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THE FUTURE OF ROBOTIC VEHICLES WITH THE CONTRADICTIONS OF PROCESS IN THE GREEN AGENDA AND PRODUCTION OF DIFFERENT POWER SOURCES[1]

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Abstract:[1] *The use of different types of cars produces paradoxes when externalities such as environmental damage are taken into account. Using an empirical method, we have attempted to analyze the contradictions within the green agenda. The proposed techniques do not have to be implemented during the study phase. The article attempts to examine current global patterns in order to identify future alternatives for replacing old infrastructure. In an era of rapid technological growth, the automotive manufacturing sector is undergoing significant changes. This transformation involves replacing outdated infrastructure with sophisticated software and energy-saving components. Although the changes represent exciting solutions, they also pose significant obstacles, especially in achieving environmental sustainability goals. The integration of automation, artificial intelligence, and modern manufacturing technologies may result in a lower demand for workers in conventional industries. The complexity of the process refers to the transformation of sustainable methods, especially in the production of batteries for electric vehicles. We used empirical research in the field of sustainable energy management, circular economy and urban planning projects to reduce energy demands. By collecting and analyzing real-world information, we hope to provide evidence-based insights into the effectiveness of different methods and*

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policies. In ensuring a resilient and sustainable future for transport, EU regulation is key in combining environmental care with economic viability. Our research shows a historic change in the transport sector, with autonomous cars playing a key role in designing future mobility options.

Keywords: *robotic vehicles, green agenda, car manufacturing sector, artificial intelligence, advanced production technology approaches, power sources*

INTRODUCTION

In this paper, we contribute to the analytical examination of sustainable transportation infrastructure, green agenda initiatives, and the transition to electric car adoption. Through our investigation, we identified the emergence of new energy sources, including lithium and sodium batteries. The future of autonomous cars lies at the intersection of technological progress and the complexity inherent in pursuing environmental sustainability as outlined in the Green Agenda. While the development and adoption of autonomous vehicles offer significant opportunities for revolutionary effects on transportation, the inherent inconsistencies must be carefully considered within a broad framework for environmental initiatives [10, 11].

Autonomous and electric vehicles can enhance traffic flow and have the potential to alter transportation networks by enhancing efficiency, safety, and accessibility, reducing accidents triggered by human error as well as contributing to a more efficient, environmentally friendly network. Improvements in rechargeable and hybrid technologies for self-driving vehicles align with the Green Agenda's goal of reducing greenhouse gas emissions while relying on existing energy sources [9]. However, tensions emerge as we examine the environmental effects and broader dimensions of sustainability. The development and deployment of robotic vehicles require resource-intensive operations that contribute to carbon footprints and e-waste. The development of improved sensors, batteries, and computer systems raises questions about environmental impact, resource exploitation, and acceptable end-of-life disposal techniques. In addition, the power sources that drive these robotic vehicles are crucial.

While electric and hybrid technologies are inherently cleaner, the environmental benefits depend on the sustainability of the electricity grid. The overall impact on the green agenda can be reduced if electricity is obtained from renewable sources. Furthermore, integrating autonomous vehicles may encourage increased vehicle use, potentially leading to greater energy consumption and environmental stress. Unless carefully managed and integrated into a broader sustainable transport strategy, the proliferation of robotic vehicles could exacerbate urban sprawl, congestion, and resource depletion [1, 12].

In navigating the future of robotic vehicles within the green agenda, a holistic approach is imperative. This includes not only advancing the technology itself, but also addressing the environmental impact of the entire life cycle, promoting sustainable manufacturing practices, optimizing energy sources, and encouraging smart urban planning to mitigate potential ad- verse effects. The future trajectory of robotic vehicles can be aligned with the green agenda through conscientious development, strategic policies, and a commitment to environmental responsibility [13, 18].

The modern vehicle manufacturing industry relies more and more on environmentally friendly technologies that are in line with the green agenda. In light of these developments, rechargeable batteries installed in vehicle systems are becoming increasingly widespread. Lithium, the third lightest alkali metal in the periodic table of elements, is used to create tiny, energy-dense batteries used in electric vehicles (EVs) and smartphones. The modernization of electric vehicles and the use of smartphones are closely linked to the adoption of lithium-ion batteries. Systems that serve to collect and display energy from renewable sources at the grid level ignore the size of the battery. This also applies to heavy vehicles such as ships and trucks. The properties of sodium indicate similarities with lithium, but are larger and heavier. Due to its characteristics, sodium batteries are often larger and heavier than others of the same energy capacity. In terms of energy density, they approach the values of earlier lithium-ion batteries, from a decade ago. Their capacities do not yet allow powering electric vehicles that are used for long distances, but they can be used for shorter distances and daily city driving.

Recent advances demonstrate the greater competitiveness of the sodium battery over certain lithium-ion batteries, particularly those using lithium-iron-phosphate (LFP) cathodes. LFP batteries are cheaper on the market, but have a lower energy density than other lithium-ion technologies. Sodium-ion batteries, with their distinctive characteristics, offer the potential for more cost-effective usage, paving the way for more affordable autonomous vehicles (AVs) with longer driving ranges on a single charge. The challenge with sodium-based batteries is that they are not yet capable of being fully replaced. However, with their advantages of lower costs and high energy density for specialized applications, these advanced solutions are poised to hold a prominent position in the evolving battery markets.

The dynamics of substitution with new solutions, such as renewable energy sources that meet the specific needs of the vehicle industry, are influenced by: controlling financial costs, solving infrastructure challenges in different operating environments, imposing industrial regulations by governments and adapting innovations for different applications. Anticipating and adapting to changes in the automotive industry sectors present economic, logistical and regulatory challenges. The continued efforts of the automotive industry to maintain a gradual transition to the adoption of technologies based on renewable energy sources emphasize the upcoming time of improvement of commercial transportation and supporting infrastructure.

The paper is organized into the following sections: Literature Review, Contributions and Novelty, Materials and Methods, Use of robotic platforms and vehicles, The road to sustainable mobility and green goals, Barriers in realizing the green agenda route, Negative aspects in the transformation processes of vehicle production, Results, Discussion, and Conclusion.

1. LITERATURE REVIEW

This paper goes beyond technical and technological analysis to investigate the impact of smart vehicles on traffic safety, explore human behavior in response to the adoption of new transportation technologies, and examine the development of critical infrastructure projects, including transportation networks, as well as their associated environmental effects. Our research addressed issues related to public opinion acceptance, legislative frameworks, and ethical dilemmas surrounding the implementation of robotic vehicles in real-world scenarios. Through the study of the material, we identified valuable insights into the methodology, applications, and future perspectives of the industrial technological aspects related to smart vehicles. By synthesizing informative sources and analyzing both the positive and negative effects, as well as the limitations highlighted in the literature, we have developed a framework for future innovative research in the dynamic industrial sector, specifically focused on modeling robotic vehicles for widespread use.

1.1. Modeling and simulation of automated and robotic systems

The authors of the study [7] recommend modeling, simulation research, and development of automated and robotic vehicle systems, including component development, virtual prototype testing, and scenario evaluation. Automated and robotic vehicles have been produced using a development process based on prototype models and will assist in the future development of this research subject.

Authors study [25] outlines five characteristics of a vision of robotic Internet-connected things (IoRT) occupying and functioning in public spaces ranging from streets, parks to retail centers. The research highlights skepticism towards the concept of drones and robotic accompaniment of people in public areas. Through the concepts of building an environment or spaces ideal for the function of robots, we went to the regulation of robotic things in public spaces.

1.2. New energy vehicles (NEV)

Nowadays, the most industrially advanced countries, such as Germany, the United States, and China, are gradually adopting new energy vehicles (NEVs), particularly electric vehicles, due to their environmental benefits. An important development [24], which is reshaping the foundation of future transportation, introduces a new strategic approach focused on autonomous robot cars. This approach is based on a robot operating system (ROS), similar to that used in electric cars, and is gradually being integrated into commercial vehicle programs. Researchers in the study [31] cover the look of the possibilities in manual control of a robotic vehicle that contains a transmitter on a hand glove. The receiver is mounted on the motor drive of the vehicle together with the PIC microcontroller and its accompanying IC driver. Through the aforementioned research, it is possible to better understand the characteristics and necessary components for the needs of the development processes of robotic technology. The primary motivations for the development of robotic machines stem from their ability to carry out a wide range of both invasive and non-invasive tasks. One such mission is reviewed in this paper covering the lunar robotic prototype MIRA3D. The authors [17] describe the processes of cooperative creation of a test development environment. Other authors [34] analyze new approaches to cooperative control, which refers to the techniques of multifaceted remote control by humans as operators. Human operators usually function in an unstructured environment, which represents the complete automation of a system that includes a vehicle and a robotic manipulator.

2. CONTRIBUTIONS AND NOVELTY

In this work, certain contributions have been made in the analysis of sustainable innovative traffic, the green agenda and state efforts for substitution with electric vehicles. The positive aspects of vehicle electrification and alternative technologies of lithium and sodium batteries are reviewed.

In accordance with the above, we can highlight the following contributions that were made during the research:

1) Highlighting sustainable mobility and the goals of the green agenda. Based on global efforts to preserve the environment, combat climate change and achieve sustainability goals, we talked about the importance of applying information technology (IT) to the automotive industry, strengthening energy efficiency, replacing standard with low-carbon transport systems, and reducing exhaust gas emissions.
2) Government strategies for the implementation of electric vehicles. In the paper, we considered the impact of state strategies on the substitution of electric vehicles, giving importance to efforts in the form of regulatory frameworks and accelerated procedures for the adoption of new technologies. Emphasis is placed on proactive management and the necessity of political initiatives to promote new directions. Financial incentives, favorable loans, investment in supporting infrastructure and regulatory mandates were launched.
3) Electrification of vehicles. Developing the discourse helps us to properly understand the new directions of development, but also the barriers that are imposed in the achievement of the set goals. While exploring the benefits of electrification, such as higher energy efficiency and lower emissions, we also deal with the issues of different battery technologies and the necessary infrastructure. From an economic, technological and

regulatory point of view, the paper provides an insight into the barriers and opportunities for vehicle electrification.

4) Study of alternative battery technologies. The characteristics of lithium-ion batteries as well as alternatives such as sodium batteries are analyzed. New possibilities and solutions for battery technologies are proposed. Contributed to ongoing research and development efforts to improve the performance and sustainability of electric vehicles.

Overall, a contribution was made to the further analysis of sustainable mobility in the transport and energy sector, the efforts of governments to create future strategic frameworks for the implementation of electric transport vehicles and alternative necessary battery technologies for their implementation in reality.

3. MATERIALS AND METHODS

In the research, we used the empirical method as a methodological way to thoroughly collect and evaluate data from real circumstances, which required the sublimation of information. In this way, we tried to answer the given research questions and objectives. Use content from a period frame that includes 2020-2024. The empirical method was used to verify our claims based on existing evidence from which we drew a detailed analysis of hypotheses and made relevant conclusions. During the research process, we tried to systematically collect data by measuring, analyzing and experimenting. Furthermore, we used appropriate qualitative and quantitative methodological approaches on the basis of which we carefully evaluated the data.

We conducted research using scientific databases such as Taylor & Francis, McKinsey & Company, Geotab, Springer Link, Appinventiv, The iNews Network, and others. During the scientific research, more than 50 different sources were considered, with 39 being chosen in the final selection.

The subjectivity of picking an appropriate source was used as a criterion for selecting articles during the research process. Further selection was based on the relationship between research questions, keywords, specialist opinions, beginning points, strategies, and a variety of other statements important to our study.

The research's initial hypotheses were founded on the opinion that the green agenda and electrification have a favorable global impact.

Relying on the empirical method in the research, we drew well-founded conclusions and established confirmed theses in connection with the phenomenon we examined. With the strategy, we increased the credibility and reliability of our claims. By committing to fact-based research, we believe that we have contributed relevant facts to the wider scientific population.

3.1. Selection Criteria

The necessary search and selection time involved peer-reviewed academic papers and specialized literature, in order to frame a series of thoughts and perspectives on future technological trends. Finding a list of relevant references supplemented relevant material that was not identified during the initial search for key elements. Furthermore, we used the screening method with the aim of assessing the fulfillment of the study framework.

We applied pre-defined criteria and after reviewing them, we included topic relevance, geographic scope, study methodology, quality of evidence, publication date. Based on the established criteria, we selected the works for additional analysis and evaluation. The extracted data were used to collect related data from each selected publication such as techniques, theoretical frameworks and main findings.

A selection of scientific material has been synthesized and analyzed to find possible gaps in the current context of knowledge within this research area. The collected knowledge should provide insight into the thematic content and further guidelines were given for the research work through which a further selection process of material related to the green agenda, electric vehicles and power sources was carried out. This was followed by a methodological synthesis approach based on keywords and research questions.

3.2 Keywords

The selection processes were realized based on affiliation and connection in areas that include the following: sustainable mobility, green goals, electric vehicles, state regulatory strategy for the implementation of smart vehicles, electrification, alternative battery technologies. In accordance with the above, the key words were derived and used:

1) Sustainable mobility
2) Green goals
3) Electric vehicles
4) State strategy
5) Electrification
6) Alternative battery technologies
7) Sodium batteries
8) Environmental sustainability
9) Policy implementation
10) Transportation innovation

3.3. Questions

Through the form of research questions, we defined the method of data sublimation, analysis and interpretation of the collected knowledge. The focus was on trying to get answers to the previously asked questions in the attachment. In this way, we ensured the research direction and made a contribution within the domain of the autonomous industry. Contributions can be presented as a supplement to existing knowledge and a basis for future researchers without previous knowledge in this field.

1) What is the complete process of vehicle substitution with renewable energy sources reserved for the next period of industrial vehicle development?
2) What is the financial aspect of the started route of the green agenda sustainable in the future?
3) What is the global world in error because of the initiated process of cancellation of fossil fuels, considering that a large financial support is allocated for the preservation of these ideas?

4. USE OF ROBOTIC PLATFORMS AND VEHICLES

In order to insert robotic platforms into the research process, it was necessary to analyse in more detail the material related to innovative technologies in the dynamic environment of the vehicle industrial sector. By studying industrial reports on the use of robotic vehicles in different sectors such as agriculture, logistics and transport, synthesizing a lot of different opinions and findings, we came to an understanding of new circumstances.

The framework of the analysis looked at the characteristics of smart vehicles during their efficient execution of orders, data collection in a real time interval and autonomous navigation on different terrains. The improvement of sensors, machine learning algorithms, artificial intelligence (AI) and characteristics of robotic vehicles (perception of decision-making) has been observed. Artificial intelligence in the form of robotic platforms has the characteristics of durability, repeatability, and efficiency. The created robotic system like Cozmo is a commercial, widely available robot that can be used to analyse the interaction of humans and artificial intelligence in a wide range of environments, including households of physical users [6].

Formed robotic systems are systematized into different modules that are connected to the Design Education Platform. Design and technology specification education requirements are associated with specific research demonstrating in-house creation of these platforms. Sublimations are knowledge about robotic systems from the mentioned architecture and used as references [21]. The majority of the findings highlight the use of the modularity principle in the design of instructional robotic systems built on the Arduino Uno platform. They consider analogies of the weather station and the search robot [35]. The application of robotic systems improves the robotic software that is tied to the hardware platform that drives the robotic system. By studying

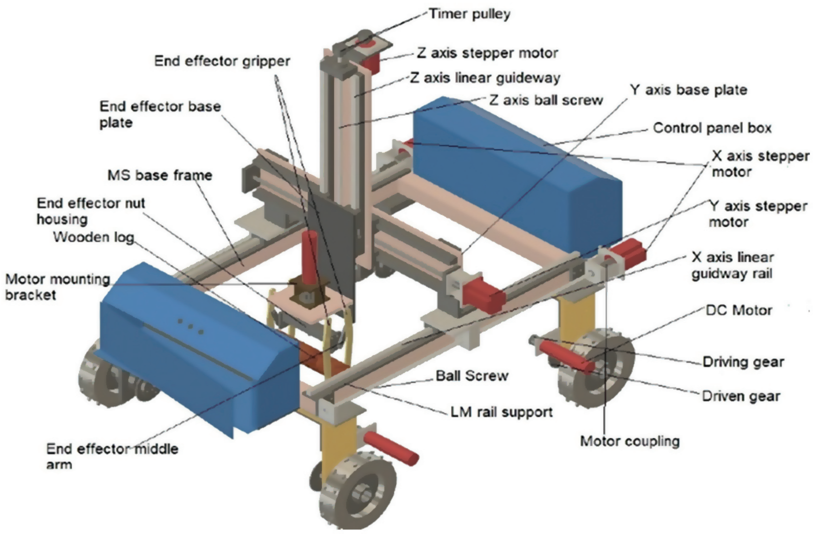

Figure 1. Schematic concept of the mobile manipulator. Source: [23].

the model that analyzes the architecture of the robotic elements on the target platform, RoboSmi determines their hardware configuration and provides software libraries for each component and thus their control [36].

In order to meet all the requirements, a more complex dynamic and kinematic analysis related to complex agricultural applications and robot design is necessary. Analytical insight gives a more complex picture of the movement and behavior of the robot, providing optimization where Figure 1 is the author's conceptual diagram [23] and it shows the visually proposed mechanism. Itincludes kinematics, dynamics and mechanical properties that provide the necessary information about the characteristics of the robot. The analysis method served to generate kinematic solutions for the proposed design. The tendency of human manipulation to create the future direction of movement (trajectory) of an autonomous vehicle generally cannot be recognized by artificial intelligence. Various authors analyze disabled people during their use of autonomous vehicles, explaining their automatic braking or deceleration.

The integrative approach of information and communication technology to the transport infrastructure as a whole will ensure greater safety and efficiency in traffic. The solution is robotic platforms that are cheap and provide partial testing of original platforms, elements and various vehicle management techniques. Automated parking systems use a robotic platform that transports each vehicle to one of several positions in a specially designed building. The machine learning classification method is coupled with Thompson's Algorithm for Efficient Multiobjective Optimization (TSEMO) to optimize continuous and discrete outputs in parallel. Most studies are semi-automated, with robotic platforms powered by machine learning algorithms [5].

5. THE ROAD TO SUSTAINABLE MOBILITY AND GREEN GOALS

Vehicles with intelligent software and rechargeable sodium batteries represent promising solutions for important aspects of the green agenda. By increasing energy efficiency and optimizing the given driving path, there is the potential of significantly reducing emissions and promoting environmentally friendly practices. The increasing implementation of intelligent vehicles unites new directions into common transport models that correlate with the goals of the green wave. This is confirmed by the possibilities of fewer vehicles on the roads and the improvement of safety measures with the accompanying infrastructure. However, there are barriers in the way of an environmentally friendly future perspective of transport in general. By considering the origin of energy sources, the technical characteristics of sustainable industrial production and the adequate installation of the necessary infrastructural traffic, the burning questions of the existence of new directions are analyzed. Adequate answers will confirm the positive impact on the environment of intelligent vehicles with sodium batteries [26].

The implementation of smart vehicles affected the economic aspect, transforming the way of doing business and redefining the established paradigm. A long-term reduction of the financial costs of investment in components and greater efficiency in the industrial production of vehicles has been made possible. Companies can turn to autonomous technology when optimizing vehicle fleet control, reducing fuel consumption and operating costs. By promoting simpler logistics and transport procedures, productivity, efficiency and financial savings are increased. The increasing presence of robotic vehicles in global markets opens new opportunities for innovation, economic growth and is in trend with the green agenda. Considering that industrial sectors are adapting to the possibilities of autonomous mobility, new forms of entrepreneurship and jobs are emerging. A new business environment is gradually being created in accordance with sustainable ecology, the improvement of specialized hardware and software components,

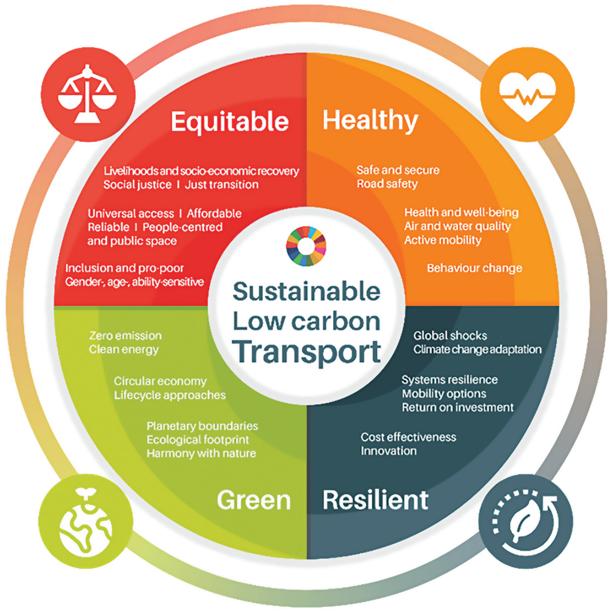

Figure 2. Sustainable, low carbon transport and mobility and the 2030 Agenda. Source: [33].

as well as the provision of support and accompanying maintenance services. New industrial directions follow ecological goals, reduce the depletion of non-renewable resources, reducing the potential risks of climate change. Companies are adapting to legal and economic regulations, reducing greenhouse gas emissions and dependence on fossil fuels. With a proactive approach, companies are protected from possible financial obligations that may arise from non-compliance

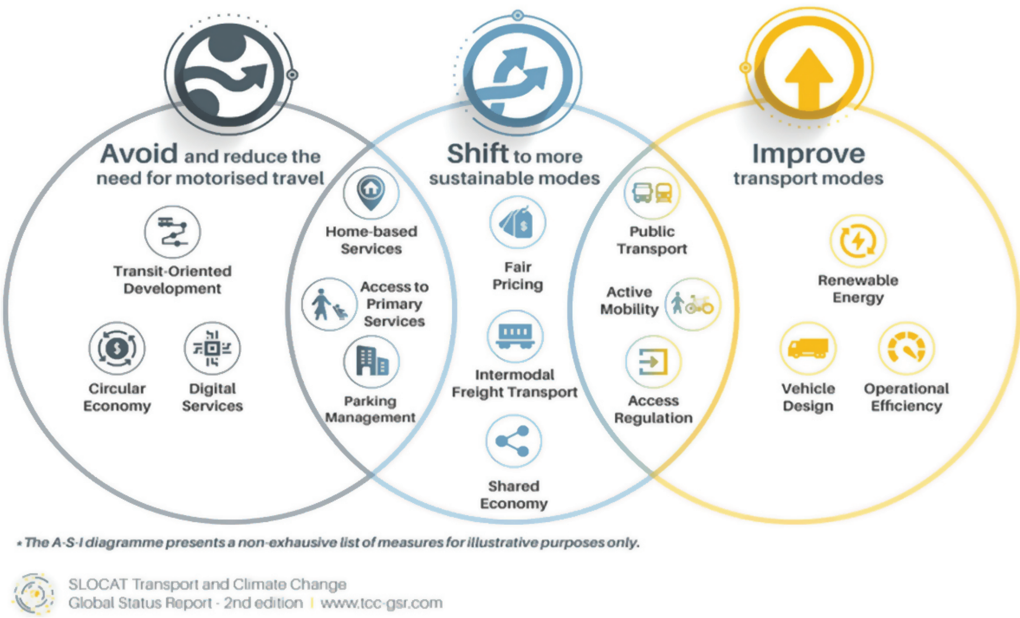

Figure 3. Avoid-Shift-Improve Framework. Source: [33].

with future environmental requirements. By accepting the new paradigm of industrial production of smart vehicles, companies are placed in a favourable position in relation to long-term competitiveness [26].

SLOCAT transport wheel Figure 2 aims to express a wide range of positive links between sustainable, low-carbon transport, mobility and the 2030 Agenda. To show these relationships, there are four cross-cutting themes: equitable, healthy, green and resistant. Each topic highlights basic principles about the socioeconomic and ecological systems that sustainable, low-carbon transport can positively impact.

While in Figure 3 three aspects can be seen. The 2030 Agenda for Sustainability calls on Member States to submit Voluntary National Reviews (VNRs) to the United Nations High-Level Political Forum on Sustainable Development (HLPF), which has met annually since 2016 under the auspices of the UN Economic and Social Council (ECOSOC). The WNR process aims to encourage countries to share their experiences, including triumphs, challenges and lessons learned, in order to accelerate the implementation of the 2030 Agenda.

5.1. State strategy for the implementation of the process of substitution of electric vehicles

Electric vehicles have the potential to completely transform transportation, consumer behaviour and society as a whole in the future. However, in order to satisfy the consumer and commercial advantages, it is necessary for the original equipment manufacturers and car suppliers to perfect new commercial and business strategies, improve new technological possibilities and answer numerous safety questions [14]. The technological aspect includes artificial intelligence, which as an integral part of vehicles can generate hundreds of billions of dollars before the end of this decade. AD autonomous vehicle driving systems have the potential to make the transportation environment more pleasant, convenient and safer.

From an economic standpoint, the government's electric vehicle (EV) replacement policy is expected to have far-reaching consequences, affecting many industries and redefining long-term economic trends. This approach involves a systematic attempt to transition from traditional internal combustion engine vehicles to EVs, motivated by the imperative to reduce greenhouse gas emissions, improve energy security, and encourage technological innovation. An important economic part of this strategy is investment and infrastructure development. Governments play a key role in supporting the development of electric vehicle charging stations, stimulating private investment in charging infrastructure, and expanding grid capacity to meet the growing electricity demand for EVs.

Activities that are causally related to the trend of the green direction encourage economic activities in the construction and energy sectors. The influence of state regulatory bodies implies financial incentives that should reduce the difference in the costs of production of AVs and traditional vehicles. Favourable bank credit lines and state subsidies are aimed at increasing demand and economies of scale. The gradual transition to electric vehicles enables the industrial development and diversification of the industrial production of vehicles. Countries that will be able to produce elements and batteries for EVs will open up the opportunity to create highly qualified jobs and seize a larger share of the world electric vehicle market.

Enabling greater economic market performance is accompanied by environmental protection and new research and development opportunities. The venture in communication between the academic community, the state and industry opens a new chapter of technological innovation and the growth of industrial competition at the global level. The transition process of electric vehicles requires greater ambitions from market leaders at the global level. The primary directions at the moment relate to the expansion of the regulatory instruments of the governments of the leading economic countries, such as the involvement of the European Union regulations on CO2 emissions for vehicles, the Chinese mandate for new energy vehicles (NEV) and the zero emission mandate (ZEV) in California (USA).

The long-term strategy of the full implementation of electric vehicles requires their integration into power systems, decarbonization of electricity and the even distribution of infrastructure for charging and production of sustainable batteries, without which movement is not possible. Existing initiatives are gradually integrating electric vehicles, however, the global crisis caused by the pandemic and war operations in the territory of Ukraine have certainly slowed down the processes of industrial transformation [23].

5.2. Electrification of vehicles

For most of the consumer society, electric vehicles represent an experience that they have yet to encounter and consume. This technology is financially more expensive for industrial production than before, but it is therefore cheaper to maintain and use. New examples of transport mobility bring different results and benefits compared to conventional models. This implies supplementing and substituting diesel and gasoline types of fuel with electricity. This fact gradually reduces the demand for non-renewable energy sources, reducing the emission of harmful environmental gases. New technological aspects are transforming the industrial production of vehicles, providing potentially large benefit options for all participants: manufacturers and consumers.

The history of the improvement of electric cars (EV) is longer than 100 years, which is why it was more noticeable at the beginning of the 20th century and was followed by a series of stops of the processes themselves. In the last ten years, scientists have progressively modeled new vehicle prototypes linked to the parallel processes of environmental protection policies, the development of batteries and their charging infrastructure. High oil prices on the global market caused by various unpredictable circumstances have only confirmed the started practices of industrial production of various components for transport traffic around the world. Politicians, industrialists, and public opinion are increasingly supporting the substitution of electric vehicles, considering them necessary in the coming period. Ambitious financial investments at the regional and state level tend to stimulate further implementation through purchase subsidies, lower registration costs, more favorable loans, and the development of supporting infrastructure [23].

Based on global trends, industrial manufacturers of electric vehicles are taking an increasing share of the world market by developing strategies and expectations, which implies mass production and a larger offer. However, the commercialization of these directions has not been successful up to this point to the extent

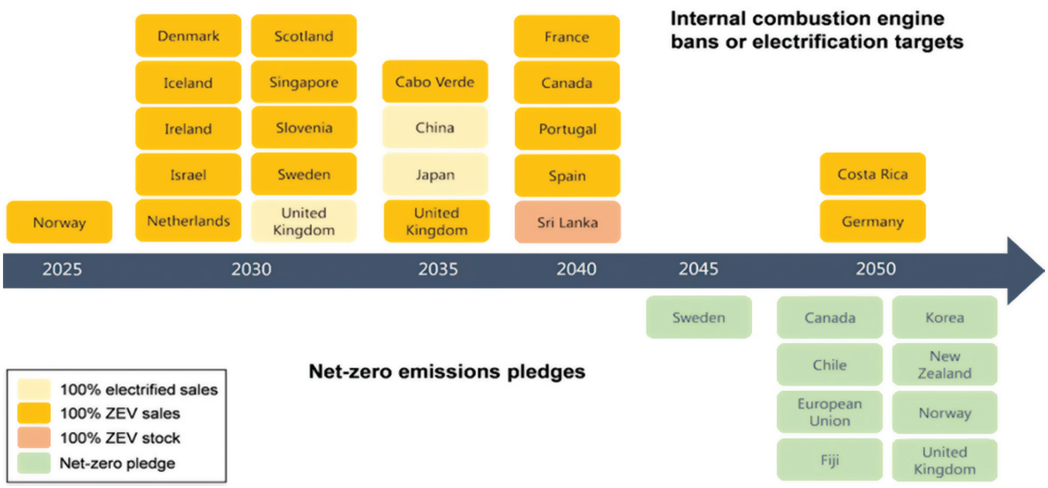

Figure 4. Policies affecting the electric light-duty vehicle market. Source: [22].

expected from the producers. The placement of final products is far from a satisfactory level and lags behind the set goals and strategies. In relation to these facts, the innovative industry is in the initial phase of development and implementation, fighting for greater efficiency in small specialized segments. Manufacturers invest great efforts in promoting innovative business models in the markets, however, there are also certain technological shortcomings related to the autonomy of vehicle movement [22]. The trend of electrification and expected sales can be seen in Figure 4.

The global automotive industry is perfecting the strategy of gradual electrification of vehicles, driven primarily by environmental protection and high consumer expectations. The financial perception of these processes creates certain repercussions related to the substitution of the old paradigm, the review of conventional business strategies, the metamorphosis of industrial sectors, and the migration of employed workers. A noticeable economic advantage of electrification refers to the possible reduction of vehicle maintenance costs during its lifetime. Electric vehicles (EVs), unlike competing internal combustion engines, have lower operating and maintenance costs because they have fewer moving components such as braking systems, oil systems, etc.

Economically speaking, in contrast to gasoline and diesel, electricity has a lower cost, which implies lower long-term costs for consumers. Given the presence of vehicle electrification, the industrial sector of vehicle production is making great efforts to create more efficient batteries that will allow for greater driving range and the improvement of charging infrastructures. The environment of creating an innovative transportation ecosystem places companies at the top of the technology chain that produce electric vehicles and corresponding components. This approach generates global economic competitiveness. A safer future is sustainable by embracing new trends that will ensure better transportation options and environmental protection. Economic potential through cost reduction, job creation and energy security offers hope for better times.

At this time, more than twenty countries have announced that they will stop producing internal combustion vehicles in the next 10 to 30 years. This was also stated by countries that are in economic expansion such as Costa Rica, Cape Verde and Sri Lanka. The dynamic trend of EBCE infrastructure is a continuous process that is not evenly distributed globally. Some countries are making strategic efforts to plan and install bulky interconnected electric vehicle charging stations along major transportation routes. The planning is about interoperability, digitization and roadmaps for the development of charging networks.

The European Union implements the Alternative Fuel Infrastructure Directive (AFID). The intentions of the EU are towards the implementation of publicly available stations for supplying energy to electric vehicles. The member states have set themselves goals and strategies until 2023 for the introduction of publicly available EV chargers. This implies a ratio of one charger to ten electric vehicles. The previous goal and mapping of the key points of the EU was to install one million chargers in public places and roads by 2025. China's fast-growing economy has opted for a $1.4 trillion digital infrastructure public spending program that includes funding for electric vehicle charging stations. The United States dropped a plan proposed in early 2021 related to transportation infrastructure that included grants and incentives to install 500,000 chargers on top of the existing 100,000 [30].

5.3. A better alternative to lithium - Sodium batteries

The need for rechargeable batteries occupies a large place in the automotive industry, and that is why it is important to look at adequate storage options for the electricity that is produced. Using renewable sources for the same production, the situation is different because electricity cannot be stored, that is, it is immediately consumed or lost [8]. The current technological approach such as using lithium batteries installed in vehicles is not adequate enough. For example, vehicles that work using electricity have a lot of weight because batteries with a weight of 400 to 500 kilograms are installed in them.

Based on the facts, scientists are investigating the future use of biomass and biofuels, because with the same amount of energy, they will be saved in a much smaller weight. We can state that lithium is not the best alternative for making batteries in the long run. Issues of environmental protection, climate change, complicated geostrategic relations in the world only further encourage research for a more affordable and sustainable system of energy exploitation. Sodium batteries certainly deserve special attention because they have the property of much easier energy storage. In the future, this could be one of the solutions of modern technological approaches in the use of batteries for the global industry [19].

5.4. Issues with lithium-ion batteries

For now, lithium-ion batteries take precedence as key factors in sustainable energy solutions based on superiority, efficiency and longevity. Their properties are characterized by light compositions, high energy density and charging options. They are represented in electronics, mobile devices, laptops and electric vehicles. They are also a key component in grid storage systems, ensuring a steady flow of electricity from renewable sources like solar and wind, making the fight against climate change sustainable.

By winning the Nobel Prize for the creators of the lithium-ion battery In 2019, the further exploitation of lithium is given importance [1]. However, there are significant barriers in these processes. Namely, the limited availability of lithium deposits creates uncertainty and concern for the long-term presence of batteries in the global industrial market. Contradictions are emerging related to the initiated processes of the green agenda. There are negative side effects of pollution of the local ecosystem based on the extraction of lithium and other rare metals such as cobalt and nickel necessary for the production of batteries, including the water-intensive and polluted mining processes of the exploitation itself.

Local communities concentrated around mining sites face a lack of drinking water and health problems caused by pollution of natural resources due to dirty mining-technological practices. Cobalt mining in the Democratic Republic of the Congo speaks of poor working conditions, public health hazards and human rights violations. Mining operations are pushing local communities out of the loop to expand their capacity and meet the growing global demand for lithium. The negative implications of exploitation cause ethical conflicts fueling numerous discourses related to the future production of these batteries. In addition to all that we have mentioned, negative implications are also represented by the technically difficult recycling of these rare metals, which at the same time require significant operational financial costs.

As a result of the negative implications, a large part of these batteries are disposed of in landfills as hazardous waste. At the moment, on a global level, the recycling percentage of lithium-ion batteries is negligible. Considering the increasing demand for the same, it is necessary to implement improved recycling technology. Expectations are that only 5 percent of these batteries will be reused worldwide [1].

5.5. How sodium batteries work

Sodium batteries work by using the properties of alkali metals. Sodium and lithium belong to the same group in the periodic table. They only have one electron in their outer shell which they can lose quickly. During the reaction of these metals with water, they lose their outer electrons. During this process, they release energy and create compounds such as sodium chloride and lithium hydroxide. Electrons released from lithium or sodium atoms as an energy source do not immediately unite with other atoms. In addition, they go over the vehicle, and the direction of the electrons represents the electric current. Meanwhile the atoms, now depleted of electrons and positively charged, move in different directions through the electrolyte, gel or type of liquid found inside the batteries. The positive characteristics of batteries are reflected in the release of energy and its storage, and depend on the separation of the movement of ions and electrons.

The efficiency of sodium and lithium in batteries refers to the reactivity that is based on reverse processes and the application of an external current, allowing the electrons to be pushed back to their initial location. The characteristics of sodium batteries in relation to lithium ones are related to the larger size, weight and bulkiness in relation to the generation of the same energy. The properties of sodium are characterized by larger atoms, with more neutrons, protons and an additional electron shell. Because of these different properties, technological applications were first linked to lithium, even though sodium is more available and has a lower cost. Regardless of certain better features, by improving materials and design, sodium batteries become more competitive in world markets, especially in situations where battery size and weight are less important [39].

5.6. Where exactly are sodium batteries currently being developed

The initiatives of China's high-growth economy are leading to an increase in the production of sodium batteries, presenting the possibilities of this essential component in the future development of electric vehicles. Representatives such as Catl, the Chinese manufacturer of sodium batteries and Chery, which represents the exclusive manufacturer of the new Icar line, are only part of the chain of brands. Representing both HiNa and JAC Group are following the trend of sodium EV technology and introducing practical and affordable models that have 155 mile highway ranges and cost around $10,000.00.

Diversification of renewable energy sources and improvement of EV technologies as key segments of the green agenda implementation plan are becoming applicable thanks to the commitment of the State of China. A viable economic plan to develop these technologies includes over 36 Chinese companies that are proactive in developing sodium batteries. Technology expansion is progressing with the development of dozens of sodium-ion battery facilities, expanding to plant development in Malaysia as well [37].

5.7. The future of sodium batteries

The use of sodium batteries in the future is possible, but not completely certain. Their technological potential is not fully developed, and scientists are putting great effort into it. The example of lithium batteries shows decades of development. Expectations say that by 2030, sodium battery plants will have significant production capacity, half of which will be used for the production of cells. This will represent only 2% of the expected production of lithium cells. Although the development dynamics of sodium batteries is slow, they represent competitors with lithium-iron-phosphate batteries and other new technologies. Regarding heavy transport, they offer an alternative to hydrogen fuel cells that rely on an infrastructure that is still under development. The success of using sodium batteries, especially in weight-sensitive applications such as electric vehicles, depends on material costs and further improvements in technical characteristics.

Due to the fact that on the world market the prices of precious rare materials such as nickel, cobalt and lithium are still high, alternatives in the production and efforts to improve the performance and energy density of sodium batteries can be realized. Future economic trends and advances in materials research will influence the strengthening of competition in the production of different batteries. Based on research, new cathode materials for sodium batteries are emerging that will be able to increase energy storage and extend the driving range of EVs [38].

5.8. Strategic waste management and balancing act in urban planning

World industrial development must be accompanied by adequate solutions related to recycling and disposal of electronic waste. Sodium batteries, whose working life is ending, require a special disposal of the material in order to preserve the environment. It is necessary to establish a balance in urban environments through the implementation of a strategy related to the establishment of a design that will be essential to maximize the use of sodium that powers the batteries in robotic vehicles while simultaneously minimizing the negative effects on the environment.

In the course of this research on future directions in the industry, a great potential for further development of smart vehicles that will use sodium batteries is observed. By introducing strategic preparations, sustainable practices and the joint efforts of the governments of the richest countries, the revolutionary paths of the green route will be paved, which will further set the environment for a thorough discussion on the aspects and challenges of a more technologically sophisticated practice [27].

6. BARRIERS IN REALIZING THE GREEN AGENDA ROUTE

The trend of economic growth and the gradual realization of the green agenda can be slowed down and prevented by various negative effects. There are barriers in the electrification of vehicles and the use of alternative energy sources. Relying on the thoughts of the economist and ethicist Adam Smith in the work “Wealth of Nations” from long ago in 1776, a human element was observed that naturally implies the desire to increase production and the efficiency of the economy in a global sense. Analyzing the obstacles, we find strategies to overcome them. Technological complexities slow down the route. sustainable production of robotic vehicles Creating more efficient and safer energy sources such as batteries or fuel cells requires financial investment in research [20].

As Smith explained [20] that the invisible hand of the market acts on the economic processes of supply and demand, we can metaphorically say that based on the wishes of consumers, industrial production can start the research and development of greener transportation alternatives. However, infrastructural limitations at this point in the industrial era reduce the full implementation of green technological innovations. Improving the supporting infrastructure, including hydrogen filling stations, requires large financial investments and the necessary global cooperation. As Smith correctly recognized, the self-interest of individuals, driven by market forces, can encourage more substantial investment in infrastructure. We can state that based on old thoughts from the time before the industrial revolution, it is possible to provide a sustainable ecological approach to transport at this moment.

The legislation does not yet have a clearer strategy for complete substitution with ecological transport. The lack of consistent and specific regulations negatively affects investor confidence and hinders innovative solutions. Recalling Smith’s thoughts that natural market competition can improve efficiency and reduce costs to a lesser extent, we can say that over time green technologies will become cheaper and more accessible to a larger volume of consumer society. In the long term, we can see the perspective of the green agenda, and the gradual reduction in the prices of new technologies will confirm the acceptance of new global transport standards [32].

A combination of infrastructure constraints, regulatory uncertainty, higher financial cost factors and technological barriers are holding back alternative energy sources. Thinking about Smith’s reflections, we can say that the invisible hand of the free market, guided by its own interests and competition, has the power to sublimate and apply innovative solutions, investments and ensure a safer future. They would add that the role of state governments is extremely important in creating policies that will ensure sustainable long-term prosperity.

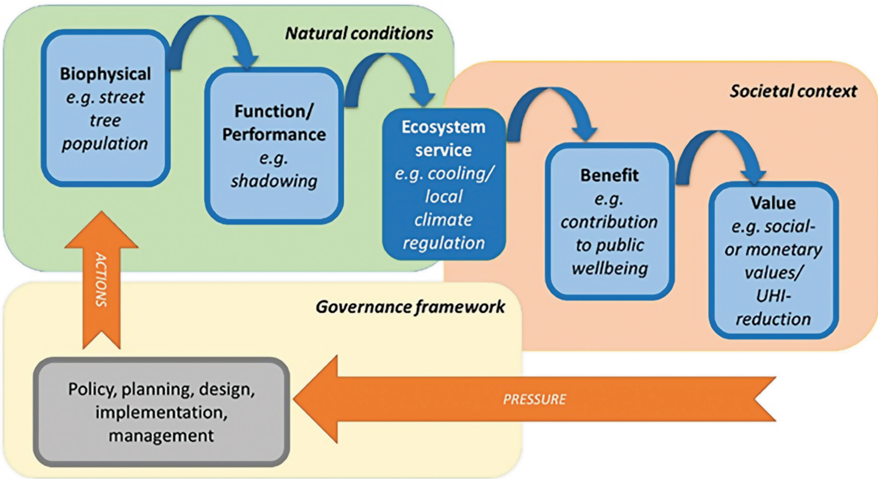

Figure 5. Cascade Model of ecosystem services. Source: [3].

The creativity and technological infrastructure context of the modern green direction (UGI) promises the efficient execution of operational activities, the provision of quality services (Figure 5) and benefits to society. It is dependent on multiple contexts that include the interaction between the physical environment (natural conditions), social values, standards, management and oversight frameworks.

7. NEGATIVE ASPECTS IN THE TRANSFORMATION PROCESSES OF VEHICLE PRODUCTION

The process of automation is mostly covered in the automotive industry. Robotization of the production process should not be viewed only negatively. A holistic understanding of the created effects should be analyzed combining other implemented technological innovations that open new jobs for people. The impact of AI or robots varies across industry sectors, geographies and population groups. The highest concentration of robot employment, 38 percent, is in car manufacturing, and it moves up to 7.5 robots per thousand workers [2].

Technological progress in the field of robotics has led to machines and robots gradually taking over jobs from humans in various industrial environments. With its ever-increasing impact on industrial sectors, AI is transforming the way of production and work. With its influence, it will certainly affect the performance of future business. At the world level, at the moment, people use robots as companions, first aid and capacities that solve problems in the field. By perfecting artificial intelligence, robots acquire the characteristics of complex performance, gradually surpassing human capabilities. The NBER study stated that, on average, the arrival of one new industrial robot on the local labor market coincides with a drop in employment of 5.6 workers [15].

The use of robots in the automotive industry refers to the performance of repetitive tasks and high-risk jobs for humans. Completing tasks in a short time interval such as designing a vehicle applies to electrical engineers. Mechanical engineers design the body of the robot. Communication systems and improvement of programming languages are realized by IT experts. Regardless of the fact that robots or artificial intelligence perform complex tasks, they still cannot match the very complex human brain. Robots are advantageous for different types of work tasks, but they are not always reliable. Technology-related procedures can lead to software errors. Business operations that are automated become more uniform across different industries, reduce the risk of error and increase work productivity. Therefore, it is possible to distinguish between activities that are best suited for machines and jobs that are intended for human skills.

8. RESULTS

The direction of the green agenda is a long-term process in which all governments at the global level must participate by working closely together. Positive and negative frequency events are related to the present time interval. When dealing with negative externalities such as environmental contamination produced by toxic gasses, insufficient garbage disposal, and so on, strategic coordination is required. In a period of widespread urbanization, an interdisciplinary discourse is required to alter the urban image, create a sustainable environment, and provide a stable future for all living organisms.

The synergy of the outcomes of urban strategic waste management planning reveals a complex relationship for ecological necessities, socioeconomic efficiency, and ethical imperatives. There is genuine concern about the preservation of a sustainable, environmentally friendly atmosphere in metropolitan areas and cities. In the pursuit of efficiency and ecological balance, significant financial resources are being directed to the energy consumption of specific resources and the alternative creation of industrial components on a global scale.

8.1. Lack of components for the automotive industry in global markets

The automobile manufacturing industry is currently in crisis, as the global market lacks the required components. In the article, we examined a variety of factors that contribute to shortages, such as supply chain imbalances, higher demand than supply of commodities, insufficient delivery time of final products, component complexity, raw material shortages, and negative geopolitical consequences. Strategic frameworks for overcoming problems, such as effective inventory management strategies, supplier network diversity, additional financial expenditures in supply chain resilience, and increased collaboration with suppliers, were examined. The negative aspects of the process of altering the technique of vehicle manufacture were analyzed, including the impact on the environment via the lens of the green agenda, the migration of labor force owing to the automation of production, and the socio-economic ramifications [29].

By consistently confronting the issues of the leading economic countries, effective strategies are used to mitigate the negative consequences

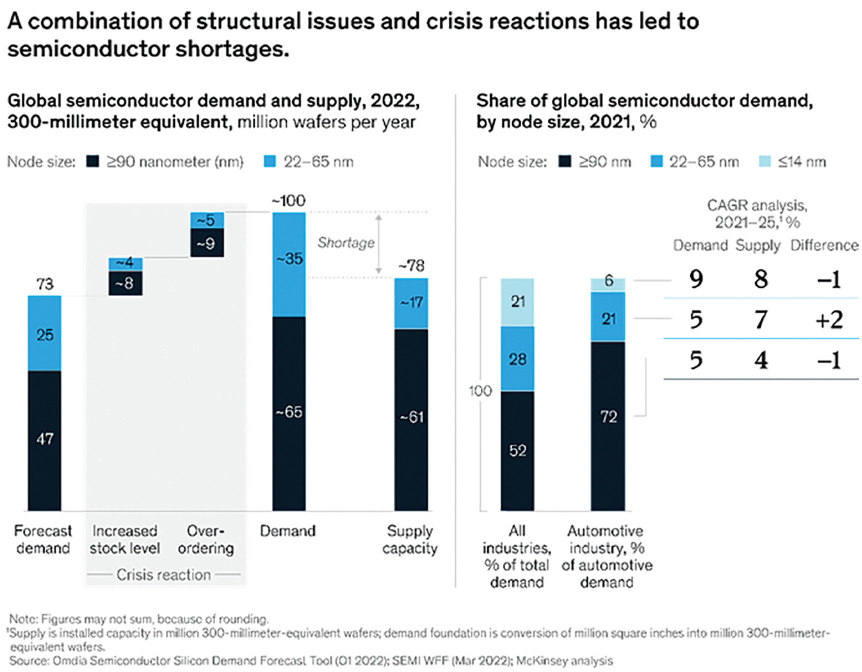

Figure 6. A combination of structural issues and crisis reactions. Source: [4].

of the technological shift. However, the industrial sector of car manufacture is trailing behind the reforms that have been begun. To save inventory costs, many OEM and Tier 1 suppliers strive for maximum efficiency when procuring semiconductors and other car components. As car sales fell in early 2020, OEMs and Tier 1s decreased chip orders, resulting in low stockpiles as demand began to increase. Companies that did not track orders related to demand were in a better position to provide additional capacity when individual suppliers canceled or reduced component orders.

Due to the unpredictability of the automotive business, a long-term supplier strategy is required, which has led to collaborative financial involvement in initiatives involving green nodes. They should instead create semiconductors in advanced or leading nodes. This way, the financial burden is shared while boosting the offer of low-margin technology. Disruptions in the semiconductor supply chain, the seeming crisis caused by Covid-19, natural calamities, and a geopolitical issue all prompted a pause in industrial production growth. The semiconductor shortage will persist in certain technical nodes for at least the next three to five years [4]. The component shortfall is driven in part by long-term structural problems such as limited capacity and car manufacturers' incorrect behavior in terms of overordering components (Figure 6).

Shortages of nodes larger than 90 nanometers (NM), which are in high demand, will persist for two reasons. The first is that the established nodes have low profit margins, so the semiconductor industry will most likely ignore the reasons for their absence; second, due to the increase in financial development costs, the possession of low qualifications, and the limited availability of people for research and development, there is insufficient incentive to switch to smaller sizes of them.

Given the large range of technologies and devices, it is impossible to determine the exact extent of the supply-demand gap for specific commodities in this category of industrial compo- nents. Companies evaluate the semiconductor deficiency in terms of short- and medium-term requirements, as well as long-term resilience and durability [4].

8.2. Energy consumed in the EU

In 2022, renewable energy accounted for 23.0% of the total area in the European Union, up from 21.9% in the previous year. In 2022, renewable energy sources accounted for 9.6% of energy used in transportation, up from 9.1% in 2021. The European Green Deal (COM(2019) 640 final) aims to make Europe

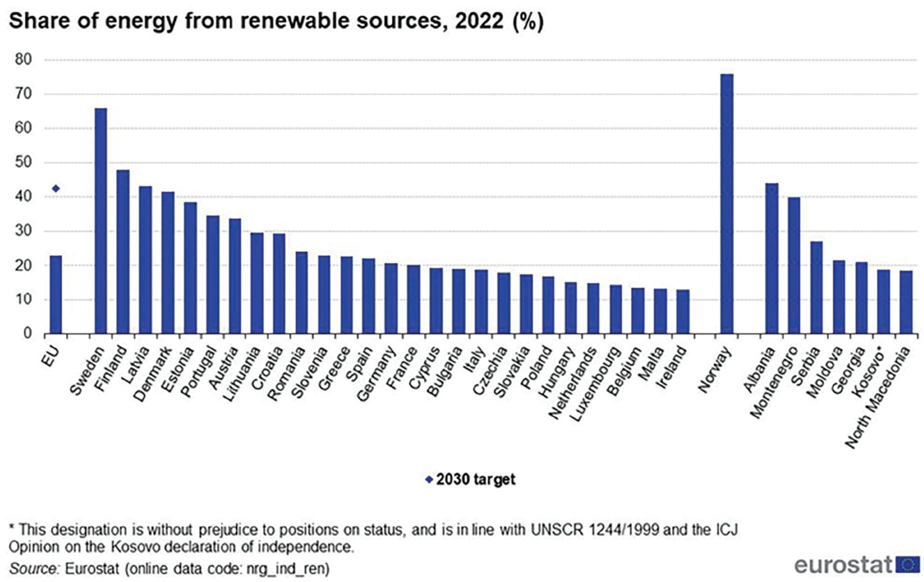

Figure 7. Share of renewable energies in gross final energy consumption. Source: [16].

the first continent to achieve carbon neutrality by 2050. It is a fairly ambitious package of initiatives designed to give citizens and businesses with the benefits of the green agenda [16].

The EU Directive 2023/2413 intends to boost renewable energy consumption in the EU by 2030 from 32% to 42.5% of total consumption. Figure 7 present the most recent available data on the proportion of renewable energy sources in gross final energy consumption.

Ursula von der Leyen (Ursula Gertrud von der Leyen), a German politician and current head of the European Commission, stated in her political guidelines that the green deal is the most crucial component of the Commission's plan for implementing the UN 2030 Agenda [16].

9. LIMITATIONS OF THE STUDY

The research opus included a wide range of themes, including strategic infrastructure planning, waste management, novel vehicle components, green direction, and renewable energy sources. We talked about the negative consequences of the new path in car production, the properties of sodium-lithium batteries, and the implementation of proper waste management in cities. We investigated the ultimate limits of research, which included resource constraints, ethical concerns, methodological obstacles, multidisciplinary viewpoints, and social duties. We underlined the intricacy and interconnectivity of the listed themes and concerns, as well as the importance of using a humanistic approach to effectively resolve them.

Through the discussion, we filtered out three key lines of study:

1) Ethical discourse in waste management research, urban planning and emphasis on environmental protection.
2) Limitation of resources related to the time interval, financial aspect and availability of data, which can limit the scope and depth of research in interdisciplinary areas.
3) Questions related to information analysis, sampling, measurement, were part of the methodological challenge that is characteristic of waste management systems and urban areas.

10. DISCUSSION

The first topic for discussion concerns the disruption of the industrial market by components necessary for vehicles. It is caused by the factors we have already listed. The emphasis is on the balance between demand and supply, that is, the so-called "Production at the right moment" and the demand for stocks of the so-called "Tampon" strategy. Companies that cut production in quantities relative to demand cause disruptions in the supply chain. We can conclude that it is very important to achieve a balance between efficiency and resistance, in order to control the deficit of components.

Another topic for discussion is related to the necessity of diversification of original equipment supply chains. The possibility of market disruption can be avoided by increasing the number of suppliers. Automotive companies can mitigate their risks by continuously monitoring the market in relation to global negative events and by diversifying the number of potential equipment suppliers. It is necessary for governments and industrial companies to act in partnership to solve the negative aspects of the transformation process of car production. This would imply adherence to the directions of the green agenda, which includes sustainable production, investment in the necessary infrastructure, solving the problem of labor migration caused by automation through appropriate socio-economic development policies in communities affected by industrial changes. For a sustainable industrial vehicle market, accompanied by the growth of production and consumption, a proactive approach by governments, companies and suppliers is necessary. For the lack of semiconductors, long-term plans must be built, investments in them must be coordinated. Careful strategic forecasting of future demand is very important to address these issues. The automotive sector could much better coordinate barriers and ensure long-term prosperity, provided that it adheres to multidimensional strategies that will strike a balance between resilience and efficiency.

Answers to previously defined questions:

10.1. RQ 1

By studying the complex activities of the integrative information technology (IT) environment in the automotive industry, we compared them with the analytical insight in the book “Capital in the twenty-first century” by Thomas Piketty [28]. Taking into account the perspectives of new directions, we can develop an analysis of the interplay of economic forces and technological progress that shape the sustainability of transport modernization. The incorporation of IT technologies into the automotive industry is transforming the classic directions of vehicles, infrastructure and fossil fuel use. Just as Piketty’s research looks at the accumulation of capital and economic injustice due to the concentration of wealth in the hands of a few families, so the consolidation of technological specialization within the automotive sector is able to change the distribution of impacts on the traffic environment, but also to effect a gradual migration of workers from the industrial sector, freeing up jobs for robotics.

10.2. RQ 2

As Piketty discusses the impact of institutions on economic outcomes, the integration of IT into automotive systems necessitates the alignment of applicable regulatory frameworks and government structures for monitoring and leading technological advancements. Ensuring data privacy and cybersecurity necessitates proactive policy actions. This would ensure that technical advancements continue to benefit societies all across the world.

10.3. RQ 3

There is a certain amount of uncertainty for technological progress. The challenges of technological progress are reflected in the risks of growing gaps. Piketty’s warnings speak of continued income disparity in the era of the capitalist concept. Uncertainty in innovative approaches to automotive technologies emphasize the importance of careful monitoring and participatory creation of policies that will prevent the marginalization of new trends. Developing a discourse on the integration of IT and the automotive industry sublimates the complexity of the modern age, symbolically recognizing the concern encompassed by Piketty’s revolutionary work.

10.4. Open Questions

Based on the research conducted, we can pose the following questions that we would like to address in the future:

1) How can car companies balance supply and demand for components to effectively address the global shortage?
2) What strategies do vehicle manufacturers use to diversify their supplier networks and thus ensure balance in the event of supply chain disruptions?
3) How can joint efforts between governments and manufacturing companies in the industry mitigate negative environmental and socio-economic impacts?
4) In what direction are the future transformations of vehicle production going, while ensuring the competitiveness and sustainability of the automotive branch of the industry?

11. CONCLUSION

Based on our research, we have arrived at certain conclusions about the green agenda process. The indicators correspond to the realization of transportation infrastructure transformations as well as the political emphasis on increased industrial deployment of electric vehicles.

The current execution of the electrification policy is modest, and the EU has set goals until 2030 for all vehicles to be electric. The key reason for failing to reach the targets is the difficult requirements for the establishment of an electrical network capable of more effectively supplying consumer needs. By correlating the partnership between IT and automotive companies, the common goals of vehicle production are present, innovative elements are shaped, safety is ensured and the experiences of consumers who have high demands are improved.

Dealing with complex barriers, stimulating continuous technological improvements and dynamically conquering the market with electric vehicles is achieved by a smart combination of skills and resources. Branches of the automotive industry are constantly on the front line as they struggle with the challenges that arise due to the global shortage of components, higher demand than supply, complicated geopolitical relations, disharmony in supply chains.

In the paper, we explored the barriers in more detail and proposed strategies to cancel them, such as diversifying the supplier network, increasing the efficiency of inventory management, encouraging greater cooperation with suppliers, and greater investment in technologies for supply chain resilience. We observed and analyzed the negative consequences of the transformation process of vehicle production, such as the impact on the environment and socio-economic issues. At the moment, there are initiatives by states, companies and scientific research centers to improve vehicle supply chains in industries and to reduce the negative effects of the transformation of their production. By better understanding the market circumstances and applying adequate strategies while reducing negative impacts, manufacturers can deal with the shortage of parts on the market. They can ensure stable production, while simultaneously contributing to sustainable social practices and economic prosperity.

The shortage of semiconductors has caused structural difficulties in the semiconductor supply chain. Prolonged crisis of lack of resources and increased demands require long-term planning, joint investment in semiconductor projects and adequate adjustments to higher demands for final products. The complexity of barriers requires proactive and collaborative efforts by all stakeholders in the global market. The industrial symbiosis of vehicle manufacturers and the IT sector enables easy implementation of the most modern technological achievements in vehicles. IT companies analyze the important data of the specific requirements of the vehicle industry and the regulatory frameworks of the countries. Then they provide solutions that meet the demanding safety and performance standards of vehicle electrification. Going beyond the refinement of new technologies, joint efforts include research projects, create policies and commercial efforts to spread the innovative market. Interoperability, standardization and scalability on electric vehicle platforms will be launched, satisfying the demanding demand for the same.

Cooperation in various technical and technological industrial fields leads to a cultural exchange because people from different backgrounds come together to work on interdisciplinary projects and exchange the best practical solutions. A joint approach promotes technical and technological growth and strengthens the competitiveness of industrial branches on a global level. In future research, there should be strategic adaptations of complementary expertise and resources that are drivers of innovation, safety and stimulate the growth of electric vehicle production. The influence of governments through regulations and economic policies, the coupling of partner industrial activities and scientific research centers pave the way for a sustainable, integrative and more electrified transport system.

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BUDUĆNOST ROBOTSKIH VOZILA SA PROTIVREČNOSTIMA PROCESA U ZELENOJ AGENDI I PROIZVODNJOM RAZLIČITIH IZVORA ENERGIJE

Rezime: *Upotreba različitih tipova automobila proizvodi paradokse kada se uzmu u obzir eksterni efekti kao što je šteta po životnu sredinu. Koristeći empirijski metod, pokušali smo da analiziramo protivrečnosti unutar zelene agende. Predložene tehnike se ne moraju sprovoditi tokom faze proučavanja. Članak pokušava da ispita trenutne globalne obrasce kako bi se identifikovale buduće alternative za zamenu stare infrastrukture. U dobu velikog tehnološkog rasta, sektor proizvodnje automobila prolazi kroz značajne promene. Ova transformacija podrazumeva zamenu zastarele infrastrukture sofisticiranim softverom i komponentama koje štede energiju. Iako promene predstavljaju uzbudljiva rešenja, one predstavljaju značajne prepreke, posebno u postizanju ciljeva ekološke održivosti. Integracija automatizacije, veštačke inteligencije i moderne proizvodne tehnologije mogu rezultirati manjom potražnjom za radnicima u konvencionalnim industrijama. Usložnjavanje procesa se odnosi na transformaciju održivih metoda, posebno u proizvodnji baterija za električna vozila. Koristili smo empirijska istraživanja u oblasti održivog upravljanja energijom, cirkularnom ekonomijom i projektima urbanog planiranja, kako bi smo umanjili energetske zahteve. Prikupljanjem i analizom informacija iz stvarnog sveta, nadamo se da ćemo pružiti uvid zasnovan na dokazima o efikasnosti različitih metoda i politika. Obezbeđujući otpornu i održivu budućnost za transport, regulativa EU je ključna u kombinovanju brige o životnoj sredini sa ekonomskom održivošću. Naše istraživanje pokazuje istorijsku promenu u sektoru transporta, pri čemu autonomni automobili igraju ključnu ulogu u dizajniranju budućih opcija mobilnosti.*

Ključne reči: *robotska vozila, zelena agenda, sektor proizvodnje automobila, veštačka inteligencija, napredni pristupi proizvodnoj tehnologiji, izvori energije*