

A Critical Review on Sustainable Transportation

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Abstract:

Modern technology and the rapid expansion of the global economy have modernized our lives, but they have had a negative impact on the sustainability and ecology of the environment. The world has recently witnessed an increase in harmful gas emissions, severe global warming, and background air pollution. Internal combustion engine (ICE) car dependence is widely criticized for increasing air pollution and encouraging the continued use of fossil fuels, both of which endanger sustainable development. Electric vehicles (EVs) are environmentally friendly substitutes for conventional high-emission vehicles in this context, ensuring economic and social growth while also contributing to the achievement of sustainable development goals (SDGs) by improving energy security. As a result, transportation sustainability is less concerned with finding technical solutions to real-world problems and more concerned with finding social, financial, and environmental solutions to complex societal problems. Modern transportation can be more than just an economical or technical solution; it can also be a planning strategy that considers the effects of multiple systems. It investigates the evolution of transportation and the recent incorporation of sustainability while taking a variety of modes of transportation into account.

Keywords: Sustainable Transportation, Green Vehicle, Environmentally Sustainable Transport, Factors of Sustainable Transportation, Review on Sustainability.

Introduction:

By increasing access to resources and markets, transportation promotes economic growth. It also enhances people's lives by connecting them to jobs, health care, education, recreation, and other amenities. As a result, transportation plays an important role in economic and social development. Nonetheless, it has a number of negative consequences, including traffic congestion, safety, pollution, and nonrenewable resource depletion. Sustainable transportation stems from the broader term of sustainable development, which encompasses all aspects of human activity. Transportation that is efficient and sustainable is an essential component of well-functioning and civilized societies. Indeed, both developed and developing countries are confronted with critical issues when it comes to selecting and planning for future transportation systems when there is a need for sustainable development that balances accessibility, mobility, human safety, and environmental protection. These general terms, which describe the movement of people and products in ways that are environmentally, socially, and economically sustainable, are the foundation of the idea of sustainable transportation. Rising levels of gases associated with climate change are attributed in part to vehicle emissions. Carbon dioxide (CO₂),

methane (CH₄), and nitrous oxide (NO_x) are the three main greenhouse gases linked to vehicle transportation (N₂O).[1]

The term "sustainable transportation" refers to modes of transportation that are both safe and do not have a negative impact on the environment. Sustainable transportation is also known as green transportation. It is critical to understand that sustainable transportation relies on renewable energy rather than coal, petroleum, or other fossil fuels that may harm the environment. Sustainable transportation, on the other hand, is safe because it uses renewable energy sources. Walking, sailing, and cycling are a few examples of environmentally friendly modes of transportation.

Cycling or biking refers to the use of bicycles for transportation, recreation, exercise, or sport. It is the most environmentally friendly mode of transportation. Cycling not only gets us in shape, but it also reduces our carbon footprint. There are numerous tools available on the market to help you prepare your bike. Bicycles are the primary mode of transportation in many parts of the world. Cycling is an efficient and effective mode of transportation for short to medium distances.[2]

Need of sustainable transportation:

In this section, we look at how sustainable ideas might improve the quality of life in society by addressing present needs without endangering the ability of future generations to do the same. Economic fairness, the environment, and social development—collectively known as the triple bottom line—must all be taken into account in order to promote a sustainable way of life. In terms of economics, the interconnected global systems that demand integrated actions to promote long-term solid growth while ensuring that no community falls behind are highlighted. In order to protect the environment, efforts must be directed toward the effective utilization of natural resources through practical, cost-effective measures that reduce resource consumption, pollution, and the destruction of natural habitats. Social development is associated with the provision of employment, food, energy, health services, education, water, and sanitation, as well as the protection of cultural and social diversity, labor rights, and the training of all members of society to participate in determining their own future. Sustainability in transportation typically refers to a community's contribution to the long-term development of a system that it owns and uses. Traditionally, transportation infrastructure development has been based on guidelines that minimized initial operation costs while emphasizing traffic mobility while taking social and environmental needs into account.[3]

Recent global worries about climate change, its effects on the environment, and the depletion of financial resources highlight the need for a new strategy in choosing transportation solutions. As a result, there is an increasing need for environmental sustainability in the transportation infrastructure system. A sustainable transportation system must be safe, healthy, accessible, and renewable, while also working fairly and limiting polluting gas emissions and the use of nonrenewable resources. The transportation sector is a driver of global economic development, so this debate is justified. It is emphasized that this theme is important to the public and private sectors, which must work together to develop and continuously improve the triple bottom line.[4]

Benefits of sustainable transportation:

Sustainable transportation helps to alleviate traffic congestion. It also aids in the reduction of air pollution and the avoidance of associated risks such as asthma. As a result of the use

of renewable energy, greenhouse gas emissions are greatly reduced. Countries and individuals who participate in sustainable transportation reduce their reliance on nonrenewable energy sources. As a result of all of this, transportation costs are reduced.[2]

Reduces environmental footprint

Cycling and walking are non-motorized modes of transportation that have almost no environmental impact. They emit no greenhouse gases, use no energy, and make no noise or pollution. Additionally, public transportation reduces the number of cars on the road, resulting in lower emissions per passenger mile than single-occupancy vehicles.[5]

Creates less congestion

Because there will be fewer private automobiles on the road, there will be fewer traffic bottlenecks. This means that even in congested metropolitan areas, people may be able to get where they need to go faster. With more open roads and areas, we can also better conserve our natural ecosystem.[6]

Saves Money

Taking the bus or train is less expensive than maintaining and purchasing gasoline for a private automobile. Cities can also save money on road and parking lot maintenance.

Improves People Health

People's health and well-being benefit from sustainable transportation. Cycling and walking are excellent ways to get some daily exercise while also maintaining a healthy lifestyle.[7]

Equity Goals

One of the most important aspects of sustainable transportation is its positive social impact. Public transportation and non-motorized transportation are accessible to people of all economic, social, and physical backgrounds.[8]

Features of sustainable transportation:

Socio& Economy

Transportation is the foundation of both the material and immaterial aspects of prosperity. Almost all human actions involve movement from one location to another across time and space. Transport systems that are efficient and effective are critical for the advancement of socioeconomic welfare. The so-called positive and negative external effects of transportation, which have received a lot of attention in the literature, play an extremely important role. The advantages of efficient transportation are visible in how markets operate more efficiently, improved access for consumers and businesses to a variety of goods and services.[4]

Environment:

Road vehicles accounted for roughly three-quarters of the 23% of global energy-related GHG emissions attributed to transportation systems in 2004, which are significant sources of greenhouse gas emissions. Currently, petroleum accounts for 95% of all transportation energy[1]. Automobile production and use, as well as the construction of transportation infrastructure such as highways, bridges, and railways, all necessitate the use of energy. Furthermore, exhaust fumes from motorized transportation contain particulates that are hazardous to human health and hasten climate change. Greater accessibility to public services, improved and easier commerce, and increased integration at various levels vices

in education, healthcare, and law enforcement. The allure and competitiveness of nations, cities, and regions, and so forth stating it Simply put, the more effective transportation networks are, the better the socioeconomic conditions. Because transportation is a necessary (but not sufficient) component of growth and quality of life. Furthermore, the transportation industry employs many people and is a global trader and investor that directly and significantly supports[9]

Green Vehicles:

When examining a vehicle's environmental impact over the course of its entire life cycle, green vehicles may not have a lower environmental impact than conventional vehicles. Depending on the embodied energy of the vehicle and the source of power, electric vehicle technology has the potential to reduce transportation CO₂ emissions. Transportation is at the heart of many economic and social development challenges because it accounts for more than 64% of global oil consumption, 27% of total energy consumption, and 23% of global energy-related carbon dioxide emissions. Making structural improvements to public transportation in the post-COVID period would go a long way toward preserving some of the beneficial effects of pandemic-fighting measures on emission levels and air quality[1].

A road motor vehicle classified as "green" or "environmentally friendly" has less of an impact on the environment than a comparable conventional internal combustion engine car that uses gasoline or diesel. These include hybrid electric vehicles, plug-in hybrid electric vehicles, battery electric vehicles, compressed air vehicles, hydrogen and fuel cell vehicles, neat ethanol vehicles, flexible fuel vehicles, natural gas vehicles, clean diesel vehicles, and vehicles that use a blend of biodiesel and ethanol fuel, also known as gasohol. Green vehicles are propelled by alternative fuels and advanced vehicle technologies. Several authors include traditional motor vehicles with high fuel economy because they believe that increasing fuel economy is the most cost-effective way to improve energy efficiency and reduce carbon emissions in the transportation sector in the short run. Environmentally friendly vehicles contribute to sustainable transportation by reducing air pollution and greenhouse gas emissions, as well as contributing to energy independence by reducing oil imports[1]

Conversion of conventional vehicles into Green vehicles:

Green vehicles can be converted from conventional vehicles. By incorporating renewable fuels or using less carbon-intensive fossil fuels, a conventional vehicle can be transformed into a greener vehicle. Typical gasoline-powered vehicles can handle up to 10% ethanol. Brazil produced cars that ran on neat ethanol, but they were discontinued. Another option is a flexible-fuel vehicle, which can run on any combination of gasoline and ethanol, up to 85% in North America and Europe and 100% in Brazil. Another possibility is to modify a traditional gasoline-powered car so that it can run on compressed natural gas (CNG). The countries of Pakistan, Argentina, Brazil, Iran, India, Italy, and China have the greatest natural gas car fleets worldwide. Although biodiesel is a powerful solvent and can occasionally harm rubber seals in vehicles manufactured before 1994, it is frequently possible to convert diesel-powered vehicles entirely to biodiesel. However, more often than not, biodiesel causes problems simply because it removes all of the built-up residue in an engine, clogging filters unless proper precautions are taken when switching from dirty fossil-fuel derived diesel to biodiesel. It is very effective at 'de-coking' and cleaning the combustion chambers of diesel engines. Biodiesel is the most environmentally friendly diesel fuel available. Diesel engines are the most efficient internal combustion engines used in automobiles. Biodiesel is the only fuel permitted in some North American national

parks because spills biodegrade completely within 21 days. Vehicles powered by biodiesel and vegetable oil are the most environmentally friendly[1].

Conclusion:

When the benefits of using sustainable transportation methods were examined, it was discovered that there is agreement in the research analysis about the approach taken to reduce pollution of pollutant gases in the atmosphere such as CO₂. Beyond this is the improvement in urban mobility conditions and the benefits generated in the performance of companies that value the use of sustainable practices. The high cost of usability, on the other hand, the significance of environmentally friendly transportation methods is emphasized, as is population culture in relation to non-use and identification of the significance in the application of those methods, which has significantly improved over the years. Finally, it is believed that more research should be conducted with the goal of developing and improving sustainable transportation methods, including an analysis of their definition, importance, new practices, and the awareness of all involved, while taking into account the social, environmental, and economic benefits, in order to meet current demand without jeopardizing future necessities.

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