# IMPLEMENTATION OF PDRI DURING FRONT-END PLANNING: A STRATEGY TO IMPROVE INDONESIA'S MARITIME INFRASTRUCTURE PROJECT PERFORMANCE

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## ABSTRACT

In recent years, Indonesia has heavily invested in infrastructure development. With the aspiration to become a Global Maritime Fulcrum, Indonesia needs to provide maritime infrastructure such as national and international ports and their facilities to support the realization of this aspiration. This certainly requires adequate project planning so that resources and investments can be optimally utilized. That is why a good front-end planning is required so that proposed maritime infrastructure projects can be well selected. One important process of front-end planning is project scope definition where a project is clearly defined and prepared for execution. This paper provides examples of failed/cancelled maritime infrastructure projects due to poor front-end planning. It also provides an idea to implement Project Definition Rating Index (PDRI) as a powerful tool to ensure the fulfillment of project scope definition. The author presents the importance of front-end planning, where the final project investment decision is being made, and explains some steps in implementing the PDRI for maritime infrastructure projects. Thus, this paper contributes in introducing the importance of front-end planning and the usage of PDRI in Indonesia especially for maritime projects so that it may enhance the overall maritime infrastructure project performance.

**Keywords**: maritime, infrastructure, investment, front-end planning, PDRI, Indonesia.

## INTRODUCTION

The geopolitical foundation of modern Indonesia is its maritime infrastructure that integrates the archipelago. Indonesia is home of more than 18,000 islands stretching from the Indian Ocean to Pacific Ocean, of those only about 6,000 islands that are populated by more than 260 million people. Maintaining the nation's unity of these fragmented islands that extends 5,271 km from east to west and 2,210 km from north to south poses a unique challenge that must be faced by the country. As an archipelago with thousand scattered islands, Indonesia is much dependent on its maritime service for the flows of logistics and people both domestically and internationally. Java as the main island is home to about 60 percent of the country's population. Java Sea along with the major straits such as Karimata Strait, Makassar Strait, Sunda Strait, Malacca Strait, and major seas such as Flores Sea, Celebes Sea, and Banda Sea, linking the main island of Java to its outer islands stretching from Sumatra to Papua. This presents difficulties and challenges in the effort of equitable development in all corners of Indonesia. With sea area greater than land area, Indonesia should be able to take advantages of its maritime potential to hold this islands nation together. Realizing this, the government has proposed an aspiration of Indonesia's Global Maritime Fulcrum (GMF). Since the announcement of this aspiration in 2014, Jokowi has consistently ensured the realization of the "Sea Tollway" program. One way is through providing adequate port infrastructure.

Infrastructure development is a necessity to support the economy of a nation. In his presentation, Minister of National Development Planning/Head of National Development Planning Agency (Bappenas) at Bandung Institute of Technology (ITB) on 26 August 2017, highlighted the importance of the government to stipulate the direction of Indonesia's sustainable development in the long term to 2045. In the context of GMF aspiration, infrastructure development should be directed to increase connectivity, thus encouraging equity of development throughout Indonesia. However, in many developing countries, it has become a challenge '*to invest in the right projects*' rather than '*to do the project right*'. The Jakarta Monorail project, the Steam Power Plant project, and the Sulawesi Railway project are some examples of failed strategic projects due to lack of project front-end planning. Previous studies have indicated the large number of infrastructure projects that failed in the planning and implementation processes (Flyvbjerg et al. 2003, NRC 2003, Gibson et al. 2010). Furthermore, previous studies have identified several problems of infrastructure planning in some developing countries, including lack of project alternatives, lack of adequate problem analysis, inadequate research of the interaction across infrastructure sectors, uncertainty on improved project impacts, underestimated costs, and overestimated benefits (Fay & Yepes 2003, Priemus 2010). Giang & Pheng (2015) stated that the lack of front-end planning process in infrastructure planning has resulted in poor decisions.

This paper raises important issues regarding project front-end planning in infrastructure which rarely studied before, particularly in Indonesian context. Government and key stakeholders have to understand the importance of front-end planning and making the right decision to approve a proposed project to be executed. Failure in understanding these issues will impact on the next project phases, i.e. implementation and closure. This paper has two objectives, namely (1) to present an idea for improving the performance of maritime infrastructure projects through effective front-end planning process, and (2) to provide an example in implementing the idea.

This paper begins with a look at Global Maritime Fulcrum as Indonesia's aspiration in the new era of government. Next, this paper discusses the requirements of a good maritime infrastructure project and the investment required to realize the project. The third issue is concerning the importance of front-end planning and project selection. This is followed by a discussion of the idea proposed in this paper, i.e. the use of Project Definition Rating Index (PDRI) as a tool in identifying and mitigating potential risks associated with the work of an infrastructure project. Finally, this paper provides the steps needed in implementing this tool during front-end planning phase.

## METHODOLOGY

This research adopts a qualitative approach based on a comprehensive literature review. In doing so, the author tries to review, critique, corelate, and synthesize all related literature in order to generate new perspectives or ideas. A total of 38 literature was used in this study. They are mainly generated using several search engines including RMIT Library search engine and Web of Science (TR). Keywords used to focus the search are 'Indonesia maritime fulcrum', 'infrastructure', 'front-end planning', 'pre-project planning', 'PDRI', and 'project planning'. Six research phases were conducted, namely:

1. Phase 1: searching for related literature/references
2. Phase 2: selecting the relevant literature/references
3. Phase 3: reading and coding the selected literature/references
4. Phase 4: analyzing the content of selected literature/references
5. Phase 5: reporting findings and developing ideas/recommendations
6. Phase 6: presenting the report

## FINDINGS & DISCUSSION

### *Indonesia's Aspiration: Global Maritime Fulcrum*

Historically, Indonesia is well-known as a maritime nation. A maritime nation is a nation that optimally use its maritime potential. Some well-known maritime nations are United Kingdom, United States, Japan, Singapore, China, Australia, and Panama. These countries are called as maritime nations because they have managed their maritime development in a comprehensive, well-planned and sustainable way (Kadar 2015). In this regard, the Indonesian President Regulation No. 16 Year 2017 defines Global Maritime Fulcrum as Indonesian vision to become a sovereign, advanced, independent, powerful maritime nation, and capable of making a positive contribution to the security and peace of the region and the world in accordance with the national interest. Unfortunately, in Indonesian context there are still many problems to be solved. The main problem regarding to Indonesian aspiration as a Global Maritime Fulcrum is the availability of adequate infrastructure (Kadar 2015). Therefore, the government has tried to accelerate the provision of maritime infrastructure for the realization of this vision through Sea Tollway program (Mandi 2017).

Sea tollway program has an objective to shorten transportation access and connect major ports in Indonesia, thus creating a smooth flow of logistics distribution from all over Indonesia. This concept is done by strengthening the shipping line in the eastern part of Indonesia. In addition to connecting the shipping line from western part to eastern part of Indonesia, this concept will also facilitate trade access from the southern Pacific countries to eastern Asian countries. This idea will open regional access by constructing two international ports as hubs that can serve large ships above 3,000 TEU or panamax ships 6,000 TEU. Thus, Indonesia is expected to play a significant role in supporting international logistics distribution (Bappenas 2015). The Ministry of Transportation claimed that the three years of sea tollway implementation has succeeded in reducing price disparities between Indonesian regions by 20 to 40 percent (Primadhyta 2017).

Besides its economic impacts, this maritime aspiration is also regarded by some countries as Indonesia transition from a maritime nation to maritime power, meaning the improved sovereignty and military power at regional as well as global level. This is what is seen by Australia (Till 2015) and United States (Quirk & Bradford 2015). In August 2016, Indonesia participated in the CARAT bilateral naval exercise with the United States. With India, Indonesia has also conducted some bilateral naval exercises (Agastia 2016). Thus, with the right strategies, Indonesia will develop into a powerful maritime country in the region.

### *Maritime Infrastructure and Project Investment*

Given the magnitude of the economic and political impacts of GMF's aspiration, currently Indonesian government is promoting its maritime infrastructure development across the archipelago. Maritime infrastructure development is closely related to the development of new strategic ports and upgrades of existing port facilities. According to Triatmodjo (2009), a decent and good port infrastructure must meet several requirements, namely:

1. Breakwaters, which are used to protect the aquatic port area from wave.
2. The shipping line that must function properly, in terms of length, width and depth, to direct the ships.

3. Shipbuilding facilities, tugboats and other equipment needed to guide ships in and out of port.
4. Port pool, an area where ships are docked and performed various activities such as loading and unloading, spinning and tethering.
5. Dock, which is a port facility that connects the ships with the land area.
6. Mooring tool, which is used to tether the ship.
7. Port warehouse, usually located behind the dock to store items/goods.
8. Equipment for loading and unloading including cranes and vehicles for lifting or moving goods.
9. Terminal building for administration purposes.
10. Fuel facilities.
11. Other facilities for the purpose of passengers, crews and cargo including customs, immigration, quarantine, and security.

In the GMF's context, Indonesian government has launched the development of 24 strategic ports that can serve large ships (panamax class) with improved service speeds. Therefore, Bappenas (2015) has planned the construction of these strategic ports with the following concept:

1. The development of international ports with large and modern capacity for export of various commodities and also serves as International Seaport-Hub.
2. The minimum Hub's pool dredging and depth is -12.5 meters to support the use of Panamax 4,000 TEUS ships moving with pendulum route.
3. Increased draft feeder ports min. -7 meters to support the use of 3 in 1 ships or 2 in 1 ships which began to be developed by PT. PELNI.
4. Modernization of facilities and loading/unloading equipment in strategic Sea toll ports to improve ports' productivity.
5. Expansion of Indonesia National Single Window (INSW) implementation in preparation for implementation of ASEAN Single Window.
6. Restructuring and rationalizing port services tariff in order to improve competitiveness.

The construction of these ports and other infrastructure facilities will certainly require considerable investment. This million-dollar investment would require a good planning in order to be fully utilized. Previous studies have investigated the relationship between project planning and project success rate (Sherif & Price 1999, Gibson et al. 2006). The failure of large infrastructure projects during its planning and execution have been observed by other studies (Flyvbjerg et al. 2003, NRC 2003, Gibson et al. 2010). Improper and inadequate project planning, especially during its front-end planning phase will lead to the approval of wrong projects to be executed. This will certainly cause economic, social and environmental losses that have occurred in many past cases of failed and cancelled projects.

Cilamaya Port project in Karawang became one of the case of maritime infrastructure project cancellation due to poor project planning. According to the Head of National Development Planning Agency/Minister of National Development Planning Andrinof Chaniago, inadequate study and planning was the main reason behind project cancellation:

> "*Cilamaya [cancellation] was due to incomplete study, the technical study of the port project is inadequate…"* (Pratama 2015).

One of the reasons behind the cancellation of this project is concerning the safety factor because the proposed project will be closely built in an area where many gas pipelines are located. Andrinof further said:

*"There are more than 200 Pertamina's platforms and gas pipelines."* (Pratama 2015).

A similar case has occurred at the Bojonegara Port project in Serang District. This port was once predicted to become the largest container port in Indonesia. The construction started with the laying of the first stone by former president Megawati. However, the idea is being changed and now it only becomes a dry bulk port. This happens due to inadequate front-end planning. The reason is that the port is not in a strategic location since industrial centers are located in the eastern part of Jakarta which are located 120 km from Bojonegara Port. General Manager of Pelindo II Banten, Chiefy K. Adi said:

*"If they are loading and unloading here, we need a trucking transport to Jakarta, and this is so burdensome for the users so that the containers will be focused on Cirebon."* (Saubani 2015).

These cancellations would certainly have an impact both economically and socially. It shows the importance of project planning process especially during its front-end planning phase. It is at this phase that a project will be planned and selected so that investment is only provided on the right projects.

***Front-End Planning and Project Selection***

In a construction project life cycle, there are at least three phases, i.e. planning phase, implementation/construction phase, and post construction phase. Front-end planning (FEP) is part of the first phase. FEP starts from the initiation of the project and ends with the final decision whether to continue the project or not (Ceelen 2014). This phase is also known as pre-project planning, front-end loading, or quality at-entry phase.

FEP is defined as 'the process of developing sufficient strategic information with which owners can address risk and decide to commit resources to maximize the chance for a successful project' (CII 2014). According to Cleland & Ireland (2002), it is a process of analyzing and explaining project's goals and strategies needed for the project to successfully reach its main objectives. This phase begins with the conception of a project, gathering information, consolidating stakeholders, defining project scope, and finally making the final decision whether the project will be proceed/financed or not (Motta et al. 2014).

There have been many studies related to the relationship of FEP and its impact on project success. Effective FEP can improve project performance (Sherif & Price 1999, Gibson et al. 2006, Safa et al. 2013). An adequate project planning is important to ensure the project success (Hwang & Ho 2012, Oh et al. 2016), while inadequate FEP can lead to poor project execution (Oh et al. 2016).

Therefore, for megaprojects such as maritime infrastructure projects, it is highly recommended to spend enough resources on FEP phase. The main objective of investing more resources in FEP phase is to increase the overall project success rate (George et al. 2008, Hanna and Skiffington 2010, Hwang and Ho 2012, Liu et al. 2013, Oh et al. 2016). Understanding the significance of FEP phase, the author develops six stages of FEP phase as shown in Figure 1 below. There is a stage gate at the end of each stage that serves to decide whether the project can move forward or not. This stage gate is also known as decision gate (DG) or phase gate. It is used to ensure that a process has met the project objectives. According to Cooper & Edgett (2012), there are five possible results of stage gate process, namely: go, kill, hold, recycle, or conditional go.

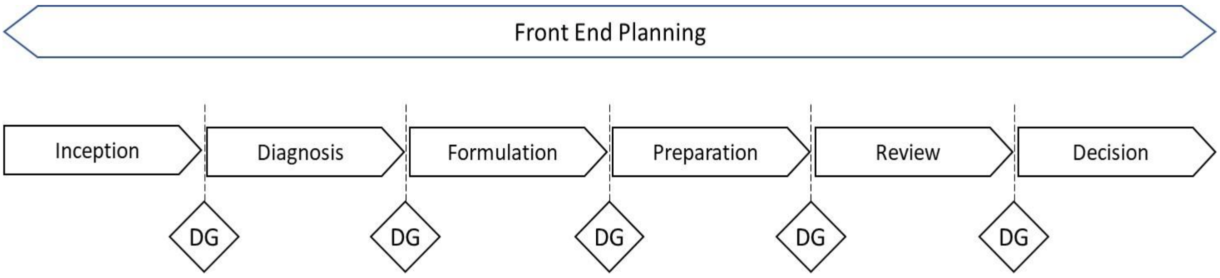


Figure 1. Front-end planning process

A project starts with the employer's idea or desire to build something (Newell & Grashina 2004). It is also called as the inception stage. The next stage is diagnosis. Here, the employer assisted with construction professionals will analyze the current situation and assess the necessity of the project (Kainth 2011). This is followed by formulation stage where all preparation needed to obtain the project objectives are formulated. In this stage, the employer has to establish a project organization or team to perform FEP process. It is important that the employer selects the right people who have adequate construction knowledge and expertise so that FEP phase can serve effectively (Oh et al. 2016).

Next, FEP project team has to prepare FEP plans which include planning targets, identifying risks, defining scope, and developing preliminary designs. These activities are grouped into the preparation stage. This stage is followed by review stage where the employer and FEP project team make a review and justification of the previous stages processes. The final stage of FEP phase is making the final investment decision (FID) whether the proposed project is approved to be further developed or not. It can be defined as a process of making a final decision whether a project will be invested or not based on key criteria and considerations to manage organization's assets. Without proper front-end planning, it is common to find that decisions are made based on intuition and hence, the employer may end up with investing in the wrong projects.

Understanding these FEP stages is crucial for decision makers and project managers so that they can make a correct decision regarding the proposed project. Thus, a proposed project will be selected in such a way as to minimize the possibility of wasting more resources in doing the wrong project.

***Idea: Implementing a PDRI for Maritime Infrastructure Projects***

One common cause of all project failures was that the decision makers failed to acknowledge the extent of uncertainty and complexity during Front-End Planning phase (Shenhar & Dvir 2007). It is therefore important for decision makers and project teams to understand the FEP process. According to Yun et al. (2012), the FEP process implementation varies throughout the industry. Several tools have been developed to improve the effectiveness of FEP implementation. This includes project benchmarking, alignment, TQM, and PDRI (Hamilton & Gibson 1996, Sherif & Price 1999). On the other hand, one important aspect that needs to be understood and ascertained in the FEP phase is the project scope definition. In 2002, Wang has examined the positive relationship between well-defined scope and project performance. One tool used to ensure that a proposed project has been well-defined is the Project Definition

Rating Index (PDRI). Previous studies have explored the correlation between PDRI score and project performance. Thus, many developed countries have utilized PDRI during FEP phase especially for their strategic infrastructure project developments.

Up to 2017, there have been five PDRI tools developed by Construction Industry Institute (CII), i.e. RT-314A (PDRI for small infrastructure projects), RT-268 (PDRI for infrastructure projects), RT-314 (PDRI for small industrial projects), RT-113 (PDRI for industrial projects), and RT-155 (PDRI for general building projects). These tools are developed to serve each specific industry needs because each industry has its own uniqueness and scope definition.

According to CII (2013), PDRI is a powerful and easy-to-use tool that offers a method to measure project scope definition. Besides its function to identify critical elements within project scope definition package, this tool can assist project team in identifying project risks, thereby helping project team to undertake mitigation actions prior to detailed design and construction (CII 2013).

This tool is designed to be used during FEP phase. It consists of three main sections, 13 categories, and 68 elements. Figure 2 below shows how a part of PDRI hierarchy is broken down into elements. Meanwhile Table 1 provides a complete list of the PDRI's hierarchy and elements for infrastructure projects.

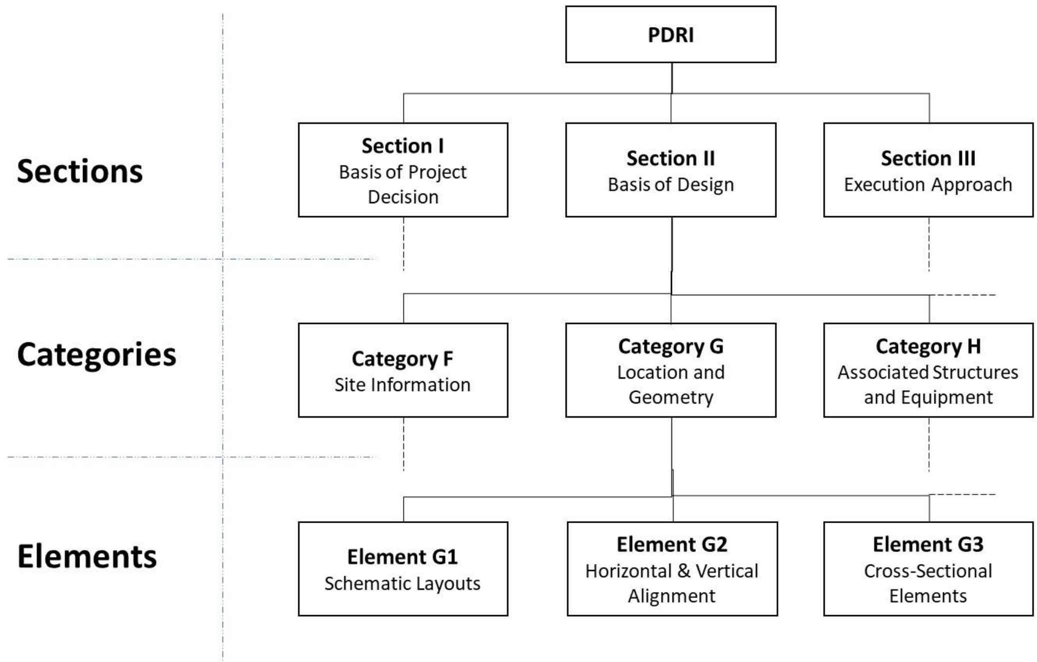


Figure 2. PDRI partial hierarchy (adopted from CII 2013)

Table 1. PDRI Sections, Categories, and Elements (CII 2013)

| | | | | | |
|---|---|---|---|---|---|
| **I** | **BASIS OF PROJECT DECISION** | | **H** | **Associated Structures and Equipment** | |
| **A** | **Project Strategy** | | | H1 | Support Structures |
| | A1 | Need & Purpose Documentation | | H2 | Hydraulic Structures |
| | A2 | Investment Studies & Alternatives | | H3 | Miscellaneous Elements |

| | | |
|---|---|---|
| | | Assessments |
| | A3 | Key Team Member Coordination |
| | A4 | Public Involvement |
| **B** | **Owner/Operator Philosophies** | |
| | B1 | Design Philosophy |
| | B2 | Operating Philosophy |
| | B3 | Maintenance Philosophy |
| | B4 | Future Expansion & Alteration Considerations |
| **C** | **Project Funding and Timing** | |
| | C1 | Funding & Programming |
| | C2 | Preliminary Project Schedule |
| | C3 | Contingencies |
| **D** | **Project Requirements** | |
| | D1 | Project Objectives Statement |
| | D2 | Functional Classification & Use |
| | D3 | Evaluation of Compliance Requirements |
| | D4 | Existing Environmental Conditions |
| | D5 | Site Characteristics Available vs. Required |
| | D6 | Dismantling & Demolition Requirements |
| | D7 | Determination of Utility Impacts |
| | D8 | Lead/Discipline Scope of Work |
| **E** | **Value Analysis** | |
| | E1 | Value Engineering Procedures |
| | E2 | Design Simplification |
| | E3 | Material Alternatives Considered |
| | E4 | Constructability Procedures |
| **II** | **BASIS OF DESIGN** | |
| **F** | **Site Information** | |
| | F1 | Geotechnical Characteristics |
| | F2 | Hydrological Characteristics |
| | F3 | Surveys & Mapping |

| | | |
|---|---|---|
| | H4 | Equipment List |
| | H5 | Equipment Utility Requirements |
| **I** | **Project Design Parameters** | |
| | I1 | Capacity |
| | I2 | Safety & Hazards |
| | I3 | Civil/Structural |
| | I4 | Mechanical/Equipment |
| | I5 | Electrical/Controls |
| | I6 | Operations/Maintenance |
| **III** | **EXECUTION APPROACH** | |
| **J** | **Land Acquisition Strategy** | |
| | J1 | Local Public Agencies Contracts & Agreements |
| | J2 | Long-Lead Parcel & Utility Adjustment Identification & Acquisition |
| | J3 | Utility Agreement & Joint-Use Contracts |
| | J4 | Land Appraisal Requirements |
| | J5 | Advance Land Acquisition Requirements |
| **K** | **Procurement Strategy** | |
| | K1 | Project Delivery Method & Contracting Strategies |
| | K2 | Long-Lead/Critical Equipment & Materials Identification |
| | K3 | Procurement Procedures & Plans |
| | K4 | Procurement Responsibility Matrix |
| **L** | **Project Control** | |
| | L1 | Right-of-Way & Utilities Cost Estimates |
| | L2 | Design & Construction Cost Estimates |
| | L3 | Project Cost Control |
| | L4 | Project Schedule Control |
| | L5 | Project Quality Assurance & Control |
| **M** | **Project Execution Plan** | |

| | | | | | |
|---|---|---|---|---|---|
| | F4 | Permitting Requirements | | M1 | Safety Procedures |
| | F5 | Environmental Documentation | | M2 | Owner Approval Requirements |
| | F6 | Environmental Commitments & Mitigation | | M3 | Documentation/Deliverables |
| | F7 | Property Descriptions | | M4 | Computing & CADD/Model Requirements |
| | F8 | Right-of-Way Mapping & Site Issues | | | |
| **G** | **Location and Geometry** | | | M5 | Design/Construction Plan & Approach |
| | G1 | Schematic Layouts | | M6 | Intercompany & Interagency Coordination & agreements |
| | G2 | Horizontal & Vertical Alignment | | | |
| | G3 | Cross-Sectional Elements | | M7 | Work Zone and Transportation Plan |
| | G4 | Control of Access | | M8 | Project Completion Requirements |

***Steps in Using PDRI for Maritime Infrastructure Projects***

This section provides the implementation steps of PDRI for maritime infrastructure projects. The use of this tool starts with providing an assessment of all elements in the PDRI. Choose only one definition level based on the best perception of how well it has been addressed. CII (2013) recommends the decision makers and FEP team to conduct open discussions in assessing these elements. CII also emphasizes the importance of all participants' understanding on the issues. Thus, it is important that the decision makers and FEP team involved are those who are most knowledgeable related to the given issues. For example, maritime infrastructure issues are deferred to the civil engineers, coastal engineers, and environmental engineers to lead the discussion.

The next step is to write the value of the score that corresponds to the level of definition chosen. Fills up the value in the "Score" column. Make sure all elements have been assessed. The score of each element in a category is summed to produce a total score for that category. The score of each category is summed to get a total section score. And finally, the score of the three sections is summed to achieve a total PDRI score. The following is an example of how an element is being assessed and scored.

Table 2. An example of PDRI section

| **CATEGORY** | | | **Definition Level** | | | | | | **Score** |
|---|---|---|---|---|---|---|---|---|---|
| **Element** | | | **0** | **1** | **2** | **3** | **4** | **5** | |
| **A** | **Project Strategy** | | | | | | | | |
| | A1 | Need & Purpose Documentation | | | | | | | |
| | A2 | Investment Studies & Alternatives Assessments | | | | | | | |
| | A3 | Key Team Member Coordination | | | | | | | |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | A4 | Public Involvement | | | | | | | |
| | | | | | | | | | |

Definition Levels

0 = Not Applicable 2 = Minor Deficiencies 4 = Major Deficiencies

1 = Complete Definition 3 = Some Deficiencies 5 = Incomplete or Poor Definition

To fill out Category A (Project Strategy), follow the steps below:

Step 1: Read the description for each element (please refer to PDRI Infrastructure Projects by CII 2013)

Step 2: Collect all the data needed to evaluate and select the definition level for each element

Step 3: Select the definition level for each element based on the discussions

Here, decision makers and FEP team will conduct open discussions to properly assess and select the definition level for each element in Category A (Project Strategy). The following is an example of how decision makers and FEP team conduct the assessment.

<u>Element A1 – Need & Purpose Documentation</u>

The government is currently planning an international port construction project. This project is vital to support the success of Sea Tollway program as well as Indonesia's GMF aspiration. The team has conducted preliminary cost-benefit analysis and other analysis related to geographic, political, and technical considerations. However, it has not conducted a review of existing conditions and vulnerability assessment. In addition, the Environmental Impact Analysis has not yet been finalized. The team feels that this element has *some deficiencies* that should be addressed prior to the authorization of the project. Definition level = 3.

<u>Element A2 – Investment Studies & Alternatives Assessment</u>

Regarding to investment studies, the team has conducted profitability analysis and look for some investment alternatives that can be done. The team has also identified some potential stakeholders as investors. Currently the team is trying to meet all the requirements related to project investment and financing. However, the team has not yet discussed the issue of insurance or bonding. Preliminary project schedule has not yet been made, making it difficult to convince investors. The team feels that this element has *some deficiencies* that should be addressed. Definition level = 3.

<u>Element A3 – Key Team Member Coordination</u>

Establishing a positive alliance among all key project members is critical for a successful outcome. Here, project manager plays an important role to manage his team. Currently the FEP team has determined potential candidates to become members of the project team. The project team will consist of experts and experienced professionals in maritime infrastructure projects, including: civil engineers, construction managers, procurement personnel, coastal engineers, environmental engineers, and safety engineers. However, the team has not yet established a final meeting and coordination procedures. The team feels that this element has *some minor deficiencies* that should be addressed. Definition level = 2.

<u>Element A4 – Public Involvement</u>

As a form of transparency and in order to support sustainable improvement, the FEP team intends to involve the public in this project. In general, the public that will be involved are citizens and property owners around the project site, business interests, and non-governmental organizations (NGOs). However, there are still many things that have not yet been defined by the team, such as types of public involvement, policy determinations regarding public involvement, notification procedures, as well as project website content. The team feels that this element has *some major deficiencies* that should be addressed prior to the authorization of the project. Definition level = 4. Table 3 below shows the filled-up form of Category A (Project Strategy) in PDRI.

Table 3. Filled-up form of Category A

| **CATEGORY** | | | **Definition Level** | | | | | | **Score** |
|---|---|---|---|---|---|---|---|---|---|
| | **Element** | | **0** | **1** | **2** | **3** | **4** | **5** | |
| **A** | **Project Strategy** | | | | | | | | |
| | A1 | Need & Purpose Documentation | | | | X | | | |
| | A2 | Investment Studies & Alternatives Assessments | | | | X | | | |
| | A3 | Key Team Member Coordination | | | X | | | | |
| | A4 | Public Involvement | | | | | X | | |
| | | | | | | | | | |

Definition Levels

0 = Not Applicable
2 = Minor Deficiencies
4 = Major Deficiencies

1 = Complete Definition
3 = Some Deficiencies
5 = Incomplete or Poor Definition

| | |
|---|---|
| Step 4 | Write the score that corresponds to its level of definition in the "Score" column (refer to Table 6). If the team considers that an element is not applicable for the proposed project, it should be given a score of "0". |
| Step 5 | Summed up the element scores to obtain a category score. Repeat this process for each element. |
| Step 6 | Take action. Use the result to identify issues that require more attention. |

Table 4. Scored-up form of Category A

| CATEGORY | | | Definition Level | | | | | | Score |
|---|---|---|---|---|---|---|---|---|---|
| **Element** | | | **0** | **1** | **2** | **3** | **4** | **5** | |
| **A** | **Project Strategy (Maximum Score = 112)** | | | | | | | | |
| | A1 | Need & Purpose Documentation | 0 | 2 | 13 | (24) | 35 | 44 | 24 |
| | A2 | Investment Studies & Alternatives Assessments | 0 | 1 | 8 | (15) | 22 | 28 | 15 |
| | A3 | Key Team Member Coordination | 0 | 1 | (6) | 11 | 16 | 19 | 6 |
| | A4 | Public Involvement | 0 | 1 | 6 | 11 | (16) | 21 | 16 |
| | | | | | | | | | 61 |

Definition Levels

0 = Not Applicable
2 = Minor Deficiencies
4 = Major Deficiencies

1 = Complete Definition
3 = Some Deficiencies
5 = Incomplete or Poor Definition

In this example, the category A (Project Strategy) has a total score of 61. Add category scores in Section I to obtain section score. Repeat the same processes for elements and categories in Section II and Section III. Finally, summed up all section scores to obtain a total PDRI score.

A low PDRI score represents a well-defined project, while a higher score indicates that certain elements lack adequate definition. CII (2013) has conducted a comparative study of PDRI score and project performance for infrastructure projects. The result shows that projects with PDRI scores under 200 outperformed projects with PDRI scores above 200 in terms of project cost, schedule and change orders. Thus, a lower PDRI score indicating a better project performance. Table 5 below shows the results of CII comparative study on PDRI scores and project performances for infrastructure projects.

Table 4. Comparison of projects with PDRI-Infrastructure Projects scores above and below 200 (CII 2013)

| **Performance** | **PDRI Score** | |
|---|---|---|
| | **< 200** | **>200** |
| Cost | 5% below budget | 25% above budget |
| Schedule | 13% behind schedule | 30% behind schedule |
| Change Orders | 3% of budget | 10% of budget |

Table 5. Weighted Project Score Sheet (CII 2013)

| **SECTION I – BASIS OF PROJECT DECISION** | | |
|---|---|---|
| **CATEGORY** | **Definition Level** | **Score** |

| | Element | | 0 | 1 | 2 | 3 | 4 | 5 | |
|---|---|---|---|---|---|---|---|---|---|
| **A** | **Project Strategy (Maximum Score = 112)** | | | | | | | | |
| | A1 | Need & Purpose Documentation | 0 | 2 | 13 | 24 | 35 | 44 | |
| | A2 | Investment Studies & Alternatives Assessments | 0 | 1 | 8 | 15 | 22 | 28 | |
| | A3 | Key Team Member Coordination | 0 | 1 | 6 | 11 | 16 | 19 | |
| | A4 | Public Involvement | 0 | 1 | 6 | 11 | 16 | 21 | |
| | | **CATEGORY A TOTAL** | | | | | | | |
| **B** | **Owner/Operator Philosophies (Maximum Score = 67)** | | | | | | | | |
| | B1 | Design Philosophy | 0 | 2 | 7 | 12 | 17 | 22 | |
| | B2 | Operating Philosophy | 0 | 1 | 5 | 9 | 13 | 16 | |
| | B3 | Maintenance Philosophy | 0 | 1 | 4 | 7 | 10 | 12 | |
| | B4 | Future Expansion & Alteration Considerations | 0 | 1 | 9 | 9 | 13 | 17 | |
| | | **CATEGORY B TOTAL** | | | | | | | |
| **C** | **Project Funding and Timing (Maximum Score = 70)** | | | | | | | | |
| | C1 | Funding & Programming | 0 | 1 | 6 | 11 | 16 | 21 | |
| | C2 | Preliminary Project Schedule | 0 | 2 | 7 | 12 | 17 | 22 | |
| | C3 | Contingencies | 0 | 2 | 8 | 14 | 20 | 27 | |
| | | **CATEGORY C TOTAL** | | | | | | | |
| **D** | **Project Requirements (Maximum Score = 143)** | | | | | | | | |
| | D1 | Project Objectives Statement | 0 | 1 | 6 | 11 | 16 | 19 | |
| | D2 | Functional Classification & Use | 0 | 1 | 6 | 11 | 16 | 19 | |
| | D3 | Evaluation of Compliance Requirements | 0 | 1 | 6 | 11 | 16 | 22 | |
| | D4 | Existing Environmental Conditions | 0 | 1 | 6 | 11 | 16 | 22 | |
| | D5 | Site Characteristics Available vs. Required | 0 | 1 | 5 | 9 | 13 | 18 | |
| | D6 | Dismantling & Demolition Requirements | 0 | 1 | 4 | 7 | 10 | 11 | |
| | D7 | Determination of Utility Impacts | 0 | 1 | 6 | 11 | 16 | 19 | |
| | D8 | Lead/Discipline Scope of Work | 0 | 1 | 4 | 7 | 10 | 13 | |
| | | **CATEGORY D TOTAL** | | | | | | | |

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|---|---|---|---|---|---|---|---|---|---|---|
| **E** | **Value Analysis (Maximum Score = 45)** | | | | | | | | | |
| | E1 | Value Engineering Procedures | 0 | 1 | 3 | 5 | 7 | 10 | | |
| | E2 | Design Simplification | 0 | 0 | 3 | 6 | 9 | 11 | | |
| | E3 | Material Alternatives Considered | 0 | 1 | 3 | 5 | 7 | 9 | | |
| | E4 | Constructability Procedures | 0 | 1 | 5 | 9 | 13 | 15 | | |
| | | | | | | | | **CATEGORY E TOTAL** | | |
| **Section I Maximum Score = 437 SECTION I TOTAL** | | | | | | | | | | |
| | | | | | | | | | | |
| **SECTION II – BASIS OF DESIGN** | | | | | | | | | | |
| **F** | **Site Information (Maximum Score = 119)** | | | | | | | | | |
| | F1 | Geotechnical Characteristics | 0 | 2 | 7 | 12 | 17 | 21 | | |
| | F2 | Hydrological Characteristics | 0 | 1 | 4 | 7 | 10 | 13 | | |
| | F3 | Surveys & Mapping | 0 | 1 | 4 | 7 | 10 | 14 | | |
| | F4 | Permitting Requirements | 0 | 1 | 5 | 9 | 13 | 15 | | |
| | F5 | Environmental Documentation | 0 | 1 | 5 | 9 | 13 | 18 | | |
| | F6 | Environmental Commitments & Mitigation | 0 | 1 | 4 | 7 | 10 | 14 | | |
| | F7 | Property Descriptions | 0 | 1 | 3 | 5 | 7 | 10 | | |
| | F8 | Right-of-Way Mapping & Site Issues | 0 | 1 | 4 | 7 | 10 | 14 | | |
| | | | | | | | | **CATEGORY F TOTAL** | | |
| **G** | **Location and Geometry (Maximum Score = 47)** | | | | | | | | | |
| | G1 | Schematic Layouts | 0 | 1 | 4 | 7 | 10 | 13 | | |
| | G2 | Horizontal & Vertical Alignment | 0 | 1 | 4 | 7 | 10 | 13 | | |
| | G3 | Cross-Sectional Elements | 0 | 1 | 4 | 7 | 10 | 11 | | |
| | G4 | Control of Access | 0 | 1 | 3 | 5 | 7 | 10 | | |
| | | | | | | | | **CATEGORY G TOTAL** | | |
| **H** | **Associated Structures and Equipment (Maximum Score = 47)** | | | | | | | | | |
| | H1 | Support Structures | 0 | 1 | 4 | 7 | 10 | 11 | | |
| | H2 | Hydraulic Structures | 0 | 1 | 3 | 5 | 7 | 9 | | |
| | H3 | Miscellaneous Elements | 0 | 1 | 3 | 5 | 7 | 7 | | |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | H4 | Equipment List | 0 | 1 | 4 | 7 | 10 | 11 | |
| | H5 | Equipment Utility Requirements | 0 | 1 | 3 | 5 | 7 | 9 | |
| **CATEGORY H TOTAL** | | | | | | | | | |
| **I** | **Project Design Parameters (Maximum Score = 80)** | | | | | | | | |
| | I1 | Capacity | 0 | 1 | 6 | 11 | 16 | 22 | |
| | I2 | Safety & Hazards | 0 | 1 | 4 | 7 | 10 | 12 | |
| | I3 | Civil/Structural | 0 | 1 | 5 | 9 | 13 | 15 | |
| | I4 | Mechanical/Equipment | 0 | 1 | 3 | 5 | 7 | 10 | |
| | I5 | Electrical/Controls | 0 | 1 | 3 | 5 | 7 | 10 | |
| | I6 | Operations/Maintenance | 0 | 1 | 4 | 7 | 10 | 11 | |
| **CATEGORY I TOTAL** | | | | | | | | | |
| **Section II Maximum Score = 293 SECTION II TOTAL** | | | | | | | | | |
| | | | | | | | | | |
| **SECTION III – EXECUTION APPROACH** | | | | | | | | | |
| **J** | **Land Acquisition Strategy (Maximum Score = 60)** | | | | | | | | |
| | J1 | Local Public Agencies Contracts & Agreements | 0 | 1 | 4 | 7 | 10 | 14 | |
| | J2 | Long-Lead Parcel & Utility Adjustment Identification & Acquisition | 0 | 1 | 5 | 9 | 13 | 15 | |
| | J3 | Utility Agreement & Joint-Use Contracts | 0 | 1 | 4 | 7 | 10 | 12 | |
| | J4 | Land Appraisal Requirements | 0 | 1 | 3 | 5 | 7 | 10 | |
| | J5 | Advance Land Acquisition Requirements | 0 | 1 | 3 | 5 | 7 | 9 | |
| **CATEGORY J TOTAL** | | | | | | | | | |
| **K** | **Procurement Strategy (Maximum Score = 47)** | | | | | | | | |
| | K1 | Project Delivery Method & Contracting Strategies | 0 | 1 | 5 | 9 | 13 | 15 | |
| | K2 | Long-Lead/Critical Equip. & Mat’ls Identification | 0 | 1 | 4 | 7 | 10 | 13 | |
| | K3 | Procurement Procedures & Plans | 0 | 1 | 4 | 7 | 10 | 11 | |
| | K4 | Procurement Responsibility Matrix | 0 | 0 | 2 | 4 | 6 | 8 | |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **CATEGORY K TOTAL** | | | | | | | | | |
| **L** | **Project Control (Maximum Score = 80)** | | | | | | | | |
| | L1 | Right-of-Way & Utilities Cost Estimates | 0 | 1 | 3 | 5 | 7 | 10 | |
| | L2 | Design & Construction Cost Estimates | 0 | 2 | 8 | 14 | 20 | 25 | |
| | L3 | Project Cost Control | 0 | 1 | 5 | 9 | 13 | 15 | |
| | L4 | Project Schedule Control | 0 | 1 | 5 | 9 | 13 | 17 | |
| | L5 | Project Quality Assurance & Control | 0 | 1 | 4 | 7 | 10 | 13 | |
| **CATEGORY L TOTAL** | | | | | | | | | |
| **M** | **Project Execution Plan (Maximum Score = 83)** | | | | | | | | |
| | M1 | Safety Procedures | 0 | 1 | 4 | 7 | 10 | 12 | |
| | M2 | Owner Approval Requirements | 0 | 1 | 3 | 5 | 7 | 10 | |
| | M3 | Documentation/Deliverables | 0 | 1 | 3 | 5 | 7 | 9 | |
| | M4 | Computing & CADD/Model Requirements | 0 | 1 | 3 | 5 | 7 | 7 | |
| | M5 | Design/Construction Plan & Approach | 0 | 1 | 4 | 7 | 10 | 14 | |
| | M6 | Intercompany and Interagency Coordination & Agreements | 0 | 1 | 4 | 7 | 10 | 13 | |
| | M7 | Work Zone and Transportation Plan | 0 | 1 | 3 | 5 | 7 | 9 | |
| | M8 | Project Completion Requirements | 0 | 1 | 3 | 5 | 7 | 9 | |
| **CATEGORY M TOTAL** | | | | | | | | | |
| **Section III Maximum Score = 270 SECTION III TOTAL** | | | | | | | | | |
| | | | | | | | | | |
| **PDRI TOTAL SCORE (Maximum Score = 1000)** | | | | | | | | | |

**CONCLUSION**

Front-end planning can be utilized to ensure the success of a project (Hwang & Ho 2012, Oh et al. 2016). Indonesia as an emerging maritime nation with plenty of investment potential should be able to take advantage of its economic revival momentum to build adequate infrastructure that becomes a basic necessity in sustainable development. Good front-end planning should also be done before more resources are invested by the government.

This research encourages the usage of PDRI as a project assessment tool by Indonesian government. Its contribution is twofold. First, it highlights the importance of front-end planning phase in selecting right projects to be invested by the government. Especially related to Indonesia's aspiration as a Global Maritime Fulcrum, Indonesia should invest its funds in appropriate maritime infrastructure projects. Improper front-end planning and project selection will cause both economic and social losses. Second, this paper promotes the usage of PDRI as a tool to enhance the maritime infrastructure project performance.

The implementation of PDRI can benefit Indonesian government as decision maker and investor in public infrastructure projects. Indonesian government can use it as an assessment tool for establishing a comfort level at which they are willing to move forward on projects. CII research has shown that the PDRI can effectively be used to improve the predictability of project performance and success rate. However, the PDRI alone will not ensure successful projects execution. It must be combined with sound business planning, alignment, and good project execution in order to improve the probability of meeting project objectives.

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