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Green transport and sustainable development: the Netherlands' experience

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I thank my teachers for encouraging me to learn more about the world and to not close myself off to new ideas or those that are different from my own. I thank my parents for encouraging me always be better. to be better. Finally, I thank my tutor, the economist Luis Pinos for his support and advice development of my thesis work.

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Resumen:

Esta investigación analizó la relación entre el transporte verde y el desarrollo sostenible, principalmente dentro de los Países Bajos, para lo cual se planteó contextualizar dicha relación, describir el entorno existente y finalmente analizar las propuestas a futuro. Para esto se realizó un análisis estadístico de correlación de Spearman, regresión vía mínimos cuadrados ordinarios y la prueba de Chow. Con esta investigación se identificó que el transporte verde tiene un gran impacto sobre el desarrollo sostenible; por ejemplo, en el pilar económico del desarrollo sostenible el transporte verde impacta positivamente en el crecimiento económico. Finalmente, de esta investigación se pudo concluir que la aplicación del transporte verde en Países Bajos generó beneficios al desarrollo sostenible en cada uno de sus pilares, demostrándose así esta relación.

Palabras clave: Ambiental, Desarrollo sostenible, Económico, Países Bajos, Social, Transporte verde.

Abstract:

This research analyzed the relationship between green transport and sustainable development, mainly within the Netherlands, by contextualizing this relationship, describing the existing environment, and finally analyzing future proposals. For this purpose, a statistical analysis of Spearman correlation, ordinary least squares regression, and the Chow test was carried out. With this research, it was identified that green transportation has a great impact on sustainable development. For example, in the economic pillar of sustainable development, green transportation has a positive impact on economic growth. Finally, from this research, it was possible to conclude that the application of green transport in the Netherlands generated benefits for sustainable development in each of its pillars, thus demonstrating this relationship.

Keywords: Economic, Environmental, Green transport, Netherlands, Social, Sustainable development

Green transport and sustainable development: Netherland's experience.

1. Introduction

This article seeks to make a descriptive analysis of green transport and its relation to sustainable development, taking into account the experience of the Netherlands because this country is one of the world leaders in green transportation and sustainable development. As we are told by the Ministry of Foreign Affairs of the Netherlands (2017), all parts of the Kingdom of the Netherlands have a long history of building partnerships for development and are also key parties for the implementation of the Sustainable Development Goals. They already have hundreds of plans and laws which support the transition to green transport systems, such as the Energy Agreement for Sustainable Growth or those plans put forward by the different municipalities in the Netherlands.

This issue is important to analyze since traditional transportation systems are highly polluting and contrary to sustainable development. Currently, world energy consumption, including the transportation sector, as presented by Todorovic and Simic (2019) 76% corresponds to fossil fuels and the difference corresponds to renewable sources, this for the year 2018. This shows us that the transportation systems currently preferred by users or to which they have greater access are the traditional transportation systems that run on fossil fuels. With this work, we want to know what the Netherlands has done regarding this issue, the policies it has developed, and the proposals for the future. This is due to the problems currently presented by using green transport systems or promoting sustainable development. An example presented by Nilsson and Nykvist (2016) tells us that the low cost of oil and the high cost of battery production make it difficult to offer affordable electric vehicles, thus hindering the transition to sustainable development.

In the following research, we will find a conceptualization of what green transport and sustainable development are, as well as the theoretical relation between both, taking into account the influence of green transport on the three pillars of sustainable development. We will also find a statistical analysis of the relationship between green transport and sustainable development in the Netherlands, taking as variables Co_2 emissions and GDP per capita, production of renewable energies, mortality due to traffic accidents, etcetera. Finally, the policies the country has developed to encourage and facilitate the use of cleaner and zero-emissions transport. The present work will be divided into 6 different sections, which are introduction where the objectives of the research and the motivation to investigate this topic will be presented, theoretical framework where the concepts of green transport, sustainable development and the way in which green transport influences sustainable development will be presented, state of the art where examples of experiences outside Europe, within Europe and the Netherlands with respect to the application of green transport systems will be presented, results which is the section where the data obtained on Spearman's correlation and Chow's test on the relationship between green transport and sustainable development will be presented, and the data found on the future proposals of the Netherlands on green transport, discussion here will compare the results obtained in the research with those obtained by other authors analyzing the points in which they agree or differ, and finally the conclusion where the most relevant results of this paper will be presented, the limitations that were found in conducting the research and proposals for future research.

1.1 Objectives

General Objective.

Analyze the relation between green transport and sustainable development, and how it has evolved in the Netherlands in the period from 2000 to 2019.

Specific objectives

1.- Contextualize the theoretical relation between sustainable development and green transport.

2.- Describe the environment of green transport systems and sustainable development in the Netherlands.

3.-Analize the proposals on green transport and sustainable development for the period 2016 to 2030.

2. Theoretical framework

In this paper we will analyze the relation between green transport and sustainable development, focusing mainly on the context of the Netherlands. Before analyzing the relation between these two, we must understand what we mean when we talk about green transport and sustainable development.

2.1 Green transport

Most people know only the general concept of green transport systems, which are, in the words of Todorovic and Simic (2019), transport systems based on renewable and environmentally friendly energy sources. But the concept of green transport systems is a much broader one, which encompasses means of

transport that are not based solely on renewable energy sources. According to Li (2016), green transport systems are transport systems that advocate the decrease in the use of private vehicles, replacing them with walking, public transport, bicycles, and vehicles that run on renewable energy. These transport systems are low-cost and non-polluting. With this concept, we can see that green transportation systems are not limited only to cars or bicycles that run on electricity, as many believe, but encompass many other means of transportation.

Currently, there are 2 ways to divide green transportation systems; depending on these, they encompass more or fewer types, which are, in the words of Li (2016), the transportation means perspective, which encompasses walking, cycling, public transport, and rail transport, and the vehicle perspective, within which are electric, hydrogen, natural gas, hybrid, and solar-powered vehicles. Electric vehicles are further divided into cars, bicycles, trains, streetcars, etc.

2.2 Sustainable development

Now that we have understood what green transport is, it is necessary to understand what sustainable development is. Sustainable development is impossible to encapsulate in a single concept. There are currently multiple concepts being developed around the world. According to Jedlička et al. (2011), sustainable development is a new development model for society with three approaches: environmental, economic, and social. All this results from changes reflecting natural environmental limits in the economy.

As for the approaches to sustainable development, also called the three pillars of sustainable development, that we find in the above definition, we can define them as follows:

The economic approach to sustainable development can be defined as directing economic development in such a way as to obtain the most significant benefit for human beings while respecting the limits of nature (Acuña et al., 2003). Another point raised by sustainable development is that an indicator such as GDP cannot show the development of a region. According to the Latin American Future Foundation (2020), we cannot see GDP as an indicator of development since these indicators limit the information they analyze. However, to analyze the sustainable development of a region, it is necessary to use a matrix of indicators that analyzes the different dimensions of sustainable development. For example, people commonly relate economic growth to the accumulation of goods and capital. However, sustainable development proposes another way of measuring economic growth. Citing the Fundación Futuro Latinoamericano (2020), sustainable growth is not measured by accumulation but by redistribution, guaranteeing security and well-being for the world.

The social development approach: As Castaño (2013) states, it consists of generating intragenerational and intergenerational equity, which means seeking that people of the present and the future have the same access to opportunities and resources since people in poverty tend to take the resources within their reach without taking into account the limits they have, knowing that poverty is the lack of material resources to satisfy a minimum acceptable level of needs, such as food and health, among others (Organización Internacional del Trabajo, n.d.).

The environmental approach to sustainable development can be defined, in the words of Sepúlveda, (2008), as paying particular attention to environmental resources such as soil, water, air, and forests since they determine the productive capacity of a place. It also focuses on development, as Castaño (2013) expresses it, based on the circular economy, a process that seeks to make the best use of resources by avoiding waste and reusing those generated.

On the other hand, Organización de las Naciones Unidas (1987) defines sustainable development as development that meets the needs of people in the present without affecting their ability to meet their needs in the future. This development has limitations in resources, technology, social organization, and the capacity of the environment to absorb the effects of human activities. Moreover, sustainable development requires that the needs of all people be met since, in a world where poverty exists, there will always be the risk of ecological catastrophe.

Although these concepts are not entirely the same, in essence, they both seek the same thing: a development in which the limits of nature are respected, allowing it to regenerate, preventing its depletion, and thus ensuring that people today and in the future can meet their needs.

2.3 Relation between green transport and sustainable development

Finally, this article will analyze the relationship between sustainable development and green transportation systems because, as stated by the Organización de las Naciones Unidas, (2021) green transportation is fundamental for sustainable development as it has objectives such as safety, reduction of environmental damage, and efficiency, among others. Because of this, it can accelerate the progress of sustainable development goals such as poverty reduction, inequality reduction, and the fight against climate change.

Knowing that green transport is a fundamental point for sustainable development, we must understand how it affects its three pillars:

2.3.1 Environmental

At this point, we must understand that transportation is one of the main emitters of greenhouse gases. According to data from the Intergovernmental Panel on Climate Change, or its acronym, IPCC (2014), transportation is responsible for 23% of emissions in the energy area and 14% of emissions globally by 2010. This affects us because if we continue in the same way, we will exceed the limits that nature has and the points of no return. One example of this, citing Crespo (2021), is the point set out in the Paris Agreement where an increase of 1.5 degrees Celsius in global temperature is considered irreversible. Similarly, according to Rodríguez and Cruz (2017), if strong policies are not implemented to mitigate these emissions, they will increase from 8.7 gigatons of Co_2 currently to 12 gigatons by 2050, given that to meet the objectives set out in the Paris Agreement, emissions by 2050 should decrease to 5.7 gigatons, thus avoiding exceeding the points of no return.

The implementation of green transportation systems is expected to reduce emissions of greenhouse gases that affect our planet and that are against the objectives of sustainable development to avoid or reduce climate change, this is because these transport systems produce much fewer emissions of this type, this we can see by analyzing the data of the U.S. Department of Energy (2021) which tell us that electric vehicles per year produce about 1, 28 tons of Co_2, plug-in hybrid vehicles emit 2.18 tons of Co_2 per year, hybrid vehicles 3.13 tons of Co_2 per year and finally gasoline vehicles 5.71 tons of Co_2 per year, this shows that electric vehicles have much lower emissions than vehicles that run on fossil fuels, being these much more efficient and environmentally friendly, i.e. sustainable.

2.3.2 Social

As for the social area, perhaps transportation is not related to the social area of sustainable development at first glance, which seeks intra- and intergenerational equity, but there is a close relationship between transportation and this area. According to the Banco Mundial (2022), countries that increase sustainable means of transport, especially in low-income areas, boost development and social inclusion because transport is essential for development because it helps to create jobs and connect people to essential services, such as health or education.

Another point in which green transport systems help sustainable development in its social aspect is in people's quality of life and health. This is because, as we have already mentioned, green transportation produces much less emissions than vehicles that run on fossil fuels and is much more efficient and safer. "Each year, nearly 185,000 deaths can be directly attributed to vehicle pollution. More than 1.35 million people are killed and up to 50 million injured each year on the world's roads" (Banco Mundial, 2022). In addition to improving people's quality of life in certain aspects, according to the U.K. Department for Transport (2021), it improves the quality of life by improving air quality, reducing traffic levels, creating new jobs, and improving health.

2.3.3 Economic

To begin with, we must first understand that sustainable development also implies economic development, but as in any area of this topic, economic development must be within the limits of nature, i.e., it must occur without affecting natural cycles. Furthermore, since transportation is vital for economic development, a transportation system with minimal emissions, such as green transportation, is fundamental.

Another point to consider about the impacts of green transport on the economy is its impact on the production area since these transport systems have a higher cost than fossil fuels. However, using them can still be profitable. As stated by the U.K. Department for Transport (2021), fuels with low carbon levels have a higher cost than their fossil fuel equivalents, but these extra costs can be offset with incentives that increase demand and make them competitive.

Currently, the transportation sector is one of the largest producers of greenhouse gas emissions, so achieving sustainable development, taking into account that this sector is one of the most important in development, is impossible, so significant investments must be made to reduce these emissions. As pointed

out by the IPCC (2014), in order to reduce emissions to a great extent, significant changes in investments must be made, since in order to stabilize Co_2 emissions, annual investments in low-emission energy (in areas such as industry and transportation, among others) must be increased by hundreds of billions of dollars by the year 2030.

3. Literature review

Although we will focus exclusively on the context of the Netherlands because of its long process of transition to green transport systems, we must also be aware of what has been done around the world concerning green transport systems and sustainable development, so we will review studies outside Europe, within Europe, and in the Netherlands.

3.1 Experiences outside Europe

The first experience to be analyzed outside of Europe is that of Thailand, which focuses on the use of electric vehicles. According to Manutworakit and Choocharukul (2022) the country has opted to generate policies to promote electric vehicles in order to boost sustainable development and meet the Sustainable Development Goals (SDGs). Among the goals sought to be met were goal 7 (affordable and clean energy), goal 11 (sustainable cities and communities), and goal 13 (climate action). Thailand started in 2015, when the government began actively promoting the use of electric vehicles with the goal of reducing CO2 emissions from road transport by 25% by 2030.

Multiple projects have been developed in China in relation to transportation and sustainable development. Because, as Qiu and He (2017) opine, air pollution represents a major challenge for sustainable human development, which is why the Chinese government has developed the green traffic program in pilot cities in order to reduce emissions of toxic gases. The program consisted of creating an environmental monitoring network for transportation, providing special funds for the construction of low-emission green transportation systems, green construction and protection of transportation infrastructure, and using clean energy at highway service points. The result was a reduction of about 10% in emissions of these gases in the cities where it was implemented.

Similarly, in China, the government has openly promoted the transition to green transportation systems, which, as Kong and Bi (2014) tell us, consists of the implementation of subsidies to electric vehicle manufacturing companies so that they can deliver a product at a much more affordable price to consumers.

In the case of the Republic of India, as presented by Panday and Bansal (2014) the government openly promotes the transition to green transportation systems through various tools, such as the National Electric Mobility Plan or the National Mission for Electric Mobility. Both of which aim to manufacture 6 million electric vehicles by 2020.

In the case of Ecuador, in the words of Cabrera (2021) the National Policy for Sustainable Urban Mobility of Ecuador seeks to promote the improvement of technologies in the transportation sector, improve public transportation, promote the use of non-motorized vehicles, and reduce greenhouse gas emissions through economic incentives, thus building a more efficient, supportive, and environmentally friendly Ecuador.

3.2 Experiences in Europe

The first case in Europe, as presented by Rolim et al. (2013), is the case of the city of Lisbon, in which EMEL (Lisbon Mobility and Parking Management Company) generated a project in which the citizens of Lisbon were encouraged to use electric vehicles by providing them with a green pass, which allowed them to park for free within the central metropolitan area of the city. In this way, the Lisbon government promoted using sustainable and environmentally friendly transportation systems within the city.

Another way of applying green transport systems in Europe is, as Yan (2018) puts it, that in Ireland, since 2008 in order to promote the use of vehicles that have zero Co_2 emissions, such as electric vehicles, the government charges an annual circulation tax of 120 euros, while those vehicles that produce emissions of between 1 and 80 g/km of Co_2 will have to pay a tax of 170 euros. On the other hand, in Germany, vehicles that produce zero emissions are exempt from paying the circulation tax.

In the case of Spain, as expressed by the Ministerio de transportes, movilidad y agenda urbana del gobierno de España (2021), the state plan for the bicycle was implemented, which seeks to encourage the use of bicycles in trips that are currently made by car or motorcycle in order to achieve that by 2030 35%

of the passengers per kilometer that are currently made are transferred to vehicles without emissions. Moreover, this contributes to the fulfillment of sustainable development goals.

Another European experience is that of Norway, a country that, as Mersky et al. (2016) tell us, has been running projects for several years to encourage the use of green transportation systems, such as exemption from toll payment, access to charging points, tax incentives, and permission to use bus-only lanes. However, one point to note about the Norwegian incentives, as Rajendran et al. (2019) tell us, is the fact that Norway is not driving technical advances but is benefiting from global technological advances. However, this does not mean that this is not beneficial since, as Aall and Husabø (2010) tell us, a 39% decrease in fuel consumed per person/kilometer has been achieved, making transportation much more efficient and environmentally friendly. Efficiency and environmental care are pillars of sustainable development.

3.3 Experiences in the Netherlands

The Netherlands has had a long experience concerning green transport because, according to the Gemeente Amsterdam (2019), it has been promoting electric mobility mainly through subsidies for this type of vehicle, such as subsidizing businesses for the acquisition of electric vehicles, or through other actions, such as announcing a national ban by 2030 on the sale of new diesel-powered vehicles.

In the Netherlands, it has had sustainable goals for its public transport for several years, meeting many of them today and on track for others. According to the Gobierno de Países Bajos (n.d.), this transport at present is pretty sustainable; all electric passenger trains have been running since 2017 with renewable energy, in addition to seeking in the future to have zero-emission buses.

Within the Netherlands, the search for the transition to green transport systems is not exclusive to the central government, but many cities have developed their transition plans, as in Amsterdam, which raises the following points:

- First: by 2022 only emission-free buses and coaches will be allowed in the city center.
- Second: by 2025 all traffic, including cabs, artisanal and municipal ferry passengers, but with the exception of passenger cars and motorcycles, must be emission-free within the ring road.
- Third: by 2030 all traffic within the built-up area must be emission-free (Gemeente Amsterdam, 2019).

Finally, in the Netherlands, there has been a long process to decrease the carbon footprint; as Statistics Netherlands (2015) mentions, since 2005, when the fiscal policy was established to incentivize the acquisition of energy-efficient vehicles, the levels of Co_2 emissions per kilometer have decreased considerably.

1. Methods

For this article, data will be extracted from reliable secondary sources such as the Web of Science, Scopus, the Government of the Netherlands, the World Bank, Statistics Netherlands, the United Nations, and the European Union. Quantitative and qualitative data of annual frequency will be used for the analysis in the time horizon: during the period from 2000 to 2019, this period was selected because we want to know if there were changes in green transport in the Netherlands in the years 2005, 2013 and 2016, because these years were selected as a cut-off point, following the creation of tax incentives for the purchase of energy efficient vehicles in 2005, the entry into force of the Energy Agreement for Sustainable Growth in 2013, the implementation and signing in 2016 of a Green Agreement on electric transportation, in addition to the municipal plans, which will be analyzed in depth later in the research.

The present research will be conducted using a descriptive analytical methodology because, in this research, we intend to analyze the relation between green transport and sustainable development, focusing on how and how much green transport influences sustainable development. The research will be conducted using this methodology due to the fact that it helps to understand the context in which a phenomenon arose and the causality of the same (Loeb et al., 2017). The work has a qualitative and quantitative approach since the information describes the relationship between the two variables and uses numerical data to support such information.

The aforementioned methodology will be conducted according to the guide posed by Loeb et al. (2017), which proposes six steps for conducting the research:

1.First step: identify the phenomenon.

2.Second step: determine what the most important characteristics of the phenomenon are.

3.Third step: identify the best forms of measurement to represent those characteristics.

4.Fourth step: identify the patterns present in the data.

5.Fifth step: Present the patterns present in the data that describe the phenomenon.

6.Sixth step: reconsider and repeat as many times as necessary.

In order to evaluate the relation between Co_2 emissions and the three pillars of sustainable development, a preliminary analysis will be carried out to analyze the trends shown by the different time series subject to the analysis. For the analysis of time series, it is necessary to understand its components, which are, in the words of Lind et al. (2012):

1. Trend component: This refers to the general movement of a series over a long period.

2.Seasonal component: This component refers to the movement patterns that a series presents in a year and which are usually repeated from year to year.

3.Cyclical component: This component refers to the oscillations that a series presents at frequencies greater than one year.

4.Irregular component: These refer to movements in a series that are unpredictable and usually occur in short periods.

Of these components, we will only focus on the analysis of the trend, which is seen mathematically as follows:

$$\hat{co_2} = a + bt \tag{1}$$

In Formula 1, $\hat{co_2}$ is the projected value of Co_2, a is the intercept with the Y-axis, b is the slope and t is the time value. This analysis will work with the Ordinary Least Squares method, which can be defined as a "technique for arriving at the regression equation by minimizing the sum of the squares of the vertical distances between the actual Y values and the anticipated Y values" (Lind et al., 2012, p. 615), which seeks to express the behavior of the series in a linear way, minimizing the data errors.

Additionally, a Spearman correlation analysis will be performed between the emissions variables and the 3 pillars of sustainable development (social, environmental and economic) in order to analyze the relation between these two variables. This methodology will be used because Spearman measures monotonic relation, which are, as explained by Mendivelso and Rodríguez (2022) relation in which the variables move in the same direction, but not at a constant rate, which is what happens with the type of variables to be analyzed. The mathematical form of Spearman's correlation is:

$$r_s = 1 - \frac{6 \sum d^2}{n(n^2 - 1)} \tag{2}$$

In Spearman's correlation formula 2 d is the difference between the ranks and n is the number of observations. Likewise, a dispersion analysis will be added in order to be able to show in a simpler way what is represented in the analysis.

After understanding what Spearman's correlation is, we must understand how to analyze the data it provides. The data obtained from this analysis in the words of Lind et al. (2012) can be between 1 and -1, being 1 a perfect positive correlation and -1 a perfect negative correlation, a correlation of 0 ranks or close to 0 means that there is no correlation, finally a correlation between -0.84 and 0.80 indicates that there is a strong correlation between the variables, the former being an inverse relation between the ranks, and the latter, a direct relation. (p. 704)

In the same way, to evaluate the impact of green transport systems on the sustainable development of the Low Countries, the Chow test will be performed to see the existence of structural changes in the time series analyzed, because the Chow test, as Maya and Peraza, 2010) express it, is a test which uses the sum of the squares of the regression errors, in order to test the existence of structural changes in any of the parameters of a model. The Chow test is represented as follows:

$$\frac{\left(SSE_c - (SSE_1 + SSE_2)\right)/k}{(SSE_1 + SSE_2)/(N_1 + N_2 - 2k)}$$

(3)

In formula 3 SSE is the sum of the squares of the residuals, K is the number of variables, N1 is the number of observations in the first set, and N2 is the number of observations in the second set.

2. Results

5.1 Ordinary least squares analysis.

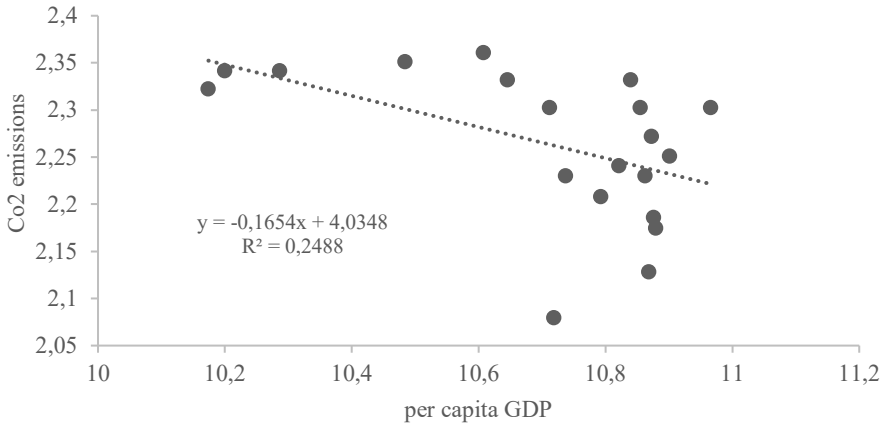
Following the steps of developing a descriptive analysis proposed by Loeb et al. (2017), we will begin by defining the phenomenon to be analyzed, which in this case is the influence that green transport has had on sustainable development in the Netherlands. First of all, in order to understand the phenomenon and the existing relation between green transport and the pillars of sustainable development, an analysis of the trend that the previously presented variables possess was performed. This analysis was carried out by establishing a relation between Co_2 emissions and the 3 pillars of sustainable development, which has already mentioned are: economic, social and environmental.

5.1.1 Relation between Co_2 emissions and the economic pillar of sustainable development.

In the case of the economic pillar of sustainable development, the analysis was carried out using GDP per capita as an element of the pillar because, although this does not fully explain the degree of sustainable development in the Netherlands, it does give us a general idea of the current situation. The following graph presents the relation between the two variables in a simpler way, after performing the analysis using the ordinary least squares method.

Figure 1

Relation of Co_2 emissions and GDP per capita



Source: Based on Co2 emissions and GDP per capita data for the Netherlands from the World Bank.

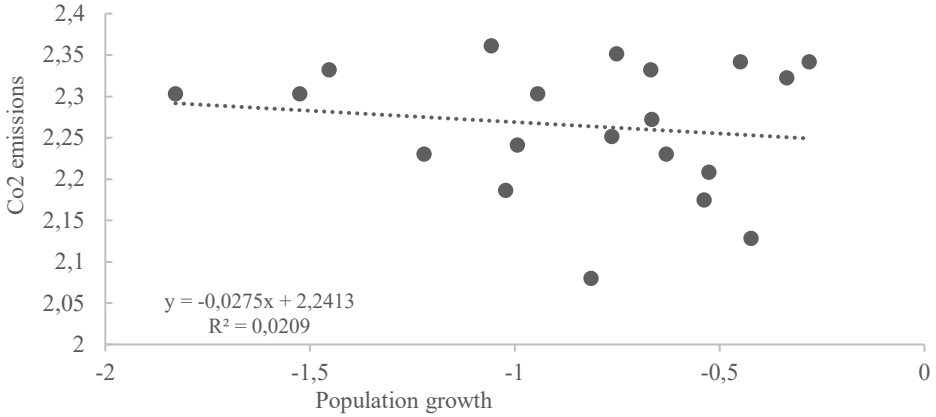
In Figure 1 we can see that there is indeed a relation between the economic pillar of sustainable development and transportation expressed through Co_2 emissions, in which as Co_2 emissions increase, GDP per capita decreases. It can be inferred that this is due to the fact that both transportation and production processes become much more efficient over time, making income from these items much higher while Co_2 emissions are reduced. Similarly, when analyzing the value of R^2 we can see that GDP per capita explains 24.88% of Co2 emissions, i.e., there is a relatively low explanation of Co2 by GDP per capita.

5.1.2 Relation between Co_2 emissions and social pillar of sustainable development.

In the case of the social pillar of sustainable development, the variables to be analyzed were population growth in the Netherlands (figure 2) and mortality due to traffic accidents (figure 3). In order to determine the relation between the variables and their trend, an analysis was carried out using ordinary least squares methodology and presented in a scatter plot to facilitate the analysis.

Figure 2

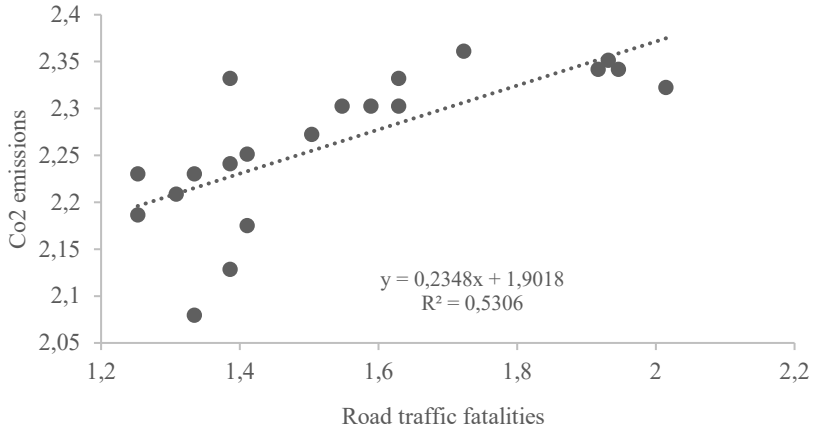
Relation between Co_2 emissions and population growth



Source: Based on Co2 emissions and population growth data for the Netherlands from the World Bank..

Figure 3

Relation between Co_2 emissions and road traffic fatalities



Source: Based on Co2 emissions and road traffic fatality data for the Netherlands from the World Bank.

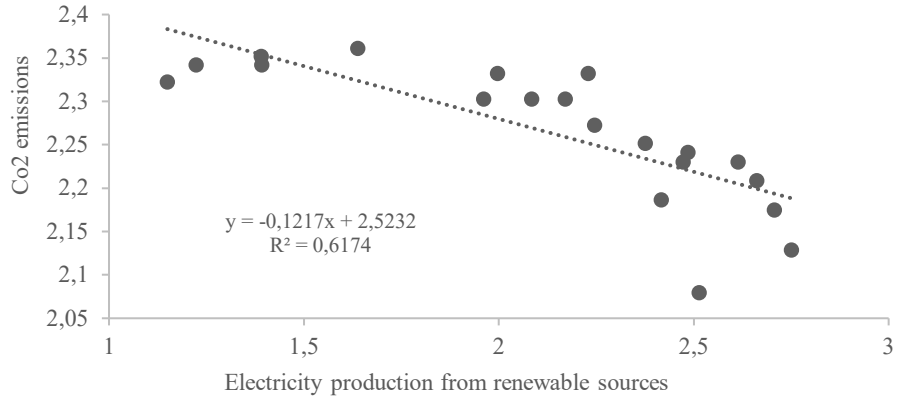
In Figures 2 and 3 we can see that Co_2 emissions have a diverse relation within the social pillar of sustainable development, since it affects each of its parts in different ways. As for population growth we can see that while Co_2 emissions increase, population growth decreases, being the opposite of mortality due to traffic accidents, which increases along with the increase of Co_2 emissions, which we can understand that this happens due to the increase in the use of vehicles. Now when analyzing the R^2 value we can see that population growth explains 2% of the behavior of Co2 emissions, i.e., it has almost no influence on this, on the contrary, mortality due to traffic accidents explains 53.06% of Co2 emissions, which has a moderate relationship with respect to Co2 emissions.

5.1.3 Relation between Co_2 emissions and the environmental pillar of sustainable development.

As for the environmental pillar of sustainable development, in order to determine the relation between this pillar and transportation in the Netherlands, an analysis was carried out using the ordinary least squares method, as in the previous pillars, relating Co_2 emissions and renewable energy generation (Figure 4) and nuclear energy production (Figure 5).

Figure 4

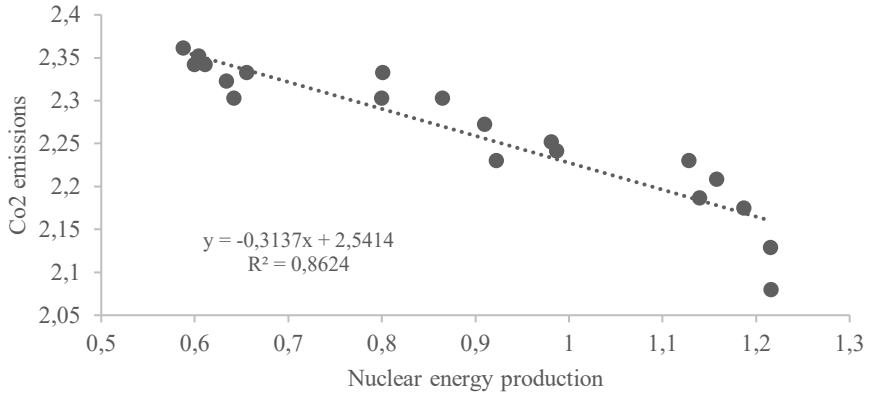
Relation between Co_2 emissions and electricity production from renewable sources



Source: Based on Co2 emissions and Electricity production by renewable sources data for the Netherlands from the World Bank.

Figure 5

Relation between Co_2 emissions and nuclear energy production



Source: Based on Co2 emissions and nuclear power production data for the Netherlands from the World Bank.

As for the environmental pillar, as we can see in the previous figures, there is a very similar relation between both variables, since as Co_2 emissions increase, both renewable and nuclear energy production is reduced. It can be inferred that this is due to the fact that by increasing energy production using these sources, which do not emit Co_2, the amount of Co_2 emitted by these items decreases. As we could see, there is a causal relation between transportation and each of the pillars of sustainable development, because when there are changes in one of these variables, there is in turn a change in the other variable. When analyzing the R^2 value, we observed that both renewable and nuclear energy production explain Co2 emissions in a similar way, being 61.74% and 86.24% respectively, with nuclear energy production explaining this variable in a greater way.

5.2 Spearman's Correlation

Now that we know in general terms that there is a relationship between the variables and the trend they show, we must understand this relationship much more deeply, so a Spearman correlation analysis will be carried out. The results of this analysis are shown in Table 1 below.

Table 1

Correlation between Co_2 emissions and sustainable development pillars

Variable 1	Variable 2	Spearman correlation

Co_2 emissions	GDP per capita	-0,583834586
Co_2 emissions	Population growth	-0,043984962
Co_2 emissions	Mortality due to traffic accidents	0,806766917
Co_2 emissions	Electricity production from renewable sources	-0,892105263
Co_2 emissions	Nuclear electricity production	-0,962030075

Source: Based on data on Co_2 emissions, GDP per capita, population growth, traffic fatalities, electricity production from renewable sources, and nuclear electricity production in the Netherlands from the World Bank.

After performing the Spearman correlation analysis between Co_2 emissions and GDP per capita corresponding to the economic pillar, it was possible to identify the existence of a moderately negative relation between the variables equal to -0.58, which as shown in Figure 1 has a negative or inverse trend, i.e., as Co_2 emissions increase, GDP per capita decreases.

Regarding the analysis of the social pillar, it was possible to identify that the relation identified between Co_2 emissions and population growth is relatively null, since the correlation analysis obtained a coefficient of -0.04. Finally, with respect to mortality due to traffic accidents, it was possible to identify that there is a very high relation between the variables, with a correlation coefficient of 0.81, in which, as Co_2 emissions increase, mortality due to traffic accidents increases.

Finally, with respect to the analysis of the environmental pillar, it was possible to identify the existence of a strong relation between the variables, finding that the relation between Co_2 emissions and energy production from renewable sources has a correlation coefficient of -0.89, which tells us that there is a very strong inverse relation between these two variables. Similarly with nuclear energy production, in which a correlation coefficient of -0.96 was identified, indicating that there is a very strong inverse relation between the variables analyzed.

5.3 Chow's Test

As previously mentioned, the Chow test was performed to identify the existence of structural changes in the time series of Co_2 emissions in the Netherlands, taking into account for this analysis the years 2005, 2013, and 2016, since, as previously mentioned, in these years several laws and incentives were created, such as in 2000 the creation of tax incentives for the acquisition of energy-efficient vehicles, the entry into force of the Energy Agreement for Sustainable Growth in 2013, and the implementation and signing in 2016 of a Green Agreement on electric transport. In the following table, we can observe the results obtained after performing the test in the mentioned years.

Table 2

Chow's test years 2005, 2013 and 2016

Year	Statistical test	Value	P. Value
2005	F-statistic	9,709481	0,006
	Log likelihood ratio	8,628058	0,0033
	Wald Statistic	9,709481	0,0018
2013	F-statistic	41,76885	0,0000
	Log likelihood ratio	24,00226	0,0000
	Wald Statistic	41,76885	0,0000
2016	F-statistic	6,450777	0,0205
	Log likelihood ratio	6,125805	0,0133
	Wald Statistic	6,450777	0,0111

Source: Based on data on Co_2 emissions, GDP per capita, population growth, traffic fatalities, electricity production from renewable sources and nuclear electricity production in the Netherlands from the World Bank.

The Chow test has the following hypotheses:

Ho: No discontinuity at the specified cutoff points.

H1: With discontinuity at the specified cut-off points.

In the three years proposed in the Chow test, there is a null hypothesis of discontinuity, which is rejected because the P value in the three years is less than the significance level of 0.05, a value that, in the words of Molina (2017), allows us to know the probability of obtaining a value far from null at random. If the probability is high, the result is due to luck being unlikely to be fulfilled in the population. But if the probability of obtaining the value at random is low, there may be a real difference. That is to say, the null hypothesis would be rejected.

Now we must understand why we take the significance value of 0.05 as a reference to reject the hypothesis. According to Molina (2017), "a P value less than 0.05 indicates that it is very unlikely that the null hypothesis is true" (pp. 377–381), therefore, as already mentioned, the null hypothesis is rejected.

5.4 Description of the policies proposed by the Netherlands in 2005

Now we must understand which policies led to the changes that we were able to observe in the analysis carried out in the work. Therefore, we will briefly describe those policies proposed in the cut-off years, such as 2005, concerning green transport and sustainable development.

This year, the policies applied to the reduction of emissions in the transport sector were mainly based on the application of new taxes and fiscal aids, of which the most important are, citing Statistics Netherlands (2015):

1. Increase in taxes on the acquisition and operation of light trucks, with the exception of those used or acquired by entrepreneurs.
2. Creation of tax incentives for the acquisition of energy-efficient vehicles in order to reduce Co_2 emissions per kilometer.
3. Introduction of a particulate filter requirement for vehicles.

Although the policies proposed this year are not as extensive nor do they comprehensively cover green transport, they can be considered an important step in the transition to sustainable transport. They have brought about a structural change within the Netherlands, leading to a decrease in Co_2 emissions and putting the country on the path to sustainable and environmentally friendly development.

5.5 Description of the policies proposed by the Netherlands in 2013.

As mentioned before, 2013 was used as a cut-off point because this was the year in which the energy agreement for sustainable growth came into force in the Netherlands. To understand the impact this may have had on green transport and sustainable development in the Netherlands, a brief description of the agreement will be given.

This agreement has 10 main pillars, of which we will focus on the seventh pillar, which refers to mobility and efficient transport. This pillar, according to the Sociaal-Economische Raad (2013), seeks to reduce up to 60% of Co_2 emissions by 2050 from 1990 emissions, generate public-private agreements for market readiness, generate strong police and charging infrastructure agreements for electric vehicles, etc.

The mobility and transportation pillar of the energy agreement for sustainable growth is divided into two main sections: long-term perspectives and short-term measures, both of which outline what the present agreement seeks to achieve.

5.5.1 Long-term perspectives

The long-term perspective has four points, which are quoted from Sociaal-Economische Raad (2013):

1. sustainable fuel mix: this point aims at the efficient and effective use of fuels to reduce Co_2 emissions, in addition to making use of available alternatives to be more sustainable, such as biofuels or sustainable liquefied natural gas.

2. Zero emissions: At this point, it is proposed that by the year 2035, all new passenger cars sold must be greenhouse gas emission-free vehicles, and by the year 2050, all passenger cars on the roads of the Netherlands must be emission-free.
3. Pay-as-you-go: This point is an investigation of how the development of pay-as-you-go transport has been developed and how it would impact the Netherlands. This is to determine the feasibility of implementing it within the Netherlands without negatively affecting the tax system or increasing the burden on businesses and households.
4. Special policy: This refers to the fact that the parties to the agreement are taking action to incorporate climate and development objectives into their territorial mobility policies and to generate an accessibility indicator for these.

5.5.2 Short-term actions

As for the short-term measures proposed in the energy agreement for sustainable growth, these are set out in eight points, according to Sociaal-Economische Raad (2013):

1. Origin policy: this point refers to the fact that the parties present in the agreement support what is proposed concerning passenger cars and are committed to ensuring that European Co_2 standards are met and strengthened, likewise for freight transport systems.
2. Preparation of the public-private market: This refers to the creation of a public-private program by 2014 at the latest, which will support businesses and products seeking a transition to green mobility.
3. Leadership in new technologies: This point refers to the continuation of the public-private electric driving project; new pilot projects will be generated, and by 2013 at the latest, an agreement on public charging infrastructure will be generated. In addition, new opportunities such as biogas or liquefied natural gas will be investigated.
4. Tax incentives for ultra-efficient vehicles: At this point, it is proposed that in the period up to 2018, passenger vehicles with zero emissions or low emissions will receive tax incentives.
5. Mobility management and fuel economy: This item aims to implement a 19 cents per kilometer fiscal pilot in 2014 to encourage commuters and business travelers to travel more sustainably, except during peak hours. Large companies will generate emission reduction plans to reduce emissions by up to 20% over 5 years. Finally, there will be a campaign to change the mobility culture in the Netherlands.
6. Public transport and clean two-wheelers: The aim is to make public transport more sustainable by generating new specifications for these transports and generating climate agreements with transport concessionaires. In addition to the promotion of regional agreements to increase the percentage of clean two-wheelers in trips to 35% by the year 2030.
7. Logistics efficiency and uniform measurement method: By 2015, a single system was established for the transportation and shipping industries to objectively compare the sustainable logistics performance of companies. In addition, by 2020, 100% of large transport companies and 25% of other companies have measured their emissions and implemented plans to reduce their Co2 emissions by 20% over five years. Finally, by 2025, 25% of freight transport should be allocated to transport companies with a validated Co2 emissions record, and this figure should rise to 75% by 2035.
8. Public charging infrastructure: Agreements between public and private parties will be established in 2013 to promote the establishment of public charging infrastructure for electric vehicles.

These policies, as well as those proposed in 2005, have strongly influenced the development of the Netherlands, driving it towards sustainable development by generating significant changes within the country.

5.6 Description of the policies proposed by the Netherlands for the period 2016-2030.

In this case, both the central government of the Netherlands and several municipalities in the country have made several agreements regarding green transport since 2016, intending to have sustainable and non-polluting mobility within the country. One of these agreements is the Green Agreement on Electric Transport 2016–2030; below, several important points about it will be presented, in addition to other existing plans on the subject in question.

This agreement aims to incentivize and increase the use of electric vehicles within the Netherlands. This is because, quoting Kamp et al. (2016), if the prosperity of current and future generations is to be preserved, it is necessary to increase the competitiveness of the economy while reducing the impact on the environment and reducing dependence on fossil energy and scarce raw materials.

This agreement raises several items to achieve a transition to much cleaner transportation systems, especially electric transportation. We will mention some of them. The most important articles of this agreement, according to Kamp et al. (2016), are:

1. Article 1: This states that by the year 2025, 50% of new vehicles sold will have an electric powertrain and a charging plug, and that 30% of these will be 100% electric vehicles. In addition, by 2020, there should be 75,000 private electric vehicles on the road.
2. Article 2: This article formulates certain objectives to be met, which are:
    a. Improve and expand the charging infrastructure for electric vehicles.
    b. Improve the storage capacity of electric vehicles in relation to the use of renewable energies and the stability of the grid.
    c. Develop the consumer market for electric vehicles.
    d. Support innovation in the sector, etc.
3. Article 4: This article refers to the fact that any organization, local government, or company interested in participating in this agreement may do so without restrictions.

While the above agreement corresponds to the central government of the Netherlands, local governments also generate their policies regarding green mobility. The Municipality of Bernheze raised a green or sustainable mobility policy, which focuses on four points: prevent (space), shorten, change behavior, and change the vehicle. These points, according to Gemeente Bernheze (2016), pose the following:

a. Prevent: keep facilities in city centers, and take advantage of opportunities provided by digitalization such as telecommuting, and cluster functions in one place to reduce the need to mobilize.
b. Shorten: reducing travel time on public transport and improving line interchanges; reducing travel time on electric bikes by using direct routes; and prioritizing freight transport to avoid braking and acceleration.
c. Change behavior: improve road safety awareness, encourage cycling, and use technological advances to support driving tasks.
d. Change the vehicle: switch to vehicles that run on clean and fuel-efficient fuels, encourage the transition from private vehicles to buses or bicycles, and use technological advances and new forms of transportation.

Like the municipality of Bernheze, the municipality of Eindhoven has also generated its policies for the transition to more sustainable and environmentally friendly transportation systems. Among the policies it has created is the Climate Plan 2016–2020. Within this plan, several points are raised, of which we will mention the most important according to Gemeente Eindhoven (2016):

a. By 2050, all mobility must be free of CO2 emissions, including cars for municipal use.
b. Incentivize the use of emission-free vehicles such as bicycles, public transport, and electric mobility.
c. By 2025, convert all public transportation, such as cabs and buses, to electric mobility.

6. Discussion

In the following section, the results obtained in this article will be analyzed and compared with the results obtained by other authors. This analysis will be divided into five sections, which are social, environmental, and economic pillars of sustainable development, proposals, and future perspectives, and finally, the limitations and future research found in this article.

6.1 Social pillar

Within the social pillar, the relationship between green transportation and mortality due to traffic accidents was analyzed with a Spearman coefficient of 0.80, which means that there is a strong relationship between these variables and that as Co2 emissions increase, traffic accidents increase, and vice versa. This is due to the increase in the use of private fossil fuel transportation systems, which generates congestion and danger on the roads, while the implementation of green transportation systems such as clean public transportation or the change of private transportation to bicycles reduces road congestion and danger on the roads. This can be confirmed by analyzing the data presented by the International transport forum (2021), in which it can be observed that the Netherlands had a decrease of 2.5% in road traffic fatalities in 2019. These results are corroborated by Bassi et al. (2022), whose research determined that after the implementation of a bus rapid transit system in Dakar, there was a reduction of up to 13% in mortality due to traffic accidents, in addition to reducing the time people have to spend in traffic by up to 30%. From this

information, we can conclude that there is indeed a relationship between green transport and the social area of sustainable development by improving road safety. We can confirm this by seeing that this type of relationship does not occur only in the place analyzed in the research but also in other places like Dakar. This also shows us that green transport is an effective tool to improve road safety and thus save the lives of many people, improving their quality of life.

Similarly, it was identified that not only does the implementation of green transport reduce traffic accidents, but it can also significantly improve people's quality of life. These results are supported by the Ministerio de transportes, movilidad y agenda urbana del gobierno de España (2021), which determined that green transport such as bicycles has a beneficial impact on the social area, improving the quality of life, health, and social development of the people who use it. Another aspect in which green transport benefits socially is by saving money on transportation, in addition to reducing transport times. In the same way, in the United Kingdom, this result is corroborated, since according to the U.K. Department for Transport (2021), the implementation of green transport systems has had a positive impact in the social area of sustainable development in aspects such as reducing vehicle congestion, improving health and well-being by generating more pleasant areas to live and work, and finally generating new sources of work in the new means of transport. After analyzing these results, we can see that the influence that green transport has on people's lives is true and beneficial, because not only in the Netherlands has this phenomenon been evidenced but also in other areas such as Spain and the United Kingdom without many differences in their results.

6.2 Environmental pillar

Regarding the environmental pillar of sustainable development, after conducting an analysis, it was possible to identify those green traffic policies, such as the facilitation and incentives for green transport, the improvement of infrastructure, such as the establishment of recharging points, and the implementation of renewable or nuclear power plants, that are important for the transition to green transport systems. This is because these transportation systems must be based on non-polluting energy sources, such as those mentioned above, which have a strong relationship with the reduction of Co2 emissions. This is evidenced by the correlation coefficients between the production of renewable and nuclear energy and Co2 emissions, which are -0.89 and -0.86, respectively, which indicate that by increasing nuclear and renewable energy production, Co2 emissions are reduced and vice versa. In addition, in the words of Ruyssenaars et al. (2021), in the Low Countries in 2019, Co2 emissions were 3.2% lower than in the previous year. These results can be reaffirmed by the data obtained in China by Qiu and He (2017), which show that after the implementation of a green traffic program in pilot cities, there was a decrease in the annual concentration of greenhouse gases of between 9.85 and 11.26 percent. There are also studies with similar results in other areas of the world, such as the study by Rolim et al. in Portugal in 2013, in London by Hens et al. in 2019, and in Dakar by Bassi et al. in 2022. In the first study, Rolim et al. (2013) identified that electric vehicles can achieve a reduction of between 35% and 43% in energy consumption and up to 63% in CO2 emissions. In the second study, Hens et al. (2019) identified the application of incentives to the use of green transportation systems, which resulted in a 20% decrease in CO2 emissions in the area of transportation. Finally, in the third research, Bassi et al. (2022) also identified the existence of a decrease of up to 13.7% in CO2 emissions after the implementation of a bus rapid transit system in Dakar. After this analysis, we can evidence the existence of a strong relationship between green transport systems and the reduction of greenhouse gases. This was evidenced by the fact that in different places where policies and projects related to transport were applied, similar results were obtained concerning the reduction of greenhouse gases. And as we were able to demonstrate, green transportation represents a great opportunity to combat global warming by reducing greenhouse gas emissions.

6.3 Economic pillar

Concerning the economic pillar of sustainable development, it was observed that green transportation policies and investment in the transition to clean transportation systems generate a reduction in CO2 emissions, which in turn has an impact on GDP per capita, since increasing CO2 emissions reduces GDP per capita, as corroborated by the Spearman correlation coefficient of -0.58, although this result could look strange since in many occasions the increase in GDP is related to an increase in the demand for transportation and therefore in an increase in Co2 emissions, these results coincide with those identified by Campo and Olivares (2013) which show that there is a relationship between Co2 emissions and economic growth, being that these increase simultaneously until they stabilize and emissions decrease, but GDP does not, this because there is an improvement in the efficiency of the processes. These results are debated by

the results obtained in India by Panday and Bansal (2014), who identified that an increase in the country's GDP leads to an increase in Co2 emissions. In the same way as Panday and Bansal in India, the results obtained by Qiu and He (2017) differ from what was found in the research, identifying that in China, with an increase in GDP, there is an increase in demand for transportation, which means an increase in CO2 emissions, which is the opposite of what was identified in the present article. By analyzing the data obtained in the research and by other authors, we were able to determine that this relationship between the reduction of CO2 emissions and the increase in GDP is true, but it depends on the degree of investment in green transportation and the availability of the same since an increase in GDP leads to an increase in the demand for transportation, and if there is no option of clean transportation, this demand will be covered by traditional transportation, increasing CO2 emissions.

In addition to the impact on the existing increase in GDP with the reduction of CO2 emissions, it was also identified that with the use of these transportation systems, there are savings in transportation costs for the users of these systems, either by reducing costs by the type of fuel, the reduction in fuel consumption, or by subsidies for the use of these systems. In the case of the Netherlands, the research identified that the government subsidizes 19 cents per kilometer to users of green transport such as bicycles, which has an impact on the economy of these users since instead of having to spend money for their mobilization, they obtain an economic income. These results are reaffirmed by India, which had similar results by identifying the existence of savings from the use of non-motorized transport such as bicycles but not by subsidies as in the case of the Netherlands. Citing Rahul & Verma (2013), in India there was a saving of Rs. 1611.4 per day due to the reduction of pollution and accidents. After analyzing these results, we can see that there is indeed a relationship between green transport and the economic pillar of sustainable development, being that this does not only affect the GDP but also the economies of each of the users of this type of transport by reducing their transportation costs and, in some cases, even generating income.

6.4 Future perspectives

Concerning prospects for the future, the Netherlands aims to reduce CO2 emissions by 60% by 2050 compared to 1990 emissions and to have 75,000 electric vehicles on the road by 2020, in addition to increasing the percentage of clean two-wheeled vehicles on the road to 35% by 2030. These forward-looking targets proposed by the Netherlands are in line with those proposed by Thailand, Portugal, Norway, Spain, and the United Kingdom. Because Thailand, according to Manutworakit and Choocharukul (2022), seeks to reduce greenhouse gas emissions by 25% by 2030 and increase the number of electric vehicles in circulation to 1.154 million units by 2035, similarly, in Portugal, according to Rolim et al. (2013), it is proposed to reduce CO2 emissions by 73% by 2050. In Norway, according to Aall and Husabø (2010), it is proposed to reduce CO2 emissions by 60% by 2050 compared to 1990 emissions. In Spain, citing the Ministerio de Transportes, Mobilidad, and Urban Agenda of the Government of Spain (2021), by the year 2030, 35% of passengers per kilometer are expected to travel by bicycle. And finally, in the United Kingdom, citing the U.K. Department for Transport (2021), the aim is that by 2030, half of all journeys made in towns and cities will be made by bicycle or walking.

Regarding the sale of emission-free vehicles in the United Kingdom, citing the U.K. Department for Transport (2021), by 2035, all light commercial vehicles and new cars sold must be 100% greenhouse gas emission-free vehicles. This is similar to what was found in the research in which the Netherlands proposes that all new passenger cars sold by 2035 must be 100% greenhouse gas emission-free. As we could see, many countries have set similar objectives to encourage the use of green transportation systems, reduce their CO2 emissions, and adhere to a more sustainable and environmentally friendly development, since many countries consider that this type of transportation is the future of mobility and have bet on it.

7. Conclusion

7.1 Response to the objectives

For the first objective of the research, which is to contextualize the theoretical relationship between sustainable development and green transportation, it's concluded that there is indeed a relationship between green transport and sustainable development in which its impact is divided into three pillars: social, environmental, and economic.

Regarding the social pillar of sustainable development, it's concluded that the use of green transportation has a major impact on this pillar by reducing mortality from traffic accidents, reducing traffic congestion, and improving the quality of life of people by reducing air pollution that affects health. This

can be evidenced by analyzing the Spearman correlation data on CO2 emissions and mortality from traffic accidents, in which this relation had a coefficient of 0.80, which shows the existence of a strong relationship between the variables.

Now, concerning the environmental pillar of sustainable development, it is concluded that this type of transportation system helps to reduce greenhouse gas emissions since it is mainly based on non-polluting energy sources or non-motorized means of transportation, improving air quality within the cities and reducing the number of greenhouse gases that reach the atmosphere. This can be observed, by analyzing the Spearman correlation data obtained, in which the energy production from renewable sources has a correlation coefficient of -0.89, which shows the existence of a strong relationship between these variables in which by increasing the amount of energy from renewable sources (On which this type of transport is based) emissions decrease and vice versa. Similarly, with the production of nuclear energy, a correlation coefficient of -0.96 was identified, which indicates that there is a very strong inverse relationship between the analyzed variables corresponding to the renewable energy data.

On the economic pillar of sustainable development, it's concluded that this type of transport has a strong influence on it, not only because of the high investments that are necessary for the establishment of this type of transport but also because the implementation of zero-emission transport systems, although at the beginning they may reduce the country's GDP, in the long term they improve efficiency by reducing CO2 emissions and increasing the country's GDP per capita. This was demonstrated by the Spearman correlation coefficient of -0.58, which means that CO2 emissions and GDP per capita have a moderate relationship in which, as emissions decrease, GDP per capita increases.

Concerning the second objective of this research, which refers to describing the environment of the Netherlands for green transport systems and sustainable development, it could be shown that the Netherlands has carried out a long process of transition to clean transport systems with the implementation of policies such as tax incentives for the acquisition of green transport or those to encourage the use of bicycles for mobilization. In this work, we were able to demonstrate the results obtained from the application of this type of transport system, both in the reduction of greenhouse gas emissions and in the reduction of mortality due to traffic accidents.

Finally, regarding the third objective of the research, analyzing the proposals on green transport and sustainable development for the period 2016–2030, it can be concluded that although the Netherlands has had a long transition process, there is still a long way to go to fully achieve sustainable development. Because of this, this country has set several future objectives to reduce the impact of the transport sector on the environment. These objectives include the elimination of the sale of vehicles that run on fossil fuels, the fact that in the future all new vehicles sold will be 100% emission-free, and an increase in the percentage of trips made by bicycle, among others. These objectives, as we have already mentioned, seek to achieve full sustainable development and are guidelines to achieve it. These proposals for the future are mostly based on the promotion of the use and sale of green transportation systems, but these only remain as objectives and do not have a clear idea of how to achieve them in an effective way that does not negatively affect people.

7.2 Limitations and future research

Regarding the limitations found during the research, it can be said that one of the most important is the lack of statistical data on transport, especially on green transportation, since in the pages of reliable sources such as the World Bank, the data on transport is incomplete, in addition to not referring to green transportation; likewise, within the municipal plans and reports of the Netherlands, there are no data on green transport.

A second limitation found is the lack of research on green transport since most of the research was focused on specific transport systems such as electric vehicles, bicycles, etc. And thus, leaving aside all other transport systems considered green transport, regarding official documents, such as laws and agreements, we can mention the lack of an English translation of these documents, as most of them can only be found in Dutch.

Another point that deserves to be mentioned is the little interest given to the social area within the research on green transport since most of the research is focused on the environmental and economic impacts that it has or how to encourage the use of these systems, but it is not taken into account how it affects or benefits people or what the relationship is between this type of transport and the social area. Because of this, future research topics include the impact that the implementation of these transportation systems has had on the population or how these types of transportation systems impact the social pillar of

sustainable development. It is also proposed to analyze the economic impact that this type of transportation has on people, not only from the perspective of GDP per capita but also from the perspective of the average income of people and the expenses they have on transportation. Another point to be investigated in the future would be the health benefits of the implementation of this type of transportation system, not only by the reduction of air pollution but also by the increase in exercise performed by people when changing to transportation such as bicycles or walking.

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