Subsidies and Consumer Environmental Awareness: A Systematic Review of Aspects and Impacts

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Abstract - **Supply-side fiscal policy holds that the growth of the country is stimulated through fiscal expansion designed to foster increased production. Subsidies given by the government to producers save many essential industries from higher cost of production thus encouraging them to increase supply of goods and services. On the other hand, subsidies provided to the public have benefitted them from paying higher prices for consumer products thus enhancing their welfare. However, these subsidies and incentives may promote overproduction and encourage overconsumption since cost of production becomes much cheaper after being subsidized. This has consequences on the consumer environmental awareness (CEA) as excessive use of certain products e.g. fuel, may result in environmental pollution. Using a systematic literature review, we explore subsidy and environmental awareness among consumers. We focus on environmental awareness as an interesting issue to bring forward in this research and our study contributes to the existing literature. The results of our study imply that the provision of subsidies on fuels resulted in excessive use of self-transport which has an impact on climate change. However, in other cases, green subsidies do benefit society in general. High environmental awareness can be decisive in influencing green purchasing behaviour, resulting in high demand for green products.**

Keywords -   *Fuel Subsidy, Green Subsidy, Consumer Environmental Awareness, Climate Change, Systematic Literature Review*

I. Introduction

The transportation sector is seen as a critical enabler of the country's economic growth and development. The rapid growth of road transportation has aided in socio-economic benefits and widespread development of both

urban and rural areas. Consequently, increase in carbon emissions and greenhouse gas (GHG) emissions have resulted from the exponential increase in the number of automobiles on the road. Emissions have a variety of effects on environment and health, comprising of (1) direct impacts, which cause direct harm such as noise; (2) indirect impacts, which are a result of direct impacts, such as health and lung problems; and (3) cumulative impacts, which are a combination of both direct and indirect effects that are often unpredictable, such as climate change (Rodrigue, 2020).

The increase in the number of vehicles in urban road transport around the world results in increased CO_2 emissions and has an adverse impact on the environment. There are different structures of subsidy applied by countries across the world, namely fuel subsidy, green subsidy, energy subsidy, export subsidy, and employment subsidy which are all unique in their impacts. Many countries allocate their fiscal expenditure on fuel subsidy to help reduce the consumers' burden of high fuel prices and to look after their general welfare. Even though fuel subsidies improve the welfare of the society with the benefits of lower fuel prices and lesser production costs, the distribution of fuel subsidies may encourage wasteful consumption of fuel which can increase energy costs and in turn lower the chances to adopt and invest in fuel-efficient vehicles such as electric cars (Asare et al., 2020; Coady et al., 2017; Rentschler & Bazilian, 2017). The provision of fuel subsidies harms the environment and imposes huge environmental degradation with the increase in CO_2 that accelerates climate change impact.

Coady et al., (2017); Rentschler & Bazilian, (2017) found that fuel subsidy in general creates barriers to clean energy investment, which in turn leads to local pollution that is exacerbated due to increased CO_2 emissions. This was supported by the study of Ramli, Kadir, Ismail, Othman, and Melo (2021) that highlighted that the fossil fuel subsidy contributes to excessive usage of petrol, which then impacts climate change and GHG mitigation. This is in line with Sasana et al., (2017) who also found that fuel subsidy will encourage consumers to utilize their vehicles more, thus leading to increased carbon emission over time. Therefore, fuel subsidy is an important issue that has been debated and needs to be defined carefully because the increased allocations provided indirectly contribute to more CO_2 emission and climate change (Ariyanti, 2017).

Therefore, the reforming of fuel subsidy will benefit society and help to reduce pollution and improve human health. High emissions in recent years have attracted much needed attention to the need to limit global warming since the 2015 Paris Agreement was signed. Moreover, the Low Carbon Mobility Blueprint 2021-2030 was introduced by the Ministry of Environment and Water to assess the best options in energy and GHG mitigation planning in the transport sector. The target is to reduce energy supply and consumption, fuel expenditure savings and GHG reduction. It is in line with The National Automotive Policy 2020 to manage sustainable mobility. On the other hand, the government has also increased their expenditure on green subsidy which is important in current times and increasingly implemented by many countries. For instance, this has initiated China to provide subsidies of up to 60 percent for their green investment projects in the Yangtze River Economic Belt, spearheading an anti-pollution drive.

The issue of road transport emissions has received a lot of attention from the government, industries, academics, and the general public. People have recognized the necessity of environmental awareness as one strategy to alleviate the sector's detrimental consequences due to the huge effects of road transport emissions (Fu et al., 2020). According to Bai, Sze, Liu, and Haggart (2020), the mode of transportation chosen will be determined by the individual's level of awareness. Environmental awareness is made up of four elements: environmental concern, environmental attitude, environmental knowledge, and behavioural intention. Based on that, people with high environmental awareness feel obligated to conserve the environment. Introducing green subsidies, renewable energy subsidies and reforming fuel subsidies can be used to develop low carbon societies and low carbon economies for the near future.

Therefore, this study aims to explore subsidy and environmental awareness among users. Subsidy distribution and environmental awareness will be highlighted in this study using systematic literature review (SLR). Studies on subsidies are numerous; however, the objectives of this study are focused specifically on a combination between 2 large concepts of subsidies and CEA, which brings little interest to look ahead because of the environmental impacts posed.

II. Theoretical framework

The supply-side fiscal theory holds that the growth economy is stimulated through fiscal policy expansion such as cutting taxes, imposing subsidies and deregulating industries designed to increased production in the market. On the other hand, these incentives promote overproduction and encourage overconsumption since the cost of production is cheaper after being subsidized. This has consequences on the CEA as excessive use of a product causes environmental pollution. For instance, the use of fuel may harm the environment when people use more road transportation. In addition, the usage of more consumer products may also harm the environment as

more packaging from the products such as plastic and undegradable materials are produced which takes time to decompose. The sustainable green and eco-friendly products are becoming relevant in current times when the economy is moving towards a low carbon society which is necessary to reduce the effect of GHG emissions towards environment and health. This has influenced public's awareness to opt for the green and environmental products.

III. Methodology and Sample Identification

The SLR adopts a transparent reporting of Systematic Reviews and Meta-Analyses known as Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) which is used to search, filter, select, and analyze the research question of the article. Scopus and Web of Science are used as a database for searching relevant literature required for the study. One research objective was identified which is exploring fuel subsidy and environmental awareness among the public. A thorough identification was done to find key terms including 'fuel subsid*' and 'environmental awareness', nevertheless only 23 related articles were found indicating a very limited topic area where the majority focused on subsidy reform.

Therefore, we broadened the definition of subsidy by not only concentrating on fuel subsidy or fossil fuel subsidy, whereby other types of subsidies, i.e., green subsidy, low-carbon subsidy, end-of-life vehicles subsidy, and electric vehicles subsidy are acceptable and included in the study. In response to the above matter, the new key terms have been used to get a larger number of articles to fulfill the research objective. It then includes 'subsid*' and 'environmental awareness', which implies all articles discussed on any issue related to green subsidies and environmental awareness are considered. The search was conducted on 29 September 2021 and gained a total of 47 manuscripts. Interestingly, the topic of fuel subsidy that we had searched for previously is included among them.
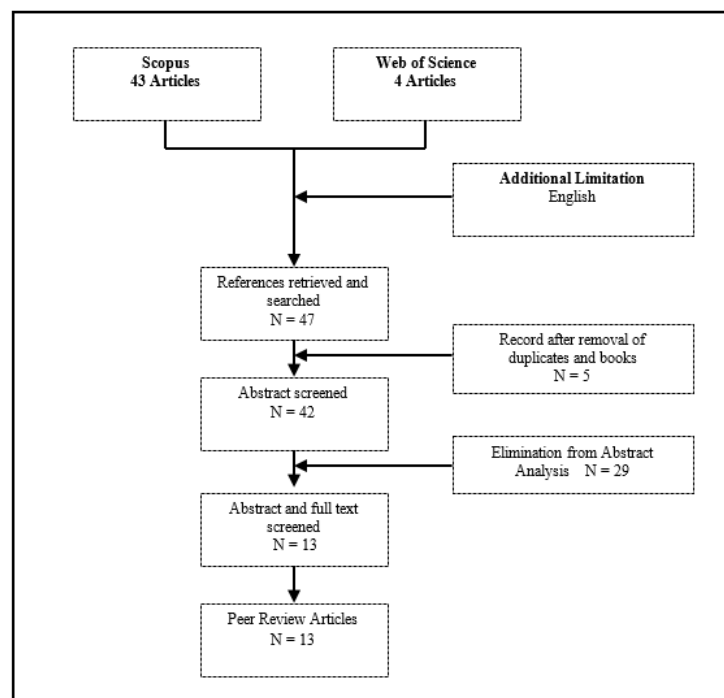

Figure 1: Flow Diagram of the Research

For the screening process, it was done by excluding all 4 duplicate articles and 1 source from a book, which then left 42 articles for abstract analysis. In the abstract analysis process, all of them were screened accordingly for eligibility. The sources used are either journal articles or proceeding papers, while sources from books are not included. Articles must be published in English from 2009 to 2021. As stated earlier, the literature review focuses on the study related to subsidy and environmental awareness. Therefore, any papers that are out of the scope will be eliminated. The elimination papers for instance emphasize farmland, household energy consumption, and agricultural and green supply chain system. Of these, 29 articles were excluded from the analyses, leaving 13 publications for the SLR review process.

All empirical research is synthesized through thematic analysis, which is useful in identifying, analyzing, organizing, describing, and reporting themes. This qualitative data produces trustworthy and insightful findings (Nowell, Norris, White, & Moules, 2017). Hence, identifying the main themes or patterns of these 13 articles is interesting to ensure that it is in line with green subsidies and environmental awareness even though fuel subsidy itself is not applied.

IV. Findings

The literature related to the fuel subsidy and environmental awareness appears to be extremely limited. The study has applied all types of subsidies - which specifically focuses on green subsidies (i.e., electric vehicles subsidy, low-carbon subsidy, and end-of-life vehicle subsidy) to fulfill the research goal. Table 1 provides a list of articles obtained from the screening and elimination processes. From the table, it shows that all 13 articles discuss our main issues, subsidies and environmental awareness, while only 6 articles concentrated on the relationship between them.

Table 1. Peer Review Articles
Source: Authors' Compilation

No	Authors	Geographic Region	Method	Subsidy	Environmental Awareness	Existing Relationships	Distinctive Features
1	Austmann, L.M., Vigne, S.A. (2021)	27 member states of the European Union	Quantitative	√	√	-	Electric vehicle
2	Zhou, Z., Hu, F., Xiao, D. (2020)	China	Quantitative	√	√	√	Low carbon Products (green)
3	Wan, Z., Liu, J., Zhang, J. (2020)	China	Quantitative	√	√	√	End-of-life vehicles
4	Zhang, X., Tao, Z. (2020)	China	Quantitative	√	√	-	Optimal pricing and carbon emission strategies
5	Liu, N., Zhang, L. (2020)	-	Quantitative	√	√	-	Green Product Design
6	Ouyang, J., Fu, J. (2020)	-	Quantitative	√	√	-	Optimal strategies for improving energy efficiency
7	He, D., Deng, X. (2020)	China	Quantitative	√	√	-	Price Competition and Product Differentiation, Green products
8	Xu, L., Prybutok, V., Blankson, C. (2019)	Texas, USA	Quantitative	√	√	-	Intention to purchase environmentally friendly cars
9	Bo, Y., Wang, Y., Wan, Z. (2019)	China	Quantitative	√	√	√	Waste electrical and electronic equipment (WEEE)
10	Lian, X., Gong, Q., Wang, L.F.S. (2018)	-	Quantitative	√	√	√	Ex-post and ex-ante Tax policy in oligopoly market
11	Zhang, L., Zhang, J. (2017)	China	Quantitative	√	√	√	Green products

12	**Yu, Y., Han, X., Hu, G. (2016)**	**China**	**Quantitative**	√	√	√	**Green products**
13	Zhang, L., Wang, J., You, J. (2015)	-	Quantitative	√	√	-	Environmental (green) and traditional products

Considering subsidies and environmental awareness that have been the focus of this article, it brings the findings to some conclusions. The study reveals that 3 themes can be developed, the first theme is eco-friendly vehicles (Austmann, Vigne (2021); Wan, Liu, Zhang (2020); Xu, Prybutok, Blankson (2019)); the second theme is green products (Zhou, Hu, Xiao (2020); Liu, Zhang (2020); He, Deng (2020); Zhang, Zhang (2017); Yu, Han, Hu (2016); Zhang, Wang, You (2015)); and the last theme is related to various aspects of the study which mainly discuss the measurement of optimal price and optimal tax, energy efficiency, and waste electrical and electronic equipment (WEEE).

It demonstrated that publications focusing on the topic related to subsidies and environmental awareness can be included in the first theme - a study involving electric vehicles or environmentally friendly cars. Moreover, topics related to green products revealed to be the largest number of publications were categorized under the second theme. The research also found that most of the papers discussed the issue of mechanisms i.e. subsidy mechanisms adopted by manufacturers, optimal pricing, optimal tax strategies, and some particular policies undertaken which have been covered in the third theme. The framework of study then can be developed as in Figure 2.
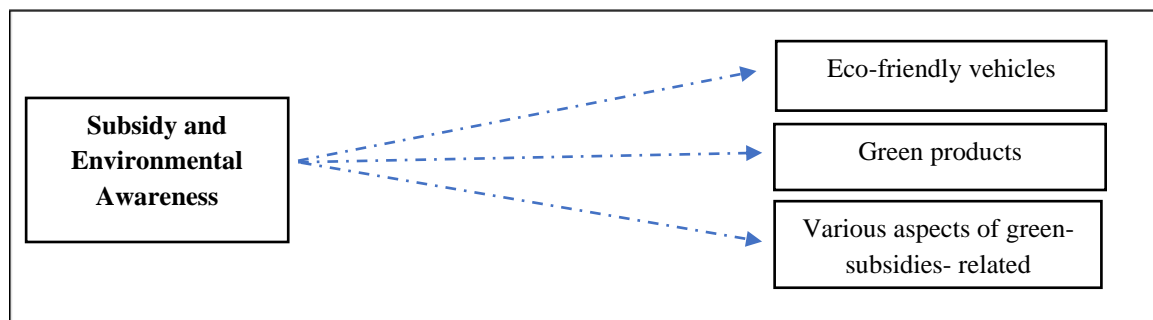

Figure 2: Framework of the Research

Based on the year of publication, research on subsidies and environmental awareness has the highest number of publications in the year 2020, with six articles published. It also shows that the growth of publication activities on this subject is from 2019 to 2020 and it seems the topic gained increased interest among scholars. The data pertaining to the topic is only available from 2015. In addition, for the geographical distribution, it is found that the most active country is China, followed by the United States and then the European Union. As presented in Table 1, the only method of analysis used for these publications is quantitative research analysis.

V. Discussion

According to the International Energy Agency, CO_2 emission is predicted to increase by 41% by 2030 with transportation having a share of about 32% of rising CO_2 and about 27% in the total production of greenhouse gases (Van Fan et al., 2018). The lower resources costs have contributed more usage of fuel and caused congestion that leads to GHG which is the primary driver of global warming. Given the importance of the environment and its deterioration, attention should be directed to the environmental considerations (Bristow et al., 2008 and Aminzadegan et al., 2022).

The importance of renewable energy subsidies and green subsidies has been given much attention by the world and highlighted as a global need to save the environment which has seen more destruction. The government allocates subsidies for environmental protection, such as subsidizing electric vehicles as mentioned by Austmann & Vigne, (2021) or subsidizing end-of-life vehicles (Wan et al., 2020).

Xu et al., (2019) believe that the intention to buy an eco-friendly car is based on environmental awareness and influenced by the level of knowledge they have. Moreover, they found environmental attitudes have a significant effect on purchase intentions namely environmentally friendly cars. In China, it is recognized that people who have purchased battery-powered electric vehicles have a strong awareness of environmental protection (Wei et al., 2020). Nevertheless, Austmann & Vigne (2021) found that consumer environmental awareness did not significantly influence the purchase of electric vehicles. Although people with elevated levels of environmental awareness have a high interest in electric vehicles, they have a low environmental awareness rather than a demand for electric cars. This is influenced by other factors. Moreover, it shows other variables, such as subsidies for electric vehicles, appear to have a considerable influence on its market.

A growing number of motor vehicles may result in a huge number of end-of-life vehicles in the future that has been considered to help mitigate carbon emissions and develop a sustainable circular economy. Wan, Liu, and Zhang (2020) indicated that the level of environmental awareness among citizens will affect the total subsidy invested by the government for end-of-life vehicles. It is suggested that as government subsidies for end-of-life vehicles increase, the number of recycled end-of-life vehicles increases significantly. They also stressed that when there is a high environmental awareness, the government should not incur higher spending on green subsidies.

In terms of green products, a study shows that subsidizing green products, in general, would help to increase the intention to purchase green products. A high level of green products will emit fewer emissions, though, the cost of production is high, and the products are more expensive. However, consumers with high environmentally conscious levels are willing to pay higher prices for more eco-friendly products. On top of that, subsidizing green products increases social welfare, and increases firms' profits as portrayed by Zhang & Zhang (2017). Accordingly, the green subsidy allocation to a consumer is beneficial to some extent when there is a small number of potential green consumers with high environmental technology. In contrast, when the number of potential green consumers increase, the subsidy should shift to the manufacturers. In other words, subsidizing the manufacturer would be more relevant and useful when consumer environmental awareness is very high. Other analysis does show that when environmental awareness is high, the optimal low-carbon subsidy rate might tend to decrease (Zhou et al., 2020).

Concerns over environmental degradation have raised more intentions among the people to opt for green and environmentally friendly products affected by recent climate change. He & Deng, (2020); Ahmad et al. (2020); Zhang & Zhang, (2017) emphasized consumer environmental awareness, which is found to be an important determinant in influencing green purchasing behavior, leading them to demand for more green products. Higher environmental awareness can be contributed by underlying factors such as environmental attitudes, subjective norms, and perceived behavioral control, as discussed extensively in the theory of planned behavior.

On the other hand, there are numerous issues discussed in the last theme. A study by Bo et al. (2019) found that subsidies can reduce the costs involved in recycling systems. It shows that greater subsidized investment makes the collection of WEEE waste greater and the profitability of recycling companies improves. Therefore, the government's role is very important (Yusoff & Asmuni, 2021) to minimize transport costs and other recycling costs for social and environmental benefits by providing incentives as subsidies to the WEEE market. In another case, Lian et al. (2018) found that emission taxes or subsidies imposed by the government are important in changing personal awareness of environmental protection. The study also found that a higher subsidy will increase their willingness to pay (WTP) against the damage that occurs in the purchasing environment of the goods. In addition, Ouyang et al. (2020) found that CEA always has a positive effect on energy efficiency. This is also in line with the study by Zhang et al. (2020) who stated that manufacturers have flexibility and have the right of decision to choose quality eco products to save the environment when they get support from the market.

VI. Conclusion and Recommendation

Research related to environmental sustainability is indeed a very interesting field, especially in countries where compliance with environmental policies is lacking in implementation. The imbalance exists between subsidizing gasoline, fuel and gas as a mechanism to combat the high cost of living and how that action has plundered the environment. The environment has now become a global agenda and the various policies used to reduce the GHG have now been strategized by numerous countries worldwide. Therefore, customer awareness has become a significant factor to realize the sustainability agenda. However, this does not mean that practitioners and policy makers are unimportant. Rather, they require further examination and there is a need to effectively plan to improve health and the environment.

Hence, this SLR explores the subsidies and environmental awareness among consumers. In general, environmental awareness has been heavily discussed in the literature but then, when associated with subsidies, such as fuel subsidies or green subsidies, it is shown to be extremely limited. The established keywords of

subsidies and environmental awareness have shown that they are measured from various angles. Therefore, we found 3 themes represented by the study area. The first is environmentally friendly vehicles; the second is green products; and the third is about various aspects that we grouped into one theme, such as measurement of optimal level, energy efficiency, and WEEE.

Moreover, the study significantly differs based on their market structure even though the geographical regions are almost identical to a limited number of countries causing the implications to vary. It was also found that various statistical methods were used but all of them captured quantitative analysis. When looking at CEA, demand is greatly increased for environmental vehicles and green products, a common finding that can be observed which contributes to lower CO_2 emissions.

This study enhances understanding of environmental awareness literature by integrating various products and market segments following the subsidy's distribution to several types of environmental vehicles such as electric vehicles, battery electric vehicles, and end-of-life vehicles that have played different roles in reducing the impact of climate change as consumers shift towards green-type of products. In addition, the consumers' awareness is not greatly influenced by the integration of optimal pricing mechanisms since their environmental awareness is high. Hence, we should place greater attention to increase environmental awareness to protect the environment.

Due to the significance of this issue and the research gap, this paper provides an overview of subsidies and environmental awareness among consumers. It can be concluded that :- (1) intention to buy an eco-friendly car is affected by environmental awareness and the level of consumers' knowledge; (2) CEA has influenced green purchasing behaviour and leading them to demand for green products; (3) emission taxes or subsidies are important in changing CEA and increase their WTP; (4) the subsidies are important to encourage consumers to use green products and increase consumer's awareness towards WEEE waste; (5) the government should not spend more on green subsidies allocation when the CEA is high.

This study has certain limitations. Firstly, it employed specific key terms of subsidy and environmental awareness in the study which resulted in a narrow search. Although it covers the subject area well, it still needs to be extended to a very specific and focused topic - CEA. Secondly, the study needs to cover the public transportation services provided in a city which is relevant and interesting to study. The urban transportation system is complex with extensive transportation networks releasing carbon dioxide into the air, which has been a central issue highlighted in this research.

Therefore, future study is recommended to capture the above mentioned points, thus we can explore a wider variety of topics of the consumer environmental awareness in accordance with the public transport services. In addition, further studies are also suggested by undertaking a different type of review such as scoping or content analysis to address the knowledge gap on CEA in various markets that are not only limited to the transportation sector. Other factors associated with CEA should be given due attention and studied in depth.

Acknowledgements

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