How humanities can tackle with the consumption and greenhouse effect: through the prism of green logistics

ISSN 1857-9973 UDC 658.86/.87:502.131.1(4-672EU)

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Abstract

Sustainable development is a complex and global problem. Poverty, inequality, opacity, drought, floods, green house effects are just a few pieces of the puzzle called a real-world ecosystem. One such piece of the multitude of global problems concerns on the transport and logistics problems in urban centers and the pronounced need for green logistics. Following modern technological trends and the need for long-term sustainable development and environmental protection, especially in urban areas, as a growing and unstoppable phenomenon caused by global technological progress, possible promising alternatives, research and solutions are focused on the concept of green infrastructure and green logistics. The concept of Green Logistics occupies an important place in optimizing the transport sector, reducing traffic congestion and reducing emissions from vehicles. The concept of Green Logistics is primarily focused on issues related to environmental protection, such as environmental pollution and emissions caused by non-standard and insufficiently professionally arranged logistics processes and the use of old and environmentally unsuitable transport technology. Green Logistics is a model that is planned, organized and implemented through an environmentally friendly and often socially friendly dimension, in addition to the economically functional one. Covers all entities, legislation, activities and participants in order to minimize the environmental impact of transport activities. The goal is to create sustainable value for the company using a stable balance of economic and environmental efficiency. To meet strictly defined environmental goals, green logistic includes all activities of the forward and reverse flows of products, information and services between the point of origin and the point of consumption. It is the aim to create a sustainable company value using a balance of economic and environmental efficiency.

Keywords: sustainable society, green infrastructure, green logistic, reverse Logistics

1. How humanities can tackle with the consumption and greenhouse effect

Poverty, inequality, opacity, drought, floods, green house effects, politics and diplomacy with the reality that barriers to the formation of environmentally friendly society, fighting, violence, unrestrained people, etc. are unacceptable, and unexpected words are hurting our daily living environment directly and indirectly. The sustainable society in the sense of social justice is now questioned. This means that our targeted sustainable development has been challenged by the global challenges (climate crisis, raw material scarcity crisis, toxicity crisis, energy crisis, etc.).**[1]** Representatives of international institutions and bodies, statesmen and experts "outwit" each other over the main culprits for these world problems, shifting the blame to various institutions and bodies.

According to UN research,**[2]** three-quarters of the world's approximately 1.3 billion poor people now live in middleincome countries and only about a quarter of the world's poor – about 370 million people – live in the remaining low-income countries, which are largely in sub-Saharan Africa.137 Income inequality in Latin America and the Caribbean is the most pronounced in the world and this has not changed in four decades. It is 36 per cent higher than in east Asia and 18 per cent higher than the level reported for sub-Saharan Africa.

The conventional consumption pattern of people in wealthy countries – and the middle classes of the developing world – is driving the vast majority of natural resource degradation. The wealthiest 20 per cent of the world's population account for 80 per cent of consumption of global resources. And we are currently using 50 per cent more natural resources than the earth can sustain, with devastating impacts on nature and on how people access food, fresh water, land and energy. The poorest 20 per cent of people, by contrast, lack the resources to have even a decent standard of living. Lack of food, water, energy and shelter mean that they are far more vulnerable in the face of threats from climate change, natural disasters and economic downturns.**[3]**

It is difficult to identify mechanisms with astronomical precision would have solved problems accumulated centuries. Sustainable development is a complex and global problem. Borrowing on the report of COP21 "Paris climate change conference 2015", for example, we argue that climate change, in general, clearly focused on the necessities to stop our current irresponsible linear activities that create "pressures on the earth's systems are having serious consequences and threatening critical, global, and local thresholds". **[4]**

The process of transformation from a linear model to a model of circular economy is still ongoing and requires intensive and comprehensive development and application of new knowledge, technologies, regulations that would produce innovative, technological and sustainable processes, products and services.

According to Buren **[5]** building a circular economy will require coherent change in consumer behavior, governmental policies and business practices. Such a transition is complex and requires simultaneous changes in various subsystems, such as the energy, logistics and financial subsystems. It also needs clear guidance and monitoring, as circular systems are not necessarily "better" than linear systems under all circumstances. Inefficient circular systems can create a lot of social, economic and environmental damage as well (e.g., due to excessive use of transport and energy, or unattractive work conditions, such as in product recovery). Undoubtedly, the shift to a value creating circular economy will lead to new business models, value chains, and product-service delivery models which entails more social benefit. It affects the design, production, use and disposal process, and the collection of products and materials for reuse. It also adds new processes to facilitate, maintain, share, repair, upgrade and remanufacture products.

2. Green infrastructure and green logistic

Following modern technological trends and the needs for long-term sustainable development and environmental protection, as possible perspective solutions, research is focused on the concept of green infrastructure and green logistics.

The term ‘green infrastructure’ was probably first introduced by Charles Little in reference to greenways in the early 1990s (in the USA, according to Sandström 2002). Shortly after, in the context of sustainable development, urban green space in general was termed ‘green infrastructure’ to put it on equal footing with grey infrastructure. Since that time the term has appeared frequently in the environmental planning and design literature. (Carne J. R., 2016) **[6]**

Green infrastructure planning represents a strategic approach to conservation that combines the efforts of previous conservation planning methodologies and practices into a systematic framework that can encompass larger landscapes and broader planning goals (McDonald et al., 2005).**[7]**

This Green Infrastructure Work Group developed the following definition for green infrastructure: *“Green infrastructure is our nation’s natural life support system — an interconnected network of waterways, wetlands, woodlands, wildlife habitats, and other natural areas; greenways, parks and other conservation lands; working farms, ranches and forests; and wilderness and other open spaces that support native species, maintain natural ecological processes, sustain air and water resources and contribute to the health and quality of life for America’s communities and people.”* **[8]**

Section 502 of the Clean Water Act **[9]** defines green infrastructure as "...the range of measures that use plant or soil systems, permeable pavement or other permeable surfaces or substrates, stormwater harvest and reuse, or landscaping to store, infiltrate, or evapotranspiration stormwater and reduce flows to sewer systems or to surface waters."

According to Working group **[10]** of Green Infrastructure Strategy for the EU physical green infrastructure is defines as the multifunctionality prospects:

- Increasingly thinner natural fabric of Europe that provides society with a wide range of vital functions.
- Green infrastructure is the multi-functional system of natural and man-made structures which provide benefits to society through functions and services arising as a natural consequence of seeking to maintain, support or enhance biodiversity in any given location or as part of any given action.
- Green infrastructure is strategically planned and managed networks of natural lands, working landscapes and other open spaces that conserve Biodiversity, ecosystem values and functions and provide associated benefits to human populations.
- Green Infrastructure is Nature. This takes us from site-based protection/restoration to landscape-scale ambitions and a holistic approach to the health of the soil, land and landscape.
- ‘Green infrastructure’ is an interconnected network of natural areas and green man-made features, including agricultural land, greenways, wetlands, parks, forest reserves, native plant communities and marine areas that naturally regulate storm flows, temperatures, flood risk water, air, greenhouse gasses, and ecosystem quality.

The meaning and importance of the terms green logistics are most vividly and content-richly described by the authors Jean-Paul Rodrigue, Brian Slack and Claude Comtois in the paper with title Green Logistics. **[11]** Namely, according to the mentioned authors the notion “Logistics” are at the heart of modern transport systems. As has been demonstrated earlier, the term implies a degree organization and control over freight movements that only modern technology could have brought into being. It has become one of the most important developments in the transportation industry. ‘Greenness’ has become a code-word for a range of environmental concerns and is usually considered positively. It is employed to suggest compatibility with the environment, and thus, like ‘logistics’ is something that is beneficial.

When put together the two words suggest an environmentally friendly and efficient transport and distribution system.

Green logistics is especially important for optimizing the transport sector and reducing emissions from vehicles. The concept of Green Logistics is focused on environmental issues, such as environmental pollution and emissions caused by non-standard and irregular logistics processes and the use of old and environmentally unsuitable transport technology. According to Saroha **[12]** Green logistics is a form of logistics which is calculated to be environmentally and often socially friendly in addition to economically functional. It describes all attempts to measure and minimize the ecological impact of logistics activities. This includes all activities of the forward and reverse flows of products, information and services between the point of origin and the point of consumption. It is the aim to create a sustainable company value using a balance of economic and environmental efficiency.

Considering that today's urban centers of growth seem to be areas where the construction of a green infrastructure network is extremely difficult. This is due especially to large concentrations of inhabitants, intensive land use, and the high density of different infrastructural elements. Furthermore, Gadziński has argued **[13]** that the concentration of people in a relatively small area, transport networks in cities are usually very extensive and traffic flows much higher than in rural areas. It should also be noted that cities are complex structures, which are constantly changing; changes in transport systems cannot be understood without analysis of the urbanization process.

It is worth noting that in the literature, but also in practice, the term reverse logistics is often mentioned. There is confusion among some authors about the similarities and differences between these two terms. An important distinction must be drawn between reverse logistics and a very related subject that we will refer to as green logistics. Reverse logistics refers to all efforts to move goods from their typical place of disposal in order to recapture value. Green logistics, or ecological logistics, refers to understanding and minimizing the ecological impact of logistics. Green logistics activities include measuring the environmental impact of particular modes of transport, ISO 14000 certification, reducing energy usage of logistics activities, and reducing usage of materials.**[14]** The need to understand the reverse logistics and closed loop supply chain has become increasingly important in this age of commerce that we live in, defined in terms of shorter and shorter product lifecycles, liberal product return policies, rapid response times, and 24/7 customer service has placed a greater emphasis on the management of the return, refurbishment, and restocking of finished goods, including whole units, product subassemblies, and spare parts. In some sectors, particularly any industries concerned with the distribution and support of electro-mechanical, electrical, or electronic equipment, this responsibility extends beyond the distribution channel to the actual replacement of products on the customer premise. **[15]** Of course in that regard, it is worth noting that some green logistics activities can be classified as reverse logistics. For example, using reusable totes and remanufacturing are both reverse and green logistics issues. However, there are many green logistics activities that are not reverse logistics related. For example, reducing energy consumption, or designing a disposable package to require less packaging are not reverse logistics activities. Designing a product to use less plastic would not be a reverse logistics activity but designing a product to make use of reusable packaging would involve reverse logistics. **[16]**

Reverse Logistics concerns activities associated with the handling and management of equipment, products, components, materials or even entire technical systems to be recovered (for succinctness we will often use the term products alone). Recovery can simply be just reselling a product. Or, it can be accompanied by a series of processes as collection, inspection, separation, and so on, leading to e.g. remanufacturing or recycling. Material recapture and product or equipment (partial) reuse is a very old practice. In the past, the primary motivation was scarcity of resources. **[17]**

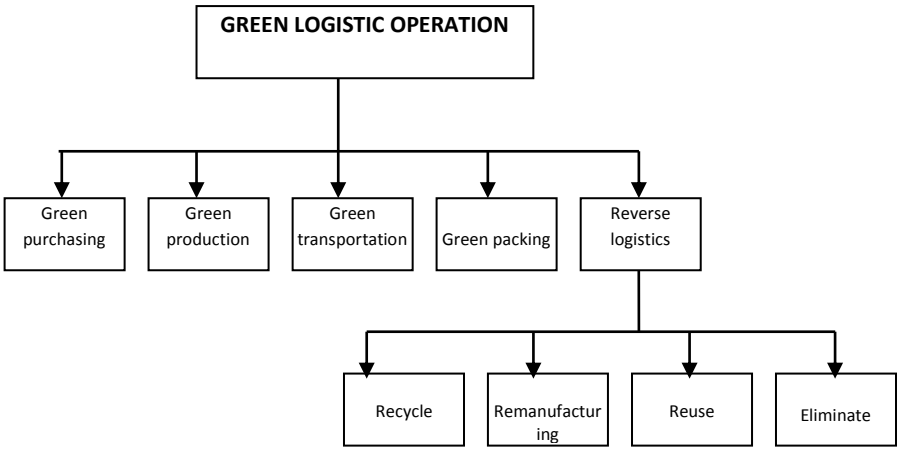

Figure 1 Green logistic operation

Source: Büyüközkan, G. & Vardaroğlu, Z. (2008). Yeşil tedarik zinciri yönetimi. *Lojistik Dergisi,* 8, 66-73.**[18]**

2.1. Green logistic in EU sustainable environmental policy

Consequently, environmental issues, tasks and goals are incorporated in the European institutions, enabling EU to give proposals and constantly measure the adoption of proposals in all member states. Moreover, the European green logistics policy made a step forward, with the goal of developing a model of European sustainable logistics. This concept covers three main fields: society, economy and environment, with different activities: **[19]**

1. Society: safety, health, access, equity.
2. Economy: employment, competitiveness, efficiency, growth, choice
3. Environment: air quality, noise, land use, biodiversity, waste and climate changes.

An analysis of final end use of energy in the EU-28 in 2017 shows three dominant categories: transport (30.8 %), households (27.2 %) and industry (24.6 %). Total energy consumption of all transport modes in the EU-28 amounted to 327 Mtoe in 2017. **[20]**

Sector	Share
Transport	30,8
Services	14,5
Industry	24,6
Household	27,2
Agriculture and forestry	2,3
Other	0,6

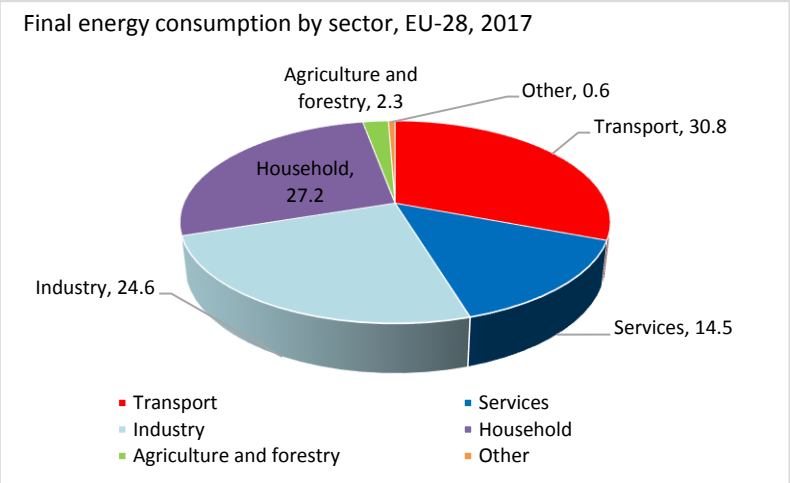

Figure 2 Final energy consumption by sector, EU-28, 2017 (% of total, based on toe)
Data sources: Eurostat (2019): Energy, transport and environment statistics. Luxembourg: Publications Office of the European Union, **2019. p.24. [21]**

The impact of road traffic emissions is the highest in urban areas with dense road networks and high volume of vehicles. The road traffic contributes to the nitrogen oxides, carbon monoxide, benzene and particulate, heavy metal and polycyclic aromatic hydrocarbon emissions. The emissions from road traffic depend on the type and age of the vehicles, mileage of each vehicle group and quality of the fuels used in the vehicles. Many analyzes of the causes of air pollution in urban areas show that transport is one of the sectors where in the last years there is a growing trend of energy consumption. The Energy Information Administration **[22]** has released data showing that the transportation of people and goods accounts for about 25 percent of all energy consumption in the world and that passenger transportation, in particular light-duty vehicles, accounts for most transportation energy consumption. Light-duty vehicles alone consume more than all freight modes of transportation, such as heavy trucks, marine and rail. Global transportation energy consumption is dominated by two fuels: motor gasoline (including ethanol blends) and diesel (including biodiesel blends). Together, these two fuels accounted for 77 percent of total transportation consumption in 2012. Motor gasoline is used primarily for the movement of people, especially by light-duty vehicles, while diesel fuel is used mostly for the movement of goods, especially by heavy-duty trucks.

However, the EU transport sector still relies heavily on fossil fuels and is responsible for one quarter of Europe's greenhouse gas (GHG) emissions a share that keeps growing. In addition, the sector is a significant source of air pollution despite significant progress achieved since 1990, especially of particulate matter (PM) and nitrogen dioxide (NO_2), as well as the main source of environmental noise in Europe. In last decade many analysis and research report increasing share of transport (from 27% in 2000 to 29% in 2018) and services (from 12 to 14%). The share of industry has decreased by more than 4 percentage points, from 30% in 2000 to 25.5% in 2018. For households the share is rather stable (27% in 2000 compared to 26% in 2018). **[23]**

According to the Energy statistics – Energy **[24]** balances provided by Statistical Office of the European Union (Eurostat) in 2017, energy consumption in the transport sector in the 28 EU Member States (EU-28) was 32 % higher than in 1990 (Fig. 1). For the EU-28 plus Iceland, Liechtenstein, Norway, Switzerland and Turkey (EEA-33), the figure was 38 % (Fig. 2). In the EU-13, most of this growth occurred in road and maritime transport. In the EU-15, however, the growth occurred mainly in air transport, although the largest absolute increase in energy consumption occurred in road transport.

Sector	Share
Road transport	73.1
Maritime	13.6
Aviation	14.2
Other Transportation	0.5
Railways	0.5

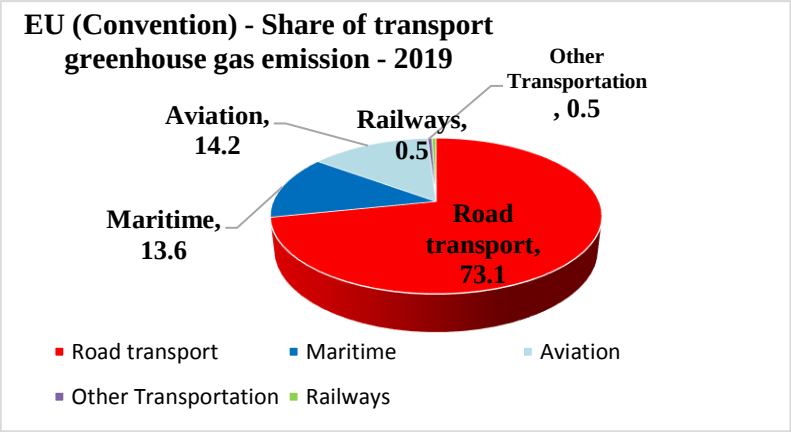

Figure 3 EU (Convention) — Share of transport greenhouse gas emission
Data sources: National emissions reported to the UNFCCC and to the EU Greenhouse Gas Monitoring Mechanism provided by **European Environment Agency (EEA) [25]**

Of the three subcategories (road, rail and air), the most dominant is road transport, with 97% participation. As a result, GHG emissions from this sector are also increasing, of which the most dominant (with almost 99%) is CO_2. The next imperative measure is the adoption of technological measures that reduce the carbon emissions of motorized vehicles per unit of travel. The other is the adoption of demand management measures that would reduce the amount of automotive travel. This includes both non-pricing controls on vehicle ownership and use (for example, restrictions on parking or days the car can be used), and pricing controls such as fuel taxes, higher parking fees, and congestion pricing.

The role of transport in sustainable development is central question in most international plenums and debates. was first recognized at the 1992 United Nation's Earth Summit and reinforced in its outcome document – Agenda 21. In undertaking the five-year review of the implementation of Agenda 21 during its nineteenth Special Session in 1997, the UN General Assembly further noted that, over the next twenty years, transportation would be expected to be the major driving force behind a growing world demand for energy. World leaders recognized unanimously at the 2012 United Nations Conference on Sustainable Development (Rio +20) that transportation and mobility are central to sustainable development. Sustainable transportation can enhance economic growth and improve accessibility. Sustainable transport achieves better integration of the economy while respecting the environment. improving social equity, health, resilience of cities, urban-rural linkages and productivity of rural areas. **[26]**

Sector	Share
Motorcycles	0,9
Heavy duty trucks and buses	19,2
Light duty truck	8,7
Cars	44,3

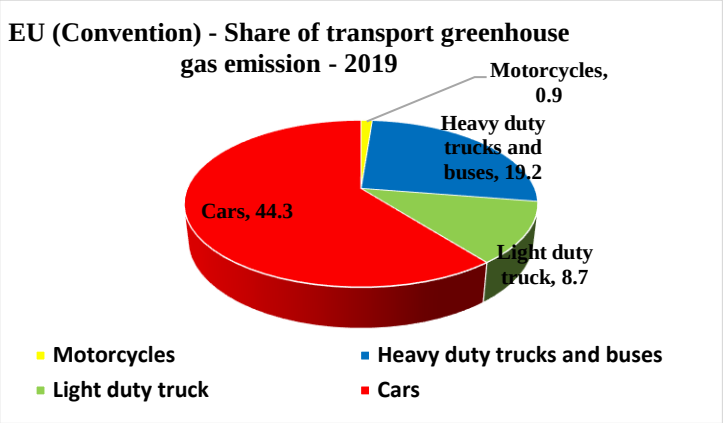

Figure 4 EU (Convention) — Share of transport greenhouse gas emission
Data sources: National emissions reported to the UNFCCC and to the EU Greenhouse Gas Monitoring Mechanism provided by **European Environment Agency (EEA) [27]**

The increase in the number of vehicles is largely conditioned by the increase in the population living in cities and the increased economic growth. There is a strong link between quality of life in cities and how cities draw on and manage the natural resources available to them. Currently, over half of the world's population resides in cities. This urbanization trend is expected to continue and more than 80 per cent of humanity is expected to live cities by 2050. Cities occupy 2-3% of the planet's land surface, but as much as 70-75% of natural resources are consumed within them. **[28]** Urban sustainability transitions require extra sensitivity to the economic, social and political contexts in which they are conceived and implemented. Although urbanization has the potential to make cities more prosperous and countries more developed, many cities all over the world are grossly unprepared for the multidimensional challenges associated with urbanization. Generally, urbanization has relied on a model that is unsustainable in many respects. **[29]** Cities drive economic growth, the consumption of materials and energy, the production of waste, and the emission of greenhouse gases. Resource efficient cities combine greater productivity and innovation with lower costs and reduced environmental impacts while providing increased opportunities for consumer choices and sustainable lifestyles. According to Eberhardt et all. **[30]** globally, buildings are responsible for 40% of all waste generated (by volume), 40% of all material resource use (by volume) and 33% of all human-induced emissions. At the same time, a great amount of all materials ever extracted in human history are located in the built environment, suggesting that buildings will become a major temporary material stock to supply future demand. Continued inefficient use of non-renewable materials will almost certainly cause significant natural-resource depletion.

In the planning of the city cores, a special place is dedicated to pedestrian zones, which will allow unhindered movement of pedestrians and cyclists in a space free of motor vehicles. Some cities have announced car-free or car-less visions, including Milan, Copenhagen, Madrid and Paris. Oslo plans to ban all cars from its city centre permanently by 2019. Pedestrian zones appear in all developed European cities in the last 30 years, driven by the need to create a space for pleasant movement and stay in urban centers. The content of the pedestrian zones should be fully adjusted to the people's residence, so in that space only the supplies of certain goods should be allowed in a certain part of the day, and the ambience itself should be enriched with many interesting contents such as greenery, benches, various cultural and convenient activities, etc. **[31]**

Often ask question that often preoccupies today's generations, institutions and policies of the highest bodies in international organizations is whether there is an alternative model for development that can deliver adequate standards of living for all, but without such high

consumption rates and unsustainable environmental damage. Today's linear economic model is reaching a tipping point. Demand is increasing alongside the growing global population and expanding middle class. At the same time, the natural and social capital costs of non-renewable resource extraction and disposal impact the cost of doing business. Companies must get into the circular mindset to address this. Commodity and raw material prices will continue to remain volatile as climate change, demographics and technological innovation impact resource supply and demand. **[32]** Addition, a circular economy goes beyond the pursuit of waste prevention and waste reduction to inspire technological, organisational and social innovation across and within value chains. Successful circular initiatives will reduce dependence on natural resources and will create value for companies and their stakeholders.

Another initiative to overcome this basic problem is to direct the attention to renewable energy modes. According to European Environment Agency, **[33]** the Renewable Energy Directive (2009/28/EC) sets a target of a 10 % share of renewable energy in the transport sector's final energy consumption for each Member State by 2020. Only biofuels complying with the sustainability criteria set in the Renewable Energy Directive and the Fuel Quality Directive (2009/30/EC) are considered for this target. According to preliminary EEA estimates for 2018, the share of renewable energy use in transport grew from 7.4 % in 2017 to 8.1 % in 2018. At the EU level, the trend in share of renewable energy in transport remains below that required to reach the 2020 goal. The share of renewable energy in transport varied across countries: from 32 % (Sweden) to close to 0.4 % (Estonia). Finland and Sweden are the only two Member States that have already reached the goal of a 10 % share of energy from renewable sources in transport. Renewable energy in this sector comes overwhelmingly from biofuels (close to 90 %); electricity still plays a limited role. A higher share of renewable electricity use in the transport sector would reduce the pressure on biofuels to reach the EU's 10 % target (EEA, 2018).

3. Conclusion

The world we live in today is full of various threats to the quality of the environment. A frequently asked question that justifiably preoccupies today's generations, institutions and policies of the highest bodies in international organizations is the concern and search for an appropriate alternative model of social development that can provide adequate living standards for all, but without additional pressures and high consumption rates and unsustainable environmental damage. We must come to terms with the fact that today's linear economic model is reaching its zenith and critical point of global concern. In this regard, the international community, including the UN, needs to make significant efforts, financial resources and adequate binding legal provisions for all countries to fully implement the principles of sustainable development. Transforming every segment of humanity, aided by the institutionalization of interdepartmental cooperation at the national and local levels, between government institutions, NGOs, academia and industry in a synergistically synchronized environment can restore hope for the sustainable development of the entire world community.

The existing green logistics model must undergo structural changes. Transport demand is growing in parallel with growing supply chains, global production, along with a growing population and the expansion of the middle class. At the same time, the natural and social capital costs of extracting and disposing of non-renewable resources affect the cost of doing business. Companies need to get into the circular mindset to solve this. Commodity and resources prices will continue to be volatile as climate change, demographics, and technological innovation affect resource supply and demand. The concept of Green Logistics is primarily focused on issues related to environmental protection, such as environmental pollution and emissions caused by non-standard and insufficiently professionally arranged logistics processes and the use of old and environmentally unsuitable transport technology.

The goal is to create sustainable value for the company using a stable balance of economic and environmental efficiency.

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