https://www.rolandberger.com/en/Publications/The-future-of-trucking-Challenges-for-the-transportation-sector.html (12.12.2020)

- Lavelle, M. 2022. Inside Climate News: Russia's War in Ukraine Reveals a Risk for the EV Future: Price Shocks in Precious Metals. Accessible on : <u>https://insideclimatenews.org/news/28032022/russias-war-in-ukraine-</u> <u>reveals-a-risk-for-the-ev-future-price-shocks-in-precious-metals/</u> (8.4.2022)
- Lewis, M., 2020. EGEB: 58% of global car sales will be electric by 2040 new study. Accessible on : <u>https://electrek.co/2020/05/21/egeb-58-percent-of-</u> <u>cars-will-be-electric-by-2040-university-california-fossil-free/</u> (15.1.2021).
- MAN Truck & Bus, 2021. Mans-full-commitment-to-autonomous-trucks. Accessible on: <u>https://www.mantruckandbus.com/en/innovation/mans-full-commitment-to-autonomous-trucks.html</u> (3.3.2022)
- Maurer, M., Gerdes J., C., Lenz, B. in Winner, H., 2016. Autonomous Driving : Technical, Legal and Social Aspects. Berlin : Springer Nature.

McCouch, B., 2019. 4 transformational trucking technology trends. Accessible on : <u>https://www.fleetowner.com/industry-</u>

<u>perspectives/ideaxchange/article/21703947/4-transformational-trucking-</u> <u>technology-trends</u> (20.12.2020)

- McDermid, J., 2020. Autonomous cars: five reasons they still aren't on our roads. (članek) Accessible on: <u>https://theconversation.com/autonomous-cars-five-reasons-they-still-arent-on-our-roads-143316</u> (15.1.2021).
- Mercedes-Benz, 2022. The-long-haul-truck-of-the-future. Accessible on: <u>https://www.mercedes-benz.com/en/innovation/autonomous/the-long-</u> <u>haul-truck-of-the-future/</u>(2.3.2022)
- Paušer, B., 2021. Prihaja vodik. kamion&BUS, 51,pp. 3.

PNO, 2020. *Truck Platooning: the future of road transport?*. *Accessible on:* <u>https://pnorental.com/truck-platooning-the-future-of-road-transport/</u>

(15.12.2020)

Plus, 2022. The future of trucking. Accessible on : <u>https://plus.ai/</u>(5.3.2022)

Sjafrie, H., 2019. Introduction to Self-Driving Vehicle Technology. Boca Raton London New York : CRC Press.

Stropnik, R., Mori, M., Drobnič, B., in Jurjevčič, B., 2016. Vrednotenje okoljskih vplivov delovanja UPS sistema s PEM gorivno celico. V : Golobič, I. ur. Svet strojništva - Oktober 2016. Ljubljana : ZSIS. (pp. 39).

SUNFIRE, 2021. E-FUEL. Accessible on: <u>https://www.sunfire.de/en/e-fuel</u> (20.3.2021)

Transmetrics, 2018. Top 5 Technologies and Innovation Trends Revolutionizing Trucking. Accessible on: <u>https://transmetrics.eu/blog/top-5-technology-and-</u> <u>innovation-trends-revolutionizing-trucking-now/</u>(15.12.2020)

Alonso Raposo, M. (Ed.), Ciuffo, B. (Ed.), Alves Dies, P., Ardente, F., Aurambout, J-P., Baldini, G., Baranzelli, C., Blagoeva, D., Bobba, S., Braun, R., Cassio, L., Chawdhry, P., Christidis, P., Christodoulou, A., Corrado, S., Duboz, A., Duch Brown, N., Felici, S., Fernández Macías, E., Ferragut, J., Fulli, G., Galassi, M-C., Georgakaki, A., Gkoumas , K., Grosso, M., Gómez Vilchez, J., Hajdu, M., Iglesias, M., Julea, A., Krause, J., Kriston, A., Lavalle, C., Lonza, L., Lucas, A., Makridis, M., Marinopoulos, A., Marmier, A., Marques dos Santos, F., Martens, B., Mattas, K., Mathieux, F., Menzel, G., Minarini, F., Mondello, S., Moretto, P., Mortara, B., Navajas Cawood, E., Paffumi, E., Pasimeni, F., Pavel, C., Pekár, F., Pisoni, E., Raileanu, I-C., Sala, S., Saveyn, B., Scholz, H., Serra, N., Tamba, M., Thiel, C., Trentadue, G., Tecchio, P., Tsakalidis, A., Uihlein, A., van Balen, M., Vandecasteele, I., 2019. The future of road transport - Implications of automated, connected, lowcarbon and shared mobility, EUR 29748 EN, Publications Office of the European Union, Luxembourg, 2019, ISBN 978-92-76-14318-5, doi: 10.2760/668964, JRC116644.

The Global Economy, 2019. Roads quality - Country rankings. Accessible on: <u>https://www.theglobaleconomy.com/rankings/roads_quality/</u> (5.3.2022)

Transport & Logistika, 2022. Leta 2021 je bilo prodanih 15.171 električnih tovornjakov. Transport & Logistika, 22 / 1-2, pp.13.

Transport & Logistika, 2022. Nova Renault Trucks T in C E- Tech. Transport & Logistika, 22 / 3, pp. 10.

Transport & Logistika, 2022. CONTINENTAL, Prihaja govoreči tahograf. Transport & Logistika, 22 / 9, pp. 13.

TRUCKER, 2020. Ponudnik storitev za mobilnost DKV je pred kratkim razširil svojo mrežo za oskrbo z LNG na sto servisov in s tem dosegel pomemben mejnik. Mreža zdaj vključuje šest evropskih držav, s tem pa je DKV dobavitelj za največje mreže za oskrbo z LNG v Evropi. TRUCKER, (novinarski članek e-revije iz baze podatkov) 2020, 1. Accessible on : <u>https://www.trucker.si/dkv-jeva-mreza-za-oskrbo-z-lng-vkljucuje-ze-100bencinskih-servisov</u> (14.1.2021).

VDA, 2021. Synthetic fuels – power for the future. Accessible on: <u>https://www.vda.de/en/topics/environment-and-climate/e-fuels/synthetic-</u> <u>fuels.html</u> (20.3.2021)

Wikipedia, 2018. LIDAR. Accessible on: <u>https://sl.wikipedia.org/wiki/LIDAR</u> (1.3.2022)

Damjan Plut⁴⁷

AUTOMATION OF INTERNAL FLOWS CAR PRODUCTION

Abstract:

The content of the article is presented with an emphasis on the feasibility of introducing the automation of the logistics process. That is, an opportunity for progress that completely replaces the supply of the production process in the body shop with the use of classic tractors and operators. Replacing the human factor - manual care with modern digitally controlled technology, which is precise with more effectiveness, safety and less possibility of production process. Changes and rationalization of internal flows for production supply are shown schematically and by comparing calculations according to the BEFORE-THEN system. This is the guide and condition for the change to be implemented or rejected. The introduction of automation of the logistics process is the foundation of economy expressed at the factory level, which affects the price of the final product-the car.

Key words:

Logistics, flows, automation, means of transport, AGV

INTRODUCTION

With the discovery of the automobile, the drive for motorized mobility and transportation grew. The constant demand for motorized means of transport as well as the desire for them increased. That was most prominently introduced by the industrialist Henry Ford with the introduction of the assembly line in 1913. With mass production in the automotive industry, logistics also developed in parallel. An increasingly strong became also the need for an organized and technologically advanced form of production supply. So, we can say that, along with other economic sectors, the automotive industry was, and still is, on a global level among the major, if not the leading, element shaping the world's economy even today. It is constantly evolving, both technically, technologically and design-wise. In order for development to be possible, in addition to automotive engineering and the production process, logistics is also very important. There is always a desire to produce as quickly as possible and sell at the same time.

A great emphasis is placed on the field of internal logistics, where new, state-of-theart technical and technological solutions are constantly being sought. So, solutions

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that replace the methods of physical supply and the use of means of transport with new, more reliable, modern technological approaches, which we call the automation of the logistics process. The introduction of this alone increases the competitiveness of the automotive industry by reducing costs, which certainly also affects the price of the vehicle. Namely, the outdated method of supply with traction compositions and the use of the human factor has many shortcomings and problems, which are present in the quality and safety of supply.

Even the automated method of care is constantly developing technologically and technically. The first systems of automated supply could be said to be analogous with the use of mechanical guides and the use of chains and systems, which, however, had greater possibilities of mechanical failures. Even newer systems of AGV (automated guided vehicles) tractors, which function on the basis of magnetic tape on the ground, are becoming obsolete and less flexible. The newer systems that are coming are already based on the WI-FI system that is distributed throughout the factory. The latest systems, however, are already satellite-controlled with satellite navigation GPS system. However, a new generation of tractors or forklifts is coming, which are equipped with AI (artificial intelligence), and these are still under development and for the time being are more focused on safety in the transport process.

PROBLEM DEFINITION

Internal logistics is for the supply in the production process among the higher costs in the distribution chain, you could call it a loss. The use of the human factor and standard-manual equipment, which is most often reflected as a problem due to the demands for ever-increasing quantities of products. In our case, it concerns the production of a car, and the maintenance of the production process which is often time-limited, often at the limit, i.e. the possibility of stopping production. At the expense of this, an enormous cost can arise on an hourly or daily basis, which the factory cannot afford under any circumstances. A time limit in the supply of physical flows can lead to a greater possibility of damage to personnel, equipment and, last but not least, installation material. Security is at risk, which must not be neglected. Because of the standard equipment, the flows take up too much logistics space that could be used for other purposes, and the supply of the process with automated systems can reduce this in areas where this is not possible in a standard way. All this can also be evaluated and compared. Crossing of physical flows and supply with an automated system is also a problem on the transport route. This can lead to untimely delivery of materials to the workplace and stop the production process. In order to avoid this, the factory's goal is to have the internal flows fully automated. How and with what approaches to change the outdated logistic chain of supply is the work of engineering, which analyses these things, prepares theses and puts them into practice with the help of knowledge, experience and tools that are available. Above all, it is important that the achieved goal is argued with calculations and supported by constructive solutions. In any case, the expected result is that the modification of flows makes sense.

LOGISTICS PROCESS OF SUPPLYING THE PRODUCTION PROCESS

A good knowledge of all the characteristics of the factory is necessary for the supply of the production process. Location of storage areas, which can be on several levels. It is necessary to know the production process, i.e. at which workplace the components are installed in the body. Only on this basis can the system of traction compositions, means of transport and supply with an automated system be planned. [1]

The number of cycles depends on many factors, but they are related to different parts of the process. The supply of the production process in the body shop is linked to primary and secondary supply. The first is carried out directly from the warehouse to the workplace, where the packaging with pieces is loaded onto carts, as well as the transport of pieces from the warehouse to the picking zone, from where the supply continues with an automated system. Secondary supply is a method of transport that goes from the workplaces where the parts are pre-assembled and transported to the place of installation in the body. All this is done through transport routes, called internal logistics flows. All factors in the entire logistics supply chain are also connected by all services at the factory level. Mallerowicz's definition is vivid "Internal transport or its functions concern almost all departments in the company, the smooth flow of most of all other reverse functions depends on the efficiency and economy of its performance. Therefore, it is necessary to properly integrate internal transport into the entire organizational structure of the company." [2]

Means of transport used in the field of bodywork operate with interrupted-cyclic operation. The selection and decision of which means of transport is chosen is optimally adapted to the supply of the production process. The choice must follow the principles corresponding to security of supply, speed and economy. It is necessary to consider the technical characteristics of the means of transport, which are specified and at the same time make it easier for us to choose only these. Towing vehicles, so-called towing vehicles or towing tractors, are an important vehicle in internal logistics, which are used together with the towing composition (trailers, chassis, ...) for the transport of material within industrial facilities. They are designed to enable the efficient and quick movement of larger cargo units on pallets, containers, and a larger number of packages in the transport cycle within the factory area. [3]

Electric tractors, which are driven by an electric motor and also make the most sense for use in internal logistics, where transport takes place inside the factory, i.e. indoors. It is ecologically acceptable and, at the same time, does not cause additional noise, like, for example, diesel-powered tractors. They are energy efficient, which helps to reduce emissions, energy costs and improve business sustainability. Like forklifts, they are designed for different purposes. Above all, this is about carrying capacity. [4]

AGV (autonomous guided vehicle) is a type of internal logistics tractor used to move cargo over short or long distances in internal logistics operations, from storage zones or picking zones to the workplace. They are equipped with sensors, a camera, a navigation system and a central operating system, which allows them to move along a predetermined route or follow certain markings on the ground without the need for human control. Designed to transport different types of cargo such as pallets, crates, trolleys and other items. The use of AGV tractors in internal logistics has many advantages. Efficiency is increased and they operate autonomously, which enables continuous movement of cargo without the need to wait for the driver. This can increase the speed and efficiency of logistics operations. They are automated and reduce human errors that can occur when moving cargo manually, which can contribute to greater accuracy and less damage to cargo. They adapt to different requirements and environments, as they can be programmed for different paths, speeds and operating modes. They can also be integrated with a warehouse management system (WMS) or other logistics systems. They are flexible in terms of moving different types of cargo and can easily adapt to the changing needs of logistics operations. However, when introducing AGV tractors in internal logistics, it is also necessary to consider challenges such as implementation costs, the need for appropriate infrastructure (e.g. navigation system, route marking, etc.), employee training and the like. [5]

Standard carts are used for the transport of standard packaging. The dimensions of the chassis correspond to the standard packaging, i.e. the loading surface is designed to be the same as the dimensions of the packaging floor plan. Smaller pieces that are not visible outside the car body are usually transported in these packaging's. The pieces are placed in the packaging randomly and are exposed to abrasions on the surface of the piece. The chassis is marked according to the type of packaging. For each newly manufactured type of cart, it is necessary to comply with standards such as the CE mark, which ensures compliance with EU requirements. The colour of the manufactured carts is also prescribed and is determined according to the RAL scale. [6]

Specific carts and trolleys are intended for the transport of packages of specific, purposeful shapes. These are usually larger body parts in packaging that have a cutout for easier ergonomic access to the parts. These are mostly body parts that are visible on the body structure and must not have any surface damage under any circumstances. These rolling bases also have a label that is compatible with the label of the packaging, i.e. it is intended for the transport of only this and not any other type of packaging.

AGV trolleys, the construction of which is adapted for towing AGV tractors. Unlike other trolleys, it does not have a towing hook and a different arrangement of wheels, which are arranged at the corners of the trolley and rotate, i.e. they are not fixed, which allows the trolley to move in all directions. It has a clamp on the chassis that is adapted to the AGV tractor.

Logistics flows in internal logistics refer to the movement of materials and services within a company or organization, including transportation, storage, processing and distribution of these elements. Logistics flows in internal logistics are key to the smooth operation of a company's production, distribution or logistics

process. Internal logistics flow refers to the movement of materials, goods or products within a company or organization. [7]

At the factory level, there are two ways of supplying the production process:

- Primary supply: Components that arrive at the factory are transported directly to the warehouse. Supply of the production process is carried out from the warehouse directly to the place of installation in the body.
- Secondary supply: In this case, the production process is supplied from the pre-assembly production, where the pieces are pre-assembled. So, the component, which is made of several pieces, is transported to the place of installation in the body. These are mainly pieces that are installed in the chassis of the vehicle.

CALCULATION OF CYCLE TIME AND OCCUPACY OF THE OPERATOR

In the logistics process, the MTM-3 method is used for the duration of the supply cycle, namely for each individual activity in the field of bodywork. With a list of all activities and the number of necessary packaging that needs to be transported per shift, the final result is the occupancy of operators, on the basis of which you can see how many operators are needed per shift or per day in the entire supply of the process in the body shop. This method is not the latest way of calculations in the industry, but it is very reliable. This method was developed based on the experience of industrial engineers H.B.Mynard, J.L.Schwab and G.J.Stegemerten in 1948. The book "Methods of time measurement" describes all the details of the development of the calculation system according to the MTM-3 method and how it is used. [8]

An example:



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GE3
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TRANSPORTS LIBRES ou VIDES ou en CHARGE 0,6 cmin/m

Dist	ance 🔸	5	10	15	20	25	30	35	40	45
en mètres		3,0	6,0	9.0	12,0	15,0	18.0	21.0	24,0	27.0
50	30,0	33,0	36,0	39,0	42,0	45,0	48,0	51,0	54,0	57,0
100	60,0	63,0	66,0	69,0	72,0	75,0	78,0	81,0	84,0	87,0
150	90,0	93,0	96,0	99,0	102,0	105,0	108,0	111.0	114,0	117,0
200	120,0	123,0	126,0	129,0	132,0	135,0	138,0	141,0	144,0	147,0
250	150,0	153,0	156,0	159,0	162,0	165,0	168,0	171,0	174,0	177,0
300	180,0	183,0	186,0	189,0	192,0	195,0	198,0	201,0	204,0	207,0
350	210,0	213,0	216,0	219,0	222,0	225,0	228,0	231,0	234,0	237,0
400	240,0	243,0	246,0	249,0	252,0	255,0	258,0	261,0	264,0	267,0
	-							-	-	

The cycle time obtained from the table is expressed in cmin/m (cent minutes/meter).

Cmin is a hundredth of a minute and is: 1 cm = 60 sec.

The table below contains the data from the MTM-3 table for the GE3 type transport vehicle, which has a speed of 10 km/h or 0.6 cm/m.

• Cycle time calculation according to MTM-3:

For a distance of 425m, a time of 45cm is taken from the table:

425 m x 0.6 cm/m = 255 cm

At a distance of 425 m, a tractor with a composition consumes an average of 255 cmin;

255 cmin/100 = 2.55 min x 60 s = **153 s**

OCCUPACY OF THE OPERATOR

Before starting to calculate the occupancy of the operators, it is necessary to measure the transport route along which the supply takes place, it is also necessary to list all activities, we could call it all the movements on the entire transport route in the continuation of the cycle, from the loading of packaging in the warehouse, and delivery to the workplace. This includes starting, fastening and unfastening the chassis, turning, waiting for the lift gate, loading and unloading packaging, driving with empty and full packaging to the workplace and back... The following is a list of the number of references (components), followed by packaging, which must be transported in shifts. The package contains a previously and systematically determined number of pieces (optimal quantity). The number of necessary packaging per shift is tied to the cadence, i.e. the number of vehicles that production is able to make per shift.

An example:

Cadence of vehicles per shift:

45 vehicles/h x 8h = 360 vehicles/shift

There is one piece per vehicle from this packaging and the packaging is ref. 123456789R, which has 40 pieces/pack

360 vehicles/ shift/ 40 pcs/pack = 9 cycles

The result is information on how many packages we must transport per shift from the warehouse to the workplace in the production process. So for each operation it calculates the cycle time and how many cycles per shift the operator can even do. Thus, we get the occupancy, which is reflected in percentages. If the calculated occupancy is over 100%, as well as if it is 0.1%, it means that the operator is too busy and it is necessary to place two operators and, consequently, two compositions with a tugboat. So, the logistics costs also increase.

CALCULATION FOR THE AUTOMATION OF THE SUPPLY

Before the implementation of automated logistics supply with components in the production process, it is necessary to determine the transport route, which can be completely different than in the case of supply with physical flows. It is necessary to measure the length of the path. The transport path can also be much narrower or as wide as the width of the transported packaging or trolley. Of course, a certain optimal path width is also required. Namely, the AGV tractor has the ability to turn on the spot. It is necessary to calculate how many trolleys are needed for supply per shift. Everything depends on the cadence of vehicle production, i.e. how many vehicles per hour the production is able to make and the number of vehicles per shift. The AGV has an average speed of 3.5 km/h on the entire transport route, and a maximum speed of 5 km/h.

It is also necessary to predict the number of AGV carts, namely one cart at the workplace, where the material is collected and installed in the body, one at the loading area in the picking zone, where the material is loaded onto the designated storage places on the cart, and at least one on the way to the workplace. This depends on the length of the transport route. [9]

EXAMPLE OF FLOW AUTOMATION IMPLEMENTATION

In the factory, a small part of the supply remained within the body shop, which is carried out with physical flows and is mixed with an automated supply. The goal of the factory is the complete supply of the production process with an automated system. Calculation according to the BEFORE-THEN system is required, i.e. proof of the profitability or justification of the introduction of automation. [10]

SUPPLY WITH PHYSICAL FLOW

Before calculating operator occupancy, the length of the route is measured in two ways. The first is done with a manual mechanical measuring wheel, which is controlled by the operator and goes along the intended, mapped transport path. Another way is possible from the factory plan with the help of an application (ACAD, Microstation, ...). The length of the transport route does not change until changes are made and remains the basis for calculating occupancy. All the activities and steps of the operators are listed.

Vhodni podatki Oskrba z vlačilcem Razdalja z polnimi embalažami: 425 metrov Razdalja za praznimi embalažami:425 metrov 3 VO/kompozicijo (povprečje)

RAZKLAD IN NAKLAD VO Z VILIČARJEM

				Cas total/emb			
Opis operacij	Symbol	Čas	Frekvenca	(c min)			
					_		
Transport iz srednje točke	TL 20	12	1	12			
Prijem prazne embalaže	PS 10	19	1	19			
Transport prazne embalaže	TC30	18	1	18			
Naklad emalaže na vozno osnovo	CC111	26	1	26			
Razklad embalaže z vozne osnove	DC111	26	1	26			
Transport prazne embalaže	TV20	12	1	12			
Odlaganje prazne embalaže	DS13	32	1	32			
Zlaganje prazne embalaže		44	0,1	4,4			
Spreminjanje smeri	CT 10	5	1	5			
Vstop in izstop iz viličarja	MD1	6,5	1	6,5			
Transport do srednje točke	TL 20	12	1	12			
			Total	172,9			
			-		_		
	Skupa	aj z doda	inim časom (4%)	180	cmir		
		Čeo sikla 1.00					
			Cas cinia	1,00			
CSKRBA Z VOZNIMI OSNOVAMI NA D	ELOVINO MESTO						
			Ċ	Čas skupaj na V	03		
Opis operacij	Symbol	Čas	frekvenca	(cmin)			
			2X 255- dodan čas	s zaradi oviranja AC	SV		
Transport z polnimi embalažami	TC 425	510	1	510			
Prepenjanje voznih osnov		140,3	3	421			
Transport z praznimi embalažami	TV 425	255	1	255			
Spreminjanje smeri	CT 10	5	6	30			
Prečkanje transportnih poti	CA12	23	2	46			
Vstop in izstop iz vlačilca	MD2	21	2	42			
			Skupaj	1304			
	Skup	choh z ic	nim časom (4%)	1356			
	Skupa	aj z doda	nim časom (4%)	1356	 cmir		
	Skup	aj z doda	nim časom (4%) Čas cikla	1356 13,56	 cmir min		
	Skupa	aj z doda	nim časom (4%) Čas cikla kla na embalažo	1356 13,56 4,52	 cmir min min		

After the calculated cycle time, all references (pieces) that need to be transported are selected from the system. Based on this, we get how much packaging needs to be transported to the workplace during the shift. A calculation is made for the existing physical flow, i.e. the occupation of one operator in a shift, who uses a forklift and a tractor to supply jobs. Occupancy changes based on the change in the cadence of vehicle production per day.

Kadenca	324	vozil/ izmeno
BJA ICE	136	
X07 ICE	133	
R4S EV	55	

							433	min/izmeno	
N O	tin ombalažo	rof	kos/	transportno	št	Čas aktivnosti v	čas/	št. operaterjev	Zacadapact
	up embalaze	Ter.	emb	sredstvo št.	emb/izmeno	min	emb	na izmeno	Zaseuenosi
Oskrba delovnih mest karoseije in odpirnih elementov z VL R074 0,71								71%	
Naklad embalaž z viličarjem CAF			R104	48	1,80	1,80	0,20		
stena karoserije D BJA	MTEM7878	760227930R	16	R074	9	13,56	4,52	0,09	
stena karoserije G BJA	MTEM7875	760234671R	16	R074	9	13,56	4,52	0,09	
stena karoserije D X07	MTEM6567	760222663R	18	R074	10	13,56	4,52	0,11	
stena karoserije G X07	MTEM6566	760234624R	18	R074	10	13,56	4,52	0,11	
zunanji del pokrova motorja BJA	MTEM7785	651228714R	39	R074	3	13,56	4,52	0,04	
streha BJA	MTEM7873	731125732R	35	R074	4	13,56	4,52	0,04	
zunanji del pokrova prtljažnika BJA	MTEM7876	901505533R	44	R074	3	13,56	4,52	0,03	

The result we got did not exceed 100% (in practice a maximum of 85%) occupancy and shows us that one operator who uses a forklift for loading and unloading material and a tractor with which he supplies production is enough to supply all the mentioned references.

Costs on an annual basis:

- The operator is approx. 2,100 €/month x 12 months = 25.200€
- Rental and maintenance of the tractor is approximately 800 €/month x 12 months = 9.600€
- Forklift rental and maintenance is approximately 800 €/month x 12 months = 9.600€

AUTOMATED FLOW SUPPLY

It is necessary to review the options of a new transport route, namely also in an area that could represent a shorter route and the place of loading on the AGV trolley is carried out in the zone where the loading is for an automated process. It is necessary to find a more optimal route from the warehouse. Usually, storage zones cover different segments of production and not all operators are equally occupied, although it is aimed at this. There are always some deviations, but they are arranged in such a way that the activity is added or taken away.

Kadenca	324	vozil/ izmeno							
BJA ICE X07 ICE R4S EV	136 133 55					433	min/izmeno		
N-0	tip embalaže	ref.	kos/ emb	transportno sredstvo št.	št emb/izmeno	čas cikla/emb	št. vlačilcev na izmeno	Število potrebnih vlačilcev/izmeno	št. potrebnih rezervnih AGV vlačilcev
Oskrba delovnih mest karoseije	mentov z AG	V				3,35	4	1	
stena karoserije D BJA	MTEM7878	760227930R	16	R074	9	30,00	0,59		
stena karoserije G BJA	MTEM7875	760234671R	16	R074	9	30,00	0,59	Skupaj:	5
stena karoserije D X07	MTEM6567	760222663R	18	R074	10	30,00	0,72		
stena karoserije G X07	MTEM6566	760234624R	18	R074	10	30,00	0,72		
zunanji del pokrova motorja BJA	MTEM7785	651228714R	39	R074	3	30,00	0,24		
streha BJA	MTEM7873	731125732R	35	R074	4	30,00	0,27		
zunanji del pokrova prtljažnika BJA	MTEM7876	901505533R	44	R074	3	30,00	0,21		

For the supply of bodies and opening elements, for the introduction of automation, it is necessary to purchase 4 AGV tractors and one as a reserve in case of failure. By purchasing a reserve, uninterrupted operation of production is ensured. In the event of a breakdown and there is no spare, production can be stopped, which the company cannot afford. Of course, the back-up plan is to deliver urgently with a towing composition, which is only used in the urgent variant. [11]

Four carts are required for each reference, i.e., for all seven references.

Cost to implement automation:

- The purchase of 5 AGV tractors is approx. 60.000 € x 5 tractors = 300.000€
- Purchase of carts for towing with an AGV tractor 28 x approx. 2.000€ = 56.000€

Total: 356.000€

CONCLUSION

Comparison according to the BEFORE-THEN system

• The cost for the existing method of care is approx. 44.400 €/year, and if we divide the cost over 10 years, the total cost is 440.000 €

• The cost of automation would be approximately 356,000€

The difference = 88,000€

Analysis with calculations showed that there is no annual saving by eliminating the operator, tractor, and forklift, and switching to automation, i.e., the cost of the introduction is not covered.

Given that the costs are viewed in the long term, i.e. at a 10-year level, a saving of 88,000 is generated. At the same time, the accuracy of the delivery of pieces to the workplace is improved, i.e. a supply hold-up is prevented. The quality of delivery of pieces, safety on the transport route has been improved. The saving is on the transport route. Considering that in the existing part the paths with the physical flow

and the already existing automated one crossed. There is no congestion. A saving of approx. 150 m2 on the storage area, where there was a transit zone for loading and unloading the composition for the physical supply of the production process, and only this can be used for storage areas or the production process. If we summarize the complete analysis, the introduction makes sense. The investment is covered in the long term.

LITERATURE

[1] Obl'č d.o.o., »Notranja logistika« (online) 2022, uporabljeno 21.11.2022, dostopno na:

http://www.oblc.si/notranja-in-distribucijska-logistika

[2] M. Medeot, L. Jakomin in R. Zelenika, »Tehnologija prometa in transportni sistemi«, Portorož: Fakulteta za pomorstvo in promet, 2002.

[3] G. Rak, »Logistika notranjega transporta in skladiščenja«, (online) 2011, uporabljeno: 21.11.2022, dostopno na:

http://www.impletum.zavod-

<u>irc.si/docs/Skriti dokumenti/Logistika notranjega transporta in skladiscenja-</u> <u>Rak.pdf</u>

[4] Linde Material Handling (online) 2023, uporabljeno 24.03.2023, dostopno na: <u>https://www.linde-vilicar.si/si/Proizvodi/Vlacilci-in-vlecna-vozila-s-</u>platformo/W20/

[5] IKU d.o.o., Novo mesto (online) 2018,uporabljeno: 21.03.2023, dostopno na: <u>https://www.iku.si/agv/izbira-avtomatsko-vodenih-vozil/</u>

[6] Bureauveritas, »Oznaka CE« (online) 2022, uporabljeno: 21.11.2022, dostopnona:https://www.bureauveritas.si/oznaka-

<u>ce?gclid=CjwKCAjw7cGUBhA9EiwArBAvonMNwVhIa4-</u> WVdLAVBvK5AXovW93fj1NNCaNW9EcGvgJ2e1A8VZrIxoCMnoQAvD BwE

[7] A. Žagar, »Optimiranje logističnih procesov v podjetju X« (online) 2016, uporabljeno 21.11.2022, dostopno na:

https://bb.si/f/docs/diplomska-dela/zagar_anja.pdf#page=16&zoom=100,129 ,500

[8] Renault, »MTM-3« (1994).

[9] ZBORNIK_PRISPEVKOV_STROKOVNA_MONOGRAFIJA_2018., (online)2018, uporabljeno: 21.11.2022, dostopno na:

http://www.fini-

unm.si/media/ZBORNIK PRISPEVKOV STROKOVNA MONOGRAFIJA 2018 .pdf

[10] S. Klopčič, »Zniževanje stroškov kot posledica informatizacije logističnih procesov- primer podjetja Etol« (online) 2003, uporabljeno:21.11.2022, dostopno na:

http://www.cek.ef.uni-lj.si/magister/klopcic218.pdf

[11] Lekše, »Avtomatizacija logistike za pametne tovarne- rešitev TPV«, (online)2022, uporabljeno 21.11.2022, dostopno na:

https://www.gzdbk.si/media/pdf/sekcije/ski/2017/lekse.pdf

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DISCRIMINATION AND DIVERSITY OF HUMAN RESOURCES

Abstract:

By connecting different parts of the world, people and businesses face cultural diversity. Individuals like individual humans create companies, but also vary greatly one from the other. As they change over time, their cultural habits change as well. What is welcomed in one culture does not necessarily have to be welcomed in another one. Companies need to learn to do business effectively not only with external employees and consumers, but also with internal employees. With this diversity, companies are on the agenda. The large differences between employees are mainly due to migration flows around the world, which in turn leads to large differences between people living in a particular area. If employees are not well-run and organized by managers and by the rest of the management, they can quickly be dissatisfied in the company. As a result, employee dissatisfaction is reflected in the company's lower efficiency and performance. The central purpose is to clarify and present the cultural heterogeneity of employees through foreign and domestic literature and the difficulties or advantages this may lead to. The diversity of employees is reflected in many spheres, with the culture being social and wider environment. There are often more invisible distinctions in companies that are more difficult to detect or manifest through different types of discrimination. With all this, managers meet every day if they want to run a business successfully. The greatest wealth that thriving companies spend and develop is in fact human resources. Employees form a company, and they differ by their very nature. These properties we will be presented below

Key words: employees, culture, diversity, discrimination

1 INTRODUCTION

For the digital age, it could be said that this is a period of proactive solutions and rapid change, constant competition, adaptation and learning. Many companies are

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in the process of moving from traditional to more modern forms of business. Globalization is one of the factors that greatly influence the transition of new forms of business. In order for companies to survive they have to be competitive with others, all over the world. As companies move or expand, companies are becoming more and more similar in one way or another.

The greater the impact of globalization on a particular company, the greater the need for reciprocity of employees coming from different cultures. Company managers play a large role in regulating the cultural diversity of employees. Not so long ago, most managers operated mainly in the domestic environment, but today they face different cultures, different habits and business practices, and are also faced with new managerial grips. A key challenge for a modern manager is to know the national culture and the impact that cultural diversity has on all aspects of the company's operations. The bigger the companies, the greater the cultural diversity, so it is more difficult to manage them from a managerial point of view (Ivanko, 2020).

The concept of discrimination is also linked to the diversity of human resources. Among the possible causes of the development of discrimination resulting from an individual'sperceptions, we can classify the personal characteristics an individual was born with, acquired from its environment or reflecting its position in the environment. In addition, these characteristics or circumstances cannot be altered or easily (i.e. ethnicity, race or ethnic origin, gender, religion, age, sexual orientation and others) also cannot have a greater impact on the properties arising from past individual's options or conduct (e.g. acquired education, past achievements, consequences of diseases or accidents, etc.). In the case of discrimination, this is a situation in which an individual or group of people treats someone unequally without a valid and justifiable reason (Babnik & Boštjančič, 2019).

Discrimination in the workplace can occur in a number of areas of a company. It can occur in employment, training, education, progress, work relationships, work tasks, working hours. working conditions. It also occurs in the case of salaries, retraining, absenteeism as well as termination of employment (Greif, 2006).

In the most general way, we can conclude that discrimination constitutes unfair treatment of people – their characteristics, work or behaviour based on inadequate beliefs and prejudice. Discrimination is not always only targeted at the individual.
A certain group of people and its members can also be discriminated against. At the same time, discrimination is an important feedback on the individual, as research has shown that people who have faced one or more forms of discrimination, stress or habe suffered from mental problems, expressed e.g. depression, anxiety, high blood pressure, obesity and substance abuse (Babnik & Boštjančič, 2019).

With this task, we want to find out how diversity and related discrimination against human resources is interpreted by different authors and how it is reflected in companies. Our central problem thus relates to employee diversity, cultural diversity and the diversity of the resulting discrimination. At the same time, we also want to exploret what types of discrimination occur in the workplace.

2 DIVERSITY OF HUMAN RESOURCES

The diversity of the population and workforce has become a common fact of life in countries around the world. Therefore, diversity issues are also becoming more complex than they were 40-50 years ago. Today, organizations understand that differences bring added value to business and enable companies to face global competitiveness. However, it is difficult to determine the origin of labor diversity initiatives (Wijewantha, 2016).

Diversity in the workplace refers to the differences between people in an organization with an emphasis on how people perceive themselves and how others perceive them. These perceptions affect interactions (Patrick & Kumar, 2012).

Diversity is based on acceptance and respect. You could say that the concept of a set of conscious practices, which include understanding and respecting the interdependence of humanity, cultures and the natural environment, respecting qualities and experiences that differ from our own, understanding that diversity also includes ways of behavior and recognizing that personal, cultural and institutional discrimination creates and retains privileges for some while creating disadvantage for others (Patrick & Kumar, 2012).

The concept of diversity management first emerged in the United States, which is known for its considerable heterogeneity in the population. In recent decades, however, the concept has become increasingly asserted within the European Union and the rest of the world (e.g. Australia and South Africa) (Kosi, Nastav, & Dolenc, 2012).

Diversity management is a process designed to create and maintain a positive working environment where the similarities and differences of individuals are valued so that everyone can show their potential and contribute to the organization's strategy and goals (Patrick & Kumar, 2012).

The labour market is therefore, as has already been mentioned, facing strong diversity for the first time in history. Nowadays, workers who belong to three different generational groups work alongside each other in workplaces in organizations side by side. While the mix of these generational groups adds a valuable diversity to organizations on one hand, it also adds complexity to them on the other (Fenzel, 2013). Such a diverse multi-generational work environment presents a new challenge for human resources management (Wijewantha, 2016).

2.1 Diversity

With the concept of diversity, we can ensure all the ways in which people differ from each other, which make us unique or different from each other. Some of the differences are visible, others less, but the fact is that they perform everywhere, even in every workplace. Differences therefore affect how people behave, respond, understand, feel and accept different situations. (Treven, 2001).

We can vary by gender, race, age, ethnicity, appearance, language, culture, religion, social class, physical abilities, etc. However, all the differentiations listed may constitute obstacles in the context of employment in the area of equal access to work, conditions, promotion and workplace benefits (Treven, 2001).

In order for the work to be successful and the employees satisfied, the organization must carry out the work properly.

2.1.1 Diversity factors

To facilitate understanding of diversity, let us look at its composition, which includes personal/ internal, external and organizational factors.

Personality is an individual dimension that creates human integrity. It is the unique style of each individual and covers all aspects of it. It is developed through experience and upbringing (Treven, 2001).

(Fromm, 2016) says that every personality is influenced by culture, both in a positive and negative way. Different types of personality respond differently to external (e.g. political, social) factors. The climate in the organization can be determined on the basis of the basic dimensions of employees. Each of them involves several personality traits.

Internal factors or primary dimensions of diversity are personality traits that do not change and have an impact throughout life. These are gender, age, sexual orientation, race, mental abilities. Together they shape our self-image and sense of identity by influencing our early learning experiences (Treven, 2001).

External factors or secondary dimensions of diversity are acquired through life. We have the ability to gain or lose them. These are education, income, work experience, marital status, family status, religion, personal habits, etc. We also differ in our choices, hobbies, fashion style, taste in music. We have more control over them than internal factors (Treven, 2001).

Organizational factors, however, are those determined by employers, trade unions, and others. By their actions they affect the quality of workplace and other organizational factors such as: work conditions, hierarchical situation, form of employment, duration of employment, type of work, etc. (Treven, 2001).

2.2 Managing the diversity of employees

In recent years, given the exceptional potential of diversity for a competitive advantage, much attention has been paid to how individuals and organizations can manage diversity more effectively.

Two basic approaches for diversity management, i.a. an individual and organisational approach, will be presented bellow.

2.2.1 Individual approach

This approach includes: firstly, learning based on obtaining professional experience and secondly, empathy based on the ability to understand the feelings and emotions of others (Treven, 2001).

2.2.1.1. Individual strategies

One of the most important elements of diversity management in the organization are the individuals themselves. They can seek to improve on four basic elements of the personal approach, which are understanding, empathy, tolerance and willingness to communicate (Treven, 2001). One of the first and most important is understanding of the nature and importance of diversity, meaning the understanding of the fact that each individual is unique and identifying differences depending on the dimension of race, ethnicity, gender, sexual orientation, socio-economic status, age, physical abilities, religious beliefs, political beliefs or other ideologies. Although people need to be treated fairly, managers need to understand that differences between people actually do exist (Treven, 2001).

Empathy is associated with understanding. People in an organization should try to understand the perspective of others. For example, when a woman joins a traditional group of white males - every man may feel a little cautious about how to deal with a new member. Perhaps they will be able to accept the new female member or try to put themselves in her place and understand how she feels (she may feel frustrated or excited about her task). If they learn more about her feelings, team members can further facilitate their ability to work together effectively (Treven, 2001).

Tolerance is an important life skill, especially in the workplace, where we are often involuntarily put into a diverse group. Tolerance could be defined as the ability to accept the differences of others. These differences can be age, gender, religion, ethnicity or sexual orientation. Differences can also revolve around political beliefs, culture or lifestyle. In fact, the golden rule says: "Treat the others as you expect others to treat you." Of course, that does not mean that we must agree or accept ideas that are different from ours or with which we disagree (Treven, 2001).

Problems often arise because people are afraid or unwilling to discuss issues of diversity or multiculturalism openly. For example, when a young employee jokes about an older colleague's age - he might not mean anything by it, but an older employee may find that joke offensive. If they do not agree properly, the jokes will continue, and the resentment will grow. Over time, a small disagreement may grow into a much bigger one. In order for communication to function properly, it must be two-way. If a person wonders whether their behavior may be offensive to another person, they should ask them, and vice versa (Treven, 2001).

2.2.2 Organizational approach

While individuals are important in the management of diversity, the organization itself must play a fundamental role. People in an organization should understand

what behaviour is and what behaviour is inappropriate through their different policies and practices. Organization culture is the ultimate context for the diversity consideration (Treven, 2001).

The organization must consider the following factors: a clearly defined vision of the organization, employee participation, well-defined objectives and accountability, effective communication, coordination of activities, evaluation of work, etc. It can also use various methods such as training programmes, multicultural groups, multicultural teams and the installation of the manager for employee diversity (Treven, 2001) as an appropriate diversity management approach.

2.2.2.1 Organizational policy

Organizations supporting employee diversity must ensure appropriate policies within the company to protect employees' rights and maintain compliance with government regulations.

It is essential for the organization to think about the impact of internal policy on diverse employees. An important aspect of organizational policy is how the organization deals with and responds to problems arising from differences between people. Companies need to create the ability for employees to anonymously provide feedback with various surveys and suggestions that help shape their views on what employees think about diversity policy within the company. All feedback received, both positive and negative, is valuable. Companies need to be prepared to adapt and change policy, as certain rules may be an obstacle or completely unhelpful to employees (Treven, 2001).

In addition to the written policy, it is important to ensure that the organization's rules are thoroughly explained to all employees.

2.2.2.2. Organizational practice

Organizations can also help with management through different practices and procedures. For example, employee benefits can be structured in such a way that they more successfully adapt to individual situations. Examples: working couples without children would prefer to be granted leave at the same time; a working single parent might prefer to have his holiday planned to coincide with the school holidays. Flexible working hours are also a useful organizational practice for adapting to diversity. (Treven, 2001).

2.2.2.3. Diversity training

Employees need to be aware of how they coexist with a diverse circle of people as well as the cultural differences and related cultural sensitivities in order to achieve harmony in a diverse workplace. Sensitivity training can help the organization manage diversity in the workplace by influencing employees to become more aware of their actions, which plays a key role in understanding their own cultural bias and prejudice (Treven, 2001).

2.2.2.4 Organizational culture

No matter what managers say or write down (unless there is a basic and fundamental belief that diversity is valued), it can almost never really become an integral part of an organization. An organization that really wants to promote diversity must shape its culture by clearly emphasizing the commitment of top management and support for diversity in all its forms in every part of the organization (Treven, 2001).

With all these approaches and methods, an enterprise can create a competitive advantage over others. Namely, the views of different people help create the best quality and offers that can satisfy customers (Treven, 2001).

Why we attribute so much importance to organizational culture (Černetič, 1997):

- culture influences how the organization perceives, analyses and solves problems,
- culture influences the quality and quantity of innovations developed by the organization (innovative organization),
- culture influences how the organization responds to changes and uncertainties of the culture of the organization,
- culture affects the motivation of employees.

2.3 Role of diversity in human resources management

It could be stated that diversity management and human resource management (AYP) are the two functions that overlap one another. Foremost addressing the approach towards the employees of the organization and the furthermore to the process of managing people within the organization. Both functions are interested in individual differences, the development and well-being of each individual in the workplace within the organization. Managing diversity in an organization can lead

to positive results only if human resource management supports a multicultural workforce that has the ability to turn diversity into an organization that can be a key success factor (Anjorin & Jansari, 2018).

In order to contribute to greater cultural diversity in the company, human resources experts must adopt a new way of thinking, predict upcoming changes and try something new. As multicultural perceptions of things such as qualifications and ambitions differ from many national perspectives, a new perspective should be considered when assessing performance and objectives to enable everyone to be treated fairly (Tervonen, 2012).

If an organisation is to achieve effective diversity, it must execute appropriate human resources strategies that should focus on learning, adaptability, knowledge creation and the development of the organization's working environment. Employees are more satisfied with their work and job (i.e. the workplace climate) when they experience that human resources management practices are fair, effective in terms of positive results, useful and focused on job development and individual development. Perceptions are the feelings or notions that an employee may have in terms of fairness, efficiency and support for staff management practices in the workplace. Knowing a worker's perceptions of cultural diversity is important for the organization, as these perceptions can be a tool for devising management strategies. It should be kept in mind that differences in perceptions regarding diversity amongst managers and employees are the result of poor implementation of staff management practices (Anjorin & Jansari, 2018).

High performance systems (HPWS) are systems implemented within an organization to improve employee efficiency and productivity. The past research on high-performance work systems has shown that employees' understanding of staffing practices is primarily influenced by their demographics (Anjorin & Jansari, 2018).

Diversity in the workplace is a major challenge for modern organizations. The basic solution is in identifying and maximizing talent and in identifying the skills of the workforce as a valuable asset to the organization. Keeping people in an organization reduces recruitment costs and has a huge impact on outcomes, as working groups where people understand and communicate effectively can work successfully in integrated groups. This also makes the resulting conflicts and tensions easier to resolve, making the management of the multicultural workforce highly essential (Nagarajan, 2018).

2.4 Managing multicultural diversity

This type of management falls within the scope of the processes of human resources management. It is the human resources function that must attract, guide and maintain human resources within the organization. You could say that it is difficult to employ a diverse workforce, but it is even harder to maintain it.

Farren and Nelson (1999) outlined four best practices for a healthier workforce. The first practice is to have an open communication, because communication is what unites the organization. Open communication is the first critical step, which must then be followed by action that shows the concerns and needs of the employee in the workplace. Companies where workers are respected perform better and are successful in maintaining employees. Another practice is education and training about other people's cultures and their sensitivity to discrimination and different feelings of employees. Some companies are trained to deal with situations related to cultural conflicts. The third practice is to provide mentors to reduce the level of discrimination. Assigning mentors helps employees network groups that are often left behind. These include women, people with disabilities and people of different races. The last practice is for managers to become more accountable for including a diverse workforce in the job description. Although top managers consider diversity programs to be important, many companies do not associate diversity practices with performance (Anjorin & Jansari, 2018).

2.5 Characteristics of cultures

Each cultural environment is a world for itself, so international companies operating in different countries must carefully examine their cultural environments and their characteristics before doing business with them and find a way to adapt optimally to them. In particular, they should examine the following elements: the language of the country, the customs and perception of consumers, the values, customs and lifestyles of consumers, the behaviour of consumers and businesspeople, the ways business is done, communication and negotiation, the importance of time, promises, agreements and the behaviour of competitors (Pečovnik, 2021).

For example, a German businessman is being discouraged by bad German because he fears that poor communication will cause inconvenience and financial damage. It is recommended that we present the German partner appropriately, indicate the age and legal status of our company, the number of employees and a short and clear expression of our basic objectives and expectations (Pečovnik, 2021).

We, as Europeans, are mostly individualists and therefore very different from the Japanese. For them, the tradition that is passed down from generation to generation is important. They are collectivists because they put an individual in the background for the community, businesses or other organizations, because they feel they need solidarity, common understanding and joint work. Japanese managers regularly motivate colleagues through consultation, talks and explanations (Pečovnik, 2021).

Chinese businessmen are very reticent and distrustful of foreigners at the beginning of the negotiations. They stick to the guangsi, which favours people from the wider family or associated persons in the group. Members of Western cultures, which are strongly oriented to the rights of the individual, often interfere with their way (Pečovnik, 2021).

Unlike the Chinese and the Japanese, Americans are individualists, so they choose negotiators who are the most professional the and ignore family connections. Because they believe that their society (much like the French) is the best, they have a missionary approach and John Wayne's negotiating style: "We shoot first, then we look at the target". They are methodical and seek to formulate clear negotiating objectives. But they don't like repetitive questions. At the beginning of the negotiations, they emphasize openness and expected sincerity (Pečovnik, 2021).

3 DISCRIMINATION

Discrimination occurs when a person is unable to execute his or her human rights or other legal rights in the same way as others because of unjustified differentiation in policy, law or consideration. These are therefore situations in which, because of their personal circumstances, individuals are wrongly treated, very frequently less favourably than everyone else. We all have the right to be treated equally, regardless of our gender, race, religious beliefs, ethnicity or sexual orientation. Discrimination is harmful and perpetuates inequality. It is completely unacceptable for someone to be treated differently because of their gender, ethnicity, age or anything as such, because these factors do not determine our value. Everyone should be treated with the same respect and equal care. However, we must not forget that not every unequal treatment is discrimination. The situation that identifies discrimination is when a person is treated unequally because of his or her personal circumstances, including gender, race, age, ethnicity and more (www.amnesty.org, 2023).

Discrimination is prohibited in Slovenia. Article 14 of the Constitution of the Republic of Slovenia guarantees equality in front of the law, which states: "*In Slovenia, equal human rights and fundamental freedoms are guaranteed, regardless of nationality, race, gender, language, religion, political or other beliefs, the state of birth, education, social status or any other personal circumstance. Individuals are all the same in front of the law. The principles of the Constitution do not allow any form of discrimination. Mechanisms that address the consequences of violations of human rights and fundamental freedoms are also included in the Constitution (Repolusk, 2011).*

We know several forms of discrimination (Repolusk, 2011):

1. Direct

Direct discrimination is an unequal treatment of individuals on account of their personal circumstances. Namely, when, as a result of those personal circumstances, a person is treated less favourably than another person. As an example, we can take the job application call with the condition that the candidates are younger men. This means that older men and women are generally excluded from the circle of candidates who can apply for the post. They shall be exclusive on the basis of at least one or more personal circumstances. In this case, they are therefore excluded on the basis of age and gender.

2. Indirect

Indirect discrimination is a disguised unequal treatment. Indirect discrimination exists on the basis of a personal circumstance which may result in a person being placed in a less favourable position than others by reason of a seemingly neutral provision, criterion or practice. As an example, we can take the company's request that those applying for a job must meet the condition that they had already lived in Slovenia for at least three years before they were in employment. If we examine this condition, it puts foreigners who wish to apply for a job in an unequal situation, as they have more difficulties fulfilling this condition than citizens of the Republic of Slovenia. In this case, foreigners are discriminated on the basis of their nationality. There is also both negative and positive discrimination. They are separated by the effects of discrimination on those who are discriminated against. Therefore, the effects of positive discrimination are positive for the discrimination and are negative in the case of negative discrimination.

3.1 Discrimination in the workplace

In the workplace, discrimination occurs in various cases. It can already be traced to the communication, information, job-share, promotion and/or reward of employees, working time or staff schedules and other areas of day-to-day business. It can be discrimination between the employer and the employee, or it may occur among the employees themselves. In fact, organizations are mainly a mix of employees, which differ in gender, age, ethnicity, religious beliefs, political beliefs and such (Perkovič, 2021).

Discrimination in the workplace takes many forms. Harassment is one of the most common forms of discrimination. This is an undesirable behaviour involving negative treatment related to the personal circumstances of the individual and/or group of people. It is behaviour aimed at the discrimination to the unintended and negative consequences. These are violations of personal dignity. These could be inappropriate remarks, gushing about a person, etc. Hate speech is also considered to be a phenomenon of discrimination. By hate speech we understand the oral or written expression of views that are discriminatory towards the individual and/or to a group of people with a certain personal circumstance. It is about inciting hatred against people of other sexual orientations, other races, genders, etc. The third form of discrimination is victimization. This comes after a person who has been discriminated against has acted against discrimination and sought help. These are retaliation actions which are considered to be adverse consequences or complaints or procedures requiring equal treatment (Perkovič, 2021). Discrimination in the workplace brings negative effects for both business and employees. In fact, people who are discriminated against do not feel comfortable in the workplace and are physically, mentally and socially at risk, which does not bring any benefit to the company. Namely, the reduction in the working capacity of employees results in more errors of pro labour, a decrease in motivation, dissatisfaction in the workplace which means that the quality of the employee's work is lower and at the same time the efficiency of work is reduced, disorganisation is increased, which undermines the company's ability to do well and threatens economic growth. In the event of a claim in the company, the organization may also be jeopardized by the high cost of punishment and loss of social position of the company (Perkovič, 2021).

As mentioned above, there are many forms of discrimination. One of the most common forms of discrimination occurring in the workplace is:

3.1.1 Sexual discrimination

It is one of the oldest forms of discrimination. This is due to gender differentiation and stereotypes that have been developed on the basis of different gender roles. Sex discrimination in the workplace can be recognized when employers treat men and women differently because of their personal circumstances - in this case, the gender of the individual. In the workplace, sexual discrimination of women is much more exposed to sexual discrimination of men. The role of women has always been considered weaker. Men have long been portrayed as strong, successful, capable, and women have been given a weaker and less capable role. Therefore, even today, women are often treated as less capable in certain cases, especially in the pursuit of senior positions in the workplace, which is, of course, discriminatory, since gender should not determine the human capacity to perform a particular role in the workplace, or be discriminated against because they are expected to be mothers one day, interconnecting maternity and various sick leaves. Of course, men can also be sexually discriminated. These are mainly situations when in the workplace they do not correspond to the stereotypical description of a man (Manenica, 2006). Examples of gender diversity phases (Mullins, 2007):

- · Classical behaviour: equal treatment of gender, but in their assumed roles.
- · Anti-discrimination behaviour: promoting equal treatment of both sexes.

• Affirmative action: adaptations for minority or potentially disadvantaged groups (for example: women's groups or networks, introduction of mentoring for women, setting women's quotas).

• Diversity management: confronting the potential neglect of women or certain groups of women, learning about the benefits that gender diversity and employee awareness can bring, promoting the development of a culture that favours gender-specific diversity and developing a flexible organizational system which does not explicitly favour only one group (e.g. introducing flexible forms of work such as work from home, part-time work for both sexes).

3.1.2 Age discrimination

This is discrimination, which is caused by the age of the individual and/or group of people. Age discrimination in the workplace may be mainly affect young and older people. Young people can be discriminated against because they are treated as frivolous, inexperienced and incompetent because of their youth, although in many cases it is young people who are keen to work - they want to gain experience and prove themselves. They bring fresh views and ideas to companies that help the company grow. On the other hand, older people may also be discriminated against. Some employers think that age is an obstacle, so even if an older employee has much better skills and much more work experience, they prefer to employ a young person. This may be due to the employer's view, for example, that it will be more difficult for older employees to integrate into the society of younger employees or not be as motivated to work as younger employees. This belief is mistaken as age does not necessarily determine how well we do our job (Perkovič, 2021).

3.1.3 Racial and ethnic discrimination

It is based on the unequal distinction of people according to their colour, race, ethnicity and national origin. This form of discrimination also occurs in the workplace. These are cases where an individual and/or a group of people is treated unequally because of personal circumstances such as race, colour and e.g. ethnicity. These may be situations when employers are reluctant to employ black people because of certain prejudices, or when foreigners are treated as less valuable, because, for example, they are not Slovenes, etc. All this can hinder an individual and/or a group of people from living and achieving their goals, which unfair, because

the abilities and qualities of the individual do not depend on the individual's race, ethnicity or skin colour (Perkovič, 2021).

3.2. Impact of discrimination in employment

Discrimination leads some people to avoid situations where they predict to be discriminated against. For example, they can omit the possibility of education, training and possible employment, which is ultimately also linked to unemployment. When calling for vacancies, some organizations or employers have the requirement for the applicant to attach a photo to the post, which is contrary, of course, to the principle of equal treatment. They can thus on the basis of appearance come to conclusions about age, ethnicity and race, sexual orientation, disability, lifestyle and, last but not least, external appearance, and similar. This allows employers to choose someone who visually suits them when overlooking candidates whose image has not convinced them, but who might have special talent and skills that could lead to the organization's success (Greif, 2006). Employers who, for reasons of expected motherhood and other unforeseen absences prefer to employ a men avoid not only the costs of the organization but

absences, prefer to employ a man, avoid not only the costs of the organization, but also find the appropriate staff and the associated time spent on deployment and training.

There is a possibility that, upon returning from maternity leave, a young mother work outdated skills returns to with knowledge or and needs spend time informing and learning. to more In this case, it is the economic aspect of employment that is mostly in consideration. (Cerar, and Others, 2005).

In the case of recruitment, if a person of one sex who is otherwise less qualified than other candidates is selected mandatory on a quotas, may be found unfair by the other candidates and less useful for the Slovenia, given the principle business. However, in of balanced gender equality, this is perfectly acceptable. In the long term, such employment can be positively reflected in discrimination or the elimination of unequal opportunities. In addition, this privileged person achieves high level of way, the а new

194

skills, which naturally contributes positively to the functioning of the organization (Cerar, and Others, 2005).

4 CONCLUSIONS

The diversity of employees creates a relatively open working environment and reduces blind tracking or 'herd behaviour'. It contributes to greater openness to new knowledge, greater diversity of thought patterns and thus to more innovative ideas, better adaptation to the wishes and expectations of diverse business partners and customers, and to a good public image of the company. Successful diversity management leads to greater commitment, satisfaction, better employee efficiency and potentially better financial performance of the organization. Diversity is becoming an increasingly important part of everyday life in the business world and thus an important part of the business, which Slovenian companies must also be aware of.

The management of human resources diversity has gained momentum thanks to the pressures on companies becoming internationally competitive, changing workforce compositions, increasing awareness of the importance of human resource management and the negative response generated by perceptions of special treatment of women and ethnic minorities.

Many organizations provide diversity training. Most training programmes reinforce the norms and values of the dominant organizational culture. Pay inequality, in particular gender income inequality, remains an important problem in diversity management. Organizations with diverse employees are more suitable to serve different external customers in an increasingly global environment. Such organizations understand the demands of the legal, political, social, economic and cultural environment much better.

Despite the growing commitment to abolition, there is still significant discrimination in employment in many organizations. This is demonstrated by the low employment of women and minorities and the lack of representation of minorities at higher organizational levels. In addition, working women and members of minorities are always disadvantaged in training, performance assessment and reward.

Discrimination in the workplace is still present and this is the main obstacle to embracing diversity in the workplace, in addition to prejudice and ethnocentrism. Organizations should take measures to manage diversity and exploit employees' potential for a competitive advantage.

LITERATURE AND RESOURCES

- Anjorin, R.A., & Jansari, A. (May 2018). Managing Cultural. Retrieved 10 May 2010. March 2023 from https://www.divaportal.org/smash/get/diva2:1217258/FULLTEXT01.pdf.
- Babnik, K., & Boštjančič, E. (2019). Discrimination in practice unequal treatment of an individual without a legitimate reason. *HRM*, *5*(*21*), 58-61.
- Cerar, M., Bošnjak, M., Kmecl, A., Kogovšek, N., Kuzmanić, T., & Strojan, T. (2005). Equality and discrimination: modern challenges for justice. Ljubljana: Peace Institute.
- FROMM, E. (29th U.S. A.M.) August 2016). Leading with diversity in mind: Do we have a choice? Retrieved 10 May 2010. March 2023 from https://www.iedc.si/blog/single-blog-post/iedcwisdoms/2016/08/29/leading-with-diversity-in-mind-do-we-have-achoice.
- Greif, T. (2006). *Measures against employment discrimination for employers*. Ljubljana: Škuc-LL.
- Ivanka, Š. (2007). Research and writing of works: methodology and technology of research and writing of professional and scientific articles. Kamnik: Cobus image.
- Ivanka, Š. (2020). *Challenges of management in a global environment*. Ljubljana: Cubus image.

Kosi, T., Nastav, B., & Dolenc, P. (2012). Diversity management in Slovenian and foreign companies. Koper, Slovenia: Publishing House of the University of Primorska. Retrieved 8 March 2010. March 2023 from <u>https://zalozba.upr.si/ISBN/978-961-6832-16-8.pdf</u>.

- Manenica, A. (2006). SEXUAL DISCRIMINATION ON THE SLOVENIAN LABOUR MARKET. Retrieved 10 May 2010. March 2023 from http://dk.fdv.uni-lj.si/dela/Manenica-Anja.PDF.
- Mullins, L. (2007). Management and Organisational Behaviour. *Harlow: Pearson Education*.

- Nagarajan, S. (April 2018). Cross Cultural Workforce Challenges and Strategies. Retrieved 10 May 2010. March 2023 from https://www.researchgate.net/publication/324219631_Cross_Cultural_Wo rkforce_-_Challenges_and_Strategies.
- Patrick, H.A., & Kumar, V. R. (June 2012). Managing Workplace Diversity Issues and Challenges. Retrieved 10. MArec 2023 from https://www.researchgate.net/publication/258187297_Managing_Workpl ace_Diversity_Issues_and_Challenges.
- Pečovnik, N. (2021). The importance of culture in international business. *University of Primorska, Faculty of Management*.
- Perkovic, U. (May 2021). DISCRIMINATION IN EMPLOYMENT AND WORKPLACE ORGANISATIONS. Retrieved 10 May 2010. March 2023 from https://dk.um.si/Dokument.php?id=150290&lang=slv.
- Repolusk, N. (December 2011). DISCRIMINATION AND MOBBING ON. Retrieved 10 May 2010. March 2023 from https://dk.um.si/Dokument.php?id=27406&lang=slv.
- Tervonen, K. (2012). The Role of Diversity Management and Human. Retrieved 10 May 2010. March 2023 from https://www.theseus.fi/bitstream/handle/10024/46549/Tervonen_Katarii na.pdf?sequence=1&isAllowed=y.
- Treven, S. (2001). International organizational behavior. Ljubljana: Economic vestnik.
- Wijewantha, P. (October 2016). Creating Multi Cultural Organizations for Diversity Management. Retrieved 10 May 2010. March 2023 from https://www.researchgate.net/publication/279726229_Creating_Multi_Cu ltural_Organizations_for_Diversity_Management.