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Sustainable Development Indicators and Solutions in the Urban Transportation Sector with Emphasis on the use of Renewable Energies Based on the Scoping Review Method

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Abstract

In recent decades, due to the increase in the urban population and the unbridled growth of urbanization, many efforts have been made to create livable cities by emphasizing the place of renewable energy in the sustainable transportation sector. Using clean, renewable, and sustainable energy resources is needed to improve social, economic, and environmental health, leading to economic development and productivity. This research tries to clarify the importance of using renewable energy in the transportation sector. In this regard, the main goal of this research is to identify effective indicators and sustainable solutions with an emphasis on the use of renewable energy in the urban transportation sector. Also, in this research, an attempt has been made to answer the questions raised by carefully examining the existing studies based on the scoping review method. The findings show that the extracted influential indicators can be categorized into environmental, economic, and social indicators, which have a significant impact on the use of renewable energy in the transportation sector. Paying attention to this index can increase the amount of use of renewable energy and the amount of desirability of the effective use of urban transportation. Finally, suggestions for strengthening sustainable development in urban transportation systems with an emphasis on the use of renewable energy have been presented.

Keywords: *sustainable development, sustainable transportation, renewable energies, influential indicators and solutions, scoping review method,*

1. Introduction

In the last decades of the 19th century and throughout the 20th century, the emergence of the industrial revolution has created various environmental, social and economic changes around the world [1, 2]. Cities in this period around the world have acted as centers of attraction and platforms for economic growth, social exchange, and scientific and technological developments [1]. These conditions have caused the uncontrolled growth of the urban population and physical expansion, which generally affects the environmental, social, cultural and economic dimensions of the world [1-3].

Due to the growing awareness of the relevance of this unbridled expansion with increasing concerns about social justice, economic vitality, and environmental durability, the concept of sustainable development has emerged in the path of balancing between these dimensions and has become an important and pivotal perspective in various disciplines [3-5]. Sustainable development is a concept that became popular in the last decades of the 20th century, which is defined globally as an approach that meets the current needs of the world without compromising the ability of future generations to meet their own needs [1-6]. One of the most fundamental urban challenges of this century is the challenges of urban transportation sector and the importance of sustainable urban transportation systems in the socio-economic structure of societies is so high that experts in various disciplines consider it the basis of sustainable development of any society [4-7].

Nowadays, a sustainable urban transportation system needs changes in its strategies, planning, and design to reduce the negative effects of transportation [1, 7]. In recent years, the concept of sustainable urban transport has become a leading research topic around the world, and the application of sustainable indictors in the urban transport sector helps to decrease its negative

impacts [2, 3]. In many countries, various movements and strategies have emerged to solve complex problems and increase the level of sustainability in the urban transportation sector [7, 8]. These strategies vary from city to city and country to country based on social, political, economic, and cultural patterns [1, 8]. The experience of using sustainable urban transportation systems in different parts of the world has shown that the use of these systems has reduced energy loss and greenhouse gas emissions, as well as recycling through the use of renewable energy sources in transportation systems [2, 6-8]. And also, it reduces the use of land resources, which results in prosperity and economic vitality and high efficiency of urban functions, activities, and environmental protection [3, 8].

It is predicted that in the future, fossil energy, as the main source of energy nowadays, will not meet all the needs [6]. This problem and the pollution created by fossil fuels have caused studies to be carried out in most of the advanced countries of the world to discover and exploit renewable energy sources [4-9]. The use of renewable energy sources will be beneficial due to their availability and cleanliness, and also, renewable energies are obtained from natural processes that can be replaced continuously [3, 10].

In this regard, the main goal of this research is to identify effective indicators and sustainable solutions with an emphasis on the use of renewable energy in the urban transportation sector. Also, according to the set goal, the following questions are answered in this research.

1. What are the main indicators affecting sustainable urban transportation with an emphasis on the use of renewable energy?
2. What are the solutions to strengthen sustainability in the urban transport sector through the use of renewable energy?

2. Theoretical foundations of research

A good city is a concept that according to the basic variables, leads citizens to the highest efficiency and satisfaction with minimum travel time and cost [5, 11]. And also, it should be achieved with justice and internal efficiency, and at the same time, it should be a continuous, connected, free place that provides the basis for development [7, 9]. From the lexical point of view, development has similar meanings such as social change, social growth, social evolution, modernization and progress [10, 12]. In other words, development is a range of interconnected changes to meet the growing needs of society, and in other words, development is a process that turns unfavorable living conditions into favorable ones [12-14]. In a more general definition, sustainable development is a system that, while responding to the demand for the movement of people, goods, and information, has the features of accessibility, communication, safety, security, and fairness compatible with the environment [1-9]. Also, the main reason for the increasing attention to sustainable development policies is the limited resources and unlimited human needs and desires [4]. Some principles of sustainable development related to transportation sector are: saving energy (fuel), reducing the distance between work and life, reducing the use of cars for business trips, developing the urban transportation network, reducing environmental pollution [1-9, 11-14]. The components of sustainable development are provided in figure 1.

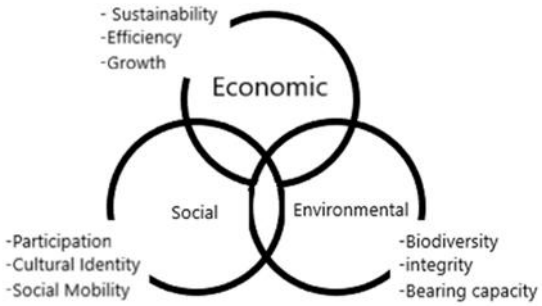

Figure 1: Components of sustainable development

2.1. Sustainable transportation and renewable energy

In present century, transportation systems inside cities mostly show an unfavorable image due to traffic congestion, accidents, lack of access to public and active transportation, and different kinds of environmental pollutions [14-16]. Accordingly, the concept of sustainability inside the transportation sector is extensively discussed [3]. The widely accepted definition of sustainable transportation is provided as follows; Sustainable transportation is a set of policies and guidelines that are integrated, dynamic, continuous and include economic, social, and environmental goals, which bring fair distribution and effective use of resources to meet the transportation needs of the society [1, 14-16]. According to this definition, the evaluation of sustainable transportation should be equally considered in environmental, economic, and social dimensions [13, 17-19]. In other words; Sustainable transportation is a system that operates on

multiple levels in terms of fuel consumption, vehicle emissions, safety, traffic congestion, and achieving economic and social goals [17, 20].

In this regard, sustainable transportation as a system can meet all the following goals: reducing air pollution, greenhouse gas emissions, waste, and noise to a level without negative effects on nature, improving energy resources and efficiency, and economical approaches in the transportation of goods [1-9, 12-17].

In this regard, one of the solutions to encourage the use of sustainable transportation is the use of renewable energy, which can be defined in the context of urban transportation systems. In general, energy in the world is divided into four groups [10, 13, 21]:

A. Polluting and non-renewable energies,
B. Polluting and renewable energies,
C. Non-polluting and non-renewable energies,
D. Non-polluting, non-renewable, and unlimited energy.

In this research, non-polluting, renewable, and unlimited energies have been specifically discussed. According to the definition, new (renewable) energies are energy obtained from continuous or intermittent energy flows that can be returned to the environment or alternative energy flows as much as they are consumed [21-23]. The meaning of new energies does not necessarily mean new energies and they have been used by humans for centuries, the creation of fire by humans, which is the energy of biomass, or heating by the sun's rays may have been among the first new energies [21, 24]. But the main meaning of the word "new" means "renewable" or "new show" which is synonymous with the English equivalent of "renewable" and at the same time includes the new technologies that have recently been developed in the field of this type of energy [10, 13, 20]. In other words; the meaning of renewable energies are energies that do not leave destructive effects on nature if they are used; In addition, these energies are renewable and do not run out in the process of using them [23,25].

There are five types of renewable energy including wind energy, solar energy, hydroelectric energy from flowing water, geothermal energy from heat of the ground, and biomass, which are renewable and cost-effective energies that are becoming more and more popular due to the importance of environmental issues and the limited availability of fossil fuels [26, 27- 29].

Among the goals of using renewable energy, it can reduce dependence on fossil resources, reduce the emission of polluting gases from the production and consumption sectors of energy resources, and also reduce the emission of greenhouse gases that have an important effect on global warming [26, 27]. In the following, the types of renewable energies and their place in sustainable transportation will be introduced:

- Solar energy: Solar energy is one of the sources of renewable energy and one of the most important of them. According to an estimate, if all fossil fuels are burned at once, the energy obtained from it is equivalent to 4 days of sunlight on the earth. The amount of solar energy radiation varies in different parts of the world and is the highest in the solar belt of the earth. Also, solar energy is classified into active and passive energy [24, 29-34].
- Wind energy: Wind energy refers to energy that harnesses the kinetic energy of moving air. With the construction of the first modern and fast wind turbines at the beginning of the 20th century, the use of wind energy became extremely important in the world. In the past few years, the average annual growth of wind energy in the world has increased by about 30%, which has the highest growth rate among other renewable energies. Also, by using small turbines, personal cars with rechargeable batteries can be expanded [30-34].
- Geothermal energy: Geothermal energy comes from the heat resulting from the decomposition of radioactive materials in the earth's molten core and the reactions inside the earth [35]. The best way to use this energy is in the production of electricity, which can improve transportation systems based on electricity [29, 34]. Geothermal sources include dry steam, hot water, hot rock, magma, and geothermal heat [35]. Also, by making a network in the traffic routes and bypassing the flow of hot water and melting the ice on the roads, it is possible to prevent ice on the roads and reduce other costs of snow removal, accidents and road preparation [29-31].
- Biomass energy (Biomass): Biomass is the most important source of energy production that is provided by agriculture, which is a source of thermal energy. Fuels

such as ethanol, bioethanol, biodiesel, solid fuels such as corn, wheat, soy, and wood, and gas fuels such as methane are considered as sources of this energy for the production of electricity and use in many systems [36]. Biomass sources are separated into 5 different and major sources, including garbage, industrial wastewater, forest waste, agriculture, and livestock. The growing use of biomass for heating, electricity generation, and transportation continues in these years, and wood pellets, biodiesel, and ethanol are among the most important primary renewable fuels in the transportation sector [29, 34, 36].

- Hydrogen energy and fuel cell: Hydrogen as the best option and the most economical fuel in the long run for use in fuel cell cars has a very high potential [29, 37]. Hydrogen is the easiest fuel to use in fuel - cell cars and increases the efficiency and simplicity of fuel - cell cars. Hydrogen has no environmental harm, but a lot of investment is needed to provide its infrastructure, and storage on passenger cars should be standardized and acceptable from a safety perspective [30, 37]. The use of this energy can play a central and controlling role in the pollution of cities [30]. Also, the fuel cell is an electrochemical system that directly converts the chemical energy of the fuel into electrical energy. Fuel cell technology, in which hydrogen is converted into electricity and heat during a chemical reaction with oxygen, is one of the best options for producing electric energy in the future due to its advantages such as high efficiency, a wide range of production, compatibility with the environment and no noise pollution is considered [37-39].
- Hydroelectric energy: Water energy is one of the main and largest renewable energies that has a significant contribution to the production of electricity in the world [28, 34]. The most common form of hydroelectric energy is obtained by closing dams on rivers and directing water to turbines and finally converting it into electricity. With grid power supply, it can be used in all kinds of urban transportation systems such as electric buses and metro. Also, this energy has several advantages over other sources of electricity generation [37]. Among these things, we can mention high reliability, proven technology, high efficiency, very low operating and maintenance costs, and easy adjustment with load changes, and the disadvantages of hydroelectric energy include high initial installation costs [27, 32].
- The energy of new batteries: new batteries with a long life and unlimited recharging capabilities have been made and used in different ways [28]. Among the advantages of these batteries are the lack of chemical degradation, the unlimited life of the electrolyte, the ability to accurately measure the amount of stored energy, and the lack of environmental pollution due to the absence of heavy metals in them. This battery can be used separately by combining it with other types of renewable energy in cars [27, 28, 34]. The energy supply of portable batteries in light vehicles such as electric bicycles or light motorcycles, and the energy of auxiliary transportation equipment is one of the uses of this energy [27, 28].
- Energy from the movement of objects: This energy has recently passed the stages of its initial tests and research and has entered the scene of renewable energies [8, 2]. The nature of this energy is that it absorbs the mechanical energy resulting from the traffic and stores it in the form of electricity by strong and flexible sensors placed under the busy roads and sidewalks. With the electricity generated from these systems, it is possible to supply the electricity needed for street lighting, traffic control equipment and fixed vehicles in that area such as buses or electric taxis [8, 15].

3. Research method

If various studies and researches have been published on a subject, they can be studied and explored again, compared in a comparative manner, or their results can be summarized and combined with each other [38, 39]. Such work is an example of an independent research. The statistical population of this research is the studies including articles and theses that have been done jointly in the field of sustainable urban transportation and renewable energy. Based on this, the method of the present research in

terms of the nature of the data and the style of analysis in the qualitative research group and based on the method of data collection, is a scoping review method. Scoping review method is one of the methods of exploratory research to create and extract a common reference framework based on the results of past research [39]. This method can be followed with two different approaches, such as following multiple research conducted by a researcher in a specific subject area and making it the basis of the review, or by examining and combining the findings of the studies of different researchers in the same field [38- 40]. Figure 2 shows the steps of scoping review method that must be considered in this study.

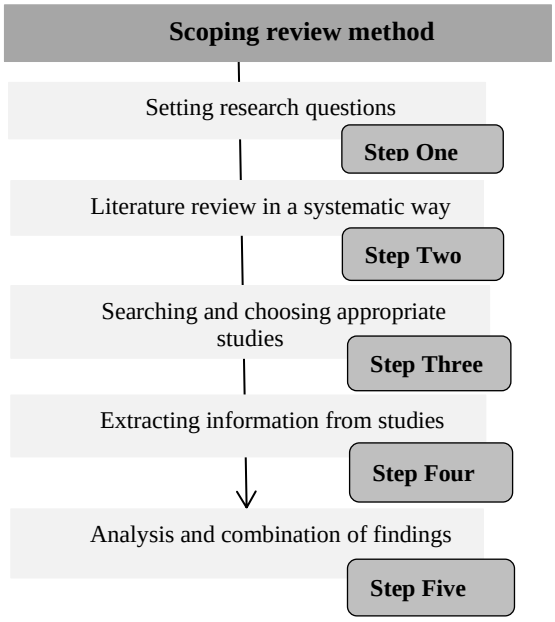

Figure.2: The steps of the scoping review method

3.2. Step One: Setting research questions

Setting the research questions is considered as the first step of the scoping review method. In line with the goal of the present research, in order to go through the principles of the scoping review method, the following questions of what, who, when, and how should be answered (Table 1).

Table. 1: Research parameters and questions

Parameters	Research questions
What	Sustainable development solutions in the urban transport sector with emphasis on the use of renewable energy
Who	Various studies published in the field of sustainable development by focusing on the topic of urban transportation and renewable energies
When	Searches have been conducted in the selected databases from 2013-2023
How	Through a content analysis method, qualitative data have been analyzed

3.2. Literature review in a systematic way

At this stage, a systematic search for published studies was made in selected databases from 2013 to 2023. These databases include Web of Science which is a well-known for searching published studies in indexed journals internationally and Magiran which is national database for Iranian to search published studies inside Iran. Consequently, in this study to understand and analyze published studies internationally and nationally, main keywords are searched together in mentioned databases. Hence, all the research conducted regarding sustainable development in urban transportation by focusing on the use of renewable energies has been searched. The main keywords used to search studies in databases are provided in table 2.

Table. 2: Main Keywords

Main keywords
Sustainable urban transport
Renewable energy

3.3. Searching and choosing appropriate studies

The logic of selecting studies is based on ten indicators including research objectives, research method, research design, sampling method, data collection, ethical considerations, accuracy and data analysis, clear statement of findings, and the value of research. Finally, 39 studies selected to be used in this research. Among selected studies, 35 studies with a focus on sustainable urban transportation and renewable energies were selected towards reaching the main aim of this study. Furthermore, 4 studies have been selected to review and understand the structure of the scoping research method that is used in this research. Figure 3 provides information about the number of studies selected and used from each database.

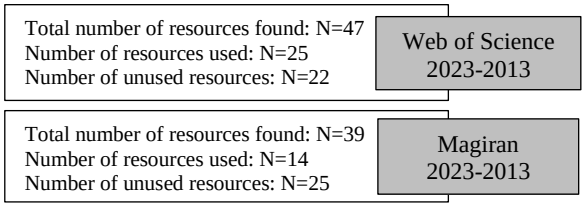

Figure. 3: The number of selected studies from each database

In figure3, the total number of used and unused sources are specified according to the databases. In this regard, some sources are not used because they were not suitable based on the main purpose

of the research. Also, in terms of time, about 23% of the studies are published in 2021, about 12.8% of the resources are published in each year of 2020 and 2018, about 7.7% in each year of 2023,2022,2019,2017, and 2013, about 5.12% of them in each year of 2016, and 2015, and about 2.5% of the selected sources are published in 2014. Figure 4 provides the number of selected studies published in selected years.

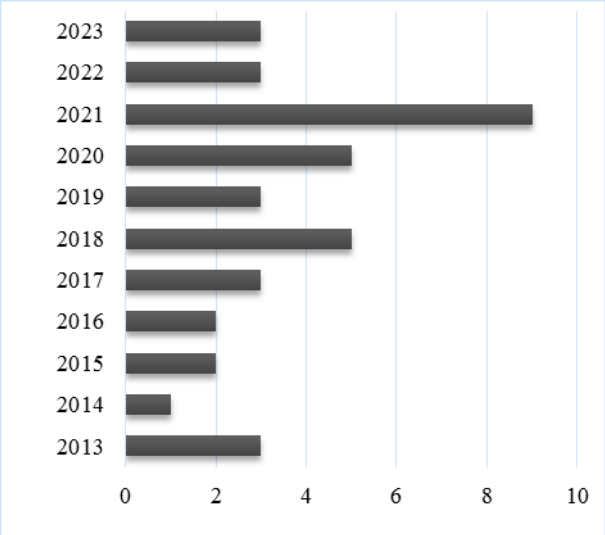

Figure. 4: The share of studies based on the published year in the selected time frame

In table 3, the analysis of the selected research methods has been discussed in terms of research type, data collection method, and research approach. The approach of the current research is descriptive-analytical. In total, the selected studies are divided into three categories in terms of research approach the first category is the researchers that have used the descriptive-analytical method (11 %) and the second category is related to the researchers that have used the content analysis method to measure the subject. have used belong to this category, equivalent to (74%), the third category is related to researches that have used a survey method to measure the subject, equivalent to (14%). Therefore, according to the type of research, the number of quantitative (5%), qualitative (46%), and mixed (49%), as well as according to the method of data collection, documentary and library studies, and questionnaire respectively equivalent to (86%) and (14%). Figure 5 shows number of research resources based on research type, data collection method, and research approach.

Table. 3: Analysis of sources in terms of research type, data collection method, and research approach

References	Type of research			Data collection		Research approach		
	Quantitative	Qualitative	Combinational	Documentation and library	Questionnaire	Descriptive-analytical	Content analysis	Survey
[1]		*		*			*	
[2]			*	*			*	
[3]			*	*			*	
[4]			*	*	*			*
[5]			*	*	*			*
[6]			*	*			*	
[7]			*	*	*			*
[8]	*			*		*		
[9]			*	*	*	*		
[10]			*	*	*		*	
[11]			*		*		*	
[12]		*		*			*	
[13]		*			*			*
[14]			*	*	*		*	
[15]	*			*			*	
[16]			*	*	*		*	
[17]		*		*			*	
[18]		*		*			*	
[19]		*		*			*	
[20]			*	*			*	
[21]			*			*		
[22]		*		*			*	
[23]		*		*			*	
[24]		*		*			*	
[25]		*		*			*	
[26]			*	*			*	
[27]			*	*			*	
[28]			*			*		
[29]			*					*
[30]		*		*			*	
[31]		*		*			*	
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[34]		*		*			*	
[35]		*		*			*	

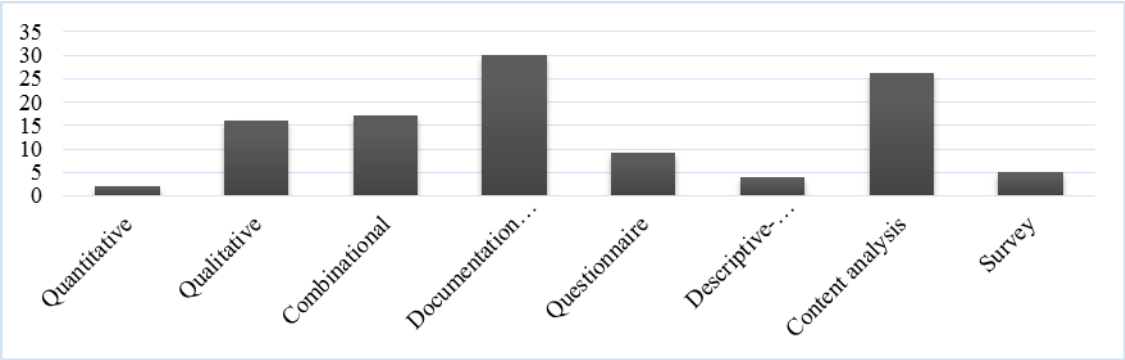

Figure.5: Number of research resources based on research type, data collection method, and research approach

3.4. Step Four: Extracting information from selected studies

At this stage, after collecting the data of the selected sources the indicators related to sustainable urban transportation and renewable energy extracted. Selected studies were reviewed and their information was extracted in the form of codes which provided in table 4. Also figure 5 shows the frequency of each indicator in the existing studies, which include; Environmental (75%) are equal to 47 indicators, economic (17%) are equal to 11 indicators, and social (8%) are equal to 5 indicators.

Table.4: Indicators of sustainable urban transportation and renewable energy based on selected studies

REFERENCES CODE	REFERENCES	INDICATORS
1	[1]	Environmental (the amount of air pollution released from the transportation system, the amount of non-renewable energy consumption of transportation systems, the amount of negative environmental effects caused by transportation systems, the amount of transportation waste such as wear and tear), economic (the cost of consumers (fuel, etc.)) social, economic
2	[2]	Economic (users' satisfaction with the urban transportation network, travel time from origin and destination, per capita travel and vehicle, diversity in transportation ways, travel costs, costs of facilities and transportation facilities), social (safety, children's trips), health), environmental (greenhouse emissions, air pollution, noise pollution, water pollution, land use effects)
3	[3]	Environmental (air pollution, energy consumption)
4	[4]	Social, economic and environmental (reducing air pollution)
5	[5]	Environmental (compatibility of public transportation fuel)
6	[6]	Environmental (reducing the use of fossil fuels, using clean fuels, reducing air pollution, reducing road waste), social, economic
7	[7]	Economic (desired economic growth, support of a dynamic economy, achieving the highest efficiency), social (satisfaction with safety, lifestyle and lifestyle), environmental (intensity of noise pollution, amount of water pollution, amount of air pollution, amount of fossil fuel use)
8	[8]	Environmental (air pollution (annual pollutant production by each person, annual pollutant emitted in the city atmosphere, pollutant production per trip, pollutant production per passenger, pollutant production due to energy consumption), energy consumption (per capita annual energy consumption, consumption energy per trip, energy consumption in moving one kilometer of vehicles), economic (direct user costs (direct cost of an urban trip), indirect user costs (daily time of each person for transportation, time of an urban trip)), social (safety of transportation (safety of transportation on population, safety of a trip)), accessibility of transportation (length of each trip), variety of transportation)
9	[9]	Environmental (the desirability of clean energy, fossil energy sources, renewable energy sources, sound, fuel consumption, air pollution production), economic (the cost of pollutants, the cost of fuel consumption), social
10	[10]	Economic (rating of overall satisfaction with the transportation system by citizens, average daily travel time from door to door, per capita cost of accidents, employment rate in the transportation sector, tax rate in the transportation sector), social (access to affordable methods transportation capacity (walking, cycling), environmental (per capita consumption of fossil fuels and carbon dioxide emissions (climate changes)
11	[11]	Economic (reducing costs caused by street accidents), physical (flexibility, improving the quality of infrastructure, improving vitality by emphasizing the presence of streets), social (improving social interactions, supporting social cohesion and development), environmental Optimizing energy consumption and reducing fossil fuels, reducing air pollution, reducing noise pollution, supporting green spaces)
12	[12]	Social (social welfare (non-motorized transportation status, motorized transportation status, safety and security (travel safety), environmental (pollutions (air pollution, noise pollution), energy efficiency

		(renewable energy and non-renewable energy)), climate change)
13	[13]	Environmental (reduction of greenhouse gases, reduction of air pollution, reduction of use of natural energy resources), economic, social
14	[14]	Economic, environmental (reduction of energy consumption and related pollutants)
15	[15]	Greenhouse gases, climate change
16	[16]	Economic (increasing consumer satisfaction, encouraging the use of mixed - used, establishing resources and facilities for electronic communication, diversity in the type of transportation means, reducing consumer costs, reducing energy consumption, green, reducing costs for road transportation), social (supporting social health, social equal access, supporting social security and safety, supporting social cohesion and development, supporting children's travel, supporting walking and enjoying social vitality, supporting the diversity of social choice, Supporting the quality of social life, supporting the social economy), environmental (reducing climate pollutants, reducing noise pollutants, preventing the release of acid and chemical pollutants, preventing water and soil pollution, preventing soil erosion, preventing from the negative effects on the uses, reducing the consumption of fossil resources, protecting biodiversity and perspectives, efficiency in the use of renewable resources)
17	[17]	Social, economic and environmental (climate changes, fossil fuels)
18	[18]	Environmental (reducing fossil fuel consumption, preventing climate change, reducing pollution caused by coal consumption), economic
19	[19]	Economic growth, fossil fuels
20	[20]	Economic, environmental, environmental pollution, reduction of pollutants
21	[21]	Environmental (increasing the health level of the society (reducing noise pollution, reducing air pollution), reducing types of pollution (reducing energy consumption, reducing fuel consumption))
22	[22]	Economic criteria (reduction of fuel costs), environmental criteria (reduction of greenhouse gas emissions)
23	[23]	Environmental (prevention of ozone layer destruction), economic (energy costs), social
24	[24]	Pollution caused by transportation, economic growth, environment and greenhouse gases
25	[25]	Emission of greenhouse gases, economic
26	[26]	Environmental factors, economic factors, social factors
27	[27]	Environmental (reduction of pollution caused by the consumption of fossil fuels), economic, social
28	[28]	Economic criterion, environmental criterion, social criterion
29	[29]	Fossil fuel systems, biofuels
30	[30]	Climate change, sustainability, pollution, fossil fuels
31	[31]	Environmental (protection of natural resources, fossil fuels, greenhouse gases), economic
32	[32]	Economic (saving energy consumption, increasing investment in the renewable energy
33	[33]	reducing cost in using new energy, improving production technologies)
34	[34]	Social, environmental (avoidance of gases, Co2, Nox, So2), economic
35	[35]	Economic, environmental (reduction of energy consumption and related pollutants)

3.5. Discussion and research findings

According to the contents stated in the section of theoretical foundations and selected studies, the list of which is given above, an attempt has been made to investigate and extract the sustainable urban transport index with an emphasis on renewable energies. In this stage of the scoping review method, the considered codes are put together in a common way, which are presented in table. 5 in order to provide a new and unified interpretation of the findings in the next steps. Also figure 6 shows the frequency of each index in the existing studies, which include; Environmental factors (75%) are equal to 47 indicators, economic factors (17%) are equal to 11 indicators, and social factors (8%) are equal to 5 indicators.

Table. 5: Explanation and classification of sustainable urban transport indicators with emphasis on renewable energies

COMPONENT	INDICATORS	SUB-INDEXES	REFERENCE CODE
SOCIAL	**Social Welfare**	Considering the benefits of everyone's transportation, citizens' satisfaction with transportation systems, creating a culture to use public transportation, supporting social health, sustainable development policies, and cycling.	17, 26, 31, 14, 13, 8, 9, 10, 11, 12, 18, 20, 21, 22, 23, 19, 6, 28, 32, 15, 16,34
ECONOMIC	**Economic prosperity**	Reducing the amount of citizens' expenses, the amount of irreparable environmental expenses, the cost of using the public transportation system, reducing energy expenses, expenses due to noise pollution, expenses due to pollutants, expenses due to fuel consumption and economic efficiency. More than solar energy and wind energy, saving energy, increasing investment in the renewable energy sector, reducing the cost of using new energy.	18, 17, 16, 15, 13, 20, 21, 19, 1, 2, 6, 23, 25, 27, 28, 32, 8, 11, 9, 12, 29, 31, 35, 32, 27,

ENVIRONMENTAL	**Pollution**	compatibility of public transport fuels, abandoning old public transport and replacing new public transport with high quality, air pollution, noise pollution, reducing the need to travel by private cars, high speed in moving from origin to destination reducing fuel consumption, the amount of air pollution emitted from the transportation system, the amount of noise pollution caused by the transportation system, reducing pollution caused by the consumption of fossil fuels, air pollution, using clean fuels, reducing soil pollution, preventing the emission of pollutants acid and chemical effects, climate change improvement, greenhouse gas emissions, annual pollutant production per person, annual pollutant released in the city, pollutant production per trip, pollutant production per passenger, pollutant production due to energy consumption , the desirability of clean energy, fuel consumption, waste production, reducing traffic congestion, reducing pollutants caused by coal consumption, environmental pollution	3, 21, 22, 19, 6, 14, 16, 17, 18, 4, 7, 12, 15,13, 34, 33, 29, 26, 24, 23, 9, 11, 8, 10, 5, 2, 27, 31, 29, 30, 20, 25, 1, 31, 28, 30, 31, 34, 35, 33
	Energy efficiency	Land use, energy consumption, reduction of energy consumption, amount of non-renewable energy consumption of transportation systems, efficiency in consumption of renewable resources, water energy, optimization of energy consumption and reduction of fossil fuels, per capita annual energy consumption per trip, energy consumption in moving one kilometer of vehicles	
	Effects on the environment	The amount of negative environmental effects caused by transportation systems, the amount of transportation waste such as wear and tear, destruction of the habitat, improvement of ecological health, ecological design, negative effects on the ecosystem, avoiding So_2, NO_x, Co_2 gases, ozone layer destruction, per capita consumption of fossil fuels and carbon dioxide emissions	

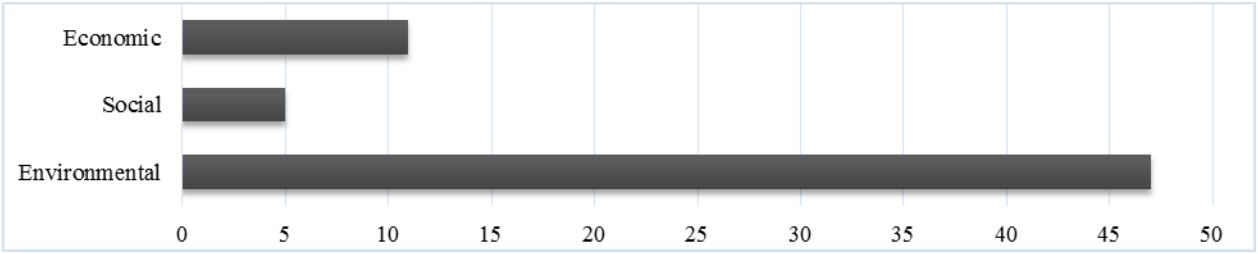

Figure.6: The abundance of the main indicators

3.6. Step Five: presentation of findings

After obtaining the meta-composite results in table 5, the main indicators of sustainable urban transportation and renewable energy have been drawn in the form of a conceptual framework. In the presented framework, environmental factors (pollution, energy efficiency, impact on the environment), economic factors (economic welfare, economic prosperity), social factors (social welfare, safety and security, social justice), on sustainable urban transportation and renewable energies are effective and affect each other (Figure 7).

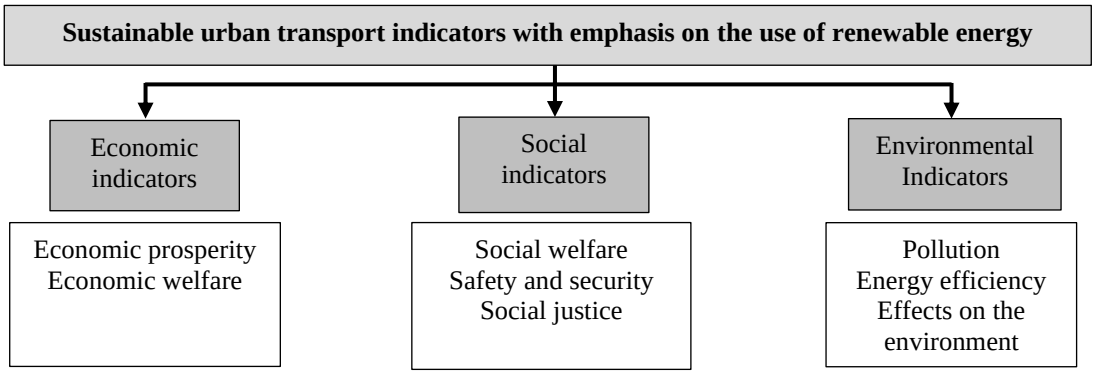

Figure.7: The main indicators of sustainable urban transport with an emphasis on the use of renewable energy

4. Conclusion and suggestions

The rate of use of renewable energies in countries all around the world is increasing and it is currently considered as one of the indicators of sustainable development. These energies take on a greater share in the world's energy supply system day by day. Also, the use of sustainable urban transportation with an emphasis on renewable

energies is considered the most important and effective factor for reducing greenhouse gas emissions and reducing various types of pollution. The purpose of this research is to identify indicators and solutions for sustainable development in the urban transportation sector with an emphasis on the use of renewable energies based on a scoping review method to provide the necessary grounds to encourage the use of renewable energies and help to identify the weaknesses and remove the obstacles. Formulation of appropriate policies for the development of renewable energy technologies is first dependent on the correct knowledge of the factors affecting the promotion of these technologies. According to the findings, the indicators related to the environment, social, and economic have an effective role in sustainable urban transportation with an emphasis on renewable energies and directly or indirectly affect each other. Based on the results of the study, it can be said that the environmental factors are the first factor. In environmental factors category, three general sub-indicators include pollution, energy efficiency, and impact on the environment have been considered. In addition, the results showed that economic indicators are in the second rank, and social indicators are in the third rank. These two categories include some general sub-indictors such as economic prosperity, economic welfare, social welfare, safety and security, and social justice that have been considered and play an important role in the development of the use of renewable energy.

Therefore, according to the results obtained in this study, suggestions related to the identified indicators to use renewable energies as much as possible in the urban transportation sector can be proposed as follows:

- Since the transportation sector is the major demander of petroleum products in the world, and cars in the world are mostly gasoline-burning, it is suggested that removing cars with old technology and replacing them with cars with new technology based on renewable energy consumption must be the focus of planners and decision-makers. Replacement of cars and improvement of their efficiency can lead to a large reduction in fossil fuel consumption and CO2 emissions in the world and can also increase the level of economic and social welfare in societies.
- Improving the quality and quantity of public transportation systems based on the use of renewable energy sources can increase the motivation of travelers to choose public transportation instead of private cars.
- It is necessary to apply incentive policies for citizens to use public transportation systems.
- Appropriate planning to increase the stability of urban transportation systems and reduce their side effects on various aspects of environment, economic and social is essential.
- Adopting correct and practical policies for the development of renewable fuel supply stations for private cars is indispensable.
- It is important to create suitable fields of public education in schools and universities by taking help from national and virtual media in expanding the use of renewable energy.
- As a strategic policy, environmental taxes can oblige car manufacturers to use environmental laws and standards and prevent environmental destruction.
- Creating suitable contexts for the use of software and hardware aligned with environmental goals and creating a culture of obligation in this regard can have a significant impact on preventing environmental destruction.
- The management of intra-city trips through the intelligentization of public transportation systems can help to reduce energy consumption, improve the environment, reduce pollution caused by fossil fuel consumption, as well as the economic and social well-being of communities. Therefore, the use of IOT technology in urban transportation systems is very important.
- Development of infrastructure and support policies related to cycling and walking in urban areas to save fossil energy resources and improve the level of social and economic well-being is an Undeniable truth.
- Use of traffic control equipment such as lights, traffic signs, and road lighting based on photovoltaic sources or other green energy sources is necessary.
- Using electricity produced from waste, geothermal, and wind energy to supply the electricity needed by public transportation systems and private cars,

and urban traffic control equipment is crucial.

- Using hydrogen energy to provide fuel for different types of transportation systems (buses, private cars, train, metro, and …).

In this study, it has focused on environmental, economic, and social indicators, and it is suggested that other influential indicators such as health indicators should be investigated in future research. This work increases the generalizability and provides the possibility of comparison. It is also recommended to review the projects implemented in this direction all around the world for a more complete understanding of the subject.

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