ISSN 0554-6397
UDK: 004.032.26
Review article
Received: 30th August 2022.

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Analysis and Assessment of the Impact of Logistics on the Perception of the Sustainability of the Urban Area: The Case of North-West Croatia

Abstract

Increasing the sustainability of the urban area is an imperative that is based on the increasing number of inhabitants but also the increasing demand for resources. In order to ensure the normal development of social processes in urban areas, it is necessary to ensure a sufficient amount of resources such as energy, water, and food, and to ensure the normal functioning of all other processes that determine the quality of life. Given that logistics is a supporting process that ensures the efficient functioning of the core process, everything described is the task of logistics. In order to investigate the potential impact that logistics has on sustainability, in this paper is described research related to the perception of sustainability and analysis of the impact of logistics on the perception of the sustainability of an urban area. The research showed that there is an impact that can be identified through several branches of logistics. Likewise, the research indicated the most important parameter that the respondents considered to have an impact on the sustainability of the urban area was

Key words: urban logistic, sustainability, urban area

1. Introduction

Globalization, urbanization, the development of technology, and the increase in the number of inhabitants on Earth have brought with them numerous positive and negative aspects [1]. The modern way of life of people in cities is accompanied by a

busy lifestyle, environmental pollution, unemployment, crime, crises due to lack of resources, etc. These problems are problems of sustainable development, i.e., problems of social, economic, and environmental sustainability [2]. Problem is recognized by the United Nations, which set 17 global sustainable development goals. These goals aim to solve the problem of environmental pollution, achieve gender equality, reduce hunger and poverty, and, in other words, to ensure the quality of life of the inhabitants, which, for each individual, is a subjective term, but in general refers to the satisfaction of all the needs of the residents [3].

Considering that the quality of life is a relative term and that each individual perceives the quality of life from a different aspect, in order to ensure all the resources necessary to fulfill the demands of interested parties from the aspect of quality of life [4], it is necessary to ensure efficient and effective logistic processes. The reason for this is the fact that logistics is a supporting process that is responsible for ensuring all the resources necessary for the normal functioning of the system [5]. In this context, the core process is characterized by the demands of interested parties, which, as part of this paper, are viewed in the context of sustainability and sustainable development [6].

Accordingly, the goal of the paper is to analyze the perception of the inhabitants of north-western Croatia about the sustainability of the urban area in which they live. Furthermore, in the paper, the main research question is:

Is there an influence of logistics on the sustainability of the urban area?

In the research, it was identified that there is an influence of logistics on the sustainability of the urban area and that the efficiency of logistics processes can determine the quality of life in the urban area. However, considering that the research was conducted in the area of northwestern Croatia, this research is the basis for conducting future research related to the connection between logistics processes and the quality of life in urban areas.

The paper is divided into four chapters. In the first chapter, the issue of sustainability is introduced; in the second chapter, an overview of the most important definitions and theoretical assumptions is given; and in the third chapter is described used model. The results of the conducted research are described in chapter four, and the fifth chapter is the concluding chapter.

2. Theoretical framework

For a better understanding of the connection between logistics and the quality of life, i.e., the sustainability of the urban area, it is necessary to look at the existing research that looks at sustainability and logistics primarily because in this paper, logistics is looked at through a different paradigm that refers to logistics as a supporting process, unlike other research which looks at logistics exclusively through the context of transport logistics.

2.1. Sustainability and sustainable development

Sustainable development can be defined as development that does not compromise the ability of future generations to meet the needs that current generations can meet with available resources [7]. The importance of sustainable development arises not only from the growing concern related to the consumption of resources but also from the growing concern about inequality among citizens, as well as the need to ensure equality in the context of equal wages, equal opportunities for advancement, housing opportunities, etc. [8] In other words, sustainable development addresses three components: the ecological component, the social component, and the economic component [9]. All three components are interconnected, and one component can determine another component.

Sustainable development is of particular importance when talking about urban areas, since the increasing number of inhabitants in urban areas means an increasing demand for resources as well as an increasing need for land that will be used for the construction of housing units [10]. However, a particularly important area is the provision of all resources such as water, electricity, and the like, which are of particular importance for meeting basic requirements from the aspect of quality of life [11].

The importance of sustainability and sustainable development is also recognized by the UN, which defines 17 sustainable development goals, among which it emphasizes the importance of the transition of existing cities, which are often unsustainable, to sustainable ones. The mentioned goals were developed within the program known as AGENDA 2030 [12], and the goals that are set are: eradicate poverty; eradicate hunger; enable a healthy life and well-being; provide quality education; achieve gender equality; ensure clean water and sanitary conditions; provide everyone with access to energy; ensure decent work for all and achieve economic growth; develop industry, infrastructure and innovation; change inequalities; make cities and communities sustainable; influence responsible consumption and production; respond to climate change; preserve aquatic life and life on land; build peace and justice through strong institutions; and strengthen partnership relations that lead to the goal [13].

But despite the importance of sustainability for the development of the urban area, no indicators have been defined that could be used to analyze the current level of sustainability of the urban area, which represents a significant problem. With this in mind, in order to analyze the sustainability of the urban area, it is necessary to define claims that are in accordance with the goals of sustainable development in order to analyze the current level of sustainability.

2.2. Logistics

Logistics can be defined as a planned activity that connects all processes in a coordinated manner and provides the processes with a sufficient amount of resources at a minimal cost, whether it is the cost of people, the cost of transportation, or the like

[14]. It represents interdisciplinary knowledge and must be viewed through several different scientific branches.

If logistics is viewed as a supporting process, it should be emphasized that the supporting process is responsible for ensuring the effectiveness of the core process [15], and that the effectiveness of the core process affects the ability to meet the demands of interested parties. In the context of an urban area, urban logistics refers to ensuring the normal functioning of all functions that an urban area has [16], such as securing the land needed for building infrastructure, collecting and removing waste, securing the resources necessary for the functioning of health institutions, shops, and the like [17].

As such, logistics is often misquoted in the literature and is viewed through the context of storage and transportation, which is a significantly narrower point of view compared to the very term that logistics implies. Accordingly, it is necessary to change the paradigm of looking at logistics, which will include within itself all the activities that are necessary for the effective functioning of the process.

Logistics can be divided into sectors, and within each sector, a branch of logistics can be identified, which is responsible for the normal development of processes within the sector:

- ◊ Primary sector: agricultural logistics, mining logistics, forestry logistics, fishing logistics
- ◊ Secondary sector: industrial logistics, construction logistics, energy logistics
- ◊ Tertiary sector: trade logistics, transport logistics, warehouse logistics
- ◊ Quaternary logistics include educational logistics, educational logistics, and health logistics.
- ◊ Fifth sector: Military logistics, insurance logistics, and financial logistics [14].

Given that all the mentioned sectors are interconnected and influence each other, it also follows that all branches of logistics are interconnected and that each branch of logistics has an impact on the normal development of the basic process that it serves.

3. Model development

In order to investigate the perception of sustainability, a model based on linear regression analysis was created, which is shown in Figure 1. The moderator variable is the statements shown in Table 1, which are consistent with the basic components of sustainability. In the survey, using a Likert scale from 1 to 5, where 1 is the least agreement and 5 is the greatest agreement, respondents were asked to rate their satisfaction, i.e. the perceived impact of the claim on sustainability.

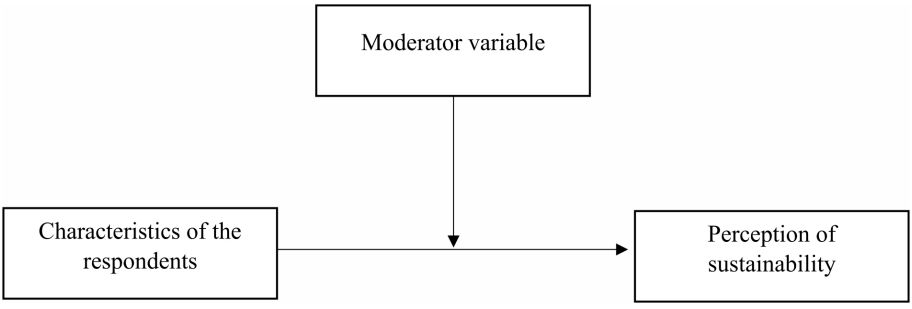

Figure 1. Moderation model

In addition to the findings related to satisfaction shown in Table 2, demographic data (Table 1) were collected from the respondents in the research in order to determine which demographic characteristics have the greatest influence on the perception of the area's sustainability.

Table 1. Demographic characteristics

Demographic indicator	**Label**
Sex of the respondent	DEM1
Age of the respondent:	DEM2
Completed level of education:	DEM3
Working status:	DEM4

The statements presented in Table 2 can be used to identify the perception of environmental sustainability are labeled VAR3, VAR6, VAR7, and VAR8. Furthermore, the statements that can be used to identify the perception of social sustainability are labeled VAR1, VAR2, VAR4, VAR10, VAR11, VAR12, VAR13, and VAR14. On the other hand, variables that can be used to identify the perception of economic sustainability, they have the labels VAR5, VAR6, VAR9, VAR13, and VAR14.

Table 2. Statements for the analysis of the perception of sustainability

Claim	**Label**
I believe that the availability and quality of education is at a satisfactory level in the city where I live.	VAR1
I believe that the availability and quality of health services is at a satisfactory level in the city where I live.	VAR2
I believe that the availability and quality of communal services is at a satisfactory level in the city where I live.	VAR3
I think that the city where I live is a safe city and I can move around the city without any worries.	VAR4
I believe that public transport (if it exists) in the city is of good quality and accessible to everyone.	VAR5
I believe that the city rationally manages the land and takes care of the condition of buildings that are in public ownership.	VAR6
I believe that the quality of energy supply in the city is at a satisfactory level.	VAR7
I believe that the city takes care of the timely removal of waste and the regular emptying of waste bins in public places.	VAR8
I believe that there is a sufficient number of shops in the city and that the shops are stocked with all the necessary foodstuffs.	VAR9
I believe that there is a sufficient number of kindergartens and that the quality of service in kindergartens is at a satisfactory level.	VAR10
I believe that there is a sufficient number of cultural institutions in the city and that these institutions offer a quality cultural program.	VAR11
I believe that there is a sufficient number of sports events in the city and that there is the possibility of engaging in sports activities.	VAR12
I believe that there is a sufficient number of housing units in the city and that the quality of them is at a satisfactory level.	VAR13
I believe that public administration institutions offer quality service to citizens in the city.	VAR14
The current level of energy efficiency and environmental protection in the city is at a satisfactory level.	ECO1

In addition to the part of the question related to the assessment of the current level of sustainability, the respondents were also asked a part of the question related to the assessment of the impact that logistics has on sustainability, i.e., the realization of sustainability. Table 3 shows the distribution of logistics, and respondents were asked to rate how much each logistic has an impact on sustainability.

Table 3. Types of logistics

Type of logistics	**Label**
Educational logistics	LOG1
Medical logistics	LOG2
Communal logistics	LOG3
Security logistics	LOG4
Logistics of public city transport	LOG5
Land logistics	LOG6
Energy logistics	LOG7
Return logistics	LOG8
Type of logistics	Label
Trade logistics	LOG9
Educational logistics	LOG10
Cultural logistics	LOG11
Sports logistics	LOG12
Housing logistics	LOG13
Public sector logistics	LOG14

The research used a methodology that is very similar to the methodology used in the research conducted by [18]. The methodology was adapted so that a similar model based on linear regression was created based on the model used by [18].

4. Empirical part

The research is based on a questionnaire that was sent to a total of 1000 addresses. The total number of respondents who responded to the survey is 336, which represents a response rate of 33.6%. The collected responses were refined in such a way that all

responses that were not complete and all responses given by respondents who do not reside in Northwestern Croatia, i.e., primarily Koprivnica, Križevačka County, and Varaždin County, were omitted from the research. By refining the data, the total number of respondents included in the research is 329, which represents 32.9% of the total number of respondents to whom the questionnaire was sent.

Of the total number of respondents, 114 (33%) are male, while 222 (67%) are female. The total number of respondents aged 18–25 is 58 (17%), aged 26 to 35 is 142 (25%), aged 36 to 45 is 68 (20%), aged 46 to 55 years is 31 (9%), and older than 56 is 37 (11%). Regarding the educational structure, out of the total number of respondents, 178 (52%) have completed high school, 85 (17%) respondents have completed undergraduate studies, 56 (16%) respondents have completed graduate studies; and 17 (5%) have completed postgraduate doctoral studies. Of the total number of respondents, 138 (41%) of them live in Koprivničko-Križevačka County, 145 (43%) live in Varaždin County, and 53 (15%) of them live in Međimurje County.

In order to analyze the reliability of the obtained results, the Chrombach alpha test was performed, the results of which are shown in Table 4. It can be seen that the obtained reliability test is 0.847 (> 0.7), which indicates a high level of reliability of the answers obtained.

Tablica 4. Crhombach alpha test

Cronbach's Alpha	N of Items
0,847	14

In addition, a model fit analysis was performed, which is shown in table 5, from which it is evident that the obtained results cover 32.5% of the variance, that is, the coefficient of determination of the model is 0.325. Furthermore, when it comes to the significance of the obtained results, the test found that the level of significance is 0.000 (0.01(5)), indicating the relevance of the obtained conclusions, that is, how the obtained results can be used to draw conclusions.

Table 5. Model fit

R	R Square	Adjusted R Square	F	p
0,570[a]	0,325	0,294	10,744	0,000

Table 6 shows the results of the obtained research using linear regression. Variables marked with an * indicate a significant result. Based on the analysis, it was identified that the variable that most affects the perception of the sustainability of the urban area is VAR1, for which the level of significance is $p = 0.000$ ($p < 0.01(5)$), while the strength of the relationship is $B = 0.322$. In other words, it was found that respondents believe

that the social sustainability of an urban area is influenced by the availability and quality of education, which is a component of social sustainability but also a determinant of the quality of life.

In addition, it was identified that, in addition to VAR1, the perception of sustainability is also influenced by VAR4 with a significance level of $p = 0.000$ ($p < 0.01(5)$) and the strength of the relationship $B = 0.232$, which means that respondents believe that security has a impact on the sustainability of an urban area, which also includes it in the component of social sustainability.

The VAR7 variable also has an effect on the perception of sustainability, with a significance level of $p = 0.018$ ($p < 0.05$) and a strength of the relationship $B = 0.156$, implying that ensuring a sufficient amount of energy from sustainable sources has an effect on the perception of sustainability, which is included in the ecological sustainability component.

Furthermore, it was also identified that variable VAR12 affects the perception of sustainability with a significance level of $p = 0.034$ (<0.05) and the strength of the relationship $B = 0.127$, so it can be concluded that respondents believe that the organization of sports events as well as the availability of infrastructure affect the perception of sustainability, which can be categorized into a social component.

Variable VAR13 is the last variable identified as having an impact on the perception of sustainability with a significance level of $p = 0.044$ ($p < 0.05$) and a strength of relationship of $B = 0.106$. In other words, it can be said that the availability of housing units affects the perception of the sustainability of the urban area, that is, the equal opportunity to exercise the right to housing. This variable, in addition to the social component, can also be included in the economic component of sustainability.

Table 6. Results of research

Model	Coefficients		p
	B	Std. Error	
(Constant)	,336	,363	,355
VAR1	,322	,065	,000*
VAR2	-,059	,061	,334
VAR3	,076	,068	,266
VAR4	,232	,065	,000*
VAR5	,023	,050	,641
VAR6	-,081	,063	,199
VAR7	,156	,066	,018*

VAR8	-,067	,057	,241
VAR9	-,105	,072	,147
VAR10	,091	,054	,095
VAR11	-,005	,068	,939
VAR12	,127	,059	,034*
VAR13	,106	,057	,044*
VAR14	,022	,067	,739

In order to get a clearer picture of the variables that influence the sustainability of the urban area, Figure 2 shows the relationships described in Table 6 with the coefficient B. From the total number of variables included in the analysis of sustainability, it was identified that respondents believe that out of 14 offered variables, 5 of them have the most influence on the sustainability of the area.

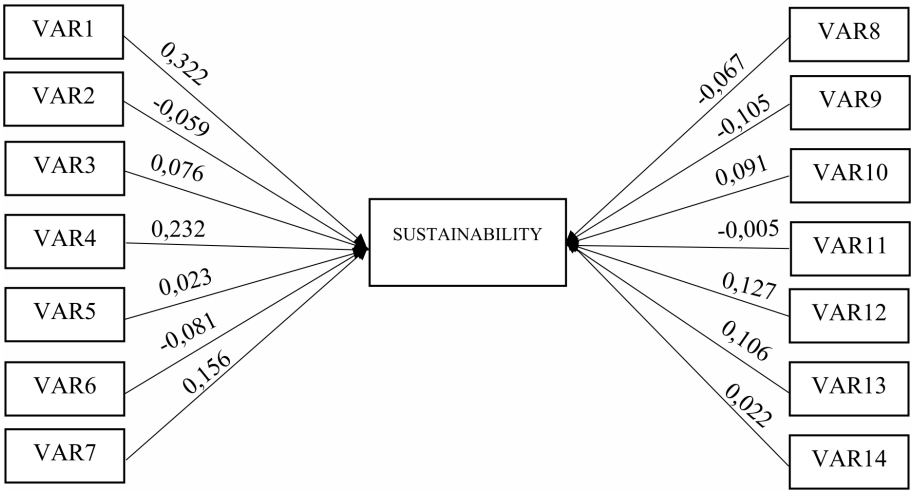

Figure 2. Result of moderation analysis

Furthermore, given the definition of logistics that is related to supporting process that ensures the normal development of the core process, i.e. the satisfaction of the requirements set by the interested parties on the core process, an analysis of the impact that certain branches of logistics have on sustainability was carried out. The analysis was performed using linear regression, and the results of the analysis are presented in Table 7.

Based on the analysis carried out, it was identified that the greatest impact on

the environmental component of sustainability is communal logistics, which has a significant positive impact of B = 1.141 (p < 0.05) and energy logistics, which also has a significant positive impact of B = 1.000 (p < 0.05). The respondents believe that educational logistics has the greatest impact, for which a very positive impact t B = 2.261 (p < 0.01), security logistics, which also has a significant positive impact B = 3.046 (p < 0, 01), land logistics, i.e. land management logistics, which also has a positive influence B = 1.213 (p<0.05) and educational logistics, which also has a positive influence B = 0.045 (p<0.05). Furthermore, the analysis identified that there is a significant positive impact of security logistics on economic sustainability, with a positive B = 1.486 (p<0.032), land logistics, which also has an extremely positive impact, B = 1.998 (p<0.01), and trade logistics, which also has a significant positive influence, B = 1.267 (p<0.045).

Table 7. Impact of logistic on sustainability

Label	Ecological sustainability			Social sustainability			Economic sustainability		
	B	p.	Std. Error	B	p.	Std. Error	B	p	Std. Error
LOG1	-,135	,761	,443	2,261	**,001***	,650	-,134	,783	,488
LOG2	-,684	,128	,449	-,251	,650	,553	-,152	,748	,475
LOG3	1,141	**,023***	,501	,382	,516	,588	,825	,140	,559
LOG4	,561	,400	,666	3,046	**,001***	,925	1,486	**,032***	,692
LOG5	,031	,926	,337	,114	,794	,434	,400	,279	,369
LOG6	,261	,581	,474	1,213	**,035***	,576	1,998	**,000***	,553
LOG7	1,000	**,045***	,499	,452	,426	,567	,639	,234	,537
LOG8	,161	,713	,440	,196	,717	,541	,141	,773	,487
LOG9	,635	,312	,627	1,528	,199	1,190	1,267	**,045***	,633
LOG10	,310	,420	,384	,854	**,045***	,495	,395	,372	,442
LOG11	-,147	,750	,462	-,660	,216	,534	-,669	,190	,511
LOG12	,562	,181	,420	,923	,074	,518	,507	,265	,455
LOG13	,348	,351	,373	,689	,140	,467	,341	,411	,414
LOG14	,279	,556	,474	,595	,314	,591	,294	,568	,515

In other words, it was identified that there is an influence of certain branches of logistics on the sustainability of the urban area and that the efficiency of logistics, i.e. support processes, can determine sustainability. Furthermore, it is evident that there is a link, since logistics such as communal logistics, which is responsible, among other things, for the maintenance of public areas, the supply of water and other resources, as well as the removal of waste, can be linked to environmental sustainability. The same applies to energy logistics, since securing energy from clean sources has a significant impact on the environmental component of sustainability.

If the social component of sustainability is considered, it is identified that a significant role is played by security logistics, which is responsible for ensuring safe living conditions in the context of a lower crime rate, and educational logistics, which ensures the availability and quality of the teaching process, i.e., provides all the resources necessary for the normal functioning of the teaching process, and that also applies to educational logistics. Land logistics implies land management as well as land maintenance, considering that the effectiveness of land management can determine equal opportunities for all residents of the area to realize the right to build a residential unit.

The economic component of sustainability is determined by security logistics, since the security of business premises, as well as the generally low crime rate, can affect the attractiveness of the area for carrying out economic activities. The same applies to land logistics, since land management can determine the possibility of building shopping centers, production facilities, etc., which can have an impact on the economic component of sustainability.

If the obtained results shown in table 5 and table 6 are compared, it is evident that there is a link between the perception of sustainability and the branch of logistics that is responsible for ensuring sustainability, which is visible in table 8.

Table 8. Comparison of impact of VAR on LOG

Statement	**Label**	**Type of logistics**	**Label**
I believe that the availability and quality of education is at a satisfactory level in the city where I live.	VAR1	Educational logistics	LOG1
		Upbringing logistics	LOG10
I think that the city where I live is a safe city and I can move around the city without any worries.	VAR4	Security logistics	LOG4

I believe that the quality of energy supply in the city is at a satisfactory level.	VAR7	Energy logistics	LOG7
		Communal logistics	LOG3
I believe that there is a sufficient number of sports events in the city and that there is the possibility of engaging in sports activities.	VAR12		
I believe that there is a sufficient number of housing units in the city and that the quality of them is at a satisfactory level.	VAR13	Land logistics	LOG6
		Trade logistics	LOG9

5. Conclusion

In the conducted research, it was identified that there is a significant impact of logistics on ensuring the sustainability of the urban area, in the context of ensuring environmental, economic and social sustainability. On the other hand, it was also identified that there is a link between the branches of logistics and the perception that respondents have towards the sustainability of the urban area.

Therefore, in order to ensure the sustainability of the urban area, it is necessary to ensure efficient logistics, primarily, based on the answers received, communal logistics, energy logistics, security logistics, educational logistics, educational logistics and trade logistics. All the logistics mentioned provide all the necessary resources that the respondents consider necessary to ensure a satisfactory quality of life on the one hand, and on the other hand to ensure the sustainability of the urban area.

This research has limitations that come down to the area where the research was conducted, which is north-western Croatia. In addition, the limitation of the research also refers to the lack of indicators that could be used to analyze the sustainability of the urban area, so with this in mind, the authors defined the indicators in the form of statements.

Recommendations for future researchers in this area is to conduct research that would include a larger number of respondents and that would enable the definition of exact indicators that could be used to analyze the sustainability of the urban area.

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