

UDC: 656.1:502.131.1(497.7)

Review Article

GREEN LOGISTICS INFRASTRUCTURE: STRATEGY CONCEPT AND THE ENVIRONMENT PLANNING

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Abstract

The development of the global economy imposes the need for different actors in every society - citizens, companies and institutions to focus on modeling and solving transport problems. But every society, depending on its legal regulations, economic power and cultural identity, responds appropriately to this challenge. Citizens are increasingly aware of the fact that transport systems play a crucial role in their well-being. But at the same time, they are also aware of how to reduce harmful emissions from motor vehicles, especially heavy goods vehicles, and to model green logistics as a template for future infrastructure solutions. Planning that determines larger environmental, political and social systems is also a key idea in the overall agenda of spatial dimensioning of long-term environmental sustainability, embedded in the concept of the so-called "environmental" model of green infrastructure. But green infrastructure model cannot achieve the desired goals unless it is aligned with the overall logistics system in one area. Balancing the objectives of cost-effectiveness and reliability with these overarching development goals can contribute to a better quality of life in the region, improve policy efficiency, mitigate the risk of unintended consequences and position the sector as a model for inclusive development.

The need to manage the balance between different modes of transport, to reduce transport costs and improve economic and resource efficiency, while at the same time taking care to improve safety and mitigate the impact of transport on the environment is imperative of "Green logistics".

Keywords: green infrastructure (GI), sustainable development, green logistics, transport infrastructure, environmental planning

1. Introduction

Space has always played an important role in all manifestations of human activity. For these reasons, the role of the natural-geographical factor in economic development and changes in space has long been emphasized. Its role is far greater than it is usually treated. The spatial distribution of production is carried out in accordance with certain laws, under the influence of certain factors, in particular the transport infrastructure, in order to obtain optimum results of operation that are manifested by achieving the highest possible production with the lowest production costs.

We live in a world of global developments, when market and other information is increasingly available to the entire world population, transportation is cheaper and significantly facilitated by new technology, consumer habits are unified and standardized as global companies exchange their products in all parts of the world.

The world economy is the rise experiencing constant transformation and combination of technological and geopolitical forces. Technological changes, improvements in transport and communication technology have significantly reduced distances and spatial barriers and trade, viewed as concept that both planners and practitioners can draw on. This combination enabled the globalization of culture, the globalization of the economy and the globalization of the environment.

The global economic space has many specificities, so it is very important for as well as economists, but and the ecologists, geographers, planners to obtain and proceed information about those specificities, as well as knowledge of the spatial impact of certain phenomena and processes which

tailored and structured our living. Studying the global environment economy, ie the global spatial dimensions of environment economic activities is just one of the approaches to sustainable development. According to Jeremy Rifkin, we are now paying the bill for the industrial age, and we need a new economic vision and a game plan that is practical and can be implemented in less than 40 years.(ITF, 2011)

Numerous authors on environmental development in their studies as a modern concept "institutionalize" the notion of "green infrastructure" as a kind of policy for space action. An examination of the development of the green infrastructure concept around the world indicates that although there is a general increase in attention to a variety of areas which could be termed 'green infrastructures', there appears to be no consistent approach to the concept or conversion into policy and action on the ground. (Mell C.I. Roe M., 2007)

The problem of sustainable development has been the focus of creative interest in corporate and national policies in recent years, with new insights emerging on topics such as the international economy, strategic foreign trade strategic routes, political economy, and international coordination of a healthy environment. For these reasons, we can point out the necessity that today, more than ever before, there is a need to study the human side of transport and logistic for a clearer understanding of world processes and changes.

As part of the dimensioning and strengthening of the green infrastructure policy, transport infrastructure and logistics activities play an important role, establishing integration and spatial connectivity in the functioning of the complex value ecosystem.

2. Legislative and practices

Green Infrastructure has numerous references suggesting that diversity in form and function supports the multi-dynamic landscape interpretation system. The role of green infrastructure in different environmental organizations, like their definitions, differs according to the focus of their work programs and policy focus. Completely defining these processes is suggested within the framework of green infrastructure literature as an important area that spatial managers should consider when developing a broader knowledge of what a green infrastructure is, how to use it, how to maintain it and how it should be managed and planning. While there are numerous definitions, two elements occur throughout - *multifunctionality and connectivity* – these lend some commonality to what may at first appear as disparate definitions.

We must bear in mind that each green space is perceived differently due to a number of factors, which include but are not limited to, size, geomorphologic structure, quality and function, but also include location within the urban, infrastructural and rural landscapes.

The differences in the complex composition and the numerous green space functions are, therefore, key to the articulation of an appropriate green infrastructure approach for landscape planning. The diversity of landscape composition and perceptions of these areas are two of the main features related to the development of the concept of green infrastructure. However, there are also questions concerning how the green infrastructure has evolved conceptually and as a process of landscape management. This will explore the different meanings and interpretations that green infrastructure is treating in the UK, Europe, and North America. This lack of unified or inclusive use of green infrastructure may prevent its integration into the regular planning policy.(Mell C., 2010)

Green Infrastructure (GI) according the EU legislative (EU, 2013) can be broadly defined as a strategically planned network of high quality natural and semi-natural areas with other environmental features, which is designed and managed to deliver a wide range of ecosystem services and protect biodiversity in both rural and urban settings. More specifically GI, being a

spatial structure providing benefits from nature to people, aims to enhance nature's ability to deliver multiple valuable ecosystem goods and services, such as clean air or water. This will in turn:

- Foster a better quality of life and human well-being, for instance by providing a high-quality environment in which to live and work.
- Improve biodiversity, for instance by reconnecting isolated nature areas and increasing the mobility of wildlife across the wider landscape.
- Protect us against climate change and other environmental disasters, for instance by alleviating floods, storing carbon or preventing soil erosion.
- Encourage a smarter, more integrated approach to development which ensures that Europe's limited space is utilized in as efficient and coherent a way as possible

Undoubtedly, green infrastructure is an important and increasingly influential concept in landscaping. In tackling this complex and multi-layered concept, green infrastructure planning has several significant challenges, one of the most important being how to integrate it within the legal process of land use planning, or at least how to maximize its impact on land use this process. It is not only the ongoing implementation of sustainable development, but also progress in mitigating or adapting to climate change.

3. Why the term "green infrastructure" is so attractive?

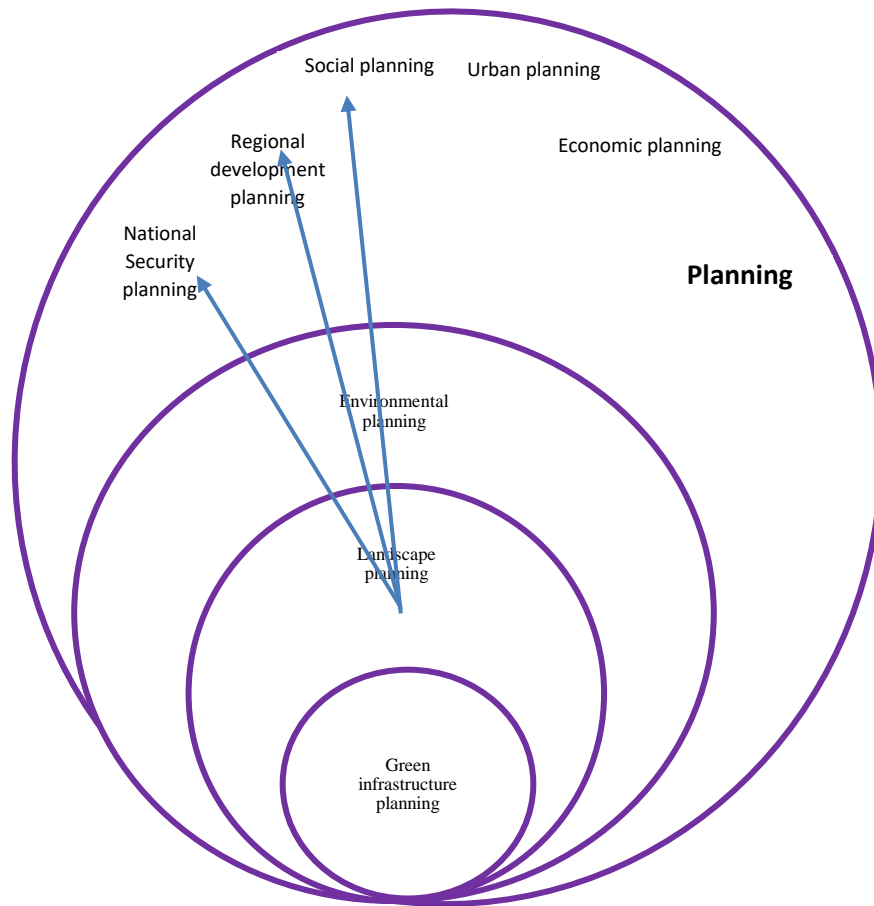
Through the academic and practitioner literature there have been several areas that have been consistently highlighted as forming elements of the green infrastructure concept. These include firstly, the aim of creating a series of steppingstones between people, the environment and service infrastructures that allow people to be linked across landscape and socio-economic boundaries. Secondly, the literature promotes participation in both the consultation and design process of green spaces and subsequent patronage of green infrastructures. Thirdly, green infrastructures should create a network of livable and sustainable spaces for both human and ecological populations. (Mell C.I. Roe M., 2007)

“Green infrastructure” (GI) is a term that is appearing more and more frequently and holds different interpretations and discussions across the country and around the world. Green infrastructure means different things to different people depending on the context in which it is used. For example, some people refer to trees in urban areas as green infrastructure because of the “green” benefits they provide, while others use green infrastructure to refer to engineered structures (such water treatment facilities or green roofs) that are designed to be environmentally friendly. From a planning perspective the GI approach makes use of the natural environment in a way that it maximizes its functions and seeks to put in place, either through regulatory or planning policy, mechanisms that ensure protection of natural environment, and proposes how these can be put in place through landscaped and/or engineered structures (such water treatment facilities or green roofs) that are designed to be environmentally friendly (Benedict and McMahon, 2006). 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)

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).

The concept of GI in European countries refers to the new or existing interlinked networks or corridors of green routes and hubs of biodiversity (Murphy, 2009), which is recognised as a valuable approach for spatial planning and is now seen in national, regional and local planning and policy documents and strategies (Lafortezza et al., 2013). On the other hand, USEPA (United States Environmental Protection Agency) lays emphasis on the protection of natural habitat in both urban and rural areas through GI (2009). (Ranjha Sh, 2016)



Graph.1 Green infrastructure planning is an activity within the field of Landscape Planning, with linkages to other planning subfields.

Source: Carne R. J. (2016): Green infrastructure and green infrastructure planning: a review of concepts and practices with particular reference to Berlin, Germany. Project Green Infrastructure Planning. 24October 2016. KGA519. p.12

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.”

Planning Policy Statement defines green infrastructure as “a network of multi-functional green space, both new and existing, both rural and urban, which supports the natural and ecological processes and is integral to the health and quality of life of sustainable communities”. It goes on to state that the local planning authority core strategy should be supported by evidence of what physical, social and green infrastructure is needed to enable the amount of development proposed for the area, taking account of its type and distribution. This evidence should cover who will provide the infrastructure and when it will be provided. The core strategy should draw on and in parallel influence any strategies and investment plans of the local authority and other organizations. (Community and eco town (2008))

Developing Green Infrastructure adjacent to infrastructure has the potential to deliver many ecosystem services. Road and railway verges and canal banks form important wildlife corridors and play a key part in the tourism appeal of the landscape for many recreational activities.

Table 1. Potential benefits provided by green infrastructure

<i>environmental benefits</i>	<ul style="list-style-type: none"> – provision of clean water – removal of pollutants from air and water – pollination enhancement – protection against soil erosion – rainwater retention – increased pest control – improvement of land quality – mitigation of land take and soil sealing
<i>social benefits</i>	<ul style="list-style-type: none"> – better health and human well-being – creation of jobs – diversification of local economy – more attractive, greener cities – higher property values and local distinctiveness – more integrated transport and energy solutions – enhanced tourism and recreation opportunities
<i>climate change adaptation and mitigation benefits</i>	<ul style="list-style-type: none"> – flood alleviation – strengthening ecosystems resilience – carbon storage and sequestration – mitigation of urban heat island effects – disaster prevention (e.g. storms, forest fires, landslides)
<i>biodiversity benefits</i>	<ul style="list-style-type: none"> – improved habitats for wildlife – ecological corridors – landscape permeability

Source: European Commission (2013).

European Commission 2013, *Building a green infrastructure for Europe*, Publications Office of the European Union, Luxembourg. p.6.

4. Green infrastructure and improving logistical performance

Logistics is one of the most important sectors of any economy, a cornerstone and a key link for doing business with other sectors. In turn, the logistics sector is highly dependent and sensitive to

national and international business: there is no flow of goods without production, transport, and trade. Logistics can also simply be treated as a way of delivering the right product to the right consumer at the right time, in the required quantity and in the conditions as ordered at the agreed price. The definition itself covers several activities that need to be done to achieve the goals of additional logistics activity.

“Logistics is a set of services including the planning, organisation, management, execution and monitoring of a company’s entire material, goods and information flows (from purchasing, production and warehousing, to added value services, distribution and reverse logistics)”(EC, 2015). According to Bowersox (Bowersowet all, 2002)Logistics is the process that creates value by timing and positioning inventory; it is the combination of a firm's order management, inventory, transportation, warehousing, materials handling, and packaging as integrated throughout a facility network. Integrated logistics serves to link and synchronize the overall supply chain as a continuous process and is essential for effective supply chain connectivity While the purpose of logistical work has remained essentially the same over the decades, the way the work is performed continues to radically change. In early 1962, Peter Drucker emphasized that logistics would remain "the darkest continent of business", the least understood sphere of business, and its prediction proved to be true until the beginning of the 21st century. (Drucker, 1962, cit.Ozment J. and Keller B. S., 2011)

The Council of Supply Chain Management Professionals (CSCMP, 2019), previously known as the Council of Logistics Management, defines logistics as the process of planning, implementing, and controlling procedures for the efficient and effective transportation and storage of goods including services, and related information from the point of origin to the point of consumption for the purpose of conforming to customer requirements. This definition includes inbound, outbound, internal, and external movements. The same source for the Logistics Channel points out as well as the network of supply chain participants engaged in the storage, handling, transfer, transportation, and communications functions that contribute to the efficient flow of goods.

However, it is clear that from this set of definitions logistics is a very elastic term using in a wide context of activities. Goods flow both within a single firm and between different firms; flows can be managed in house or outsourced to professional service providers, and ultimately logistic activities take place in one form or another in more or less every sector of the economy. The size of the logistics sector and the quantification of its economic importance therefore depend very much on the definition used. (Doncker D.H., 2017).The logistic system is composed of objects related to transport services. Objects are places where materials are processed (production, storage, sorting, sale or use). Transport services move materials between objects using vehicles - trucks, tractors, trailers, pallets, containers, cars and trains. Logistic systems require great efforts to synchronize, coordinate and operate multiple elements, i.e. entities, in order to raise the level of quality in the products and services they offer.(Arsova, Temjanovski, Jovanov, 2019)

Table 2. Impacts of urban freight logistics

ECONOMIC IMPACTS	ENVIRONMENTAL IMPACTS	SOCIAL IMPACTS	IMPACTS OF SCALE
road congestion	pollutant emissions	physical consequences of pollutant emissions on public health	few resources
inefficiency	use of non-renewable fossil-fuel	traffic accidents	lack of co-operations

waste of resources	Land and aggregates	noise	less policy considerations
	waste production	visual intrusion	few logistics providers based in cities
		other quality of life issues	little infrastructure

Source: CIVITAS: Smart choices for cities making urban freight logistics more sustainable. p.11.

Improving logistics performance is at the core of the economic growth and competitiveness agenda. Policymakers globally recognize the logistics sector as one of their key pillars for development. Trade powerhouses in developed or in developing countries see seamless and sustainable logistics as an engine of growth and of integration with global value chains. Indeed, inefficient logistics raises the costs of trading and reduces the potential for global integration. This is a hefty burden for developing countries trying to compete in the global marketplace.(IBRD, 2014)

Green logistics is especially important for optimizing the transport sector and reducing emissions from vehicles. 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. Namely, the share of transport in final energy consumption increased from 24% in 2012 to 32.5% in 2015. 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 CO₂. In the total emissions at the national level, the transport sector increases its share of 10% in 2012 to 13% in 2014. Air pollution in the country is a cause of serious concern as the limit values set for protection of human health, especially for particulate matter, are exceeded significantly, primary in the urban and industrial areas. The situation is the worst in the biggest urban settlements such as Skopje and Tetovo, with the annual mean concentrations of PM₁₀ exceeding the annual limit value (40 µg/m³). Therefore, and following the modern policies in the transport and logistics sector, green logistics should be included in the top policies for environmental protection and implementation of European transport regulations to reduce emissions of pollutants from vehicles.(see Temjanovski, 2019, for more information.)

5. Conclusion

The success of logistics activities depends to a large extent on the reliability of supply chains and the predictability of service delivery for producers and exporters. Logistics is the integration of transport, warehousing, freight forwarding, and information services. By directly improving competitiveness of products and services, efficient, smooth, and low-cost logistics services make a significant contribution to the economy and to people's livelihoods and national pride. Transport is a core component of logistics, moving goods between different points in the supply chain.

In terms of global competitiveness, the image of a company depends largely on the quality of the products it offers, but also on the environmentally friendly approach. So, it is of utmost importance for every company that the complete shift from the traditional corporate model to a sustainability-focused business model. Since companies aim to be customer-oriented, companies must help maintain the environment and try to help fight global problems in any way possible. One of the major problems in the industry is green logistics - a trend that has become increasingly widespread in recent times.

The term “green infrastructure” is appearing more and more frequently in land conservation and development discussions across the country and around the world. Because of environmental problems and the worsening scarcity of natural resources, companies must be producing more reliable, healthier products which damage the environment minimally. Starting from that point, companies have been moving forward with a sense of social responsibility and adopting green logistics in order to design cleaner manufacturing processes and manage environmental risks. From this reasons, green logistics is necessary to understand the interactions of logistics with the socio-economic system as a whole, enabling sectoral policies to be reconciled with the overarching policy goals of the region. In such an environment, growing industry, such as the logistics sector, plays a key role in the region's long-term sustainable development.

Green logistics is especially important for optimizing the transport sector and reducing emissions from vehicles. In the Republic of North Macedonia, the analyzes for the main polluters and climate change show that transport is one of the sectors where in the last years there is a growing trend of energy consumption. The situation is the worst in the biggest urban settlements such as Skopje and Tetovo, with the annual mean concentrations of PM_{10} exceeding the annual limit value ($40 \mu g/m^3$). Therefore, and following the modern policies in the transport and logistics sector, green logistics should be included in the top policies for environmental protection and implementation of European transport regulations to reduce emissions of pollutants from vehicles.

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