The Influence of Institutional Policies and Information Technology Adoption towards Sustainable Logistics Transportation

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***Abstract*— Logistics is the movement engine for cargos and merchandises both for domestics and international. People complete their business process through logistics transportation, especially to move cargos and merchandises reaching their end users around the world, hence transportation also can be considered as the backbone to business supply chain. Unfortunately, their operations produced negative impacts to our environment and society. Thus, business activities nowadays goes beyond sustaining economic sustainability solely. They are concern dearly on the environmental quality and human well-being as well. The objective of this paper is to review the influence of institutional policies and information technology (IT) adoption towards sustainable logistics transportations in the economic, environmental and social performance. Through understanding of Institutional Theory and Resource-Based View (RBV) Theory, institutional policies and IT adoption can be considered as the enabler for logistics performance and their sustainability. This paper expects to provide new insights to the logistics practitioners and policy makers in sustaining logistics sector in parallel with today's world demand, Sustainable Development Goals (SDGs).**

***Keywords*—** *Logistics transportation, freight, technology adoptions, institutional policies, sustainable development*

1. Introduction

"Transport is a second-order activity which is generated by other economic activities" [1, p.505]. As such, the demand for transport relies heavily on economic activities, consumption and their dynamic changes. In other words, whenever the economy is growing, production and consumption will both rise. It thus escalate the demand for transport and vice versa [2]. Logistics transportation which is also known as freight transportation plays a vital role in this second-order activity. Freight transportations are including road, air, sea and rail freight transportations. Basically, domestic movements use road and rail freight, and international movements use air and sea medium. However, both domestics and international need road freight transportation to reach their end consumers. This has made road freight is the biggest percentage in logistics transportation [3].

An analysis of economic trend by the Organisation for Economic Co-operation and Development (OECD) in 2012 reported that more than 70% of world's population in 2050 will live in miscellany. This trend will increase the demand of private household which simultaneously increase the demand of household productions and the retail sector [4]. In business circulation, the hiking in productions and retails automatically boosting up the demand for freight transportation, especially small-scaled deliveries, in matched with the private household merchandizes. This kind of deliveries normally use small and medium sized automobiles [4]. Literature supported that this relationship is true in most industrialized countries; the higher the economic growth, the higher the transport demands [5].

Despite the positive side of economic and transport evolution, the road freight transport

activities contribute to numbers of environmental and social problems [5]. According to Aschauer et al. [1], negative environmental effects of transportation are derived from three sources; construction of its networks like roads, operation of the transportation itself; and disposal of vehicles and their parts. For example, transport necessitates road infrastructure, rail ways, airports, and harbours. The construction of these infrastructure normally pollutes landfills with dismantled parts and toxic materials. Furthermore, higher freight transport volume on roads, including traffic congestion generate greater noise and greenhouse gas (GHG) emissions [4] like carbon dioxide (CO_2) and nitrous oxide (N_2O) [6]. Both gasses are emitted from the combustion of fuel in vehicles. A developed country like United States (US) for instance, produced 32% of CO_2 in 2015, as a result of transportation sector solely, laid second after the electric sector. Meanwhile, US also produced 5% of N_2O, emitted from the transportation emission [6]. Even though the percentage of N_2O is far lower than CO_2, yet it contributes greater effect to global warming. This is why NASA called N_2O as a powerful GHG [7].

As a matter of fact, the GHG emissions produced will caused global warming effect, in which will increase natural disasters and harmful consequences for natural environment, including human beings and animals [5]. Moreover, most of NASA's climate scientists agreed that the main cause of global warming is the GHG [7]. The global warming results in climate change. The change in climate obviously further negatively affect ecosystem, biodiversity and ecosystem service [8]. Ecosystems are living and non-living things in particular areas that interact with each other like sunlight, water, air and soil [9]. Biodiversity is the group of animals and plants species live in a specific climate [10]. The combination of both ecosystems and biodiversity produces benefits which are called as ecosystem services, such as food. Thus, this ecosystem services contribute to necessities in life like health, job, economic growth, and human well-being [8].
In other words, a healthy ecosystem and social well-being are strongly interrelated.

In addition, the non-regulation of freight deliveries together with the increasing traffic of commercial vehicles punish urban environment and give a weighty burden on city life in terms of energy consumption, air quality degradation, visual and noise pollution increase. Furthermore, freight transport is also blamed of public space occupation, and of having share in accidents risks in urban areas. The lack of urban freight transport organization seem like to increase these negative waves [11].

In this regard, logistics or freight transportation, which plays major roles in any business have to design environmental and social friendly approaches to lessen negative impacts of their logistics activities, yet at the same time gaining many potential business benefits and competitive advantage [12], [13], [14], and [15]. In such a way, governmental regulations, institutional policies, globalized business environment and customer pressure draw serious attention to freight transportation companies to emphasize on sustainable development which concern about economic, environment and social performance [12], [16] and [17]. As mentioned previously, globalized business environment is one of the drivers for freight logistics companies to adopt sustainable efforts. This is because the transportation logistics sector has experienced great competition [18], [19] when international players have entered into the game [20]. They compete in terms of competitive price, service level, reduce in traffic congestion and, safety issues [12], [21] and [22]. In this situation, IT executions are the performance key enabler [23], [24], equally providing efficient and effective services [23] and [3]. Internal measures for efficient and effective freight transportation contribute indirectly to economic, environment and social sustainability.

Therefore, this conceptual paper focuses on sustainable logistics transportation in the light of institution policies and IT execution. RBV theory and Institutional Theory will explain how these two variables work hand in hand to achieve the sustainability. The paper is hoped to deliver new understandings to logistics players and policy makers in their efforts to reach Sustainable Development Goals, a 'promise' from around the world in eradicating poverty, protecting the earth and ensuring economic well-being for all [25].

Government and non-government institutions, and other stakeholders are now talking about Sustainable Development Goals (SDGs). Their cooperation is crucial in achieving 2030 Agenda for SDGs. The 17 sustainable goals aimed for 2030 are including "(1) no poverty (2) zero hunger (3) good health and well-being (4) quality education

(5) gender equality (6) clean water and sanitation (7) affordable and clean energy (8) decent work and economic growth (9) industry, innovation and infrastructure (10) reduced inequalities (11) sustainable cities and communities (12) responsible consumption and production (13) climate action (14) life below water (15) life on land (16) peace, justice and strong institution, and (17) partnership for the goals" [25, pp.1].

There are several SDGs that relate to the logistics transportation companies. For example, they are much related to good health and well-being; industry, innovation and infrastructure, sustainable cities and communities; responsible consumption and production; and climate action. In other words, the operations of logistics transportation need to concern about efforts to achieve those goals. Achieving economic sustainability alone is not enough nowadays. Everyone is anxiety about socio-environmental sustainability as well.

Thus, the pressure from stakeholders is an important motivation for the companies to act for sustainability. Government institutions or authorities [26], [27] are seen as the significant figures in encouraging the companies through rules and policy adopted in the sector. Other than institutions, adoption of technology [23], [3] in the transportation is said to help freight transportation companies in providing efficient works with less negative effect on the environment and society. Efficient and effective logistics transportation performance helped to reduce congestion, produce less emission, reduce operation cost and ensure employees' well-being [28].

2. Theoretical Foundations

The importance of stakeholder's pressure especially institutions is explained by Institutional Theory. The Institutional Theory originates that "firms institutionalize individual and organizational structures by adding either values or constraints to their internal activities or system" [29, pp. 5]. The values are including the integration of social legality by adopting traditions, social norms and influences [30]. Social norms are then come together with economic returns [31]. On the other side of coin, managers are normally pressured to make decision based on stakeholders' requests [29]. Thus, "the theoretical perspective that can capture the impact of social networks is a much more comprehensive way of explaining organizational behaviors, when compared with the rational perspective that captures only the economic aspect" [26, pp.5]. In other words, the external pressures that lead to social norms are the best influence for organizational behaviors as it produces both social and economic benefits. Gopal and Gao [32] added, it is viewed as a necessary condition to compete, driving organizations to adopt processes that lead to isomorphism. There are three types of mechanisms which lead towards institutional mechanism; coercive, mimetic and normative [33].

Therefore, in this case the institutional pressure is considered powerful to influence the actions of the companies [27]. In Institutional Theory, the institutional pressure is categorized as coercive pressure. Coercive isomorphism means that formal and informal pressures applied on certain organizations by other organizations, by certain expectations from the civilization and both organizations are dependent on each other [33]. Thus, it means that the institutions exert pressure to companies to operate in economic, environmental and social accountability [34], [35], and [15].

On the other hand, RBV theory suggests that inimitable resources and capabilities of a company are two basic elements for its competitive advantage. Resources encompass all assets, capabilities, organizational processes, firm attributes, information, knowledge, etc. that are controlled by a company. They enable the company to implement strategies to enhance the performance and competitive advantage [36]. Meanwhile, capabilities are the ability of the company to convert its resources for value creation [37], which give positive impacts to customers satisfaction [3].

As regard to the literature, technology adoption is considered as the key enabler that can transform resources into capabilities which at the end producing effective and efficient services [3]. Jeffers [38] supported that RBV is appeared as the fundamental theory that explains the strategic roles of IT adoption. In the light of RBV perspective, the process, knowledge and capabilities of IT executed by the freight transportation companies that allow them to become socially and environmentally sustainable can be seen as organizational resources. Not only social and environmental, the sustainable practices or operations enhance the company's image and reputation. This leads to marketability of

services and products [34]. Above all, sustainability efforts brought by IT execution in the companies bring them to long-termed competitive advantage [39] and [38].

3. Institutional Policy

Even though the freight transportation is one of the major components in the traffic of city, but the mobility plans seem ignored the policies and measures of distribution process [11]. Most local authorities concentrate on public transportation, as they found freight transportation is much complicated and less interesting to deal with [40]. Eventually, the freight policies fall under local authorities' responsibility. They need to engage with transport policy-making and measures for freight mobility to meet with environment sustainability [11]. It is very important to set policies that focus on the environmental sustainability because "in order to make Earth and societies truly sustainable, must prioritize the environment first, society second, and economics third, on the premise of enhancing all three sectors" [41, pp. 1]. Hence, in the case of freight transportation, combining both technological package and behavioral policy measures is the solitary means to ensure environmental sustainability [42].

Since freight transportation deal only with mobility, the policies must also focus on measurements that relate to the mobility. A good example from a small-medium size city, Serres, Greece which developed a sustainable environment policy measures on the freight transportation. Among the main objectives of the policy measures for freight transportation are "traffic calming measures, operational regulations, like restrictions on the weight and size of the fleet, their load weight standards, use of non-conventionally fuelled vehicles and green technology solutions, information maps regarding loadings spots or even paths, time-slots, information communication technologies like e-platforms enabling the cooperation with stakeholders and the cooperation of deliveries through loading spots booking system etc." [11, p.669].

Other than Greece, Gdynia also has started their research on freight transportation policy as the sector becomes major share in city's development. However, Poland does not has any formal document on this matter as the country inexperience in such policy. As an effort of self-assessment, Gdynia analysed some strategy papers including Strategic Plan for Gdynia 2003 – 2013, Transport Policy for Gdynia and Draft of the Sustainable Urban Transport Plan. As a result, they come out with few recommendations on the freight transport policy to the country. Among them are "reduction of HGV's transit within the city center, identification of routes for trucks, implementation of temporary restrictions for trucks and delivery vehicles, implementation of low emission vehicles, provision of parking spaces for HGV's at the city outskirts, zoning and concentration of transport and logistics related activities, and enforcement of parking regulations for trucks as well as control of their technical standards in terms of noise and emission levels" [43, p.890].

Above all, the policies for freight transportation in both developed countries are to be practiced as the outcome of responsibility towards environmental sustainability. Those policies will be the enforcements to logistics players to follow the rules and policies. Those restrictions directly control negative effects to mother earth, and indirectly taking care of social and economic sustainability [41]. Formal policies act as a 'force' and 'assistance' for sustainability efforts amongst them.

Transportation system is closely related to dimensions of sustainability pillars; environmental, economic and social dimensions. Thus, in order to develop sustainability in transportation sector either freight or commercial, policy makers should take a wide three-pronged approach: "(1) physical policies related to physical infrastructure, (2) soft policies aiming to change behavior by informing the actors on the consequences of their choices, and (3) knowledge policies that emphasize the critical role of investment in R&D" [44, p. 37]. Another opinion also suggested that in order to sustain in those three elements, the policy makers should give extra focus on environmental policy [41]. Thus, the measurements for this study concern on green environment as to eliminate GHG emission produced by freight transportation. These measurements are adopted and revised from the study done by Chu et al. [26]; (1) strengthen government policies on environmental protection and consumer rights to force companies to implement green practices, (2) government environmental policies influence companies to act green and, (3) potential conflicts between services and environmental policies will affect green environmental management of the companies.

4. Technology Adoption

Extant literature identifies two categories of relevant IT resources. The first is explicit, comprising the hardware and software components of a generic information system. The second is the more recently defined tacit IT resources – managerial capabilities believed to play an important moderating role in leveraging explicit IT resources [38]. Some literature measured IT adoption into basic and advanced technologies [23], [45] and [3]. But Wade and Hulland [46] argued that basic categories of IT like software and

hardware are easy to be replicated by competitors. Thus, based on the concept developed by Porter and Millar [47], Jeffers [38] introduced 'IT resources'. The IT resources are comprised by two components which are physical component and information-processing component. Physical components include operations to create products, while information-processing is the steps to capture, manipulate and channel the essential data to execute the operations. These two components are the significant combinations of IT adoption in assisting the services of production of companies.

Same goes to freight transportation companies, the kind of IT adoption is vital as logistics is very much relies on the smooth coordination and timeframe. Additionally, visibility and transparency are the golden value added to their strategic capabilities which significantly improve their customers' satisfaction [38]. Besides that, the tracking capabilities and swift prediction of sudden changes in logistics process and conditions are the key for the companies' competitiveness, especially in today's dynamic market environment [48]. By fulfilling those terms, the logistics companies seems occupied for effective and efficient services. Effective service means that the service produce intended results, while efficient service is the service which produces results taking into considerations the used resources [28]. The common used measurements for logistics transportation companies are shown in Table 1. Table 2 shows the categories of sustainable contributions with respect to the effective and efficient logistics service measurements, as they indirectly contribute to economic, environmental and social sustainability.

Table 1: Performance indicators for logistics companies

Effectiveness	Efficiency
On-time delivery performance increase	Total distribution cost decrease
Number of delivery per day increase	Total delivery cost decrease
Total loading capacity increase	Employees' overtime hours decrease

Source: [3], [28], [49], [50], and [51]

Table 2: Effective and efficient services and their types of contribution to sustainability

Effectiveness	Contribution to Sustainability	Efficiency	Contribution to Sustainability
On-time delivery performance increase	Economic, Environment, Social	Total distribution cost decrease	Economic
Number of delivery per day increase	Economic, Environment, Social	Total delivery cost decrease	Economic
Total loading capacity increase	Economic	Employees' overtime hours decrease	Economic, Environment, Social

From Table 2, the execution of IT resources in their operations can increase the on-time delivery performance and number of delivery. In this case, Radio-frequency Identification (RFID), Electronic Data Interchange (EDI) and Enterprise Resource Planning (ERP) [23] are usually adopted at the warehouses to help their storing and loading process, and companies-customers communication.

Whereas, Global Positioning System (GPS) [23] is normally installed to their freight transportations. The GPS helps to make the delivery easy by providing accurate information about congestion and the best routes to be taken easily and quickly reached the desired locations. When the deliveries are effectively and efficiently done in normal operation hours, even though the numbers of delivery demands are high due to good business performance, it still decreases the overtime hours. This conditions can save fuel and operation costs, produce less GHG to the environment and the employees experience less fatigue. Hence, economic, environmental and social sustainability can be achieved.

In this paper, the measurements of IT adoption are much wider in nature to give them bigger range with regards to the companies' requirements. By adopting a research work from [52], IT adoption is measured by six items; (1) a web-based information system, (2) advanced equipment for logistics operations, (3) improving logistics systems, (4) improving technology usage, (5) infrastructure for communication tools, and (6) infrastructure for software and computer systems.

5. Conceptual Framework

Figure 1 shows the conceptual framework for this paper. It indicates that both institutional policies and IT execution influence the sustainability of logistics transportation. Other than policies that lead freight companies to service sustainability, government in some countries also provide funds and loans for the companies to develop. Since IT adoption needs large investment, most of logistics companies in developing and less developed countries could not afford to implement IT

equipment and systems. This is because they are mostly small and medium companies, thus having less capital to adopt the IT resources [53] and [54]. In this sense, government's loans and funds help them to adopt the IT resources in their companies. Thus, other than policies for regulations, fund policies [55] also encourages freight companies to produce sustainable services.

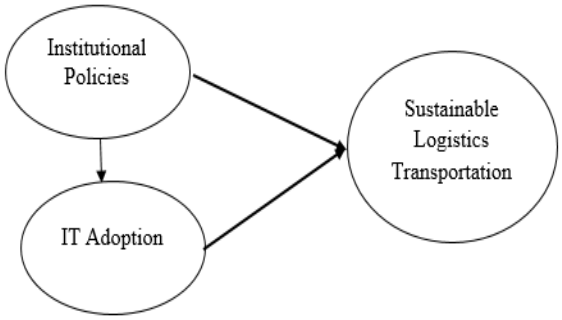

Figure 1: Conceptual framework for this study

6. Future Perspective of Logistics Transportation

Logistics or freight transportation plays a major role in business activities. Business around the world seems paralysed without logistics transportation. In whatever situations, logistics transportation have to sustain in order to cater numerous industries which stand as pillars for every countries' economic growth. As for nowadays and future, logistics transportation companies need to emphasize on how to control the negative effects of their activities. In respect to the logistics transportation, environmental pollution is identified as the ignitor for the social unsustainability. This is crucial as it affects important elements for sustainable development. Hence, all bodies that build logistics transportation companies, plus their stakeholders especially policy makers have to be responsible in any ways for the sustainable efforts to eliminate destructive outcomes to the nations as a whole, but at the same time sustain their economic performance.

Therefore, in very near future, logistics transportation will go for 'drone' as the freight and commercial transportation. Besides protecting earth with its zero emission, it also contributes to safety, reducing traffic congestion and efficient delivery services. Today, world giant company like Amazon already started its trial drone delivery. The first delivery has touching down safely to its customer in Cambridgeshire, East England. The drone service named Prime Air took only 13 minutes to reach the destination. Looking at the efficiency and effectiveness, Amazon hopes to widen the drone's coverage in future. But, Amazon said that the vision and full service can only be realized when they have regulatory support [56].

Meanwhile in Dubai, the country was experimenting with drone as commercial public transportation. The fully remote drones, Ehang 184 can occupy one passenger at one time, flying over the city to transport the passenger up to 23 minutes, 63 miles an hour [57]. In another news, Dubai's Road and Transport Authority (RTA) has announced Velocopter as world's first self-flying taxi. The Velocopter just started its testing at year-end 2017, and will last in five years of evaluation period. RTA also reported that they are now working with Dubai Civil Aviation Authority to develop the first's autonomous aviation laws and regulations. It is more interesting when Dubai plans to make other public transports like road-taxis and busses autonomous as well by 2020, as the extension of Dubai Metro. This is because RTA confirmed that autonomous transports is much efficient, cleaner and safer [58]. Other than Dubai, Las Vegas is reported to follow the footsteps very soon [56].

7. Sustainable Transportation and Supply Chain

Logistics transportation and supply chain have vast impact on business, society and national economic. Logistics transportation moves economic activities through supply chain to the industries. Nowadays, effective transportations activities means that they efficiently works while conserving environment and social by reducing GHG emissions, congestions and noise, thus contributes positively to the nature, communities and economic in the long run [59]. Transportation and supply chain are related through length of supply chain and fuel used along the lines in which producing GHG emission and noise [60]. This is the reason why organizations are urged to choose environmental friendly choices into their supply chain management [59]. Therefore, logistics transportation firms with sustainable management criteria would be favourable by the stakeholders. This situation is then being a significant factor for their economic sustainability. All in all, coercive

pressure from governments and the usage of new technology help the firms to economically sustainable while protecting environment and society.

8. Conclusion

The increase in the volume of logistics or freight transportation is crucial not only in business environment but also in our daily lives. The society seems to have direct contact with trucks and other freight transportation on road as they are now busy making deliveries day and night, using almost the same routes used by society for their day-to-day routines. Other than a good indicator for economic growth, the flooding of the freight transportation produced negative impacts on environment and social well-being. The GHG emission issue, noise, safety and harmonic life are highly concerned by the world nowadays. Thus, UN comes with SDGs with the purpose to protect environment, social and economic sustainability. Based on the RBV theory and Institutional Theory, the institutions or responsible authorities need to control, yet contribute to the resources of freight transportation in order to produce good impacts on the society, environment and other creatures, not only focus on economic growth. Therefore, through the freight policies, the practitioners are forced to adopt related technologies which assist them in producing effective and efficient services. Effective and efficient services are actually pays for the three big elements of sustainability; environmental, social and economic. Due to these crucial issues, the developed countries like Dubai and United States started to move forward to drone technology for the freight and commercial transportation in order to reduce congestion, emission, noise, as well as to increase efficiency and safety. Thus, the objective of this paper is achieved as it offers new insights on the current and future direction of logistics transportation. This research suggests to further investigate how governments and institutions could help the freight transportation companies in adopting IT to their operations. This is because most small and medium companies unaffordable to invest in IT adoption, particularly in developing and less developed countries.

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