Key role of transport sector to Sustainable development

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Abstract

The Brundtland Commission in 1992 put the definition of Sustainable Development as "*development that meets the needs of the present without compromising the ability of the future generations to meet their own needs*". Some efforts have been made through nations, such as CO_2 reduction as called for in the Kyoto Protocol. Today, sustainability has been paid a lot of attentions in different sectors, for instance, industry, transportation, residential, commercial, but in my opinion, transport sector needs to be concerned the most. As can be clearly seen in the figure 1 below, the CO_2 emission in transportation has been increasing rapidly and continuously to become the highest in 2010 by nearly 2000 million metric tons of CO_2, compared with 1600, 1200, 900 million metric tons contributed by industry, residential, and commercial sector, respectively. The problem seems to be very dangerous as what the figure has shown us. The increase of CO_2 emission in transport sector has been rising gradually and seemed not to stop, meanwhile, that number of industrial sector decreased, though, CO_2 produced in this sector made the biggest share in 1970s and 1980s. Some measurements for increasing transportation sustainability has been given, for example, demand management, operations management, pricing policies, vehicle technology improvements, clean fuels, and integrated land use, and transportation planning. Actually, these strategies have not shown their effectiveness due to complexities of the underlying issues along with too many uncertainties. It now requires for more effective and efficient actions leaded by regional planners, governments and residents who play the most important role in improving the quality of life sustainably. This paper will include summary of the present situation and then be about to conclude some more solutions which can be applied among students to improve the situation.

Keywords: sustainable development, environment, economy, society, students.

1. Introduction and Overview

Today, sustainable development is viewed as the development that improves the standard of living and quality of life, together with protecting and enhancing the natural environment and honoring local culture and history. People need a healthy transportation to circulate goods, freights; moreover, that transportation should play a role in protecting environment, and help to maintain cultural values. The transport sector should play an important role in keeping development patterns under sustainability. In this context, sustainable transportation is seen as transportation that meets the mobility needs while also preserving and enhancing human and ecosystem health, economic progress now and for the future.

Most of the time, the role of transportation to sustainable development is understood as cutting down as much of CO_2 emission as possible; however, as far as it is analyzed, sustainable transportation actually is a much broader concept having economic, social, and environmental impacts. These impacts seem to be separated in the first look but they have mutual relationship, and back affect the transportation

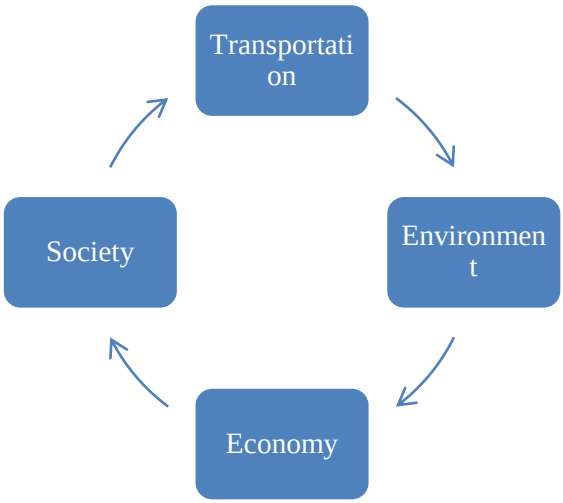


Figure1.Sustainable transportation's dimensions

This paper is trying to analyze shortly the three impacts of transportation on economy, society, and environment, and relationships between them. Besides that, some strategies which can be applied to improve the situation also are mentioned. Finally, this paper would like to propose some solutions which hopefully can be done by the students in the current context; some of them might have been in action but the need of multiplying them is really necessary and benefit to the processing of living sustainable.

2. The environmental impact of transportation

The environmental impacts of transport activities have always been paid a lot of attentions by not only the governors but also the inhabitants; despite of lacking professional knowledge, people are still able to identify influence of transportation on our environment. Aligning with the development of transport sector is the increasing of warning level of environmental problems, such as: climate change, air quality, noise pollution, water quality, soil quality, biodiversity,land take, and energy consumption.

- **Climate change:** The activities of manually transport industry release several million tons of gas into the atmosphere. These include lead (Pb), carbon monoxide (CO), carbon dioxide (CO_2); not a pollutant), methane (CH_4), nitrogen oxides (NOx), nitrous oxide (N_2O), chlorofluorocarbons (CFCs), perfluorocarbons (PFCs), silicon tetraflouride (SF_6), benzene and volatile components (BTX), heavy metals (zinc, chrome, cooper, cadmium) and particular matters (ash, dust). Some of these gases, for instance, CFC, particularly nitrous oxide are the main agents to deplete the stratospheric ozone (O_3) layer which naturally screens the earth's surface from ultraviolet radiation. We all know how importance is the stratospheric ozone is to the existence of people on the planet as well as transport infrastructure. For example, if the sea level rises by 2 meters, the whole Mekong Delta of Vietnam will be immersed under water, this definitely requires higher road elevation and much soil treatment works, and probably leads to the need of new mode of transport, like anational sea transport system where capital investment and technology really are challenging.
- **Noise:** Noise represents the general effect of irregular and chaotic sounds. Transportation is a major contributor of noise pollution, especially in urban areas. It is generated during both constructions (constructing driven piles), and operation (taking off or landing of an aircraft …). Long term exposure to noise levels above 75 dB seriously hampers hearing and affects

human physical and psychological wellbeing.

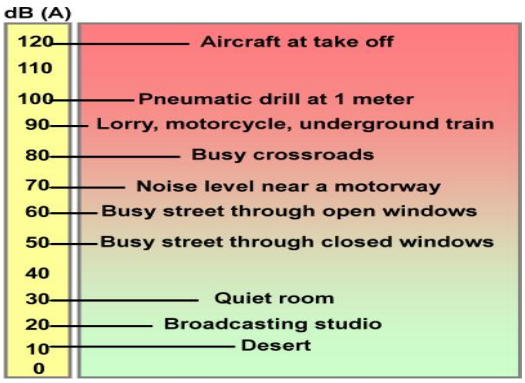
- 

Figure2. Noise levels from different sources

Source: adapted from R. Tolley and B. Turton (1995) *Transport Systems, Policy and Planning: A Geographical Approach*, Burnt Mill, Harlow Essex: Longman Scientific & Technical, p. 279.

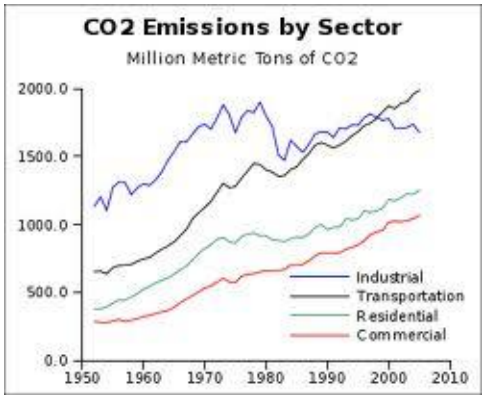
- **Air quality:** Highway vehicles, marine engines, locomotives and aircraft are the sources of pollution in the form of gas and particulate matters emissions that affects air quality causing damage to the health.
- 

Figure1. CO_2 emission by sector
Source:
http://vort.org/2007/12/

As can be clearly seen in the figure 1, the CO_2 emission in transportation has been increasing rapidly and continuously to become the highest in 2010 by nearly 2000 million metric tons of CO_2, compared with 1600, 1200, 900 million metric tons contributed by industry, residential, and commercial sector, respectively. The problem seems to be very dangerous as what the figure has shown us. The growth of CO_2 emission in transport sector has been rising gradually and seemed not to stoppable, meanwhile, that number of industrial sector decreased, though, CO_2 produced in this sector made the biggest share in 1970s and 1980s. The emissions of sulphur dioxide (SO_2), and nitrogen oxides (NOx) in the atmosphere form various acidic compounds that when mixed in cloud water creates acid rain. Acid precipitation has detrimental effects on the built environment, reduces agricultural crop yields and cause forest decline. Particulate emissions in the form of dust emanating from vehicle exhaust as well as from non-exhaust sources such as vehicle and road abrasion have an impact on air quality.

- **Water quality:** As the demand for shipping services is increasing these days, marine transport emissions represent the most important segment of water quality inventory of the transport sector. The main effects of marine transport operations on water quality predominantly arise from dredging, waste, ballast water and oil spills.
- **Soil quality:** The environmental impact of transportation on soil consists of soil erosion and soil contamination. For example, once a bridge is built up, it directly reduces downstreamarea, at the same time; this increases the speed of the water which leads to the soil erosion at river banks and damages the bridge as well. Soil contamination can occur through the use of toxic materials by transport industry. Fuel and oil spills from motor vehicles are washed on road sides and enter the soil. Chemical

used for the preservation of railroad ties may enter into the soil. Hazardous materials and heavy metals have been found in areas contiguous to railroads, ports, and airports.

- **Biodiversity:** Transportation also influences natural vegetation. Firstly, the need for construction materials and the development of land-based transportation has led to deforestation. Many animal species are becoming extinct as a result of changes in their natural habitats and reduction of ranges.
- **Energy consumption:** The ramping growth in industrial and economic growth during the past century has been closely related to an abundant supply of inexpensive energy from fossil fuels. Transport sector is supposed to consume more than half of the petroleum products. As known, fossil fuels are un-renewable materials, the high consumption of them lead to the leakage fuels in the short future, further, exploitation of fossil fuels probably harms the environment a lot.
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3. The economic impact of transportation

Transport sector itself does not make profits, but it is a motivation of economic growth. In the President's Technology for America Economic Growth, A New Direction to Build Economic Strength, it is noted that "*a competitive, growing economy requires a transportation system that can move people, goods, and services quickly and efficiently*".The economic importance of the transportation industry can be assessed from a macroeconomic and microeconomic perspective:

- **Macroeconomic level:** transportation and the mobility it confers are linked to a level of output, employment and income within a national economy. In many developed countries, transportation accounts between 6% and 12% of the GDP
- **Microeconomic level:** transportation is linked to producer, consumer, and production costs. The importance of specific transport activities and infrastructure can be assessed for each sector of the economy. Transportation accounts on average between 10% and 15% of householdexpenditures while it accounts around 4% of the costs of each unit of output in manufacturing, but this figure varies greatly according to sub sectors.

Below are 2 figures showing how transportation impacts on the economic growth.

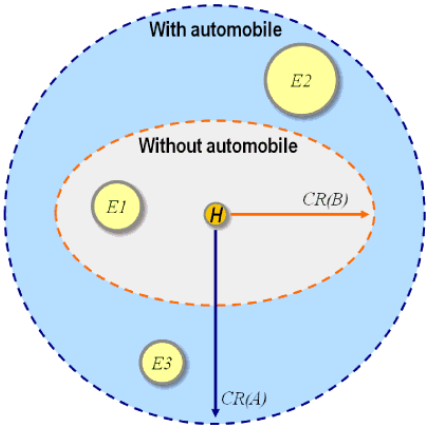

Figure3. Economic opportunities according to automobile ownership

Source: http://people.hofstra.edu/geotrans/eng/ch7en/conc7en/mobilitygap.html

An individual having access to a car (CR(A)) has a more significant commuting range than an individual without a car (CR(B)). When an individual located at point H can have access to employment zones E1, E2, and E3, while an individual without a car can only access employment zone E1. In this case, CR(A) has larger economic opportunities and the mobility gap is simply CR(A)-CR(B). At higher

level, countries having a transport network which can move people, goods, and services quickly, reliably always have a good chance to attract FDI. One more example has been proved since the first days of human beings. At that time, transport system was not developed, ancient cities always located by the river, which makes trading activities easier.

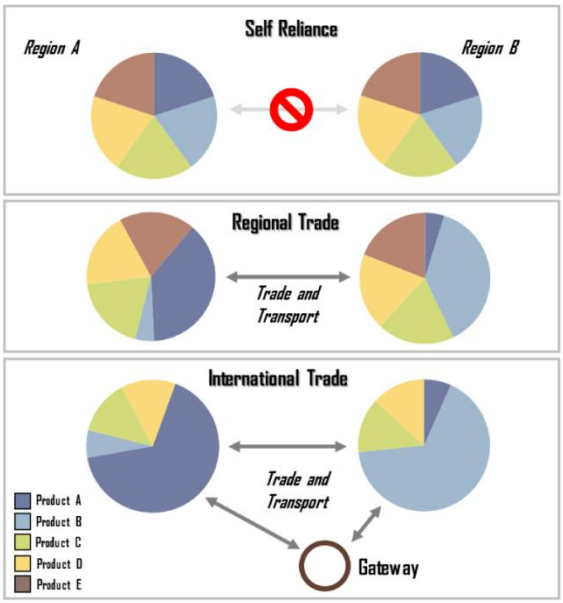

Figure4. Trade, Transportation and Geographic Specialization
Source: Adapted from: E. J., Gauthier H. L. and M. E. O'Kelly (1996) *Geography of Transportation*.

The evolution of transport systems impacts the trading activities between regional economies. Before the appearance of transport, they are isolated from one another and must satisfy their own needs. The problem was region A has a potential as well as material to produce product A, region B can produce a lot more product B, but without transportation link they have to produce the product which is on not their strength. It is the constraint of regional economic growth. Regional specialization is greatly expanded with international trade. Even though, the cost of transportation increases, but the relative cost of product may be declining.

4. The social impact of transportation

Social impact of transportation is the last one mentioned about the influence of transport sector towards sustainable development. Besides environmental impacts written in Section 2 which can directly affect individuals of society, transport sector is expected to play a role in forming settlements and reducing number of fatalities each year in order to achieve sustainable society. This section is going to present the social impacts of transportation at the moment through the 2 problems mentioned above.

From the beginning of civilization, the man is living in settlements which located near banks of major junctions, a port. A lot of great empires have been witnessed to be by the side of big rivers in the world, for example, Egyptian was of the biggest and the most famous ancient civilizations locating by side of Nile River, one of the greatest river in the world of all time. The development of transportation systems does impact on the formation of settlements not only at the beginning but also at the moment. Normally, places which transportation systems are modern having a good chance to attract the investment, as the result, be able to form big settlements. Nowadays, a lot of cities in the world developed as a circular city with radial routes. The development of transportation is expected to increase the size and pattern of cities. For example, people living far from the city centers but they have to work in the city centers and travelling time is quite long, then they have to choose to stay in the city centers which leads to many negative effects, such as the overloading of city centers, but the vicinity areas are absolutely empty. Further, it impacts on the management of social problems: controlling crimes, solving housing demand, etc.

There is attracting the concerns of the whole world, the number of fatalities caused by transportation activities annually. Whenever an event causes about more than 200 deaths, it is considered to be a disaster, but about 14000 people killed from transport accidents a year in Vietnam in particular, and that number does not change through years. Transportation fatalities should be considered to be a man-made catastrophe.

5. The interrelationship of transportation's impacts.

Although a transportation plan can tackle one aspect of sustainable development successfully, satisfying the three dimensions of sustainability in one action seems to be very much challenging and impossible. The interrelationship between environmental, economic and social impacts of transportation makes the sustainability of transport systems so much difficult. For example, a plan is given to reduce the carbon dioxides discharged into the air by the transport sector, say 20% of carbon dioxides emission by 2050. Governments make effort in encouraging residents to replace private vehicles with biking, walking, or public transportation, constraining unnecessary and long moving of goods by changing in locating of industrial zones for example. Such efforts absolutely make the plan of cutting down gas and greenhouse emission in the short-run possible; the 2050 target is pretty attainable. The fact is not as simple as what it is supposed to be. A small change like that can affect the whole society not only in short term but also in long term. Socially, transforming from private vehicles to public transportation alters the long-run habits of people. People have to get the bus stop at the right time; otherwise they might miss the bus. However, punctuality of such public vehicles is not secured at the moment, so the debate about whether present public transportation system can satisfy the need of people is ongoing. Further, services quality and safety of passengers on bus still are unanswered questions. On the aspect of economic impacts, things get more complex. Whether the changes in habits of employees can affect the effectiveness in working, how relocating industrial zones impacts on the supply of goods. Relocating industrial zones may have alternations in rebuild or reinvest transportation infrastructure, whether it brings advantages to the economy.

The uncertainties ofabove ideas are real and major challenges for planners. It is easy to give some prediction about the impact of a plan, but there is no official and qualified study or figures about the effects of the alternation. Everything is now on papers, for example, will the investment on transportation infrastructures will include more benefits than drawbacks in the long term because sustainable is the long-term target.

In conclusion, efforts should be made carefully and slowly as this problem is not easy. Before making any transportation changes, it has to be considered on both dimensions: environment, economy and society. More importantly, after a short time of applying, transportation regulatory need to be revised and improved in order to accomplish its expectation.

6. Strategies for Sustainable Transportation to achieve Sustainable Development.

There are 3 groups of strategies which have been suggested to improve the situation and head for a sustainable development. They are vehicles changes, guide ways and operations improvements, demand management, and land use and urban development.

- **Vehicles changes:**improved efficiency of conventional vehiclesproduce new technologies which are environmentally friendly (new vehicles, new fuels)

- **Road/operations improvements:** traffic signal timing, intelligent transportation systems, driver education
- **Demand management:** modal substitution, pricing incentives and disincentives, developing a good public transport system
- **Urban development:** compact development.

The first group, vehicles management, aims to improve the performance of current convention vehicles in order to reduce emission of pollutants and greenhouse gases in short run.

In the long-term vision, a lot of efforts have been given to introduce to the world new technologies and new fuels, which could lead to safer, cleaner vehicles. People currently hear a lot about electric cars which discharge no carbon dioxide to the environment, or biofuel that uses energy from carbon fixation.

The second category is roadways and vehicle operations. Conventional traffic flow improvements such as traffic signal timing have the potential to cut energy use. In addition, small changes in red time also have impacts on improving the attitude of drivers, which could lead to the reduction of number of fatalities. Driver education should be paid a lot of attention as the drivers are people directly influence on how effectiveness such strategies can be. Drivers training is hoped to result in minimizing sudden accelerations and decelerations and to be mindful of the fuel consequences of high speed.

Demand management category tries to improve the sustainability of transport systems. Governors try to call for replacing of car trips with transit, public vehicles, biking or even walking for a short distance. This can be accomplished by providing better modal options, for instance, improving the service quality, accessibility of buses that can attract more and more potential users like students, elders, disable. Pricing incentives and disincentives could be used in the short term to reduce demand and encourage the use of alternative modes. Governments could raise the fee of owning a car or the fuels, at the same time, propose reasonable prices of using buses.

Land use and urban development strategies alter demand by reducing trip length (by providing a choice of close-by destinations) or by making alternatives to the auto more competitive and cost-effective. For example, try to plan a region which having close distance from work sites to the residential area, that reduces time travel, emission and encourage another modes of transport replacing private vehicles.

7. Proposal solutions applied to students.

Students make a big share of population participating transport activities daily and also accounting 40% of public transport users, but this number can be higher. Further, students are supposed to be the future of the world and to take the leadership soon in sustainable development. The most important thing is to educating them about the sustainable development in general and sustainable transportation in particular for those whose major related to transportation. The fact is that not so many students studying in universities have a chance to be contiguous with the ideas of what sustainable development is. This is so serious, students will take the leadership in keeping developing patterns under sustainability but they don't know the definition of sustainability that really defends them from continuing what the previous generation has done. In addition, the ability of transferring information of students to others is really massive making the propaganda works effectively.

Encouraging students to use biking, walking or public transport should be paid a lot more attention. Although, more than a half of student using buses this number does not meet

the expectation. In order to achieve the objectives, students need to be given strong tools by providing accommodation located near their campus, the priority prices when using bus, etc.

There is a very intelligent action which has been applied in Hanoi at the moments, not only the student can participate but also everyone can. A society contacts with the restaurants, cinemas, entertainments… and requires them to give pricing incentives for those who go to these places by bikes. This action should be multiplied, and made media that not only a small group of people can know but everyone. Biking makes cleaner transportation systems, reduce fatalities… If anyone wants to learn more about this amazing activity that is being carried out in Hanoi, you can go to this address and find more information.

https://www.facebook.com/YouCycleYouSave

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