THE NEEDS FOR COORDINATION IN SUSTAINABLE URBAN INFRASTRUCTURE DEVELOPMENT

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ABSTRACT

Urban infrastructure systems shape the interactions between civilized society and the natural environment. Whilst these urban systems are the most visible impact of humanity upon the environment, sustainable development of them is also crucial to minimize the impacts of human activities on the environment. Coordination among different agencies involved in the urban infrastructure development is an essential factor to achieve sustainability in the process. Co-ordination is a key enabler that brings together these agencies to make their endeavors more compatible with the interests of environmental, economic and social aspects, the triple bottom line of sustainability. From a sustainability point of view, this paper by identifying and analyzing the effects of lack of coordination, aims to delineate the role coordination in the context of sustainable urban infrastructure development.

Keywords: coordination, sustainable development, urban infrastructure.

The notion of sustainability has been broadly discussed following dissemination of two influential documents, namely, "The Limits to Growth" [1] and "Our Common Future" [2]. Sustainable development of urban infrastructure is of essential issues in the context of rapid urban expansion. This is because urban infrastructures are intimately linked to urban development. In conformity

with this, Afolayan [3] argues that modern civilized society cannot grow, develop, and function efficiently without urban infrastructure systems. Urban infrastructure systems, particularly electric power grid, gas piping network, water supply system, wastewater collection network, telecommunication network, and urban street network, are the most visible impact of human activity on the environment. Therefore, sustainable development of these fundamental systems minimizes the effects of urban land development on the earth.

The issue of sustainable urban development is linked to urban infrastructure sustainability [4]. In turn, sustainable development of these essential systems is subject to coordination between agencies involved in the development process of urban infrastructure systems [5]. That is, in the absence of a robust coordination between these agencies, their developing process results in environmental issues, economic inefficiency, and social problems. In other words, lack of coordination negatively affects three pillars of sustainability. Towards this end, this paper aims to highlight the essential need for coordination in the process of sustainable development of urban infrastructure

systems. The reminding sections of the paper are structured as follows: a conceptual review on coordination is presented in Section 2 while Section 3 presents a critical review on the notion of sustainability. Section 4 deals with statement of issue. The essential needs for coordination in the context of sustainable urban infrastructure development is articulated in Section 5. Finally, discussion and concluding remarks are presented in Section 6.

2. COORDINATION: A CONCEPTUAL OVERVIEW

Coordination is a golden word in the 21st century world. Different authors from different disciplines have proposed a number of definitions for coordination. Lindblom [6] offered one of the first academic definitions for coordination as a rational relation between decisions such that it can produce desirable results for participants and omit undesirable outcomes. A selection of coordination definitions is presented in follows:

- An integrated decision-making process to interconnect different subunits [7].

- A set of mechanisms for decision-maker entities aimed to organize their interactions [8].

- Integrating planned actions into a greater designed whole [9].

- "The harmonious functioning of parts for effective results" [10].

- Establishing harmonization between tasks in order to guarantee the performance of various tasks is in the right quantity as well right order [11].

- Coordination is a multifaceted process, concerning the harmonization of correlations at the field, regional, and national levels [12].

- Coordination is a way for describing and analyzing the function and structure of organizations [13].

As it can be inferred, the term coordination covers a wide range of abstract concepts. The concept varies from Lindblom's [6] view on coordination as a trait of decision to a concept related to organizational structure [13]. This wide range of possible definitions for coordination implies a complexity in defining as well as a multiplicity in starting point of coordination investigation. In conformity with this, Hossain and Wu [14] point out that coordination is an absolutely abstract concept and it is hard to be defined from a quantitative point of view. However, without any doubt, the most acceptable definition of coordination has been posed by Malone and Crowston [15, 16]. These

two pioneers in coordination science theorized coordination as "the act of managing interdependencies between activities performed to achieve a goal." In contrast to other explanations of coordination, coordination theory [16] focuses on the interdependencies between activities. Therefore, if there is no interdependence, there is nothing to coordinate [15].

3. SUSTAINABILITY: A CRITICAL REVIEW

Following the dissemination of two influential documents, namely, "The Limits to Growth" [1] and "Our Common Future" [2], sustainability expanded its literary life [17]. In spite of the abundant literature on sustainability issues, there is no consensus on the definition of sustainability. In this context, Zaccai [18] sarcastically argues that its openness, flexibility to different contexts, and multiplicity of interpretation of sustainable development lead to a situation in which the term has been a game for academicians, politicians, and journalists. Sustainable development has frequently been defined. Allen [19] defines sustainable development as a development that can satisfy the needs of the current generation and improve their quality of life, while allowing natural resources and ecosystem to keep revitalizing themselves. The connection of "quality of life" and "ecosystem conservation", in this definition, implies the discussion of weak sustainability in which human capital and natural capital are substitutable. Hammond [20] argues that sustainability is a balance between environment protection, social well-being and economic development. These three elements are known as "triple bottom line" [21]. From another perspective, Baumgärtner and Quaas [22] believe that sustainability is a normalized concept, referring to the appropriate interaction between humanity and nature and the community responsibility towards the next generation. Oxfam [23] points out that achieving sustainability means ensuring that society has needed resources and humanity's use of natural resources does not stress critical earth system processes. However, the most acceptable definition of sustainable development is "development that meets the needs of the present without compromising the ability of future generations to meet their own needs" [24].

Several common points can be elicited from these various definitions of sustainable development [25]: considering the future consequences of current actions; inter-generational responsibility; public engagement; respect to social, economic, and ecological aspects; and the existence of doubts relating to the results of our present actions. Despite these common points, there is no universally accepted definition of sustainable development. Hall [26] points out that the unclear definition of "humanity need" is a controversial point in sustainability arguments. Another dialectical aspect of sustainability argument is "inter-generational responsibility". However, summarizing the

above discussion, the concept of "triple bottom line" of sustainability can concisely address the issue of sustainable development. Where, it adjusts the interaction between the conservation of ecosystems and capital nature, quality of life, and economic growth rate. In other word, a development can be labeled as sustainable development if it yields positive outcomes for planet, people, and prosperity [27].

4. STATEMENT OF ISSUE

It may particularly difficult for the process of urban infrastructure provision to achieve sustainability without coordination. Several interacting agencies such as Water and Wastewater Company, Electricity Company, Gas Company, Telecommunication Company and Transportation Company are involved in the process. Because of three unique features of urban infrastructure systems, coordination between these agencies plays a vital role in achieving sustainable infrastructure development. These features are: interconnected and interdependent nature of urban infrastructure system, sharing in a limited construction space, and complex nature of these essential urban subsystems. That is, lack of coordination between agencies involved in the process jeopardizes the sustainability of urban infrastructure provision. However, In the following sections, this paper, by illustrating the effects of lack of coordination, authenticates the need for coordination in sustainable urban infrastructure development.

5. NECESSITY OF COORDINATION IN SUSTAINABLE URBAN INFRASTRUCTURE DEVELOPMENT

Sustainable development of urban infrastructure that can support the daily life of society, while protect the environment as well as encourage economic growth is of essential importance in the context of rapid urban expansion. Since several independent agencies are involved in the process of urban infrastructure development, coordination between them play a vital role in the sustainability of the process. This is because in the absence of coordination between these agencies, the process of urban infrastructure development cannot achieve sustainability goals and objectives. In other words, lack of coordination in the context of urban infrastructure development negatively impacts the three pillars of sustainability, namely, economy, environment, and society. In the following sections, the effects of lack of coordination in the process of infrastructure development across these three bottom lines of sustainability are presented.

5.1. Economic Effects of Lack of Coordination

In the absence of a coordination structure, divergent policies and measures chosen by agencies involved in the process of urban infrastructure development result in economic inefficiency and increased overall cost of the process. Coordination is a key enabler that brings together these agencies to make their activities more compatible in terms of economic efficiency. However, Lack of coordination leads to the following economic problems in the process of infrastructure development:

- Duplic 8]. It is obvious that duplication of activities results in an unforeseen increase in the cost of urban infrastructure projects.

- Missed deadline: missed deadline or failure in meeting deadline of the project is another drawback of lack of coordination in the context of infrastructure development. Late completion of a project compared to its schedule time called time overrun or missed deadline. According to Schwindt and Zimmermann [29], as a project deadline is missed, the overall cost of the project will increase dramatically.

- Demolition of Urban Infrastructure: demolition of infrastructure systems is one of the most visible negative effects of lack of coordination in the process of infrastructure development. Since the streets are the common bed for construction of all kinds of urban infrastructure systems, lack of coordination between urban infrastructure agencies (UIAs) leads to demolition of system during construction of other systems.

- Bad Implementation: lack of coordination between agencies involved in the process of urban infrastructure development results in bad implementation of these essential urban systems [30]. Bad implementation indicates unsatisfactory in infrastructure service delivery, delay in complementation of the projects, and consequently cost increases.

5.2. Environmental Effects of Lack of Coordination

Urban infrastructure systems are the greatest effect of modern civilized society on the environment. Therefore, according to World Bank [31], one of the fundamental challenges facing the process urban infrastructure development is how to make the process more environmentally sustainable. Coordination between those involved in the process of infrastructure development is a significant key enabler to achieve this goal. In other words, lack of coordination in the context urban infrastructure development can result in following environmental issues:

- Natural Resource Depletion: As discussed earlier, demolition of infrastructure elements during the construction process of them is a result of lack of coordination. Since these elements are the physical transformation of natural resources, it can be deemed that lack of coordination in the process of infrastructure development can result in natural resource depletion.

- Waste Disposal: a major portion of the elements of urban infrastructure systems is made up of irresolvable or hard to rotten materials such as plastic. Therefore, as discussed above, when because of lack of coordination these elements are destroyed, the remains cause waste disposal problem, an urgent current environmental issue [32, 33].

- Soil Pollution: soil pollution is yet another environmental issue caused by lack of coordination in the process of infrastructure development. Many elements of the urban infrastructure systems are installed underground. Therefore, when lack of coordination results in demolition of one infrastructure elements, the underground remains of these elements can cause soil pollution.

- Water Pollution: Lack of coordination can result in the damaging wastewater collection network during the excavation process of other infrastructure systems. When a sewage network is damaged, the leaked wastewater can pollute the underground water beds, one of the main potable water resource [34, 35].

- Public Health Issue: lack of coordination between agencies involved in urban infrastructure development can directly and indirectly pose risk to health of urbanites. Contamination in water supply systems, a major risk to public health [36], is a result of lack of coordination. When because of lack of coordination during the digging trenches for other infrastructures a water supply system is damaged, the system would be polluted. Consequently, caused public health issues.

5.3. Social Effects of Lack of Coordination

Today's civilized society is dependent on normal operation of urban infrastructure systems. Therefore, declining in quality of these critical systems or stoppage in their functions certainly result in social issues. As discussed earlier, lack of coordination between those who are involved in the process of urban infrastructure development can create challenges for normal operation of these essential urban systems and consequently cause related social issues. A selection of these challenges is presented as follows:

- Overlap of Responsibility: lack of coordination in the context of urban infrastructure development can result in overlap of responsibility [37]. Overlap of responsibility, in turn, leads to a situation in which one urban infrastructure agency blames its failure to provide adequate commodities on other agencies [38].

- Lack of accountability: one of tangible drawbacks of lack of coordination between those involved in the process of infrastructure development is lack of accountability on the associated issues. Considering the notion of sustainability, which is nothing more than accountability on matters such as social and environmental issues [39], it can be concluded that lack of coordination can create sustainability challenges especially social problems in the context of urban infrastructure development.

- Fragmentation of Responsibility: lack of coordination between those involved in the process of urban infrastructure development leads to fragmentation of responsibility [13, 40]. According to Bührs [41], many of the development and social issues that confront urbanites have their roots in fragmentation of responsibility.

- Public Discontent: the ultimate effect of lack of coordination in the process of infrastructure development is public discontent. This is because the daily life of modern society is strongly dependent of these crucial systems [42]. Therefore, any stoppages or declining in quality of these essential services results in social discontent.

6. DISCUSSION AND CONCLUDING REMARKS

The issue of sustainable city development is linked to urban infrastructure sustainability [43]. Sustainable urban infrastructure development simply means a development process that considers three pillars of sustainability, namely, economy, environment, and society. Coordination between those who are involved in the process of urban infrastructure development plays a vital role in achieving sustainable goals and objectives. In recognition of the importance of coordination in urban infrastructure sustainability, this paper identified and analyzed the economic, environment, and social impacts of lack of coordination between agencies involved in the process of urban infrastructure development. With respect to the effects of lack of coordination on the triple bottom lines of sustainability, it can be inferred that lack of coordination is a great challenge that impede achievement of sustainability goals in the context of urban infrastructure development. In other words, coordination is a pivotal concept in urban infrastructure sustainability discussion.

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