Leveraging COBIT 2019 Framework for Recommending ERP System Module Development at Cardboard Manufacturing Industry

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Abstract

The manufacturing industry is a cornerstone of Indonesia's economy, contributing significantly to the nation's GDP and exhibiting consistent growth. The sector's advancement is closely linked with technological innovations, particularly those associated with Industry 4.0, which integrates advanced technologies into production processes. Enterprise Resource Planning (ERP) systems play a pivotal role among these technologies. However, maximizing the potential of ERP systems necessitates robust IT governance, which can be assessed using the COBIT 2019 framework. This research targets the Cardboard Manufacturing Industry, which has not previously undergone an IT governance assessment, primarily due to the lack of a dedicated IT division. The study evaluates the current state of IT governance within the industry, focusing on specific objectives, including APO12 (Manage Risk), BAI09 (Manage Assets), APO14 (Manage Data), and EDM05 (Ensure Stakeholder Engagement). The methodology involves a comprehensive evaluation using the COBIT 2019 framework to identify gaps between the current and desired capability levels. The findings reveal significant discrepancies in IT governance maturity, highlighting improvement areas. Consequently, the study proposes recommendations to bridge these gaps, enhancing overall IT governance. Suggestions for developing customized ERP modules are further provided to support the industry's technological integration and efficiency.

Keywords: Cardboard Manufacturer, COBIT 2019, ERP System Module, Recommender.

1. INTRODUCTION

The manufacturing industry is one of the economic sectors that has a significant contribution to the Gross Domestic Product (GDP) in Indonesia [1]. This contribution can be seen from the GDP growth that continues to increase until the third quarter of 2023, with the growth rate of the manufacturing sector reaching 5.20% [2]. Despite its important role in increasing GDP, the manufacturing sector remains linked to technological development and innovation [3]. The use of technology is in line with the Industrial Revolution 4.0, which

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characterizes integration in various production and manufacturing processes [4]. The revolution has led companies to improve the quality, quantity, and productivity of their business so that they can compete effectively [5]. One of the technologies that can be used by companies to improve the quality and quantity of business productivity is Enterprise Resource Planning (ERP), a system that is integrated into various business processes [6].

To optimize the use of technology in the cardboard manufacturing industry, it is essential to measure its effectiveness and efficiency [7]. Therefore, it is necessary to measure information technology governance to ensure that existing IT is maximally used along with IT risk management and is aligned with business processes [8], [9]. COBIT (Control Objectives for Information and Related Technologies) is a framework published by ISACA that can be used to measure IT governance with a focus on evaluating overall performance to make business decisions and meet stakeholder needs [10], [11]. This framework was published by ISACA (Information Systems Audit and Control Association), with its latest version called COBIT 2019, which is a development and refinement of the previous version [12]. COBIT 2019 categories governance objectives in the Evaluate, Direct, and Monitor (EDM) objective, while management objectives are categorized into four objectives: Align, Plan, and Organize (APO); Build, Acquire, and Implement (BAI); Deliver, Service, and Support (DSS); and Monitor, Evaluate, and Assess (MEA) [13]. This research uses COBIT 2019 because it is results-oriented, flexible, and prioritizes alignment between IT and company goals [14].

Established in 2002, Cardboard Manufacturing Industry is a company engaged in the cardboard manufacturing industry [15]. Currently, Cardboard Manufacturing Industry has configured its business processes into a personalized ERP system, tailored to the company's needs. Despite being 22 years old, the company has never measured information technology governance. It is known that the company does not have an IT division, so the problems faced by the company are closely related to the human resource factor. This is the cause of the less-than-optimal use of technology in the company.

Therefore, through this research, the measurement of IT governance for Cardboard Manufacturing Industry is carried out. There are four objectives measured in this study, namely APO12 (Managed Risk), BAI09 (Managed Assets), APO14 (Managed Data), and EDM05 (Ensure Stakeholder Engagement). The purpose of the research is to help companies evaluate the performance of information technology used, to be able to increase business value and optimize the use of technology. The results of this study are in the form of recommendations for improvement and recommendations for developing ERP modules.

2. METHODS

The research method used in this study refers to two previous studies [16], [17]. Figure 1 is the research flow that will be carried out in this study with the following.
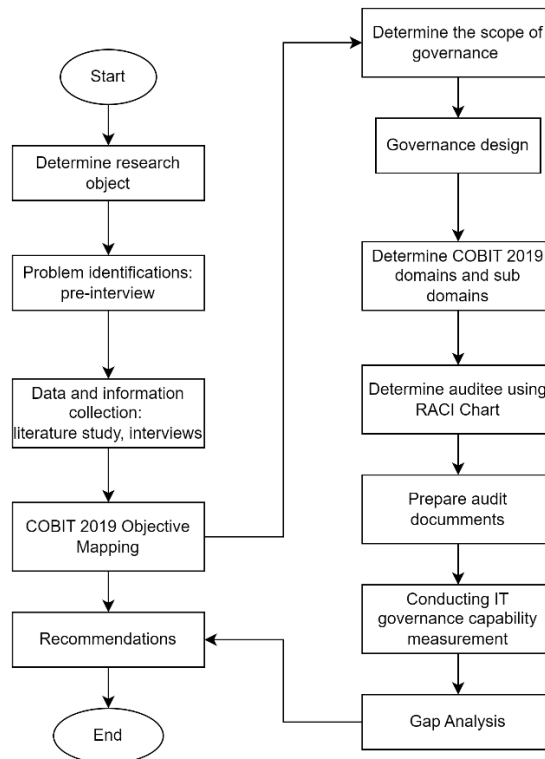

Figure 1. Research Method

1) Determining the object of research: The initial step in this research is to determine the object of research, namely Cardboard Manufacturing Industry.
2) Problem identification: The problems found are related to HR factors, namely the absence of an IT division, and the company has also never measured information technology governance capabilities.
3) Data and information collection: Data and information to support research are collected through two methods: literature studies to deepen understanding of the IT governance capability measurement process using COBIT 2019, as well as interviews with Cardboard Manufacturing Industry, to obtain information about company problems and capability measurements.
4) COBIT 2019 objective mapping: The mapping is guided by the COBIT 2019 framework and adjusted to the company's problems and objectives.

Some of the things done include filling in design factors, determining COBIT 2019 objectives, preparing audit documents, determining auditees using RACI charts, measuring capability levels, and conducting gap analysis.

5) Generating recommendations: After taking measurements, recommendations will be made consisting of recommendations for improvement and recommendations for developing ERP modules.

Here's a detailed explanation of each step in the process illustrated by the Figure 1.

1) Start: The initial phase is where the project officially begins.
2) Determine Research Object: Identify the specific industry or organization to be studied, in this case, the Cardboard Manufacturing Industry. This step involves selecting the unit of analysis for the research.
3) Problem Identifications: Pre-interview: Conduct preliminary interviews to identify existing problems within the organization's IT governance. This helps in understanding the context and specific issues that must be addressed.
4) Data and Information Collection: Literature Study, Interviews: Gather relevant data through a thorough literature review and conducting detailed interviews with key stakeholders. This step ensures a comprehensive understanding of the current IT governance practices and challenges.
5) COBIT 2019 Objective Mapping: Map the organization's objectives against the COBIT 2019 framework to identify relevant governance and management objectives. This involves aligning organizational goals with COBIT 2019 domains and sub-domains.
6) Recommendations: Based on the analysis and findings, actionable recommendations to improve IT governance should be developed. This includes proposing interventions and enhancements to align the organization's practices with COBIT 2019 standards.
7) Determine the Scope of Governance: Define the scope of the governance assessment. This involves deciding which areas of the organization's IT governance will be evaluated.
8) Governance Design: Design the governance framework for the assessment. This step involves structuring the framework to fit the organization's specific needs.
9) Determine COBIT 2019 Domains and Sub-domains: Identify the relevant COBIT 2019 domains and sub-domains that apply to the organization. This will help focus the assessment on specific areas of IT governance.
10) Determine Auditee Using RACI Chart: Identify the individuals who will be assessed using a RACI (Responsible, Accountable, Consulted, and Informed) chart. This chart helps clarify roles and responsibilities within the organization.

11) Prepare Audit Documents: Prepare all necessary documents required for the audit. This includes creating templates, checklists, and other tools for a thorough assessment.
12) Conducting IT Governance Capability Measurement: Measure IT governance capabilities within the organization. This step involves evaluating current practices against the COBIT 2019 framework.
13) Gap Analysis: Analyze the gaps between the current IT governance capabilities and the desired state per COBIT 2019 standards. This involves identifying areas of improvement and potential risks.
14) End: Conclude the project with a summary of findings, final recommendations, and a plan for implementing the suggested improvements. This marks the completion of the research process.

Each step is crucial for conducting a comprehensive IT governance assessment and developing practical recommendations for improving the organization's IT governance practices. Data collection is carried out using two techniques: a literature study to increase understanding related to capability measurement using COBIT 2019 and interviews with the company to find out the problems faced by the company and to measure governance using audit documents. The two data analysis techniques used are: data analysis using the COBIT 2019 toolkit to determine the objectives to be measured and gap analysis between expected capability level and current capability level [16]. Each objective generated through filling out the factor design has a different target level of capability based on the value obtained. The target scale of the capability level can be seen in Table 1 below [17].

Table 1. Expected Capability level based on objective value.

Objectives values	Expected Capability Level
≥75	Level 4
≥50	Level 3
≥25	Level 2
≤24	Level 1

Capability Level Equations: Based on the previous research the following is the formula used to determine the level of capability [18].

$$CC = \Sigma CLa / \Sigma Po \times 100\% \qquad (1)$$

Where CC = Governance level achieved, ΣCLa = Total value of governance and management scores. ΣPo = Total value of governance and management activities.

3. RESULTS AND DISCUSSION

Problem Identification: Based on interviews, it is known that the main problem experienced by the company is related to the human resource factor (HR). The company does not have a division in charge of managing the company's information technology. Meanwhile, tasks and responsibilities related to IT are handed over to other people. Therefore, management related to information technology in the company has not reached an optimal level.
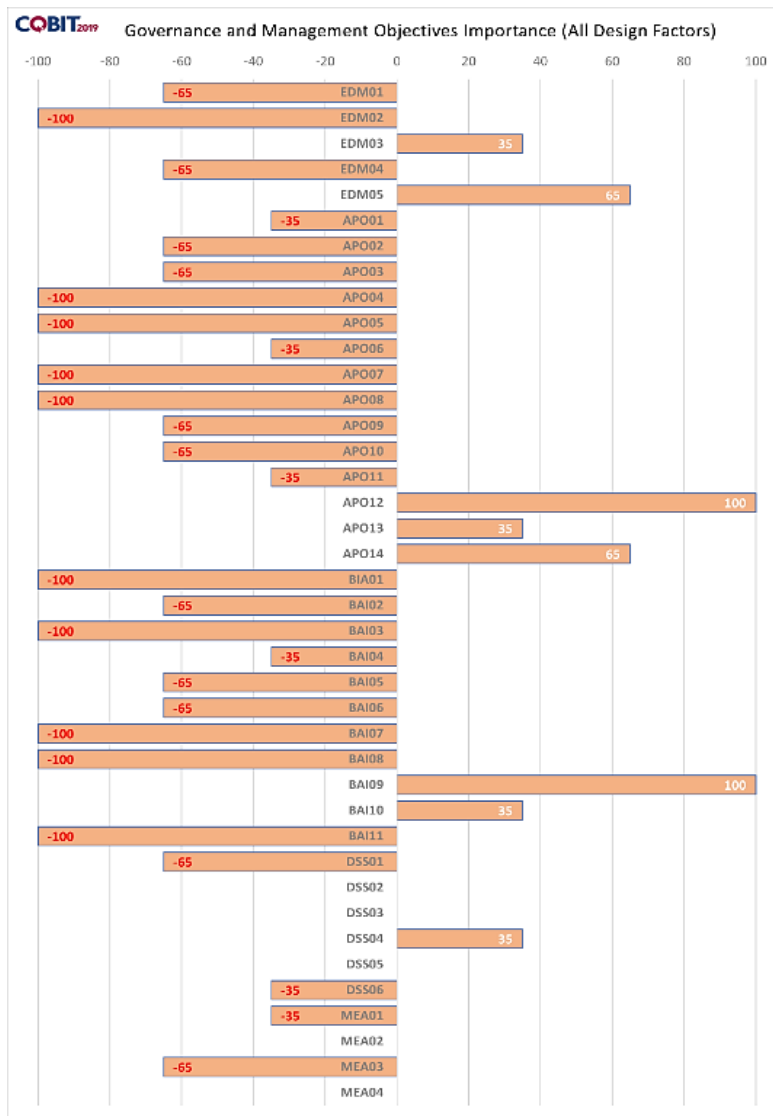

Figure 2. COBIT 2019 Objectives

COBIT 2019 Objectives Mapping: Based on the COBIT 2019 Design Toolkit, there are two stages that must be carried out to obtain the objectives to be measured. The first stage is to determine the scope of governance, which is obtained by measuring design factor 1 (enterprise strategy) to design factor 4 (IT related issues). Then proceed with refining the scope of the governance system by measuring design factor 5 (threat landscape) to design factor 11 (enterprise size) [19].

Referring to Figure 2, the objectives that are prioritized for assessment are those that have a value above 75%, with a target capability level of level 4. In addition, domains that have a value above 50% are also selected for evaluation and measurement with a target capability level of level 3 [17]. Therefore, in this study, measurements will be made for four domains, including APO12 (Managed Risk), BAI09 (Managed Assets), APO14 (Managed Data), and EDM05 (Ensure Stakeholder Engagement).

Capability Level Measurement: Objective level measurement can proceed to the next level if the resulting average for the previous level is 85%. If the average obtained is <85%, it means that the calculation stops at that level [20]. Based on the audit documents that have been filled out by representatives from Cardboard Manufacturing Industry, the following are the measurement results obtained for the four objectives selected.

3.1 APO12 (Managed Risk)

The results of the average calculation for each process contained in the APO12 objective are as follows.

Table 2. Objective assessment results for APO12

APO12 Processes	Value (%)
APO12.01	62,5
APO12.03	51,67
APO12.05	60
Total	**174,17**
Average	**58,06**

Based on Table 2, it is known that the average value obtained is 58.06%. This value does not meet the criteria for continuing the measurement to the next level because it does not reach 85%. Therefore, the measurement of the capability level for objective APO12 stops at level 2.

3.2 BAI09 (Managed Assets)

The results of the average calculation for each process contained in the BAI09 objective are as follows.

Table 3. Objective assessment results for BAI09

BAI09 Processes	Value (%)
BAI09.01	65,67
BAI09.02	66,67
BAI09.03	73,67
BAI09.05	75
Total	281
Average	**70,25**

Based on Table 3, it is known that the average value obtained for objective BAI09 is 70.25%. This value does not meet the criteria for continuing measurement to level 3 because it does not reach 85%. Therefore, the measurement of the capability level for objective BAI09 stops at level 2.

3.3 APO14 (Managed Data)

The average calculation results for each process contained in the APO14 objective are as follows:

Table 4. Objective assessment results for APO14

APO14 Processes	Value (%)
APO14.01	80
APO14.02	73.33
APO14.03	81.67
APO14.07	86
APO14.08	80
APO14.09	83
APO14.10	88,33
Total	572,33
Average	**81,76**

Based on Table 4, it is known that the average value obtained for objective APO14 is 81.76%. This value does not meet the criteria for continuing measurement to level 3 because it does not reach 85%. Therefore, the measurement of the capability level for objective APO14 stops at level 2.

3.4 EDM05 (Ensure Stakeholder Engagement)

The results of the average calculation for each process contained in the EDM05 objective are as follows.

Table 5. Objective assessment results for EDM05

BAI09 Processes	Value (%)
EDM05.01	60
EDM05.02	73,33
Total	133,33
Average	**66,67**

Based on Table 5, it is known that the average value obtained for objective EDM05 is 66.67%. This value does not meet the criteria for continuing measurement to level 3 because it does not reach 85%. Therefore, the measurement of the capability level for objective EDM05 stops at level 2.

Gap Analysis: Based on the results of measuring the level of capability obtained, the next step is to calculate the gap. Gap analysis is performed by reducing the expected capability value with the current capability value. In this study, the expected capability for objectives APO12 and BAI09 is at level 4 because the value of the two objectives is more than 75. However, objectives APO14 and EDM05 have an expected capability at level 3 because the two objectives are at 65, which is more than 50 but less than 75. The following is a gap analysis for the four objectives.

Recommendations are given to companies to help make improvements based on the results of the measurements that have been taken. The recommendations given are divided into two, namely: recommendations for increasing capability levels and recommendations for implementing ERP modules. Recommendations for increasing the level are adjusted to the expected capability level based on gap analysis. In addition, recommendations for implementing ERP modules are also given to increase company productivity.

4.5 Recommendations for increasing levels.

1) APO12 (Managed Risk)

The following are the level 3 improvement recommendations given for objective APO12 in Table 6.

Table 1. APO12 Level 3 Recommendations

Process		Recommendation
APO12.01	a.	Create a team and provide training on IT risk collection, classification and analysis methods.
	b.	Collect data related to IT risks by ensuring the relevance of such risks to the company's internal and external environment.
APO12.03	a.	Conduct regular recording of risk profiles and prepare plans to deal with these risks. Conduct regular recording of risk profiles and prepare plans to deal with these risks.

Process		Recommendation
	b.	Identify risks by category and identify resources related to the risk profile.
APO12.05		Create a risk-handling plan by considering the costs, benefits, and impact on the current risk profile. And classify the handling based on risk.

The recommendations are then continued for improvement to level 4, as listed in Table 7.

Table 2. APO12 Level 4 Recommendations

Process		Recommendation
APO12.01		Perform a risk taxonomy to help classify risk scenarios based on their likelihood of occurrence and impact.
APO12.02	a.	Determine risk analysis efforts by considering all existing risk factors.
	b.	Periodically update the existing risk profile and risk management plan by adjusting to threats that may or are occurring and by considering the losses and benefits obtained.
	c.	Classify risks based on the ability to handle risks and make plans for handling risks that cannot be tolerated.
APO12.03		Routinely record risk profiles and risk management plans in integrated risk documentation.
APO12.04	a.	Reporting risk analysis to stakeholders on a regular basis by including the possibility of loss, gain, impact, and effectiveness of risk handling.
	b.	Create worst-case scenarios related to losses that may be achieved periodically while still identifying IT opportunities to generate profits from these risks.
APO12.05	c.	Ensure the involvement and responsibility of each party in the company to operate in accordance with the level of risk.
	d.	Create scenarios that are able to reduce existing risks by considering costs, benefits, and their impact on the current risk profile.
APO12.06	a.	Prepare, implement, maintain, and test specific steps to be taken in the event of a risk that has a significant impact on business processes.
	b.	Create appropriate scenarios for risk handling in order to minimize the impact.

2) BAI09 (Managed Assets)

The following are the level 3 improvement recommendations given for objective BAI09 in Table 8.

Table 3. BAI09 Level 3 Recommendations

Process		Recommendation
BAI09.01	a.	Periodically identify and record the company's IT assets on the balance sheet, including hardware and software.

Process		Recommendation
	b.	Ensure that the company's IT assets can operate properly and in accordance with the purpose of their existence.
	c.	Ensure that all existing assets meet applicable regulatory standards.
BAI09.02	a.	Categorize the company's important assets and ensure the dissemination of information related to existing assets to all parties involved.
	b.	Routinely check the company's assets, in order to measure the risk of failure that requires asset replacement action.
BAI09.03	a.	Ensure that the company has the necessary assets to be directly involved in the company's business processes.
	b.	Routinely check, test, calculate, and record the company's assets.
	c.	Ensure that the assets obtained are in accordance with the supplier's agreement.
BAI09.05		Use software that has and complies with the official license.

The recommendations are then continued for improvement to level 4, as listed in Table 9.

Table 4. BAI09 Level 4 Recommendations

Process		Recommendation
BAI09.01		Record assets in company accounting, considering the reconciliation value and service life of each existing asset.
BAI09.02	a.	Create maintenance schedules and scenarios for the company's assets by considering costs, parties involved, and changes in asset value.
	b.	If a third party is involved in the asset maintenance process, make sure there is an agreement that needs to be adhered to, especially regarding access rights and confidential data.
	c.	Perform maintenance for all hardware assets and ensure that the infrastructure supporting the maintenance process can only be operated when these activities are carried out.
BAI09.03	a.	Establish standard asset management scenarios starting from the installation process, testing, to implementing assets before being involved with the company's business processes.
	b.	Create an asset allocation procedure that contains criteria for the cause of asset allocation, allocation approval, and transfer of responsibility with due regard to the efficiency of the resources involved.
	c.	b. Ensure that every asset that is no longer in use has gone through a cleaning process to avoid data leakage, potential environmental pollution and regulatory violations, and potential risks.
BAI09.04	a.	Conduct regular evaluations of the company's assets, to measure and increase the value of these assets to align with business needs.
	b.	Adjust assets if there is a mismatch or incompatibility of assets with company needs. This can be done by making repairs, additions, reductions, or replacements to the assets in question.

Process	Recommendation
BAI09.05	Routinely check the validity period of software licenses so that extensions can be made immediately when the grace period is approaching to avoid limitations in the use of the software.

3) APO14 (Managed Data)

The following are the level 3 improvement recommendations given for objective APO14 in Table 10.

Table 5. APO14 Level 3 Recommendations

Process	Recommendation
APO14.01	a. Create a team responsible for data collection, processing, use, and storage activities in the company. b. Establish regulations related to data management to avoid any misuse of company data. c. Involve information technology in developing the organization's data management strategy.
APO14.02	a. Create a document containing business terms used by the company and ensure that the document is accessible to all company employees. b. Use standardized business terms that are easy to understand and appropriate to the company's activities. c. Ensure that business terms are used consistently in accordance with their definitions and are involved in the development of a project.
APO14.03	a. Create, categorize, and validate enterprise metadata to analyze the impact of data changes. b. Evaluate the use of metadata regularly so that the company can make improvements if necessary.
APO14.07	Establish data maintenance procedures and mechanisms and perform regular data cleansing to maintain data history.
APO14.08	a. Establish procedures and regulations related to the use of data for mutual benefit, considering the requirements and needs of each party involved. b. Ensure the relevance of any data listed and used in the company's business processes. c. Creating procedures for data management that require changes based on the agreement of each party involved. d. Make rules and mutual agreements if the data used needs to be changed.
APO14.09	Regularly perform and record the data backup process, so that the company has a complete data history if needed. Ensure that data archives are stored in a secure location and have risk mitigation in place.
APO14.10	Create scenarios, schedules, techniques, and procedures related to data backup, testing, and recovery.

4) EDM05 (Ensure Stakeholder Engagement)

The following are the level 3 improvement recommendations given for objective EDM05 in Table 11.

Table 6. EDM05 Level 3 Recommendations

Process	Recommendation
EDM05.01	Establish procedures, principles, and policies for communication with internal and external parties, including communication channels, forms of communication, and communication intensity.
EDM05.02	Evaluate current reporting procedures and create new strategies to improve reporting procedures.

5) Recommendations for implementing ERP modules.

The following Table 12 shows some ERP modules that are recommended for development by the company [23-27]:

Table 7. ERP Modules Recommendations

Modules Recommendations	Module Benefits	
Asset Management	a.	Assist companies in recording asset life, asset value, and asset performance.
	b.	Make it easier to track the location and condition of company assets.
	c.	Helps companies make schedules and determine the person in charge of asset maintenance.
	d.	Integrate documentation related to asset usage, purchase, management, and license agreements.
Training Management	a.	Assist and facilitate the company in providing, customizing, documenting, and delivering training to employees.
	b.	Improve the efficiency and effectiveness of the training process because companies can add learning modules to the system without having to create training schedules again.
	c.	Ease of access to learning materials by those who need them.
	d.	Assist companies in evaluating and assessing employee understanding by adding reporting features.
Risk Management	a.	Assist the company in recording and classifying risk profiles periodically.
	b.	Make it easier for companies to evaluate through reporting that can be obtained from systematic and periodic recording.
	c.	Helping companies make risk management plans through their records and evaluations.

Based on the three recommended ERP modules, the following User Interface is designed to clarify the functions and benefits of each module.
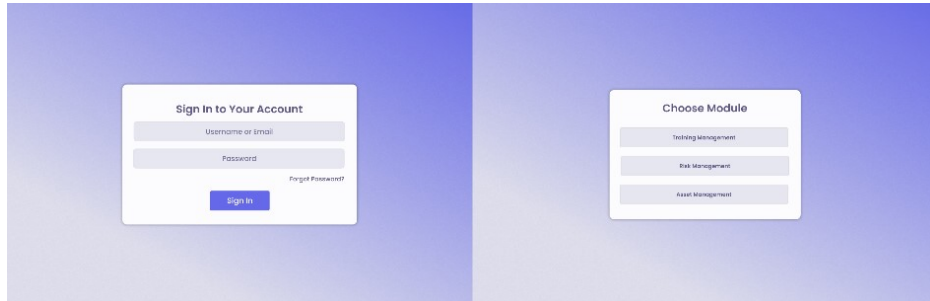

Figure 3. Prototipe of ERP System login page.

The ERP system login page prototype features a streamlined and user-friendly interface. Users are prompted to sign in if they already have an account or to create a new account if they do not. The login form requires users to input their username or email and password. For those who may have forgotten their password, a "Forgot Password" feature is available to help them reset it. Once logged in, users can easily access and utilize the specific ERP modules they need for their tasks.
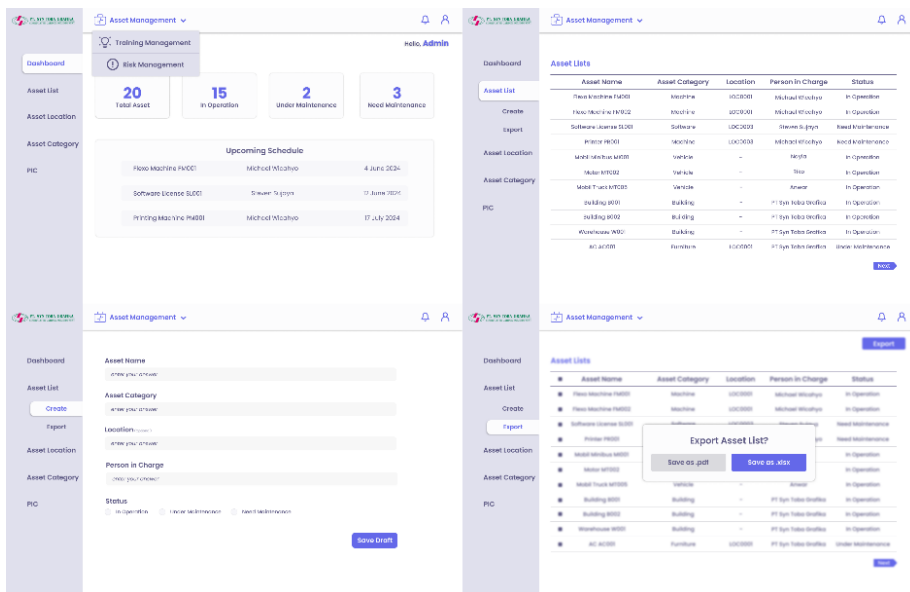
Figure 4. Prototipe of Asset Management Module.

The prototype of the ERP system's asset management module includes a variety of menus designed to streamline and enhance asset management processes. The

Dashboard menu overviews key metrics and asset-related information, offering a quick snapshot of the system's status. The Asset List menu allows users to view and manage all assets within the organization. In contrast, the Asset Location menu enables tracking of asset locations to ensure efficient utilization and easy retrieval. The Asset Category menu helps categorize assets for better organization and management. The module also includes a Person in Charge (PIC) menu, where responsible personnel for each asset are designated. Additionally, there are Training Management and Risk Management menus, which facilitate the organization of training sessions related to asset use and identifying and mitigating potential risks associated with asset management.
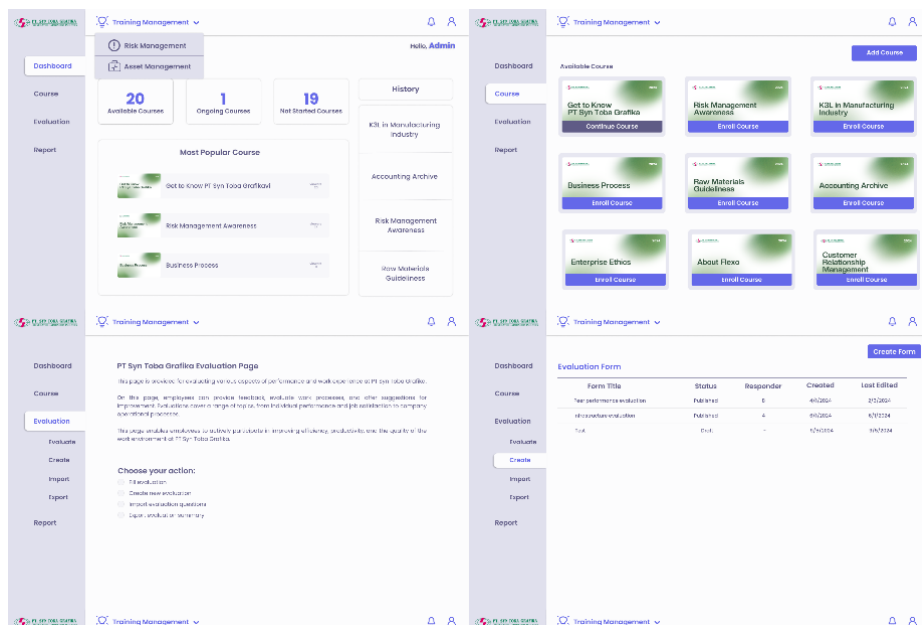

Figure 5. Prototipe of Training Management Module.

The ERP system's training management module prototype is designed to provide comprehensive support for employee training and development. The Available Course section lists all the training programs currently open for enrollment, allowing users to browse and register for courses that meet their needs. The Ongoing Course section tracks training sessions that are currently in progress, enabling participants to stay updated on their status and progress. The Next Started Course section also highlights upcoming training sessions, helping employees plan and prepare for future learning opportunities.

Furthermore, the module includes a History section, which records all completed training programs, providing a detailed account of each employee's training journey and achievements. This historical data is crucial for performance evaluations and career development planning. The Evaluation section allows for assessing completed courses, where participants can provide feedback and evaluations, ensuring continuous improvement of the training programs. This feature also enables trainers to assess the effectiveness of their courses and make necessary adjustments to enhance the learning experience.
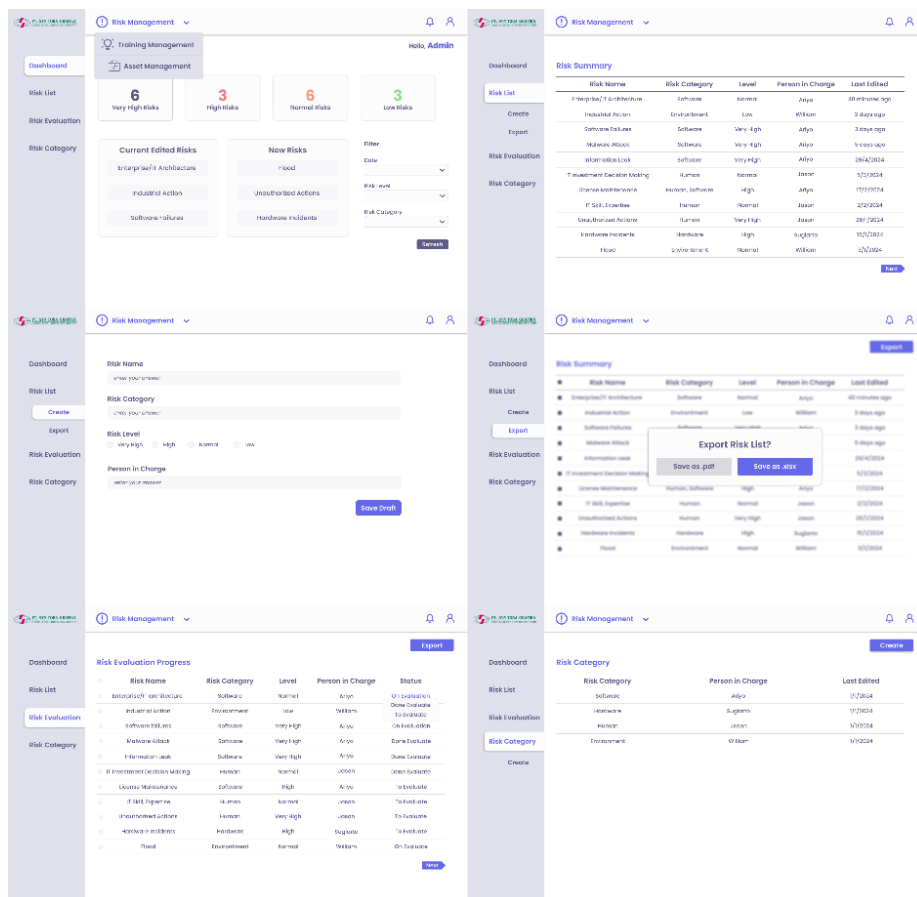

Figure 6. Prototipe of Risk Management Module

The ERP system's risk management module prototype is structured to provide a thorough and organized approach to identifying and managing risks. The module categorizes risks into four distinct levels: Very High Risk, High Risk, Normal Risk, and Low Risk. These categories help users prioritize and address risks according to their potential organizational impact. Additionally, users can create custom risk

categories, allowing for tailored risk management strategies that meet their organization's specific needs. Within this framework, users can input detailed information for each risk, including the risk name, category, level, and Person in Charge (PIC) responsible for managing the risk.

Beyond risk categorization, the module includes features for tracking and evaluating risks over time. The Risk Evaluation Progress section allows users to monitor each identified risk's ongoing assessment and mitigation efforts, providing insights into how effectively risks are being managed. This continuous evaluation ensures that risk management strategies are adaptive and responsive to changing conditions. The Risk Summary section comprehensively overviews all identified risks, their categories, levels, and current statuses. It offers a consolidated view that aids in strategic decision-making and resource allocation. This holistic approach to risk management ensures that organizations can proactively address potential threats and maintain operational stability.

4. CONCLUSION

The IT governance measurements indicate that all four objectives are currently at level 2. In contrast, the capability targets for these objectives are set at level 3 and the other at level 4. This reveals a gap of 1 to 2 levels between the current and desired capability levels, highlighting existing deficiencies in the company's business processes. Specific recommendations have been provided to address these gaps to help the company enhance its IT governance and achieve the targeted capability levels. Additionally, recommendations for developing customized ERP system modules, including asset management, training management, and risk management, have been proposed. These modules will support the company's progress by providing structured and efficient ways to manage assets, facilitate employee training, and mitigate risks, ultimately improving overall operational efficiency and alignment with industry best practices.

ACKNOWLEDGEMENTS

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