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Identification of Green Retrofitting Procurement and Permitting Processes in High-rise Office Buildings in Jakarta Based on PerMen PUPR No.21 Year 2021 and GBC Indonesia that Affects Project Time Performance

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Abstract

The concept of green buildings or green buildings is highly needed in the present era, considering the drastic decline in global climate conditions. However, its development is greatly hindered because the implementation of green building concepts is primarily focused on new constructions, while almost two-thirds of the world's buildings are already built. Therefore, the objective of this research is to enhance the Performance of Green Retrofitting Implementation Time, which is expected to accelerate the growth of existing green buildings in Indonesia by identifying the Procurement and Permitting Processes of Green Retrofitting in High-Rise Office Buildings in Jakarta based on PERMEN PU NO 21 TAHUN 2021 (Regulation of the Minister of Public Works and Housing Number 21 of 2021) and Green Building Council Indonesia (GBCI) through work breakdown structure (WBS) along with their high-risk activities and improvement strategies using a preventive approach that Influences the Performance of Green Retrofitting implementation time. This research analysis involves 15 respondents' data on risks in the procurement and permitting processes, which will be processed using a qualitative risk approach. Based on the results of literature studies, expert validation, and respondent questionnaires, a total of 83 activities in the procurement and permitting processes of green retrofitting were identified, 214 risk indicators that affect the performance of green retrofitting schedule, along with 56 prevention strategies for the high-risk situation, aiming to accelerate the growth of existing green buildings in Indonesia.

Keywords: Green Retrofitting, High Rise Office Building, WBS, Procurement, Permitting, Schedule Performance

1. Introduction

Several studies in recent years have estimated the impacts of global and regional climate change across various sectors. These changes pose challenges for all countries worldwide [1]. Based on the literature review, current climate change has reached a range of 0.5-0.8°C over the past century [2]. Scientists are striving to keep the global average temperature increase below 2°C from pre-industrial levels and aiming to limit the temperature rise to 1.5°C above pre-industrial levels. This is expected to significantly reduce the risks and impacts of climate change [3].

Countries worldwide are making efforts to address the impacts of climate change, including through agreements such as the Paris Climate Agreement. One key point in this agreement is the achievement of net zero emissions. The Paris Agreement was initiated during the 21st Conference of the Parties (COP 21) to the United Nations Framework Convention on Climate Change (UNFCCC) held in Paris on December 12, 2015. The event was attended by 195 countries, including Indonesia [4].

Gases such as CO2, methane, nitrous oxide, CFCs, and other elements are the main contributors to climate change and the greenhouse effect. Among these gases, CO2 is the largest contributor,

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accounting for approximately 50% of the global greenhouse effect, with billions of tons being emitted into the Earth's atmosphere each year. Other gases, such as CFCs, CH4 (methane), O3, and NOx, contribute in smaller proportions, approximately 20%, 15%, 8%, and 7% respectively [5]. In 2018, CO2 emissions reached a record high of around 33.1 billion tons, further exacerbating global warming [6].

The construction/building industry has a significant contribution to CO2 emissions, which play a role in global warming. It is estimated that around 33% of CO2 gas emissions worldwide come from buildings [7]. According to the Global Share of Buildings and Construction Final Energy and Emissions 2019 data, carbon emissions generated by the building industry reached 38% of the total global carbon emissions. The construction sector itself contributes to emissions in several categories, with 27% coming from the operational phase of existing buildings, 6% from the construction of new buildings, and 7% from other sectors within the construction industry [8]. This indicates that the construction/building industry plays a crucial role in environmental degradation and contributes significantly to CO2 emissions.

In response to that, it is necessary to implement the concept of green building. Green building is a concept for 'sustainable buildings' and has specific requirements, including location, planning and design systems, renovation, and operation, which adhere to energy-saving principles and must have a positive impact on the environment, economy, and society [32]. Green building refers to structures and processes that are responsible for the environment and efficient resource use throughout the building's life cycle: from site selection to design, construction, operation, maintenance, renovation, and demolition. This practice extends and complements classic building design concerns about economics, utility durability, and comfort [32]. According to Regulation of the Minister of Public Works and Housing No. 21 of 2021, a green building is a building that meets the Technical Standards for Building Construction and has a significant measurable performance in energy, water, and other resource savings through the application of Green Building principles (BGH) in accordance with its function and classification at each stage of its implementation.

However, looking at the projected number of buildings already constructed by 2040, existing buildings are estimated to make up two-thirds of the buildings in that year [8]. The demolition of non-green buildings not only involves a significant waste of resources and energy but also leads to secondary pollution and ecological damage. On the other hand, if non-green buildings continue to be used, their negative impact on the environment will persist. Therefore, retrofitting existing buildings with green solutions (Green Retrofitting) is a more resource-efficient and sustainable approach compared to developing new green buildings.

To achieve success and ensure proper implementation in green retrofitting activities, it is important to have adequate procurement and permitting processes. In this regard, a comprehensive reference is needed that covers all stages of the building lifecycle, including procurement and permitting stages. The development of a Work Breakdown Structure (WBS) and risk management are also crucial in this context. WBS helps identify and organize the work activities involved in the project, while risk management helps identify high-risk stages of work and offers appropriate solutions and responses to mitigate those risks.

The Work Breakdown Structure (WBS) is a crucial component in project planning. It starts with a hierarchical arrangement of tasks and levels that help identify the flow of the project within the designated and established timeline [9]. With a well-defined WBS and effective risk management, the implementation of green retrofitting activities can be carried out in a focused and efficient manner, ensuring the successful achievement of project goals.

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2. Literature Review

2.1 Concept of Green Retrofitting for High-rise Office Buildings

The definition of green retrofitting according to Regulation of the Minister number 21 of 2021 is the effort to adjust the performance of a utilized building to meet the requirements of Green Building Criteria (Bangunan Gedung Hijau- BGH) [10]. Meanwhile, according to the U.S. Green Building Council (USGBC), green retrofitting is any type of improvement to an existing building, either fully or partially occupied, aimed at enhancing energy and environmental performance, reducing water usage, and improving comfort and indoor environmental quality in terms of natural light, air quality, and noise, all done in a financially beneficial manner for the owner [11].

The aspects considered in the implementation of green retrofitting are categorized into 6 criteria: Appropriate Site Development (ASD), Energy Efficiency & Refrigerant (EER), Water Conservation (WAC), Material Resources & Cycle (MRC), Indoor Air Health & Comfort (IHC), and Building & Environment Management, as outlined by the Green Building Council Indonesia [12].

Regulations related to the assessment of green building performance/certifications currently include assessments conducted by the government through Regulation of the Minister of Public Works and Housing No. 21 of 2021, and non-government assessments by GBCI through Greenship, as well as EDGE, developed by the International Finance Corporation (IFC).

GREENSHIP Existing Building (EB) is a building certification system designed for buildings that have been constructed and operational for at least one year. The implementation of green building practices in GREENSHIP Existing Building focuses on operational and building maintenance management [12]. GREENSHIP itself is a rating system product issued by the Green Building Council Indonesia, taking into consideration the local conditions, natural characteristics, and regulations and standards applicable in Indonesia. The certifications provided include New Building (NB), Existing Building (EB), Interior Space (IS), Homes, Neighborhood (NH), and Net Zero Healthy (NZH).

Regulation of the Minister of Public Works and Housing (Peraturan Menteri PUPR) No. 21 of 2021 is a regulation concerning the Assessment of Green Building Performance issued by the government and enacted on March 31, 2021. The green building performance assessed in this regulation is divided into two categories: new buildings and existing buildings (retrofitting). For existing buildings, the stages are divided into two phases: utilization and disposal phases [10].

2.2 Procurement Process for Green Retrofitting in Indonesia

According to Presidential Regulation, Number 12 of 2021 concerning Government Procurement of Goods/Services, procurement of goods/services through Providers is a way to obtain goods/services provided by Business Entities. Business Entities refer to companies or individuals engaged in specific fields of business or activities. The Government Goods/Services Providers, hereinafter referred to as Providers, are Business Entities that provide goods/services based on contracts [13].

The only government institution responsible for developing and formulating policies for government procurement of goods/services is the Government Goods/Services Procurement Policy Institution (LKPP), while the implementation of government goods and services is carried out by the Electronic Procurement Services (LPSE) [13].

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E-procurement is an auction system for government procurement of goods/services that utilizes internet-based technology, information, and communication to ensure effectiveness, efficiency, transparency, and accountability [14]. According to Andrianto [15], e-procurement is defined as the digitalization process of government procurement tender/auction assisted by the Internet. The features of e-procurement include E-auction, E-Tender, and E-catalogue. E-auction is an online auction system between goods/services providers and users. E-Tender is the procedure for selecting goods/services providers, open to all registered providers in LPSE. E-catalog is an electronic list developed by LKPP.

The procurement process for green retrofitting activities only applies during the retrofitting phase for private buildings, and the planning is carried out by the building management. On the other hand, for government building renovation procurement, it applies to both the planning and implementation phases.

2.3 Permitting Process for Green Retrofitting in Indonesia

Permitting is a process where the government unilaterally grants approval to individuals or communities to legally perform certain acts or activities. In essence, this process serves as a regulatory instrument by the state to control the conduct of its citizens in activities that should not violate the law or harm others [16]. Based on Ministerial Regulation Number 21 of 2021, the licensing process applicable to green retrofitting activities involves PBG (Building Use Approval) and SLF (Certificate of Functionality) during the utilization phase of green retrofitting work. Meanwhile, for the disposal phase, the required permit is RTB (Technical Demolition Plan). According to GREENSHIP Existing Building (EB) by GBCI, the necessary permits for green retrofitting are PBG, SLF, and UKL/UPL documents issued by BAPPEDAL (Environmental Impact Control Agency) [12].

Building Use Approval (PBG) is a permit granted to the owner of a building to construct, modify, expand, reduce, and/or maintain the building in accordance with the technical standards for building construction [17]. The related regulations are governed by Government Regulation Number 16 of 2021. PBG is a reporting permit that can be processed during the construction process [18].

Certificate of Functionality (SLF) is proof that a building has been tested for its safety and functionality. By possessing an SLF, a building is officially recognized and is expected to provide a sense of safety and comfort to its occupants. The regulations related to SLF are governed by the Minister of Public Works and Housing Regulation Number 19/PRT/M/2018 on the Implementation of Building Construction Permits (IMB) and Certificate of Functionality, and Minister of Public Works and Housing Regulation Number 27/PRT/M/2018 on the Certificate of Functionality for Buildings [19].

Environmental Impact Analysis (AMDAL), Environmental Management Efforts, and Environmental Monitoring Efforts (UKL-UPL) are Environmental Documents that must be prepared by businesses whose activities have a significant impact on the environment. These documents will outline the process of developing business infrastructure (such as buildings, factory installations, etc.), soil conditions or geological aspects, types of potential environmental impacts (including liquid waste, solid waste, gas, and noise), as well as how the business entity intends to manage and monitor its activities to minimize potential environmental damage risks [20]. The regulations concerning UKL-UPL documents are outlined in the Minister of Environment Regulation Number 16 of 2012 on Guidelines for the Preparation of Environmental Documents [20]

The Technical Demolition Plan, abbreviated as RTB, is a planning document issued by the owner of a building to the government as a declaration that the said building will be demolished, and there is a plan for the demolition of the building [18]. The plan for the demolition of the building must comply

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with technical standards as stipulated by laws and regulations. To determine whether the demolition plan meets these technical standards or not, a consultation process involving experts with the relevant expertise and skills related to building construction is necessary.

2.4 Work Breakdown Structure of Procurement and Permitting for Green Retrofitting

Work Breakdown Structure (WBS) is an extremely effective tool used in project management. It serves as the foundation for effective project planning, execution, control, status tracking, and reporting. All the work contained within the WBS must be identified, estimated, scheduled, and budgeted. The WBS is a structure and code that integrates and links all project work along with the required resources (scope, schedule, and cost) [21].

A project WBS involves grouping project work elements oriented towards products that organize and define the total project scope. It is a multi-level framework that graphically represents elements indicating the work that needs to be accomplished in logical relationships. Each lower level represents a more detailed definition/division of project components. It is a structure and code that integrates and links all project work and is used throughout the project life cycle to identify, establish, and track specific work scope. The WBS is created with enough detail so that each control account has a unique WBS element [21].

According to the PMBOK 6th Edition, the main benefit of creating a Work Breakdown Structure (WBS) is to provide a framework for what needs to be delivered in the project. The process of creating a WBS is only done once or at designated points in the project. Additionally, the WBS represents a hierarchical decomposition of the total work scope to be performed by the project team to achieve project objectives and deliver the required outcomes. The WBS organizes and defines the total project scope and represents the work specified in the currently approved project scope statement [23].

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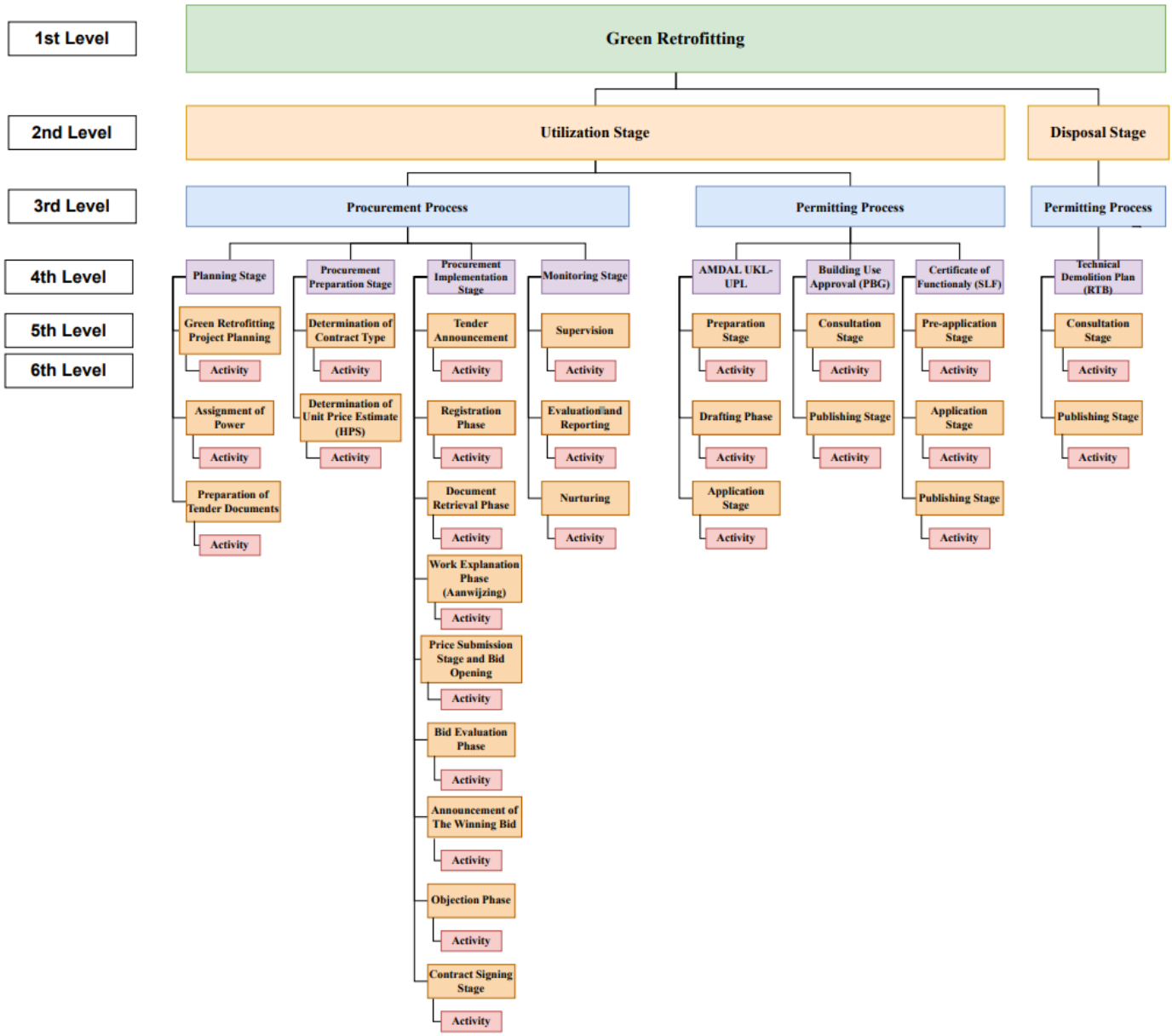

Figure 1: Work Breakdown Structure of Procurement and Permitting for Green Retrofitting

Source: Self Administered

In this research, the Work Breakdown Structure (WBS) for the Procurement and Permitting Process of Green Retrofitting Activity aims to define activities within a project related to the procurement process and permitting process at the utilization and demolition stages. The development of the WBS structure for the Procurement and Permitting Process of Green Retrofitting Activity is based on the requirements of GREENSHIP Existing Building (EB) and on Peraturan Menteri PUPR No. 21 Year 2021 (Regulation of the Minister of Public Works and Housing Number 21 of 2021). The following details the levels in the WBS for the Procurement and Permitting Process of Green Retrofitting Activity:
Level 1: Green Retrofitting
Level 2: Work Phases
Level 3: Work Phase Processes
Level 4: Process Methods
Level 5: Process Support
Level 6: Work Activities

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2.5 Risk Assessment

According to the PMBOK 6th Edition, a risk event is something that has been identified beforehand that may or may not occur. If it happens, it can have either a positive or negative impact on the project. Uncertainty is the lack of knowledge about an event that reduces confidence in the conclusions drawn from data. Risk management is the process of identifying, evaluating, and planning responses to events, both positive and negative, that may occur during the project [22].

Risk management is an approach taken toward the risks of a project, which, involves understanding, identifying, and evaluating the project's risks. Subsequently, it considers what actions to take in response to the potential impacts and the possibility of transferring or reducing the risks. Risk management encompasses a series of activities related to risk, including planning, assessment, handling, and monitoring of risks [23]

The purpose of risk management is to recognize risks within a project and develop strategies to reduce or even avoid them, while also seeking ways to maximize existing opportunities [24]. According to the PMBOK 6th Edition, risk management processes are divided into 7 processes, namely: Risk Management Planning, Risk Identification, Qualitative Risk Analysis, Quantitative Risk Analysis, Risk Response Planning, Risk Response Implementation, and Risk Monitoring. The PMBOK 6th Edition is widely used as a reference for risk management planning, especially in construction projects [22].

The risk assessment in the green retrofit project was ranked for 19 risks using the risk criticality index (RC), which is the result of the likelihood of occurrence and effect indexes (MI). Revealing that the top 5 risk rankings are as follows: "post-retrofit tenants' cooperation risk," "regulatory risk," "market risk," "financial risk," and "pre-retrofit tenants' cooperation risk." [25]. The highest risk in the rating was the "post-retrofit renters' cooperation risk," which indicated that tenants were likely to be uncooperative once the green retrofit was finished. Achieving the most effective use of energy-saving equipment and maximizing all potential benefits would not be possible without the tenants' involvement. Bon-Gang Hwang et al emphasized that the top 5 risks in LO (Likelihood of occurrence) and MI (magnitude of impact) values are "Complex procedures to obtain approvals", "Overlooked high initial cost", "Unclear requirements of owners", "Employment constraint", and "Lack of availability of green materials and equipment". The top position risk (Complex procedures to obtain approvals) was because green residential building projects always involve some particular green features, which would result in lengthier planning approval and permit procedures [26].

2.6 Project Time Performance

Time performance is the comparison of the actual project implementation period to the estimated project implementation period. Time performance can be used as a measure of slippage in a construction schedule. The project implementation begins on the agreed-upon date specified in the contract agreement and ends when all the work is completed. This ratio or comparison serves as the standard measure of project performance, allowing the estimation of project performance through statistics [27].

Time performance is crucial in construction implementation and is one of the primary factors for the success of a construction project. Both design-build and traditional systems of construction projects generally have specific implementation plans and schedules, determining when the project should start, when it should be completed, how it will be executed, and how resources will be allocated [28].

Good time performance seems to be one of the indicators of project success. Poor time performance can lead to various undesirable issues. Time performance is considered good when a project is completed according to the agreed-upon schedule by all parties [29]. In the procurement process, time performance control is crucial and requires leadership, strategy, and management systems. The time needed for procurement and permits significantly impacts the project's implementation and completion time [30]. Project owners must have accurate

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scheduling, recording of work completion status, and contractual authority to accelerate project completion (project time efficiency) [31].

3. Research Methodology

To answer the objectives of this research, the researcher used a qualitative research method. Data validation was carried out using a structured questionnaire and interviews with 5 experts who are proficient in the procurement and permitting of buildings for the green retrofitting activity. Data collection was conducted using a standardized questionnaire administered to 15 experienced respondents who have experience in implementing procurement and permitting. The following figure shows how this research was conducted in order:

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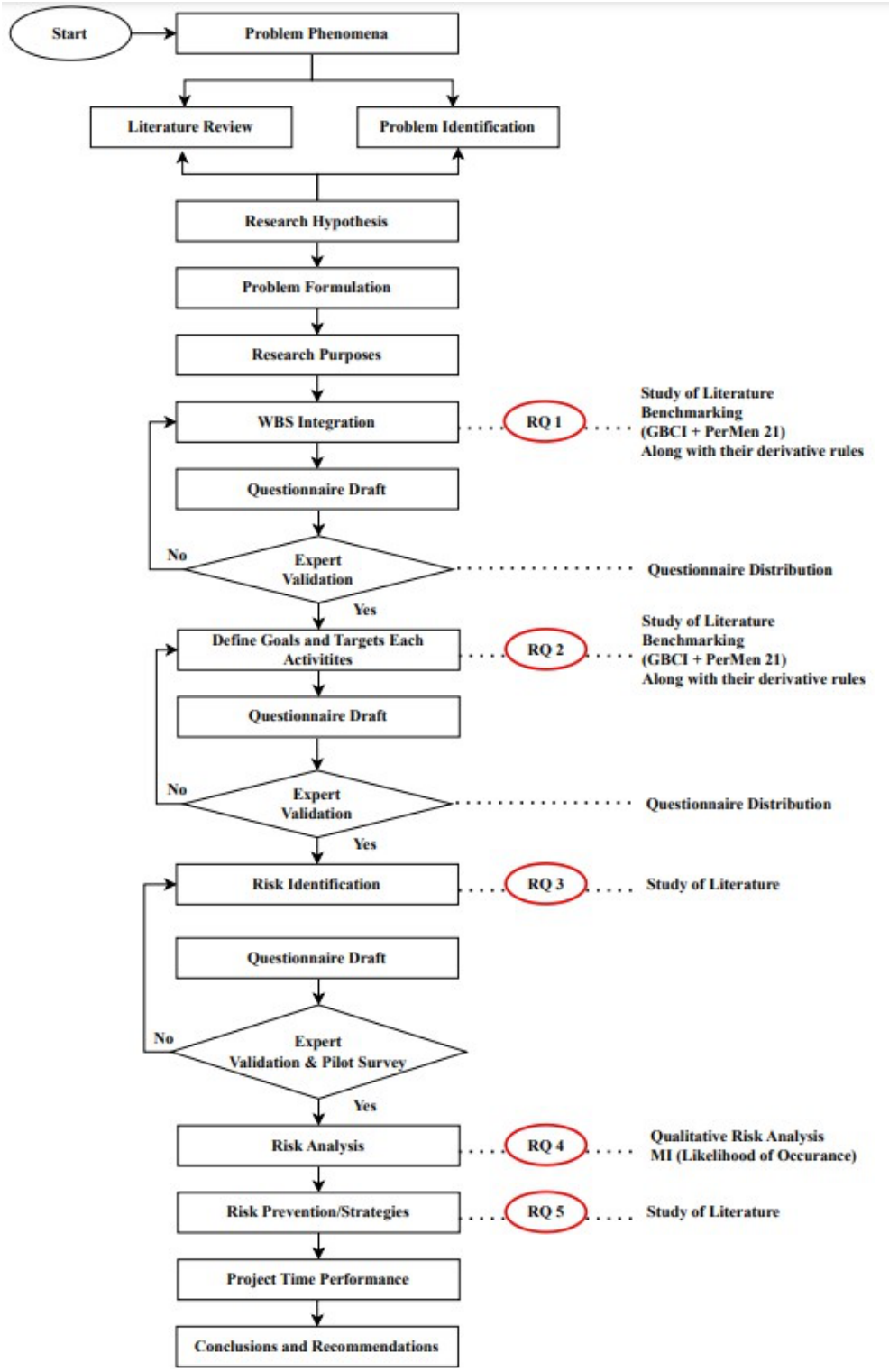

Figure 2: Research Flowchart

Source: Self-Administered

4. Conceptual Framework

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Conceptual framework this research represents the Relationships Model between Variables in the Relationship between Green Retrofitting WBS, Procurement Activity, Permitting Activity, Risk, and Risk Strategies, and Project Time Efficiency of High-rise Office Buildings with The Accuracy Level based can show likes:

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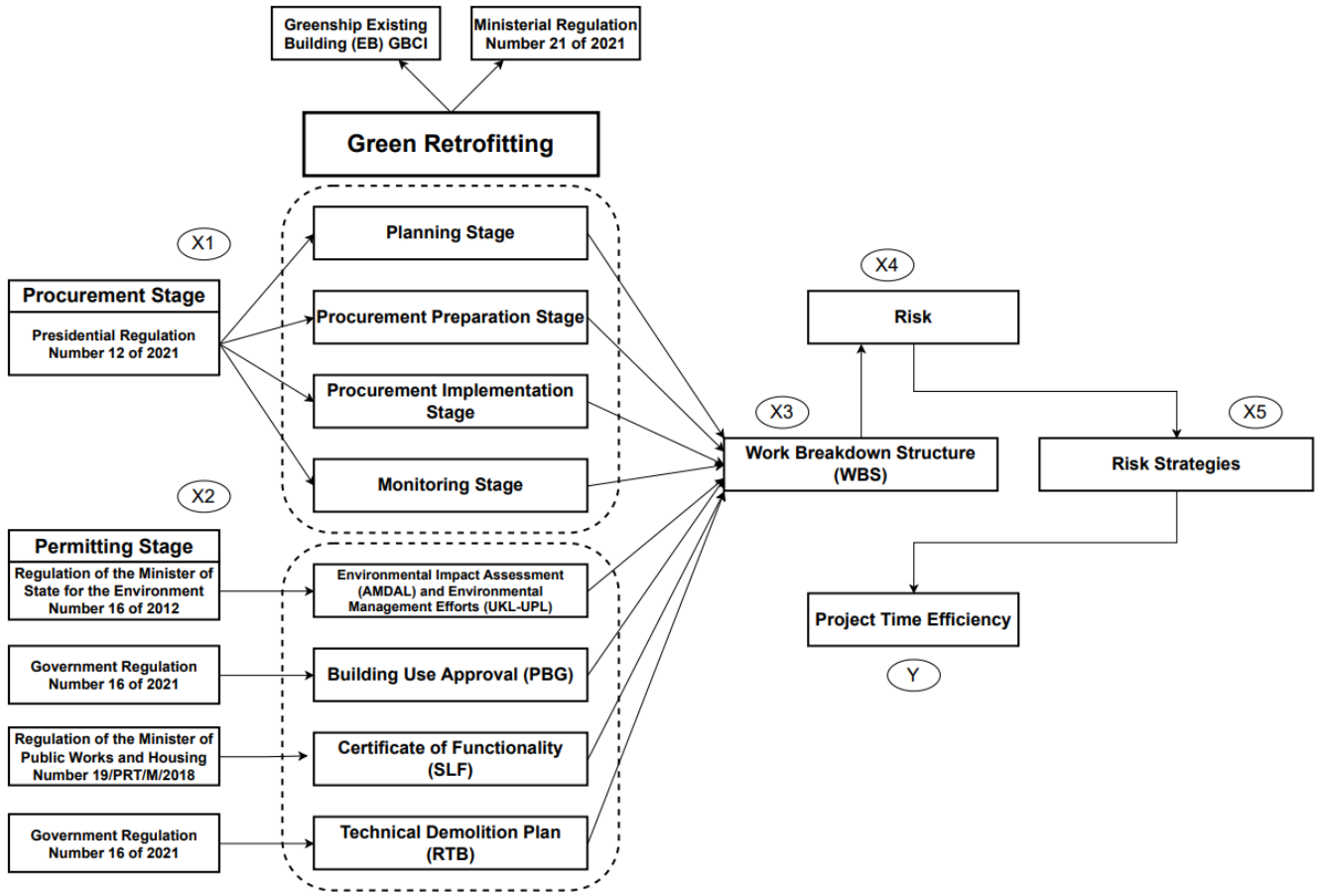

Figure 3: Conceptual Framework of the relationship between green retrofitting and project time

Source: Self-Administered

When doing categorical analysis, factor variables must be transformed into a collection of indicator variables. Finding the risks that have an impact on the scheduled time performance of green retrofitting office high-rise buildings based on procurement and permitting activity is the next stage after achieving the WBS standard. Below is an explanation of the risk variables used in this study:

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Table 1: Research Indicator Variables
Source: Self-Administered

VARIABLE		INDICATOR		Reference
ZX1	PROCUREMENT STAGE	X1. 1	Planning Stage	[13]
		X1. 2	Procurement Preparation Stage	[13]
		X1. 3	Procurement Implementation Stage	[13]
		X1. 4	Monitoring Stage	[13]
X2	PERMITTING STAGE	X2. 1	Environmental Impact Assessment and Environmental	[20]
		X2. 2	Building Use Approval (PBG)	[18]
		X2. 3	Certificate of Functionality (SLF)	[19]
		X2. 4	Technical Demolition Plan (RTB)	[18]
X3	WBS	X3. 1	Input	[22]
		X3. 2	Techniques and Equipment	[22]
		X3. 3	Output	[22]
X4	RISK	X4. 1	Risk Identification	[22]
		X4. 2	Risk Analysis	[22]
		X4. 3	Risk Strategies	[22]
Y	PROJECT TIME EFFICIENCY	Y	Schedule Performance	[22][31]

5. Discussion & Conclusion:

The activities in the procurement and permitting process of green retrofitting have been organized using the Work Breakdown Structure (WBS) tools based on GREENSHIP Existing Building Ver 1.1 by GBCI, which includes regulations and guidelines related to environmental permits, such as: Environmental Impact Assessment (AMDAL) Permit: Based on Regulation No. 16 of 2012 on Environmental Impact Assessment Document Preparation for AMDAL UKL-UPL. Building Permit (PBG) Requirements: Based on PP No. 16 of 2021 for building permit requirements. Technical Demolition Plan (RTB): Based on the Technical Regulation of the Minister of Public Works and Housing No. 21 of 2021. Certificate of Occupancy Permit: Reference is made to Regulation of the Minister of Public Works and Housing No. 19/PRT/M/2018 regarding the Implementation of Building Permit (IMB) and Certificate of Occupancy for the execution of green retrofitting activities. Regarding procurement, it is based on Regulation of the Ministry of Public Works No. 21 of 2021, which pertains to the implementation of procurement for green retrofitting activities. There are a total of 27 work packages in the procurement phase, with 17 of them related to procurement activities and the remaining 10 being associated with the permitting phase.

From the 27 work packages related to procurement and permitting activities for green retrofitting, it has been determined that there are a total of 83 activities. These activities are based on GREENSHIP Existing Building Ver 1.1 by GBCI for permitting in the implementation of green retrofitting activities and Regulation of the Ministry of Public Works No. 21 of 2021 for procurement. Each of these activities can be used to identify their objectives and targets, which are useful for identifying potential risks or risk factors that may occur due to the non-fulfillment of activity goals. This risk identification is crucial for the successful execution of green retrofitting projects, as it allows for proactive risk management and mitigation strategies.

From the 27 work packages related to procurement and permitting, based on the findings from the previous sections and in alignment with the research objectives, a total of 214 risks/factors have been identified in the procurement and permitting phases of green retrofitting activities. Out of these, 84 are associated with the procurement phase, and the remaining 130 risks/factors are related to the permitting phase of green retrofitting activities, mitting activities for green retrofitting, it has been determined that there are a total of 83 activities. These activities are based on GREENSHIP Existing Building Ver 1.1 by GBCI for permitting in the implementation of green retrofitting activities and Regulation of the Ministry of Public Works No. 21 of 2021 for procurement. Each of these activities can be used to identify their objectives and targets, which are useful for identifying potential risks or risk factors that may occur due to the non-fulfillment of activity goals. This risk identification is crucial for the successful execution of green retrofitting projects, as it allows for proactive risk management and mitigation strategies.

Based on the risks/risk factors identified in the stages of procurement and permitting for green retrofitting activities, it was found that out of the total risks, 56 were categorized as high risks, 72 were categorized as medium risks, and 86 were categorized as low risks. The total of 83 activities in the procurement and permitting processes of green retrofitting were identified, 158 risk and 56 high-risk indicators that affect the performance of green retrofitting schedule from each of the procurement and permitting activities, along with 56 prevention strategies for the high-risk situation.

The results of research by developing WBS on the procurement and permitting stage of Retrofitting are guided by GBC Indonesia and PUPR Ministerial Regulation Number 21 of 2021 (Regulation of the Minister of Public Works and Housing Number 21 of 2021) along with their derivative regulations and developing the risk strategies for the high-risk activity expected to significantly increase the project time efficiency of green retrofitting in Indonesia.

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Contribution of Researchers

A statement regarding the contribution rate of the researchers should be given in this section.

Conflicts of Interest

Conflict of Interest Statement should be given in this section.

Ethics committee approval (if needed)

Ethics committee approval statement (board name, board date and issue number) should be given in this section.

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