Stakeholders interaction framework of utilities development in and adjacent to the public right of way in Indonesia

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Abstract. Public infrastructure development in Indonesia is an integral part of the national development planning system, and the government attempts to ensure the process is done rigorously to fulfill the system’s objectives. Part of public infrastructure is roads, and the utilities that are installed nearby. The development of utilities in and adjacent to the public right of way in Indonesia involves various stakeholders that should be managed properly to avoid unnecessary interface problems. Those stakeholders include government agencies, community groups, private enterprises, and state or regional owned enterprises. The interaction between stakeholders of utilities in and adjacent to the public right of way should be identified clearly, and for sustainability objective, an identification of the process and interaction first should be done in the low level of the government i.e. district area. This paper is a preliminary study of a research about stakeholders’ interaction structure in Indonesia’s district public infrastructure development process. This paper focuses on utilities that installed in and adjacent to the district’s road in Indonesia. The purpose of this paper is to explain the interaction framework of stakeholders involved, and the methods that are used to describe the relationship.

1. Introduction
Infrastructure is defined as physical facility that is intentionally built to help people fulfill their needs in daily basic. Public infrastructures are infrastructures that are provided by government as part of government’s services for its people. Goodman and Hastak [1] define public infrastructure as follow: “Public works is applied to facilities that usually require substantial capital investment; provide public services or solve problems perceived to be the public responsibility; and are planned, designed, constructed, and operated by or under the supervision of government agencies”. Moreover, the American Public Work Association defines public work as physical structures and facilities that are provided by government bodies in order to administer the government functions by providing clean water, electrical/energy, waste disposal facilities, transportation infrastructure and other services for social and economic purposes [2].

Based on the Indonesian presidential decree No. 38/2015, public infrastructure is defined as engineering facilities, physical or system form, hard or soft type, that is required for the community services and support structural system in order to ensure the social and economic community objectives will be achieved [3]. Government has an important responsibility in public infrastructure development,
and becomes a main key in its process. In order to do its functions, the government assigns various governmental bodies which each has specific role in development process. Indonesian legislation rules that every region has their own autonomous government called Province that is divided into districts [4]. Districts are provincial coverage with smaller areas and have their own autonomous government as well. In these areas, the development process begins as part of the people’s wills to fulfill their necessities. The event of this start point of development is called District’s development plan deliberation (Musrenbang Kabupaten).

The Musrenbang process involves stakeholders from various origins and interests, such as governmental bodies (government agencies), private enterprises, community groups, professionals, state owned enterprises, regional owned enterprises, environmental groups, media, and so forth. They are all interrelated and interdependent during planning phases, and have even more complicated relationships during execution phase of the development projects.

This raises our awareness that there are interactions between the stakeholders in district infrastructure development process, and these interactions could be overlapping in the field. This paper will discuss the interaction framework of stakeholders for public infrastructure development in district’s right of way network involving utilities facilities (water, electrical and telecommunication) which implicate their organizer such as Local Government Public Work Unit, state owned enterprises for telecommunication and electrical (PT Telkom and PT PLN Persero), regional owned enterprises for water supply (PDAM), and other community groups.

This paper discusses how the interaction framework of stakeholders should be created as the initial activity of making the coordination system and to support the research on coordination that currently being carried out. This paper is a literature research which is used as preliminary study of a current research for academic purposes in expertise group of Construction Engineering Management, Faculty of Civil & Environmental Engineering, Institut Teknologi Bandung.

2. Background and problems

This research is started with idea that the number of stakeholders affects a project and it is a great deal in achieving project success. Shokri [5] states that the large number of stakeholders could drive project into problems. Public infrastructure development involves many activities that are done by different specific stakeholders. Those stakeholders are interdependence and interacted in a platform called interface. It is defined as the contact point between two or more self-directed organizations which having interdependent relationship and interacting each other in order to reach the system objectives as a whole [6]. In a development system, the interface will occur between different sectors of organizations whose task to organize different kind of infrastructures.

This contact point between such organizations/stakeholders is vulnerable to friction because each stakeholder has their own interest according to their orientation towards their products. Frictions between stakeholders can be emerged from several causes, especially potential causes happen in the project’s site. Some different infrastructures are shared in a same location. For example, utilities are, for some reasons, placed along and under the road sides. District road is described as a public road that serves as a local road in primary road network system [7]. Some utilities shared location in the road side for efficiency reasons; however the efficiency is not in line with how it was done. The way those utilities installed overlapping with others existing infrastructures. The typical problem in site is lack of communication and lack of information sharing that lead to risks.

The road authority for district’s road is the public work services i.e. Bidang Bina Marga. This is a local government agency whose responsible in organizing the road under and responsible to the Mayor/Bupati as the District’s head of government. The district government is also dealing with province and national road authority, resulting in overlap in distribution of responsibilities. Other governmental bodies who have interest are Bidang Cipta Karya, who is affiliated with district’s government secretary in order to provide clean water supply along with a regional owned enterprises i.e. local water company (PDAM). Moreover, there are two other types of utilities installed upper and under the road side such as electrical company (PT PLN Persero) and telecommunication infrastructures.
company (PT Telkom). All of them work and place their products at the same location and during their project life cycle they could meet and overlap. The frictions can be caused by lack of coordination between stakeholders whose work on the road, including the road authority.

Risks that exist in this location will be the damages that occur to other infrastructures during a project execution. Those damages could be one or combination of damages as follows: 1) road shoulder damage due to excavation of water pipe or cable optic or electric poles installation; 2) water pipe leak or cable optic is disconnected when road improvement work is conducted; 3) electric poles that have to be removed; etc. The implication of these damages is citizens’ complain that lead to customers dissatisfaction, traffic problems, and dispute between stakeholders.

In order to reduce the damages and to improve the quality of inter-public infrastructure development in the district area, there should be a coordination system among those stakeholders; therefore each stakeholder would be able to share information about their current active infrastructure and future work plan. Afterward, the system will be used to organize the project life cycle of future public infrastructure development planning in a particular range of time.

3. The role of interface management

Interface management is a branch of management discipline that is focused on communication management and responsibility amongst parties in a project organization, thus they can be coordinated to achieve the desired results [8]. Shokri et al [6] consider interface management as an organizing process of communication, responsibility, and coordination amongst parties involved in a project, phases, or other physical entities which is interdependent. In a nutshell, interface management is a process to organize communication, responsibility and coordination between interdependence organizations in construction project and/or inter-construction projects that is related one another.

Interface management will be valuable to obtain a more structured picture of interface and its relationship among organizations. We would like to understand the interaction of the stakeholders from the interface side. Therefore, it is considered as the basis theory for this research.

Interaction between stakeholders can be identified using interface management theory. According Chan [8] there are 4 steps on the interface management procedure: 1) interface identification; 2) simplify the interface; 3) prioritize the interface; and 4) interface matching. To understand the interaction framework of stakeholders, we have to recognize all steps above respectively.

The common issues between road’s authority and utility companies are as follow [9]:

- Utility relocations cause the road projects delay and require additional costs.
- The quality data infrastructures are often poor.
- Cost is incurred due to the decrease in road service life as a result of utilities cutting newly constructed pavement.
- Efforts are needed to obtain equitable cost sharing in terms of the right of way management, pavement degradation and utility relocation.

4. Methodology

The study methodology will include literature review and survey on the district’s road authority and utility companies in Indonesia. After literature review, a survey will be conducted to gather interface problems and recent communication structure between stakeholders. Questions will be developed to examine [9]:

- The relationship and issues between road’s authority and utility companies.
- Legislation and policy
- Project planning
- Design and construction
- Standard utility alignment
- Working in the right of way

The survey will be scheduled in 5 districts and 5 cities in Indonesia. The research methodology is described in figure 1.
5. Discussion on interaction framework

In order to identify the interface, we should determine all the stakeholders involved in the public right of way. As aforementioned above that the stakeholders are including public work services (Dinas PU Bidang Bina Marga) as the road authority, Bappeda Kabupaten, PT Telkom, PT PLN Persero, PDAM and others community organization (NGO, environmental group and so forth). Each stakeholder has specific characteristics, orientation on project life cycle, orientation and interest towards project results, and possesses specific technical standards. Those characteristic should be listed and used as valuable information to determine interface for each other.

What is the meaning of interaction framework?

Interaction (noun form of interactive) is described as influencing each other by two way communication [10]. According to William–Webster online dictionary, framework is a basic conceptual structure or ideas. Therefore; interaction framework is the conceptual structure of communication between two or more organizations that have specific relationship. Interaction can be illustrated as a closed loop graph, a static call graph or a dependency structural matrix. This study intends to arrange those interactions in a dependency structural matrix (DSM) model. The process to make a DSM is explained as follows:

First, we list all stakeholders involve in a project development. In this activity, we use government’s business process for road construction project life cycle based on district’s development planning stipulated in the national development planning system, which is called Rencana Kerja Pembangunan Daerah Kabupaten/Kota 1 tahun, one year district regional work plan (RKPD) as a new timeframe. It is important to make the later timeframe because each stakeholder has its own project life cycle which is completely different from other stakeholder’s. By doing that, we could limit the number of stakeholders involve in one year, and the timeframe will help the researchers to identify relationship between stakeholders based on time. The result of this activity is coordination level based on project life cycle and activities that are related to the coordination level (WBS).

Second, we configure relationship between stakeholders. This is a delicate action; we have to do a deep interview with all stakeholders to obtain accurate answer about this matter. The relationship should not be ambiguous nor are they unclear. Some relationships are sometimes quasi-relationship, meaning that two organizations probably related, but perhaps not actually. Even though, it is important to know such relationship to understand the stakeholder characteristics. At the end we want to make a simple closed loop diagram that provides enough accurate information in an effort to obtain the structure of the interaction among stakeholders.
Third step is to develop a dependency structure matrix (DSM). The DSM model shows interaction between organizations, phases/schedule, and tasks of activity which is involved in a project. Eppinger mentions that the dependency relationship among the design activity consists of three – i.e. independent, dependent and interdependent [11]. Relation between stakeholders in right of way is interdependent. The old fashioned project management tools such as CPM, Gantt chart and PERT only work for sequential and parallel process, but not for interdependent relation [12], so it cannot be modeled [11]. DSM is an appropriate method to describe interaction framework of interdependency. It is a method of sensible shared information involving a complex task or team relationship and makes a sequence activity that can be transformed into a simple model.

5.1. Previous studies
In the United States, each transportation agency has the responsibility to maintain highway right of way under its jurisdiction and to preserve the operational safety, integrity and function of the highway facilities [13]. Therefore, for utilities that are located or intersected on the highway right of way must be regulated and authorized by the road authority. Transportation agencies authorize and regulate the use of utilities within highway right of way, and they are obliged to supervise and control the use made of right of way acquired for public highway purposes [13]. Despite of the different law and regulation in each state, the regulation on right of way engineering requirement has reasonable uniformity that should be employed by transportation agencies to regulate highway right of way by utility companies. The AASHTO guide general condition explains the utility in and adjacent right of way should consider following aspects: safety, design, location, preservation and reservation, and visual quality. Utility accommodation should not unfavorably affect highway constructability, operations, maintenance, and safety [13].

In Canada, the road authority has responsibility to ensure the safety and convenience of road users, including utilities within right of way. One must consider the long term needs of utility companies to install, operate and repair their facilities in a coherent, safe and efficient manner while minimizing the disruption to road users and other utility infrastructure [9]. Disputes occur as result of the lack of information sharing and understanding due to no join agreement on road of way, and in terms of cost sharing. Many disputes are resolved outside the courtroom with the help of justice department, but some must be decided in the federal courts. The study found that the important aspect concerning the efficient of the system is relationship developed between utility companies and road authority [9].

5.2. Developing the interaction framework
Interaction framework is illustrated by graph representation. As aforementioned, relationship in a system has three configurations i.e. independent, dependent and interdependent. Inter-public infrastructure is an interdependent relationship, and it can be described as closed loop diagram (figure 1). That means each stakeholder could have more than one relation, including relation which is overlapped.

The steps of dependency relationship structure for this study are as represent in figure 3.
From figure 3, interaction framework is carried out in the second step; i.e. relation configuration between stakeholders. This step is a brainstorming to develop an interface sequence table as shown by the example in table 1. The principle of this activity is the entire sequence of dependencies is carried out within the time frame according to RKPD, and conducted by the entire project team. It is needed to comprehend that all the information in the example (table 1) merely the sample data for this paper only, NOT the actual conducted data survey.

| No | Code | Stakeholders | Sequence/interdependent |
|----|------|--------------|-------------------------|
| 1  | A    | Dinas PU Kab | C, D, E                 |
| 2  | B    | Bappeda Kab | A, C, D, E             |
| 3  | C    | PT PLN Persero | A, D, E, F, H, A |
| 4  | D    | PT Telkom | A, C, E, F, H, A |
| 5  | E    | PDAM | A, C, D, F, H, A |
| 6  | F    | Community group | - A, B |
| 7  | G    | Environment group | F A, B |
| 8  | H    | Costumer C, D, E | C, D, E |

Activity of making interface sequence table and identifying interface problems is done carefully by involving the entire project team. Furthermore, the matrix is transform to the closed loop graph that will be looked like the following graph (figure 4):

![Figure 4. Closed loop graph](image)

This graphic in figure 4 looks complicated, especially if there are more stakeholders involved. Since a closed loop graph cannot be modelled, then DSM will answer how the dependency model should be made (figure 5). Dependency matrix simplify the closed loop graph, thus the relationships are recognized easily. The rows and columns axis shows the stakeholders in sequential same order based on how much interests they have on the project. The horizontal position of stakeholders explains stakeholders who provide information to certain stakeholders, while the vertical position explains stakeholders who obtain information from certain stakeholders. It can be seen that the DSM model is much simpler compared to the closed loop graph in figure 4. Figure 5 is just the initial of the DSM modelling; and the model is not completed yet. The completion of the model is not further discussed in this paper, but it will be an integral part of more in-depth research.

6. Conclusion
In conclusion, the interaction between stakeholders in public right of way can be identified using interface management knowledge; because it helps to understand the relation, information exchange, and problems more clearly. Subsequently, the interaction framework can be compiled using DSM model, which avoid the complexity of closed loop graph, especially when involving numerous potential
stakeholders in the field. DSM model shows a simple representation of the relationships, with better understanding on how information exchanged amongst stakeholders. Eventually, the interaction framework will be helpful in designing a coordination system that is more beneficial for local government in development planning.

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