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FOREWORD

Greetings!

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In this December 2022 edition, ULTIMA InfoSys enters the 2nd Edition of Volume 13. In this edition there are seven scientific papers from researchers, academics and practitioners in the fields covered by Ultima Infosys. Some of the topics raised in this journal are: COBIT 5.0: IT Governance Measurement on Reputable Bank in Indonesia, Measurement of Capability Level Using COBIT 5 Framework (Case Study: PT Andalan Bunda Bijak), Enterprise Resource Planning (ERP) SAP Business One Evaluation and Improvement Recommendation using Customized Odoo, Evaluation of Ultima InfoSys Site Usability Using Usability Test & System Usability Scale Method, Measuring Technology Readiness Index (TRI) of Management Information System Adoption in Higher Education, Implementation of Simple Additive Weighting on Decision Support System for Accoustic Guitar with Web-Based (Study Case: Chaniago Sport), The Development of Web-based Sales Reporting Information Systems using Rapid Application Development Method.

On this occasion we would also like to invite the participation of our dear readers, researchers, academics, and practitioners, in the field of Engineering and Informatics, to submit quality scientific papers to: International Journal of New Media Technology (IJNMT), Ultimatics : Jurnal Teknik Informatics, Ultima Infosys: Journal of Information Systems and Ultima Computing: Journal of Computer Systems. Information regarding writing guidelines and templates, as well as other related information can be obtained through the email address ultimainfosys@umn.ac.id and the web page of our Journal here.

Finally, we would like to thank all contributors to this December 2022 Edition of Ultima Infosys. We hope that scientific articles from research in this journal can be useful and contribute to the development of research and science in Indonesia.

December 2022,

Fenina Adline Twince Tobing, S.Kom., M.Kom.
Editor-in-Chief

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COBIT 5.0: IT Governance Measurement on Reputable Bank in Indonesia

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***Abstract*— PT X is required to ensure that IT governance runs well. The maturity level of IT governance needs to be measured to determine what factors each company can improve on. The purpose of this study is to assess the level of capability of PT X, which will be measured using the COBIT 5.0 framework from ISACA, as well as to provide recommendations regarding governance and management of information technology that can build PT X. Measurements were carried out on BAI09 (Manage Assets) and DSS03 (Manage Problems). The results obtained are the BAI09 process and the DSS03 process both stop at Level 4 (Predictable Process), with an average value of 81.30% for the BAI09 process and an average value of 81.84% for the DSS03 process.**

Index Terms-COBIT 5.0, Maturity Level, Measurement of IT Governance.

I. INTRODUCTION

Information technology governance is rife at this time. Companies must take measurements to determine their governance's maturity [1]. However, information technology governance is not only the focus of companies. Profit, nonprofit, education, and government can also measure IT governance [2]. The banking industry gives the highest concentration compared to other sectors regarding IT governance because it is closely related to their business processes [3]-[8]. PT X is a financial institution (bank) established in 1955.

Currently, PT X is the fourth largest bank in Indonesia in terms of assets and is recognized for its achievements and excellence in customer service and management development. This achievement requires PT X to ensure that IT governance runs well. The maturity level of IT governance needs to be measured to determine what factors can be improved by each company [8]. In addition, the results of the maturity measurement can also get recommendations for improvement to the company [5]. There are various kinds of IT governance maturity measurement tools, such as ITIL, TOGAF, COBIT, and so on [3]-[8].

COBIT, or Control Objective for Information Technologies, is a standard guide to information technology management practices issued by ITGI (IT Governance Institute), which is part of ISACA [9],[10]. COBIT has given various versions to measure IT governance in a company [11]. The most commonly used version by companies is COBIT 5.0, although the latest version of COBIT 2019 has emerged [11].

The purpose of this study is to determine the level of capability of PT X, which will be measured using the COBIT 5.0 framework from ISACA, as well as to provide recommendations on governance and management of information technology that can build PT X.

II. THEORETICAL BASIS

A. IT Governance

IT governance is the responsibility of the board and senior management. It's an integral part of running a business. It consists of leadership and organizational structures and processes that ensure that IT maintains and extends its strategies and goals [12].

B. COBIT 5.0 (Control Objective for Information and Related Technology)

COBIT is a collection of documentation and guides that lead to IT governance that can help assessors, management, and users to bridge the gap between business risks, control requirements, and technical problems in organizations or companies [13].

COBIT 5.0 has five principles: meeting stakeholder needs, covering the enterprise end-to-end, applying a single integrated framework, enabling a holistic

approach, and separating governance from management. following the principles of COBIT 5.0 [9]-[11], [13].

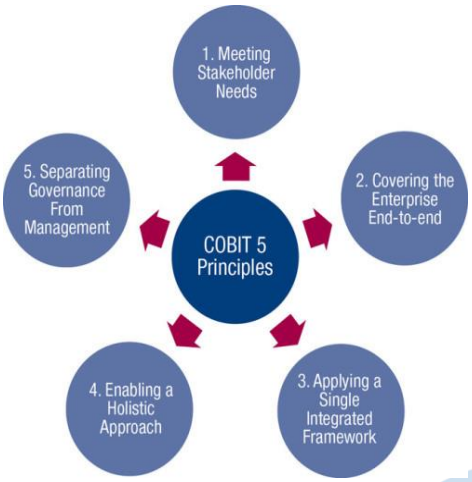

Fig. 1 COBIT 5.0 Principles [13]

1. Meeting Stakeholder Needs
   The company creates value for its stakeholders by balancing profit realization and risk optimization and using existing resources to follow company goals. Stakeholder needs are translated into Goals Cascade into more specific, actionable, and customized goals in the context of Company goals (Enterprise Goals), IT-related Goals (IT-related Goals), and Goals to be achieved by the enabler (Enabler Goals). That way, the company can adjust COBIT 5.0 to suit the company's goals and needs according to the company's context.
2. Covering the Enterprise End-to-end
   This second principle covers all the functions and processes needed to manage and manage enterprise IT wherever information is processed. This second principle is also helpful in integrating corporate IT governance into corporate governance. The IT governance system carried by COBIT 5.0 can be combined with the corporate governance system properly. Within the enterprise, COBIT 5.0 handles all internal and external IT services and internal and external business processes.
3. Applying a Single Integrated Framework
   This principle enables enterprises to use COBIT 5.0 as a comprehensive and integrated IT governance and management framework. This principle also unifies all knowledge previously scattered in various ISACA frameworks (COBIT, Val IT, Risk IT, BMIS, ITAF, etc.).
4. Enabling a Holistic Approach
   COBIT 5.0 defines a set of enablers to support the implementation of a comprehensive corporate IT governance and management system. COBIT 5.0 views that each enabler is interconnected with the other and can determine whether the performance of COBIT 5.0 will be successful.
5. Separating Governance from Management
   COBIT 5.0 provides a clear separation between management and governance. They involve different activities, require other organizational structures, and serve different purposes.

III. METHOD

A. Object of Research

PT X was founded in 1955, 26 September 1955 to be exact as a national private financial institution. Once formed, building core values and employee professionalism is the company's main concern in the banking sector. As a result, PT X is widely recognized as a trusted provider of quality products and services. In 1969, when the private sector in Indonesia was hit by a crisis, PT X was able to survive and was entitled to obtain a guarantee from Bank Indonesia. PT X then revised its business plan in 1974, and changed to a commercial bank in order to meet customer needs.

In 1976 PT X launched the Professional Credit Program, namely loans for professionals such as engineers, doctors, and so on. Furthermore, from 1981 to 1982, PT X became the first bank in Indonesia to implement an online banking system and a branch office network system. The next step taken by PT X was to form a network of official foreign exchange business units in a number of branch offices in 1985 along with a variety of new products.

In 1987, PT X distinguished itself from its competitors in the domestic market by being the first financial institution to offer banking services through ATM machines in Indonesia. This achievement is widely recognized as Indonesia's entry into the world of modern banking. PT X became a public company on the Jakarta Stock Exchange and Surabaya Stock Exchange (now the Indonesia Stock Exchange/IDX) in 1989.

PT X began providing services for middle class and upper class customers in 1998, in order to increase the number of customers. Commerce Asset Holdings Berhad (CAHB), which is now widely known as X Group Holdings Berhad, acquired shares of PT X in 2002. In 2007, all share ownership moved to X Group as part of an internal reorganization to consolidate the activities of all X Group subsidiaries. In May 2008, PT X officially changed its name. In order to comply with the Single Presence Policy (SPP) set by Bank Indonesia, Khazanah Nasional Berhad as the majority

shareholder of Lippo Bank and also the controlling shareholder of PT X (through X Group), officially merged the two banks on November 1 2008 which was followed by the introduction of the logo to the wider community.

B. COBIT 5.0

In this study, there are stages of measurement using COBIT 5.0. the following are the steps carried out:

1. Determine the goals and problems that exist in the company
2. Analyze the issues that exist in the company
3. Choose the process priority of the 37 processes from COBIT 5.0 that the company wants to measure
4. Conduct an assessment for each process that has been selected
5. Determine the level of capability of each process
6. Determine the target level of ability desired by the company
7. Provide recommendations under the findings and the resulting impacts

C. Stages of Evaluation

The stages of measuring IT governance have four steps [14]-[16]:

1. Planning. Determining the object to be measured and determining the purpose of the measurement, as well as identifying existing business processes in the company
2. Preparation. The preparations made are to collect data for processing. The first thing to do is to give Enterprise Goals to the company to be sorted from the most important to the least important. The second is to map IT-related Goals according to the company's goals, vision, and mission; the last is to map the COBIT 5.0 process.
3. Measurement. Collect and evaluate evidence and data through interviews and provide questionnaires to the company's IT. Data collection uses qualitative data collection methods by conducting environmental observations and observing documents owned by companies that have become standards or provisions of COBIT 5.0, as well as by conducting interviews and giving questionnaires to the company's IT division so that evidence and company data will be obtained, and can It is known that the level of corporate information technology governance capability is at what level.

Reporting. In the last stage, all data and evidence obtained will be processed and made into a report containing the results of evaluation activities and recommendations for the company. The information will later be given to the company to be a reference so it can develop even better.

IV. Result and Discussion

A. Planning

The object of this research is PT X, a bank that managed to survive when the crisis hit Indonesia in 1969. PT X was established on September 26, 1955, as a national private financial institution. To meet the needs of its customer's customers, PT X has an IT division that will manage and make the IT infrastructure at PT X always run well so that all PT X operational activities can run well without any obstacles.

Therefore, the role of the IT division in a company is significant because, in modern times, most companies and people use technology in their daily lives. If the IT division experiences disturbances in its operational activities, all of the company's operating activities will be disrupted, starting from the slow service to customers or PT X customers, not recording tickets or logs of problems that occur, thus disrupting operational management activities.

This makes it necessary for PT X to measure the level of IT governance at PT X, with the hope that this research can increase the level of IT governance at PT X to help PT X improve the existing system at PT X to improve services. To customers or customers of PT X. In measuring the level of IT governance, this study focuses on the Build, Acquire, and Implement 09 (BAI09) process on asset management and Deliver, Service, and Support 03 (DSS03) on problem management.

B. Preparation

The steps to prepare for the evaluation are to determine the company's chosen processes. For this reason, this study determines the goals of PT X first. Then the company analyzes the IT Related Goals of COBIT 5.0, which are following the goals and vision, and mission of PT X. After completing an analysis of the IT Related Goals, the company chooses which process is very much needed by the company so that the IT system at PT X can develop and become even better, here are 37 techniques that are in the COBIT 5.0 framework.

Table 1 Process on COBIT 5.0

#	Process	Description
1	EDM01	Ensure Governance Framework Setting and Maintenance
2	EDM02	Ensure Benefits Delivery

#	Process	Description
3	EDM03	Ensure Risk Optimisation
4	EDM04	Ensure Resource Optimisation
5	EDM05	Ensure Stakeholder Transparency
6	APO01	Manage the IT Management Framework
7	APO02	Manage Strategy
8	APO03	Manage Enterprise Architecture
9	APO04	Manage Innovation
10	APO05	Manage Portfolio
11	APO06	Manage Budget and Costs
12	APO07	Manage Human Resources
13	APO08	Manage Relationships
14	APO09	Manage Service Agreements
15	APO10	Manage Suppliers
16	APO11	Manage Quality
17	APO12	Manage Risk
18	APO13	Manage Security
19	BAI01	Manage Programmes and Projects
20	BAI02	Manage Requirements Definition
21	BAI03	Manage Solutions Identification and Build
22	BAI04	Manage Availability and Capacity
23	BAI05	Manage Organisational Change Enablement
24	BAI06	Manage Changes
25	BAI07	Manage Change Acceptance and Transitioning
26	BAI08	Manage Knowledge
27	BAI09	Manage Assets
28	BAI10	Manage Configuration
29	DSS01	Manage Operations
30	DSS02	Manage Service Request and Incidents
31	DSS03	Manage Problems
32	DSS04	Manage Continuity
33	DSS05	Manage Security Services
34	DSS06	Manage Business Process Controls
35	MEA01	Monitor, Evaluate, and Assess Performance and Conformance
36	MEA02	Monitor, Evaluate, and Assess the System of Internal Control
37	MEA03	Monitor, Evaluate, and Assess Compliance With External Requirements

In the end, PT X, through the IT leadership of BHOSD chose the BAI09 (Manage Assets) and DSS03 (Manage Problems) processes because there were several shortcomings regarding asset recording and problem management at PT X. Then, this study compiled a questionnaire and interview questions for PT X, who are part of the audit steps. Questions and questionnaire statements refer to the process chosen by PT X and based on the guidelines from COBIT 5.0.

C. Measurement

The audit implementation uses an evaluation of interview data and questionnaires given to the company. Interviews were conducted with leaders or heads of the IT Division, while questionnaires were given to all three members of the IT Division. Then to support the audit results, observations were made, both environmental comments and document observations. The following explains the company's observations, interviews, and questionnaires.

1. Observation

   Environmental observations were carried out when observing the IT BHOSD room, namely the IT Division room at PT X. At the time of keeping the IT Division workspace which was located on the 2nd Floor, the workspace looked neat, organized, organized, calm, and has enough privacy to make members or employees who become part of the IT Division can work well and comfortably. PT X also made security for the IT Division's workspace quite tight, namely by using two (2) types of protection, namely with employee cards that have been installed with barcodes and also by entering a combination of PINs that have been registered in the security system that has been created. This is intended so that not all and not just anyone can access and enter the IT Division's workspace at PT X. Meanwhile, and document observation is done by asking the company whether PT X, especially the IT Division, has the required documents and is required to be owned by the company. PT X or not. This refers to the Process Assessment Model (PAM) document in COBIT 5.0. The following is a list of documents that must be owned by PT X based on the PAM documents on COBIT 5.0 and documents that are already owned by PT X:

Table 2 List of Documents

#	Documents of COBIT5
BAI09 (Manage Assets)	
1	Update to asset inventory
2	Configuration repository
3	Asset register
4	Result of physical inventory checks
5	Result of fit-for-purpose reviews
6	Communication of planned maintenance downtime
7	Maintenance agreements
8	Approved asset procurement requests
9	Updated asset register
10	Authorized asset retirements
11	Results of cost optimization reviews
12	Opportunities to reduce asset costs or increase value
13	Register of software licenses
14	Results of installed license audits
DSS03 (Manage Problems)	
1	Risk-relate root causes
2	Criteria for problem registration
3	Problem log
4	Incident resolutions
5	Closed service requests and incidents
6	Problem classification scheme
7	Problem status report
8	Problem register
9	Root causes of problems
10	Problem resolution reports
11	Known-error records

#	Documents of COBIT5
12	Proposed solutions to known errors
13	Closed problem records
14	Communication of knowledge learned
15	Problem resolution monitoring reports
16	Identified sustainable solutions

From the list of documents in Table 2, PT X has all the documents required by COBIT 5.0 so that the IT governance capability at PT X can develop better in the future. This is supported by the existence of a document that lists the assets owned by PT X, the purpose for which these assets are held, and the assets' lifetime. In addition, there is a document containing a report on what assets are being updated or rejuvenated for these assets so that all purchases used at PT X are always in the best performance.

2. Interview

Interviews were conducted directly at the company's location in Gajah Mada, Central Jakarta. On this occasion, the opportunity to work an interview with the IT Leader of BHOSD as the IT Division at PT X. The interview questions posed to PT X related to the two processes that had been selected, namely BAI09 on how to manage company assets and DSS03 on how how to address problems that exist in the company. The questions asked were nine items with an interview time of about 10 to 15 minutes. From the results of the interviews that have been carried out, several conclusions can be drawn as follows:

a. There are no unused or unused assets if assets such as computers have been ordered according to needs.
b. There are no expired or expired assets that are still being used.
c. There is no benchmarking process at PT X. PT X already has its standards.
d. PT X pays several licenses to support PT X's operational activities.
e. Any problems that exist will be recorded at the service desk. Then the service desk will provide a ticket so that the problem (problem) can be recorded, and
f. There are rarely problems that are proactive in management activities.

3. Questionnaire

The questionnaire given contains statements and questions that are per the two COBIT 5.0 processes that have been selected by PT X, namely BAI09 (Manage Assets) and DSS03 (Manage Problems). The questionnaire given to the company consists of 5 levels, where level 1 contains specific statements, while level 2 to level 5 has general questions. To advance to the next level, the average score on the questionnaire must reach a minimum of 85%. However, if it is less than 85%, the questionnaire stops at that level, which is the level of capability of PT X towards the COBIT 5.0 process that PT X has chosen.

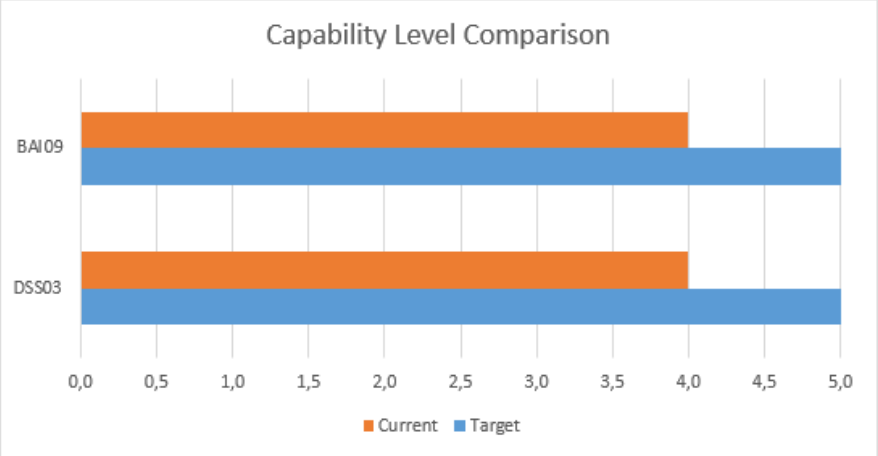

Fig 1 Comparison Chart

Figure 2 shows a graph of the achievement of the capability level of IT governance that has been achieved by PT X and the targets to be performed by PT X. It can be seen that the orange-colored graph shows the level of capability of IT governance at PT X, which reached Level 4, while the chart The blue color target for the desired level of IT governance capability from PT X is Level 5. This is quite good because the level of IT governance capability and the target chosen by PT X are only one level different. So this research is

considered good enough because PT X only needs to develop and improve some things that are considered lacking so that the level of governance capability of PT X can reach Level 5. Then several findings are produced, which are crucial for the company if not handled quickly and appropriately. Here are the results:

1. Lack of information processing required for asset management and problem management processes
2. Lack of review or analysis of asset valuation and measurement data
3. Lack of identification and establishment of procedures and frequency of assessments by the objectives of problem management
4. Lack of anticipation or corrective action in case of special conditions regarding problem management

V. CONCLUSION

Based on the results of the evaluation of the measurement of the level of IT governance capability in the IT Division of PT X using the COBIT 5.0 framework and using the BAI09 (Manage Assets) process and the DSS03 (Manage Problems) process, the results obtained are that the BAI09 process and the DSS03 process both stop. At Level 4 (Predictable Process) with an average value of 81.30% for the BAI09 process and 81.84% for the DSS03 process.

The recommendation given to the shortcomings that exist in PT X is to make a schedule in terms of conducting a review of the valuation of existing assets at PT X so that every support in PT X can be appropriately recorded for its useful life so that there are no assets that are not used even though they have a useful life. Has not been exhausted. Then control the party who analyzes the assessment data so that the data can be used if special conditions occur at PT X. and determine the objectives of problem management properly so that all kinds of information needed can be adequately provided so that problem management activities can run smoothly. and take corrective actions that must be taken if special conditions occur in PT X.

The advice to PT X is to process other processes that exist in COBIT 5.0 so that governance development can be even better, and make improvements or developments per the recommendations that have been given..

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Measurement of Capability Level Using COBIT 5 Framework (Case Study: PT Andalan Bunda Bijak)

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***Abstract*— PT Andalan Bunda Bijak is a company that distributes baby equipment. In running its business, PT Andalan Bunda Bijak implements a system called MySoft to assist the company's business activities. The business development of the company has not entirely run optimally. This is because there are still problems related to risk management (no SOP for handling problems, no division to handle issues, and no problem recording) and information security (no information security policy and no information security training). With this problem, it is necessary to measure the level of capability in corporate information technology governance. This study was conducted to analyze the level of corporate information technology governance capability using the COBIT 5 framework. This study uses three domains (EDM, APO, and DSS) and four processes (EDM03, APO12, APO13, and DSS05) obtained from the mapping results PT Andalan Bunda Bijak's vision, mission, goals, and strategies for the problems faced by the company. Data was collected by interviewing the company's operational leaders and managers and observing the systems, documents, and company environment. The results of this study determined that each process was at level 1 (performed process). There is a gap of 1 level between the level of capability of the company's current state and the level of capability of the company's expectations. There are 28 recommendations for improvement given to the company.**

Index Terms—*Capability Level; COBIT 5; Information Technology Audit; PT Andalan Bunda Bijak*.

I. INTRODUCTION

Fulfilling the organization's vision and mission is an important thing that every organization must realize. One way to realize the organization's vision and mission can be done by utilizing existing information technology (IT) [1]. The utilization of information technology penetrates almost all areas of the organization, be it government, private companies, education, health, industry, and so on [2]. Using trusted information technology can help and facilitate every activity carried out by its users. Good use of information technology must be supported by good information technology governance and aligning information technology to align with the organization's vision and mission [3].

Information technology governance can be good if the use of information technology goes as expected [4]. Information technology governance helps an organization manage its infrastructure and performance [3]. In addition, information technology governance is also helpful for convincing organizations that information technology (IT) can appropriately manage IT-related risks and opportunities, support organizational goals, and maximize investment in IT [5]. To determine whether information technology governance in the organization has been implemented correctly, directed, and appropriately, it is necessary to carry out an information technology audit process [4].

Information technology audits have the benefit of correcting errors and irregularities that exist in IT implementation and can evaluate the maturity level of IT use in the organization [6]. Information technology audits are carried out by examining every process, asset, and control that exists at various levels of the organization to ensure that all of them comply with applicable standards [7]. Implementing an information technology audit requires a framework, one of which is COBIT [6].

COBIT stands for Control Objective for Information and Related Technology [2]. COBIT is a directed IT management and governance guide to bridge the gap between business risks, control needs,

and problems [8]. COBIT evolves from one version to another, and the latest version of its development is COBIT 2019 [6]. However, many studies have not used the version of COBIT 2019 but are still using the version of COBIT 4.1 and COBIT 5.0 [9].

COBIT 5.0 is a guide that helps a company generate value and achieve company goals through effective information technology management and good governance [8]. Apart from that, the use of COBIT 5 itself can provide a practical and comprehensive approach regarding the relationship or relationship between business processes and IT [2], [10] and has been widely applied or implemented in companies, making it easier for companies to implement it [11]. COBIT 5 first appeared or was published in 2012 [12], and the renewal of this type of COBIT is based on the addition of several frameworks and standards, such as IT risk, IT val, ITIL, and ISO standards which are integrated into COBIT 4.1 [13], so COBIT was born. COBIT 5 consists of two areas, five domains, and thirty-seven processes [14]. The application of the COBIT 5 framework is intended for PT Andalan Bunda Bijak.

PT Andalan Bunda Bijak is a company engaged in distributing baby equipment products. This company was founded to facilitate the distribution of products in the market. The company's business strategy in 2022 is to expand the company's business scope by opening new company partners so that later products from this new partner can be distributed by PT Andalan Bunda Bijak, which of course, is still related to baby equipment. However, to carry out this strategy, PT Andalan Bunda Bijak has several problems within the company that hinder the implementation of this business strategy.

Based on the results of a pre-interview with Mr. Joko as the leader of PT Andalan Bunda Bijak, some problems hinder the implementation of business strategies for the company, namely the lack of risk management for a problem that occurs in the company both in general and from the system used. The absence of SOPs and special units responsible for risk management causes problems in this company. In addition, in terms of risk management, PT Andalan Bunda Bijak does not have a recording document regarding events or issues that pose a threat and risk to the company.

Apart from problems regarding risk management, PT Andalan Bunda Bijak also has one more focus for the company, which is related to the security of the company itself. Mr. Joko believes that security for the company is critical because it will relate to data and information held by the company, both internal data (employees, finances, total stock) and external data of the company (customers and suppliers). In terms of security itself, PT Andalan Bunda Bijak does not have an information security policy that regulates physical safety, network security, and access rights to the MySoft system, and every employee in the company is not provided with training on physical security and malware to form self-awareness of every employee. Table 1 below describes the problems, impacts, and focus areas of the issues faced by PT Andalan Bunda Bijak:

Table 1. Company's Problem, Impact, and Focus Area

No.	Problem	Impact	Focus Area
1	Does not have SOP and a special risk management unit in the company.	Problem-solving time is longer.	*Risk management*
2	Do not have documents recording events that are threatening and risky for the company.	The magnitude of the threat and the potential loss experienced cannot be known with certainty.	*Risk management*
3	Does not have an information security policy that governs physical security, network security, and access rights to the MySoft system.	There is potential for employee negligence in terms of misuse of IT facilities and company information.	*Resource management*
4	There is no training on physical security and malware for company employees.		

Given the problems and important focus for the company, the company needs to conduct an audit of the information technology governance that exists in the company using the assistance from the COBIT 5 framework to prepare the business strategy of PT Andalan Bunda Bijak in 2022, namely expanding the scope business of the company. This information technology governance audit will focus on the part of risk management that is a problem for the company and security, which is an important focus and special request from the company.

II. Theoretical Basis

A. IT Governance

Information technology governance or IT Governance is a component of integrated company activities that include business processes and organizational structures to ensure that information technology follows corporate strategy and goals [15]. Information technology governance has five focus areas that describe the topics that executive management needs to address to manage IT within the company. The five focus areas include strategic alignment, value delivery, resource management, risk management, and performance management.

B. Information Technology Audit

Evaluation and inspection activities of an organization's IT infrastructure, data, applications, procedures, and operational activities fixed on recognized standards and established policies are the meaning of information technology audits [16]. In conducting an audit, of course, some stages must be considered. According to Gallegos, there are four stages of an audit, including planning, fieldwork, reporting, and follow-up [17].

C. COBIT 5

COBIT 5 is a standard for companies that is useful in helping a company to generate value and achieve company goals through effective management of information technology and good governance [8]. COBIT 5 first appeared or was published in 2012 [12], and the renewal of this type of COBIT is based on the addition of several frameworks and standards, such as IT risk, IT val, ITIL, and ISO standards which are integrated into COBIT 4.1 [13], so COBIT 5 was born.

COBIT 5 will be used to determine the selected IT process. 4 processes must be carried out in choosing the IT process, which can be seen in Figure 1 below [18]:

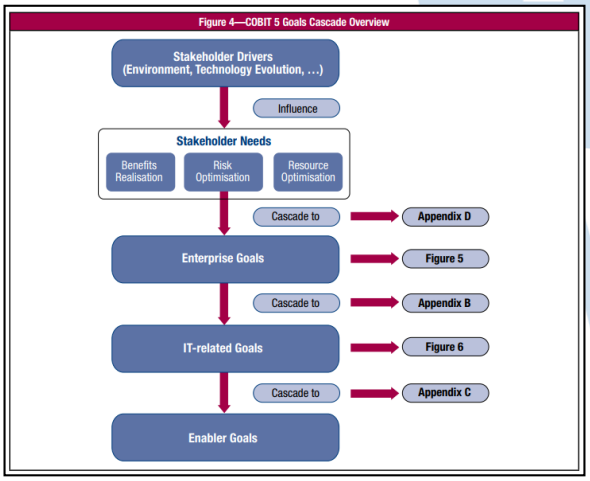

Figure 1. COBIT 5 Goals Cascade

1. Stakeholder drivers influence stakeholder needs

   Determining the needs of stakeholders can be influenced by several driving factors, including changes in the company's business strategy, changes in the business environment, changes in applicable rules and policies, and the emergence of new technology to replace old technology.

2. Stakeholder needs cascade to enterprise goals

   After the needs of the stakeholders are obtained, the next step will be to map these needs into several general goals for the company. There are 17 general goals in the company provided by COBIT 5.

3. Enterprise goals cascade to IT-related goals

   After the company's goals are obtained based on the mapping carried out, these goals will be mapped into IT-related goals. There are 17 IT-related goals provided by COBIT 5.

4. IT-related goals cascade to enabler goals

   The final stage to be carried out is to re-make the IT-related goals obtained previously to become one of the enablers. The enabler in question is the IT process. There are 37 IT processes divided into five domains and two areas.

D. RACI Chart

RACI chart is an acronym for Responsible, Accountable, Consulted, and Informed chart, a matrix describing the activities and powers of an organization or company in making decisions [19].

E. Capability Levels

The capability level is adapted from ISO/IEC 15504 - 2 and is a substitute for the maturity level used in the assessment process. This assessment process is based on the organization's ability to carry out the functions specified in the assessment model [20]. This capability model consists of 6 levels or levels, and four scales are used to assess each stage to advance to the next step or level [21].

F. Gap Analysis

Gap analysis is done by comparing the current situation with the expectations or targets of a company. To get the results of this gap, there is a formula used as shown in Figure 2 below:

$$Gap\ Analysis = expected\ value - current\ value$$

Figure 2. Gap Analysis Formula.

III. METHOD

The research method used to measure this information technology's governance and management capabilities of this information technology is the COBIT 5 method, with the research object being PT Andalan Bunda Bijak. In addition, this study uses the audit stages of Gallegos [17], namely:

A. Planning

The first stage in conducting an information technology audit is planning. Planning, in this case, is related to determining the object of research to be audited, which in this case is PT Andalan Bunda Bijak, as well as conducting initial communication

with the company to analyze the company's vision, mission, goals, and strategic plans in the future (this is done by running pre-interview with Mr. Joko as the leader of PT Andalan Bunda Bijak) to later be mapped based on the stages of the COBIT 5 method to determine the selected process. Once selected, each process will produce a RACI chart and respective audit documents as a guide for conducting more detailed and in-depth interviews regarding information technology governance.

B. Field Work

The second stage in conducting an information technology audit is conducting fieldwork. Field works are carried out to collect all necessary information in the audit process. In this study, information collection can be done by conducting observations and interviews with resource persons from PT Andalan Bunda Bijak. Observations are carried out by monitoring the MySoft system used at PT Andalan Bunda Bijak and every document that is made and adhered to, such as SOPs, policies, and so on, as well as monitoring the company's environmental conditions. The interview technique is carried out by asking questions to the informants based on the guidelines from COBIT 5 to get answers or more detailed and in-depth explanations as the basis and evidence for conducting an assessment later for each selected COBIT 5 process.

C. Reporting

The third stage in conducting an information technology audit is reporting. All data collected through observations and interviews will be analyzed, and the capability level will be calculated. After the capability level is obtained, the next step is to analyze the gap between the current actual situation in each COBIT 5 process and the expectations or targets of PT Andalan Bunda Bijak. After the capability level and gap analysis results are obtained, it will be continued by making an audit report containing an assessment and capability level, gap level, and recommendations for improvement to increase the expectations of PT Andalan Bunda Bijak.

D. Follow Up

The last or fourth stage in conducting an information technology audit is to follow up. The follow-up, in this case, is a continuation of the previous step, namely reporting where the completed report will be given to the company for re-evaluation. Furthermore, all recommendations for improvement are entirely the company's responsibility, whether existing enhancements will be implemented or become a reference for future improvements.

Then, measuring the value of the capability level of governance and information technology management is carried out by carrying out some stages/flows from COBIT 5, namely, determining company goals which will then be used for mapping with COBIT 5 enterprise goals. The next step is mapping Enterprise Goals to IT Goals. Whose results are used for mapping to the COBIT process.

The scoring will be based on the criteria in the capability level. The levels of capability level can be seen in Table 2 [21]:

Table 2. Capability Levels

Capability Levels
5 – Optimising Process
4 – Predictable Process
3 – Established Process
2 – Managed Process
1 – Performed Process
0 – Incomplete Process

The capability level has six levels, starting with level 0, then the highest level weighing 5. The achievement technique at the capability level is mature, which means the company needs to meet the low level to reach the next level. Companies must get a score of 85% to continue the assessment to the next level. The assessment category in using the capability level can be seen in Table 3 [21]:

Table 3. Assessment Category

Category	**Score**
N (Not Achieved)	0% - 15%
P (Partially Achieved)	> 15% - 50%
L (Largely Achieved)	> 50% - 85%
F (Fully Achieved)	> 85% - 100%

IV. Result and Discussion

The following are the results of the analysis and discussion of research following the stages of the Gallegos audit [17]:

A. Planning

In the planning stage, five things must be done. The first is to determine the object of research. The object of research to be studied is PT Andalan Bunda Bijak. Next was to conduct a pre-interview with Mr. Joko, the director of PT Andalan Bunda Bijak. Pre-interviews were performed two times via zoom. The first pre-interview discusses the general picture of the company,

while the second pre-interview discusses the problems faced by PT Andalan Bunda Bijak.

The third step is to determine the selected IT process. The determination of the established IT process begins with deciding enterprise goals. Enterprise goals were set based on an analysis of the vision, mission, goals, and business strategies of PT Andalan Bunda Bijak. The results of the selected enterprise goals can be seen in Table 4 below:

Table 4. Selected Enterprise Goals

Code	Enterprise Goals
01	Stakeholder value of business investment
07	Business service continuity and availability
11	Optimisation of business process functionality
14	Operational and staff productivity
16	Skilled and motivated people
17	Product and business innovation culture

After the enterprise goals are selected, the next step is determining IT-related goals. Mapping enterprise goals do determination of IT-related goals into IT-related goals. The results of the selected IT-related goals can be seen in Table 5 below:

Table 5. Selected IT-Related Goals

Code	IT-Related Goals
01	Alignment of IT and business strategy
03	Commitment of executive management fot making IT-related decisions
04	Managed IT-related business risk
05	Realised benefits from IT-enabled investment and services portfolio
07	Delivery of IT services in line with business requirements
08	Adequate use of applications, information, and technology solutions
09	IT agility
10	Security of information, processing infrastructure, and applications
11	Optimisation of IT assets, resources, and capabilities
12	Enablement and support of business process by integrating applications and technology into business processes
13	Delivery of programmes delivering benefits, on time, on budget, and meeting requirements and quality standards
14	Availability of reliable and useful information for decision making
16	Competent and motivated business and IT personnel
17	Knowledge, expertise, and initiatives for business innovation

After selecting IT-related goals, the next step is determining the IT process. Determination of IT processes is done by mapping IT-related goals into IT processes. The results of the selected IT processes can be seen in Table 6 below:

Table 6. Selected IT Processes

IT Processes	Process Purpose Statement
EDM03 (*Ensure Risk Optimization*)	Ensure that IT-related enterprise risk does not exceed risk appetite and risk tolerance, the impact of IT risk to enterprise value is identified and managed, and the potential for compliance failures is minimised
APO12 (*Manage Risk*)	Integrate the management of IT-related enterprise risk with overall ERM and balance the costs and benefits of managing IT-related enterprise risk
APO13 (*Manage Security*)	Keep the impact and occurrence of information security incidents within the enterprise's risk appetite levels
DSS05 (*Manage Security Services*)	Minimise the business impact of operational information security vulnerabilities and incidents

The fourth step taken at the planning stage is to make a RACI Chart of each selected IT process which can be seen in Figures 3, 4, 5, and 6 below:

EDM03 RACI *Chart* (*Ensure Risk Optimization*)

Key Governance Practice	Commissioner	Director	Operational Manager	Sales Manager	Admin Sales	Invoice Admin	Tax Team	Head of Warehouse	Sales Coordinator	MD and SPG team	Sales Team	Programmer
EDM03.01 (*Evaluate risk management*)	A/I	R	C	C								C
EDM03.02 (*Direct risk management*)	A/I	R	C	C								C
EDM03.03 (*Monitor risk management*)	A/I	R	C	C								C

Figure 3. RACI Chart EDM03

APO12 RACI *Chart* (*Manage Risk*)

Key Governance Practice	Commissioner	Director	Operational Manager	Sales Manager	Admin Sales	Invoice Admin	Tax Team	Head of Warehouse	Sales Coordinator	MD and SPG team	Sales Team	Programmer
APO12.01 (*Collect data*)	I	A/I	R	C	C	C						C
APO12.02 (*Analyse risk*)	I	A/I	R	C	C	C						C
APO12.03 (*Maintain a risk profile*)	I	A/I	R	C	C	C						C
APO12.04 (*Articulate risk*)	I	A/I	R	C	C	C						C
APO12.05 (*Define a risk management action portfolio*)	I	A/I	R	C	C	C						C
APO12.06 (*Respond to risk*)	I	A/I	R	C	C	C						C

Figure 4. RACI Chart APO12

APO13 RACI *Chart* (*Manage Security*)

Key Governance Practice	Commissioner	Director	Operational Manager	Sales Manager	Admin Sales	Invoice Admin	Tax Team	Head of Warehouse	Sales Coordinator	MD and SPG team	Sales Team	Programmer
APO13.01 (*Establish and maintain an ISMS*)	I	A/I	R	C	C	C						C
APO13.02 (*Define and manage an information security risk treatment plan*)	I	A/I	R	C	C	C						C
APO13.03 (*Monitor and review the ISMS*)	I	A/I	R	C	C	C						C

Figure 5. RACI Chart APO13

DSS05 RACI *Chart* (*Manage Security Services*)													
Key Governance Practice	Commissioner	Director	Operational Manager	Sales Manager	Admin Sales	Invoice Admin	Tax Team	Head of Warehouse	Sales Coordinator	MD and SPG team	Sales Team	Programmer
DSS05.01 (*Protect against malware*)	I	A/I	R	C	C	C						C
DSS05.02 (*Manage network and connectivity security*)	I	A/I	R	C	C	C						C
DSS05.03 (*Manage endpoint security*)	I	A/I	R	C	C	C						C
DSS05.04 (*Manage user identity and logical access*)	I	A/I	R	C	C	C						C
DSS05.05 (*Manage physical access to IT assets*)	I	A/I	R	C	C	C						C
DSS05.06 (*Manage sensitive documents and output devices*)	I	A/I	R	C	C	C						C
DSS05.07 (*Monitor the infrastructure for security-related events*)	I	A/I	R	C	C	C						C

Figure 6. RACI Chart DSS05

The last step in the planning stage is to create an audit document. The audit document will contain questions from the COBIT 5 guide for each selected IT process. Every question must be answered, and an assessment will be made based on the answers given to get the value of the capability of the company's current state.

B. Field Work

At this stage, information collection is carried out by collecting data which is applied in 2 methods, namely interviews and observations, which will then produce audit evidence regarding PT Andalan Bunda Bijak. Observation activities are carried out online and have several scopes, namely system observations, document observations, and observations of the company's current environment.

1. System observations

   The observation results obtained on the system used by the company today is that the system can only be accessed with the appropriate user username and password. So far, the system used rarely has a significant problem, where the issues that arise are usually related to differences in the amount of stock and an inaccessible system (error). The frequency of occurrence of this problem is also infrequent (2-3 months) based on information from the system developer. In addition to problems, the system still has several shortcomings, especially those related to security and preventing potential risks. The system used in the company does not have a reminder or alarm that detects an intruder in the system. In addition, the company's system cannot see multiple users with the same account. The lack of this company system can raise several potential threats, such as data theft and personal and corporate identity, that hackers and company insiders can carry out.

2. Document observations

   Observation of company documents is carried out by analyzing the contents of company regulatory documents. The company's regulatory documents have entirely and in detail explained the general provisions, rights, obligations, and rules that apply to each employee. However, unfortunately, the document does not contain conditions governing security, access rights, and risk management for obstacles or problems faced by the company.

3. Company environmental observation

   The company's environmental observations revealed that the company had completed physical security by implementing 10 CCTVs spread over several points of the company. In addition to implementing CCTV, critical company data safety is better maintained when the company has a special cupboard permanently locked in the Operations Manager's room. To access the company or the room, every employee must use an identity card (id card), while company employees must accompany guests or outsiders. The company's room and access door will be locked after office hours and guarded by shophouse security guards. Currently, the company owns 7.

In conducting interviews, the sources to be interviewed are determined based on the results of the RACI chart indicated by the letter R. Based on the results of the existing RACI chart, and there are two sources to be interviewed, namely directors and operational managers. The interviews are based on questions taken and summarized from the ISACA COBIT 5 guide.

C. Reporting

At this stage, three activities will be carried out, namely measuring the level of capability, conducting a gap analysis, and making recommendations for improvement where these three activities will be combined in the form of an audit report to be submitted later to the company.

The first activity carried out is to calculate the level of capability. The calculation of the level of capability is based on an assessment of the answers presented by the interviewees at the time of the interview. The first step in this calculation is to calculate the average value of IT activity to get a value for each existing IT sub-process. After getting the score for each IT sub-process, the next step is calculating the average return for each current IT sub-process value to get the value for each selected IT process. Calculations for each selected IT process can be seen in Figures 7, 8, 9, and 10 below:

$$average\ value\ of\ EDM03\ process = \frac{86{,}67\% + 72{,}50\% + 86{,}75\%}{3}$$

$$average\ value\ of\ EDM03\ process = \frac{245{,}92\%}{3}$$

$$average\ value\ of\ EDM03\ process = 81{,}97\%$$

Figure 7. Average Value EDM03

$$average\ value\ of\ APO12\ process = \frac{36{,}43\% + 64{,}29\% + 57{,}14\% + 56{,}60\% + 60{,}00\% + 80{,}75\%}{6}$$

$$average\ value\ of\ APO12\ process = \frac{355{,}21\%}{6}$$

$$average\ value\ of\ APO12\ process = 59{,}20\%$$

Figure 8. Average Value APO12

$$average\ value\ of\ APO13\ process = \frac{95{,}71\% + 47{,}14\% + 12{,}00\%}{3}$$

$$average\ value\ of\ APO13\ process = \frac{154{,}85\%}{3}$$

$$average\ value\ of\ APO13\ process = 51{,}62\%$$

Figure 9. Average Value APO13

$$average\ value\ of\ DSS05\ process = \frac{68{,}33\% + 38{,}89\% + 85{,}00\% + 96{,}63\% + 71{,}43\% + 92{,}00\% + 72{,}00\%}{7}$$

$$average\ value\ of\ DSS05\ process = \frac{524{,}28\%}{7}$$

$$average\ value\ of\ DSS05\ process = 74{,}90\%$$

Figure 10. Average Value DSS05

The capability levels from PT Andalan Bunda Bijak in all IT processes are measured to stop at level 1, namely the performed process (PT Andalan Bunda Bijak has succeeded in carrying out the IT process and achieving the expected goals). Table 7 below contains conclusions from all measured IT processes:

Table 7. Conclusion of all IT processes

TI Processes	Score	Conclusion
EDM03	81,97%	Stop at level 1
APO12	59,20%	Stop at level 1
APO13	51,62%	Stop at level 1
DSS05	74,90%	Stop at level 1

The second activity carried out is conducting a gap analysis. The calculation of the gap analysis is carried out to find the differences between the current condition and the conditions expected by PT Andalan Bunda Bijak and what efforts must be made for recommendations for improvement. This analysis is carried out by comparing the current capability levels (as-is) and the expected capability levels (to-be). Here is Figure 11, which is a radar chart gap analysis that occurred at PT Andalan Bunda Bijak:

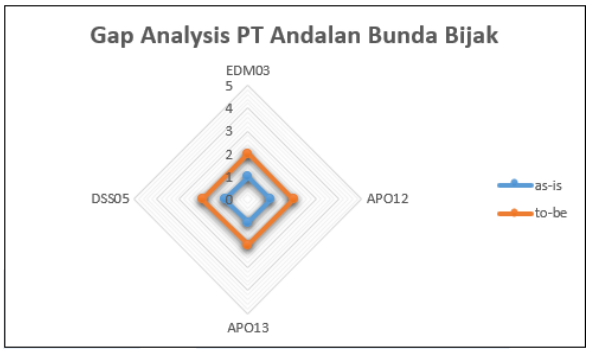

Figure 11. Radar Chart Gap Analysis

The third activity carried out is making recommendations for improvement. Making recommendations for improvement is based on each action that has not been maximized in its application to the company. Determination of activities that have not been maximized is done by comparing the values obtained from each activity in the IT process based on answers from sources with the average value of the IT process. Recommendations for improvement for the four selected IT processes at PT Andalan Bunda Bijak can be seen in Table 8 below:

Table 8. Recommendations

Recommendations
EDM03
- Improve the alignment between the IT risk strategy and the company's risk strategy by minimizing errors in the current system to switching to a new system. - Disseminate information about IT risks and their impacts on each employee. - Carry out monitoring of risks as often as possible (once a week) and expand the scope of monitoring to the existing IT side.
APO12
- Make notes with excel that contain descriptions of events, categories of IT risk levels, factors causing IT risk, impacts that arise, and how to solve problems. - Carry out risk control so that later it can compare the results of implementing these controls with an acceptable level of risk tolerance and determine the best response to risk. - Analyze the recording of risks that occur to discover indications of a risk occurrence. - Make a classification of the existing risk action plans based on the level of the risk. - It was reporting on the description of the risks that occur in the company to stakeholders. - Provide socialization to every person in the company regarding the risks that exist or occur so

that later these employees can monitor the movement of risks.
APO13
- Making a cooperation proposal with the condition of the information security risk management plan requires new parties in its implementation. - Provide input to the person in charge of design, development of management practices, and solutions of information security risk management plans. - Conduct information security training for all company employees. - Planning the internal audit of the information security management system (ISMS) implementation by applying the ISO 27001 standard. - Conduct regular information security system (ISMS) management reviews to ensure that the scope remains adequate and that improvements can be identified. - Provide input to the person in charge of maintaining the information security plan by looking at the findings and existing recording documents. - Create documentation regarding events that can affect the performance of the implementation of an information security management system (ISMS) in the company.
Recommendations
DSS05
- Apply email inbox filters to Gmail and also apply filters to downloads via some software, such as NetWorx. - Conduct training on malware for every employee of the company. - Create policies that govern connectivity security. - Create policies that regulate access restrictions to the company's network. - It installs firewall software on every computer in the company. One example of firewall software that can be used is SolarWinds. - It installs file encryption software on every computer in the company. One of the software that can be installed is AxCrypt. - Conduct penetration testing internally or request assistance from third parties regarding the company's internet network to ensure the adequacy of network protection. - Perform system security tests to ensure the adequacy of system protection. - It installs firewall software on every computer in the company. One example of firewall software that can be used is SolarWinds. - Create documentation related to access to the computing room.
- Conduct training on the importance of physical security for every employee in the company to form awareness among employees. - Define and disseminate information about the types and characteristics of each security threat.

D. Follow Up

The auditor provides the audit report to the company. The entirety of the audit report submitted contains the results of measuring the level of capability, the results of the gap analysis, and recommendations for improvement that the company needs in each of its IT processes.

V. Conclusion

Based on the results of the research on measuring the level of capability using the COBIT 5 framework at PT Andalan Bunda Bijak, the following conclusions can be drawn:

1. There are 4 IT processes selected from COBIT 5, namely EDM03, APO12, APO13, and DSS05. EDM03 got a score of 81.97%, APO12 got a score of 59.20%, APO13 got a score of 51.62%, and DSS05 got a score of 74.90%. The entire IT process stops at level 1 capability level, namely the performed process, which means PT Andalan Bunda Bijak has succeeded in carrying out the IT process and achieving the expected goals.
2. There is a gap of 1 level between the current capability level, which stops at level 1, and the expected capability level of PT Andalan Bunda Bijak, which is at level 2.
3. There are 28 recommendations given to PT Andalan Bunda Bijak. Three recommendations for the EDM03 process, six for the APO12 process, seven for the APO13 process, and 12 for the DSS05 process. Of the 28 recommendations, 19 offers can be implemented, and nine cannot be implemented. All recommendations that can be implemented have received approval from the company and will be carried out when the company already has adequate human resources.

Based on the results of the research on measuring the level of capability using the COBIT 5 framework at PT Andalan Bunda Bijak, there are suggestions that the company can consider. The suggestions are:

1. Designing applications that help the company's business processes by having system security in the form of detection or alarm when an unauthorized user login into the system and detects multiple users logging into the same account.

Measure the level of capability using the COBIT 5 framework on the same object and focus in this research to measure the effectiveness of implementing the recommendations given and ensure that the company has achieved the desired expectations, namely level 2.

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Enterprise Resource Planning (ERP) SAP Business One Evaluation and Improvement Recommendation using Customized Odoo

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***Abstract*— The study was conducted to find out the problems arising from the use of the SAP Business One system by evaluating and understanding the level of success of SAP Business One. Based on the results of the evaluation that has been carried out, it concluded that development is still needed to meet user needs. With limited access rights to develop SAP Business One, this research will set it on an Open-source ERP platform using Odoo ERP ver 15.0, which will be customized. The results of this study indicate a significant increase in the assessment of system quality, information quality, service quality, and user satisfaction on the customized Odoo ERP following the evaluation results recommendations on SAP Business One. The conclusion is that Odoo's open-source ERP can be a solution for customization according to company needs.**

***Index Terms*—DeLone and McLean; ERP; Information Systems Success Model; Odoo; SAP Business One**.

I. INTRODUCTION

With the fast growth of technology, businesses are attempting to employ cutting-edge technology to gain a competitive advantage [1]. One of the most excellent options in the present business scope is to use the company's resources, also known as ERP (Enterprise Resource Planning) [2] . Since the 1990s, businesses have begun implementing ERP, which provides several benefits. One of them is to help the company's business procedures [3].

PT Bando Indonesia is an Indonesian V-Belt and Conveyor Belt company that uses ERP (Enterprise Resource Planning) technology. ERP is a software application system feature that allows businesses to manage their operations better [4]. ERP offers advantages such as reduced stock and inventory levels, increased production, and improved communication between divisions, which will affect the company's profitability [5].

PT Bando Indonesia uses SAP Business One as a solution to integrate all types of business operations in the firm. Since the implementation of ERP, there has never been a review of the use of this SAP system by PT Bando Indonesia [6]. As a result, firms must perform assessment studies to determine the success of the ERP system. The current level of technology in the world is continually increasing [7].

This study is being conducted to assess the SAP Business One system deployed at PT Bando Indonesia [6]. By examining developments, you may determine whether the firm is meeting or exceeding expectations. This study is organized into three sections based on the Delone and McLean Information Systems Success Model. The first step examines each Business One system series from implementation to going live. The user satisfaction unit evaluates the system, information, and service quality at this level [8]. Afterward, the next step involves the user for system use analysis and user satisfaction to examine the user experience using the PT Bando Indonesia ERP system. So subsequently, we can explore and analyze the success of SAP Business One's performance in fulfilling the demands of the organization based on the data acquired during this review [6].

This study also configures and customizes Odoo version 15.0 open-source ERP. With this setup and customization, recommendations for flaws in the prior system will be made [10]. because there are limited access rights to perform customization in the SAP

Business One system. Based on that reason, the possible solution is to modify and tweak the Odoo application to highlight the benefits and shortcomings of the SAP Business One application [11]. This study evaluates ERP SAP Business One at PT Bando using the Delone and McLean methods. From the evaluation, results can be recommendations to improve aspects such as system quality, information quality, service quality, and user satisfaction. Due to limited access rights to make modifications on SAP Business One, further customization is carried out on the open-source ERP Odoo Vers.15.0 according to the recommendations from the evaluation results that have been carried out previously.

II. METHOD

1. *Evaluation*

There is also a definition of evaluation, which states that evaluation is an interpretation based on quantitative data derived from measurement results [12]. Some of these theories conclude that evaluation is an activity based on specified criteria and observations [1].

2. *System Configuration*

System configuration is a word or statement used in system engineering to describe the arrangements and their limits. For example, the steps of controlling module selection and system configuration settings, as well as resolving issues with each stability and performance [10].

3. *System Customization*

Previous to customization, the configuration process is carried out, which involves the selection of settings and modules that agree with the agreed-upon outcomes. Customization is a procedure that delivers a highly competitive value, but it is also a challenging process since there is a link between flexibility and the program being built [10].

4. *Enterprise Resource Planning (ERP)*

ERP is a functional company system supported by a software module device that is interconnected to support the company's in-depth and fundamental business processes [13]. ERP software for manufacturing companies will help process and check sales, inventory, delivery, BOM (Bill of Materials) data, and estimates of raw material usage and labor requirements [14].

5. *SAP Business One*

SAP Business One is SAP's ERP software for small and medium-sized businesses [15]. SAP developed SAP Business One because it frequently causes issues for firms utilizing R3 if the complexity and scale of the reach are insufficient for medium-sized businesses. Later, other issues would surface, such as high implementation costs and lengthy implementation timeframes [4].

6. *The DeLone and McLean Model Systems Success*

Essentially, there is no method to assess the success and failure of ERP standard adoption because measuring methods are continuously developing [9]. In general, the measuring process is an improvement over the prior measurement method. William H. Delonee and Ephraim R. McLean pioneered the information system success model. In 1992, a survey was conducted to determine the elements contributing to information systems' success [8].

7. *Open-Source ERP: Odoo*

Odoo is an open-source ERP application. Odoo is very suitable for applications from SMEs to large companies. Odoo has 30 modules, which can be increased to support business processes [14]. Odoo has a high degree of flexibility, making it easy to use, accessible, and adaptable to business needs. Odoo modules cover sales management, purchasing management, CRM, MRP, warehouse management, inventory management, accounting, and finance [10].

III. RESULT AND DISCUSSION

3.1 Overview of Research Object

1. Company Profile

PT Bando Indonesia has the main factory located in the Tangerang area and a marketing office in Central Jakarta. The company was founded on November 25, 1987, and started to produce industrial belts and automotive power transmission belts [6].

Figure 1. PT Bando Indonesia logo

3.2 Research Methods

This study uses quantitative methods. Quantitative data based on this research were obtained from questionnaires in the form of google Forms, which included information quality, system quality, service quality, and user satisfaction. The questions received in the questionnaire include closed and open questions., as follows:

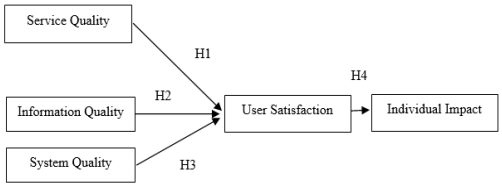


Figure 2. Research Methods

3.3 Data collection technique

The data collection phase was collected from respondents' opinions, attitudes, characteristics, and experiences. This activity was conducted using a method to collect primary data by using a survey method and collecting preliminary data using closed and open questions.

3.4 Sampling Techniques

This study's population is SAP Business One users at PT Bando Indonesia. While the sample used is a probability sampling technique utilizing simple random sampling. With a simple random sampling technique, it is done by asking respondents to fill out a questionnaire. The sample of this study amounted to 41 users who are still active by using simple random sampling and types of primary data.

3.5 Data analysis technique

The data analysis technique aims to determine whether the data results can be distributed generally by conducting a normality test. This study used SEM (Structural Equation Model) analysis with Partial Least Square (SEM-PLS) with the help of SMART-PLS verse software.03 to perform model analysis. There are five stages [5], as shown in Figure 3.3:

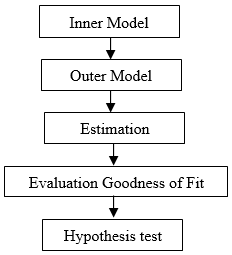


Figure 3. SEM

3.6 System Requirements

The following are the system requirements obtained from the results of the open-ended question questionnaire, which uses the Delone and Mclean indicators. With open-ended questions, respondents can explain system requirements that occur when the system is running on SAP Business One, including:

Table 1. System Requirements

No.	Problem	Problem details	Development Suggestions
1.	UI display Not user friendly	The resulting display does not produce a satisfactory display for employees aged > 30 years.	Implement a user friendly UI
2.	Company difficulty managing inventory	There are errors or inaccuracies in inventory related to logistics activities in the company	Configure the Inventory feature in Odoo
3.	Information regarding (status, process, production schedule, and material requirements).	There are no features that can manage the movement of materials and process results inside and outside the factory that can track manufacturing orders	Manufacturing configuration that is able to provide detailed information on the movement and process results to the company.
4.	Search feature that displays data that does not match	The search feature sometimes doesn't match what you're looking for	Customize filter grouping, to make it easier to search and simplify what has been created
5.	The resulting report is less effective	Reports that are made cannot be edited, can only be accessed by the IT team and must be canceled so that they can be continued and there is often a mismatch between the SAP system and monthly reports.	Integrate reports in the system according to monthly reports.

3.7 Analysis and Research Results

A. Analysis Problem

This phase aims to configure and customize Odoo's creation from the results of deficiencies in data processing through the evaluations discussed in the previous chapter. This configuration and customization will make recommendations for the shortcomings of the previous system.

B. Solution

Based on the analysis, to overcome the problem, this research will configure and customize the Odoo application to suggest the shortcomings of the SAP Business One application.

3.8 Questionnaire Results

A. Inner Model

When evaluating this measurement model for respondents from SAP Business One users at PT Bando Indonesia, the indicators used were not entirely valid and reliable. So that a structural model that is suitable for research can be obtained, which is as follows:

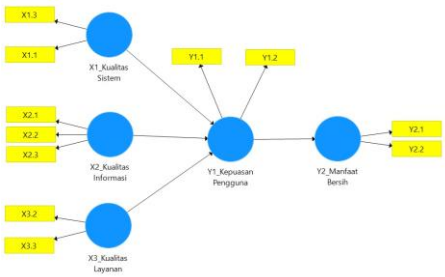


Figure 4. Inner Model

1. The exogenous latent variable Quality System (X1) has two manifest variables (indicators), namely, ease of use which is expressed by X1.1; Declared System Reliability (X1.3).
2. The exogenous latent variable Information Quality (X2) has three manifest variables (indicators), namely, completeness by variable (X2.2); and accurate data expressed by the variable (X2.3).
3. The exogenous latent variable of Service Quality (X3) has two manifest variables (indicators), namely, the guarantee stated by the variable (X3.2); and responsive, which is expressed by the variable (X3.3).
4. The endogenous latent variable User Satisfaction (Y1) has two manifest variables (indicators), namely, overall satisfaction expressed by the variable (Y1.1); and information satisfaction defined by the variable (Y1.2).
5. Endogenous latent variable Individual Impact (Y2) has two manifest variables (indicators), namely, increasing productivity as stated by the variable (Y2.1); and an increase in job performance expressed by (Y2.2).

B. Outer Model

Outer Loadings

Matrix	X1_Kualitas Sistem	X2_Kualitas Informasi	X3_Kualitas Layanan	Y1_Kepuasan Pengguna	Y2_Manfaat Bersih
X1.3	0.803				
X2.1		0.711			
X2.2		0.804			
X2.3		0.733			
X3.2			0.869		
X3.3			0.868		
Y1.1				0.921	
Y1.2				0.942	
Y2.1					0.922
Y2.2					0.880
X1.1	0.831				

Figure 1. Outer Model

The output shows that the loading factor is above the suggested value of 0.5. convergent if it has a loading factor > 0.7 and has an average variance extracted (AVE) of 0.50. After re-estimation, the results have met convergent validity because all loading factors are 0.7. Thus, the concurrent validity for system quality, information quality, service quality, user satisfaction, and net benefits can be valid. Therefore, the values of the indicators used in this study have met convergent validity, so the indicators used in this study have met convergent validity (Convergent Validity).

C. Discriminant Validity

In related reflective indicators, it is necessary to test discriminant validity by comparing the cross-loading table values. So, a hand is declared valid if it has the highest loading factor value to the intended construct compared to the loading factor value of other constructs.

Discriminant Validity

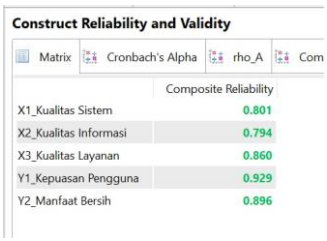
Fornell-Larcker Criteri... | Cross Loadings | Heterotrait-Monotrait ... | Heterotrait-Monotrait ... | Copy to Clipboard: | Excel Formu

	X1_Kualitas Sistem	X2_Kualitas Informasi	X3_Kualitas Layanan	Y1_Kepuasan Pengguna	Y2_Manfaat Bersih
X1_Kualitas Sistem	0.817				
X2_Kualitas Informasi	0.713	0.750			
X3_Kualitas Layanan	0.645	0.770	0.868		
Y1_Kepuasan Pengguna	0.800	0.686	0.644	0.932	
Y2_Manfaat Bersih	0.680	0.714	0.649	0.817	0.901

Figure 2. Discriminant Validity

Evaluation of discriminant validity is done by comparing the square root of the Average Variance Extracted (AVE) value for each construct with the correlation value between constructs in the model. A good AVE value should be > 0.5. In this study, the AVE value can be seen in the following figure:

D. Construct Reliability and Validity



Construct Reliability and Validity

Matrix | Cronbach's Alpha | rho_A | Com

	Composite Reliability
X1_Kualitas Sistem	0.801
X2_Kualitas Informasi	0.794
X3_Kualitas Layanan	0.860
Y1_Kepuasan Pengguna	0.929
Y2_Manfaat Bersih	0.896

Figure 3. Realiability and Validity

In addition to the validity test, there is also a reliability test. Reliability shows that something can be trusted as a data collection tool because the instrument is already good. To confirm that the measuring device can work reliably, it will be tested in two ways using Cronbach's Alpha and composite reliability (CR). The Rule of Thumb is a guide that provides simplified suggestions for some ground rules when completing or approaching a particular task. So, the power of thumb is used to assess construct reliability, namely the composite reliability value > 0.7, as follows:

E. R Square

Evaluation of the structural model (inner model) aims to predict the relationship between latent variables by knowing if it has a constructive match. The Structural Model (inner model) can be evaluated by looking at the percentage of variance explained by looking at the R-Square value of the endogenous latent construct. The higher the R-Square value, the better the prediction model of the proposed model. In the 2 test, this value uses the smartPLS 3.0 computer program, and the data obtained are as follows:

R Square

Matrix | R Square | R Square Adjusted

	R Square	R Square Adjusted
Y1_Kepuasan Pengguna	0.674	0.648
Y2_Manfaat Bersih	0.667	0.658

Figure 4. Rsquare

The value of 2 (R-Squared) measures how much influence certain independent latent variables have on the latent dependent variable. The result of 2 is 0.60, which indicates that the model is categorized as good [40]. Figure 3.27 shows the value of the construct of User Satisfaction of 0.674, which means that the variability of the construct of user satisfaction which can be explained by the variables of system quality, information quality, and service quality is 67.4%. In comparison, 32.6% is explained by other variables. Then the value of the net benefit construct is 0.667, which means that the variability of the net benefit construct that can be defined by user satisfaction is 66.7%. In comparison, 33.3% is explained by other variables outside those studied in this study.

3.9 Configuration

A. Inventory Module Configuration

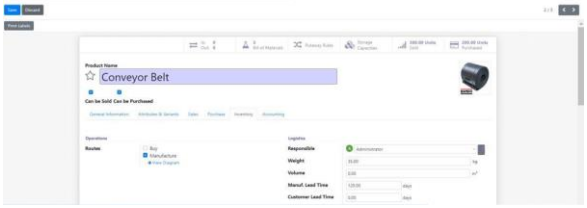


Figure 5. Inventory Module Configuration

After filling in the General Information tab, fill in the operational data in PT Bando Indonesia for the Conveyor Belt product, namely "Manufacture." Then, fill in data such as weight, volume, manufacturing period, and who is responsible for each process carried out in the Responsible field, namely "Administrator".

B. Purchase Module Configuration

If there is already a "PAID" written on it, it explains that the supplier has made the payment.

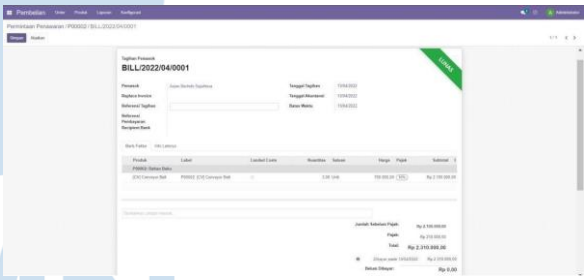


Figure 6. Purchase Module Configuration

C. Manufacturing Module Configuration

Figure 7. Manufacturing Module Configuration

In the last stage, a pop-up will appear after clicking "Mark as Complete," as shown in figure 12. Then click "Apply" Even though the status is not available, if there is a notification, as shown in figure 12, it can be declared successful. If stock is unavailable, a "create back-order" or "back-order not available" pop-up will appear, confirming that the item is not in stock.

D. Sales Module Configuration

Figure 13. Sales Module Configuration

Explain that invoices containing a "PAID" notification mean that the customer has paid for the product.

3.10 Customization

A. Adding Signature Column in Sales Order Document

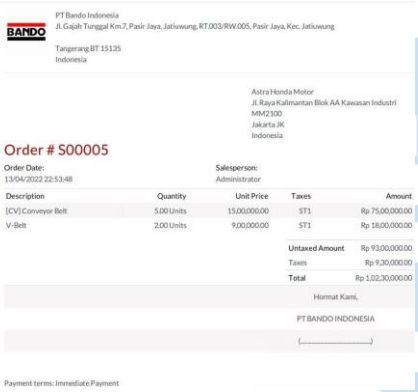


Figure 8. Customizzation Sales Order

The creation of this signature column is found in the Sales Order module. This is done so that this invoice can be said to be official and up-to-date with the information listed following the approval of the person in charge of the invoice issued.

B. Adding Signature Column in Purchase Order Document

Figure 9. Customization Purchase Order

In this process, add the code in the Purchase Order section. PT Bando Indonesia previously did not have a format that applied internal approval to purchases and sales through operations.

C. Adding Price Contract Information

Pricelist	Terms and conditions
Public Pricelist (IDR)	
Public Pricelist (IDR)	
Public Pricelist (IDR)	

Figure 10. Adding Price

PT Bando Indonesia sets the price value on each agreed contract for the sale made. Therefore, to make it easier to identify the price contract on the sale order and trace the contract agreed with the customer, this customization was made to include the “Terms and conditions” and “Pricelist” columns.

D. Adding a Bank Account in the Header

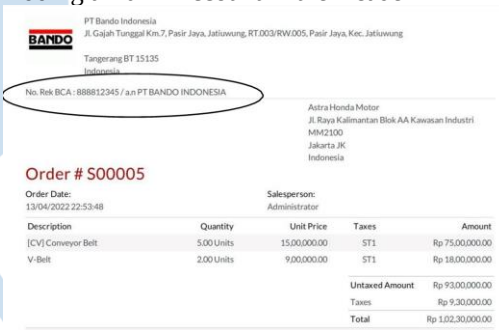


Figure 11. Adding a Bank Account

Add a bank account number in the header section that is created after the company profile information to make it easier for customers when making payments through transfer via bank.

E. Creating Grouping Filters

```
Sub Menu Sales Orders
> 'group_by' : ('partner_id','date_order','pricelist_id')

Sub Menu Purchase Order
> 'group_by':('incoterm_id','date_order','partner_id')

Sub Menu Inventory Product
> {'default_move_type': 'out_invoice'},|'group_by':('state','commercial_partner_id','date_invoice')

Sub Menu Manufacturing Order
> {'search_default_todo': True, 'default_company_id': allowed_company_ids[0]}
```

Figure 12. Creating Grouping

In making this grouping filter, it aims to make it easier to search and simplify what has been made.

3.11 User Acceptance Test

Based on the system that has been created, potential users are asked to test the features and modules, and this is useful for later the system will be used. Therefore, several stages of system testing with UAT standards are needed using the Black-Box Test method. This test is based on the appearance and function of the features and modules used on the Odoo ERP system.

Table 2. UAT results

Description	Case	Status
Log in	User's input username and password.	OK
Discuss page	Create a discussion room/forum to discuss with each other (user).	OK
User information Account	Display the user information (profile).	OK
Dashboard module	Display the available module.	OK
Inventory module	Display and Input Category, Product data, etc.	OK
Purchase module	Display information of vendor and invoice.	OK
Manufacture module	Display cost of materials and section.	OK
Sales module	Display customer data, product, invoice, and receipt.	OK
Add new module	Create a new module based on the requirements	OK
Change password	Change user password	OK
Log out	User's can log out after finish the task or an activity.	OK

3.12 Comparison of implementation

Table 3. SAP B1 vs Odoo Implementation

No	Using SAP B1	Using Odoo
1	User Interface of SAP B1 is not user friendly.	The price is costly and a one-time purchase when implementing the SAP program. The company must buy the hardware and software needed by the company to run all the programs in the system.
2	difficulty managing supplies	SAP offers flexibility for growth purposes. With this, many small companies gain benefits significantly.
3	Lack of information regarding status, process, production schedule, and material requirements	Manufacturing configuration can provide customers with detailed information on movement and process results.
4	Search feature that displays data that does not match the criteria	Customize filter grouping, to make searching easier and easier which has been made.
5	The resulting report is less effective	Integrate the reports in the system according to monthly reports.

IV. Conclusion

1. The system's quality has a positive and significant effect on user satisfaction. In testing the hypothesis, the 4.347 count is feasible > 2.021. The higher the system's quality, the higher the level of satisfaction.
2. The quality of the information produced positively affects user satisfaction but is insignificant. In testing the hypothesis, the count value is 1.243 < is worth 2.021. Need to be improved again and needs other variables that can have a significant effect.
3. Service quality, which is produced, has a positive effect on user satisfaction but is insignificant. In testing the hypothesis, the count value is 1.055 < Table is worth 2.021. need other variables that can have a considerable effect.
4. User satisfaction affects the net benefit (net benefits) positively and significantly. The variability of the net benefit construct that can be explained by user satisfaction is 66.7%, while 33.3% is explained by other variables outside those studied in this study.
5. The recommendation activities are related to developing suggestions from the evaluation results in SAP Business One. This module complements the activity modules not in SAP Business One by recommending the inventory and manufacturing module.

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Evaluation of Ultima InfoSys Site Usability Using Usability Test & System Usability Scale Method

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***Abstract* — Web Ultima Infosys is one of the websites owned by Universitas Multimedia Nusantara (UMN), which contains a collection of papers majoring in information systems. Based on the results of a survey conducted on the Ultima Infosys website for information system students, many students feel that the website's appearance is lacking or difficult to use. Especially in journal search and journal submission. Therefore, the usability evaluation of the Ultima Infosys web was carried out. The method used in this research is a usability test and system usability scale (SUS). Where the researcher will evaluate using questionnaires and interviews. The results of the questionnaire were measured using SUS. Based on the results of the evaluation score that SUS has measured, the result is a score of 50.25. Knowing that the score is below the average, a recommendation for improvement is made in the form of a mockup. After re-testing and measuring using SUS, the mockup of the recommendation results got a value above the average of 81,265. Thus, it can be concluded that the mockup of the recommendations proved to be easier to understand and use by users.**

Index Terms—*Web Ultima Infosys; Usability Evaluation, Usability Test, SUS*.

I. INTRODUCTION

The Ultima Infosys website is one of the sites that contain information system student papers. On this site, students can search for journals as references in helping with their final project or thesis. In addition, the Ultima Infosys site provides access to every student outside and inside the Universitas if the journals they make want to be included in the website as a collection of information system papers. The Universitas Multimedia Nusantara Information Systems Study Program, in collaboration with UMN Press, manages the Ultima Infosys website. Ultima InfoSys is also inseparable from how the service was designed, where users will feel comfortable using a website.

However, based on the User Experience Questionnaire (UEQ) that the researchers did previously, there were 20 student information system users; it was known that the Ultima InfoSys web was considered complicated to use and difficult or unclear in searching journals based on the results of the UEQ questionnaire.

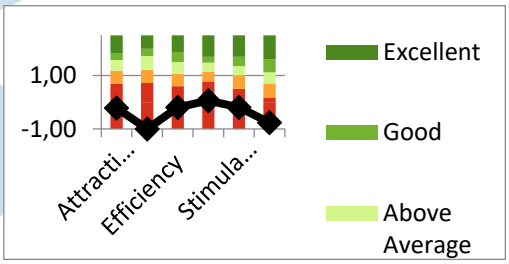


Fig. 1. UEQ Results Graph of 20 Information System students

From Fig. 1, The results of the 26 questions on the UEQ show that the Ultima InfoSys website, in terms of Attractiveness, Clarity, Efficiency, Accuracy, Stimulation, and Novelty, is still lacking. Therefore, the researcher chose the Ultima Infosys web as the object of research to evaluate it further by using Usability Testing and SUS as a method for measuring the website's usability. As well as providing recommendations for improvement in the form of a prototype to become a reference in future system development.

II. THEORY

1. *Evaluation*

According to the general description, evaluation is an activity to collect information about the performance of something (methods, people, equipment). The report will determine the best decision alternative [1].

2. *8 Golden Rules*

According to Ben Shneiderman in his book "Designing the User Interface", there are guidelines for designing a User Interface. These guidelines are referred to as the eight golden rules, which contain: [2]

1. *Strive for consistency*
   Consistency is required between application pages or between applications that are always connected. The goal is for users, especially beginners, to always see that the page they are viewing is still in scope or relevant to the application they are using.
2. *Cater to universal usability*
   The designer must consider the user's variations when designing an application interface. Both in terms of cultural and linguistic context and differences in how well users understand the app.
3. *Offer informative feedback*
   Informative feedback is not necessarily a response from the application to the user. Still, it can be in the form of a change in appearance every time the user acts so that the user understands that the action has been taken and answered by the application.
4. *Design dialogs to yield closure*
   This point is included in informative feedback; by saying that the process performed by the user has ended, the user understands that he does not need to wait if there will be another step after completing a cycle.
5. *Prevent errors*
   This is to prevent users from making mistakes during operation. This is necessary so that users don't get bored while using the application because they can't find the correct format/operation when trying the function.
6. *Permit easy reversal of actions*
   This point is quite important to support the user experience of an application. Usually, the back button is considered the achievement of this point.
7. *Support internal locus of control*
   This point is highly appreciated by users who are accustomed to using the application because, in general, they want a display that can be adjusted according to user preferences.
8. *Reduce short-term memory load*
   At this point, people tend to focus more on menu design and button layout. But in reality, it will be more effective if applied to the process when the user needs to provide input to the system.

3. *Website*

Websites are known as sites or portals. A website is a collection of interrelated web pages, the first page of a website, and each is independently called a web page [3].

4. *User Interface*

A user interface is a form of graphical display that is directly related to the user (user). The user interface connects the user with the operating system so the computer can be used. The design must be user-centered, meaning the user is highly involved in the design process. Therefore, there is an evaluation process carried out by the user on the design results [4].

5. *User Experience*

User experience (UX) is the experience that a website or software provides tools to make interactions exciting and fun. If the application had good usability in the past, it was enough. UX relates to users using or interacting with a product or service [5].

6. *Usability*

Usability is a measure of user experience interactivity related to a user interface, such as a site or software, in the form of an application. A system or software interface is said to be user-friendly if it is easy to learn [6] and helps the work and tasks of people who use it effectively and efficiently so that it is satisfying and attractive when used [7].

7. *Usability Testing*

Usability testing is testing the use of a system or product to find usability problems [8]. Based on the ISO 9421-11 standard, it is stated that the requirements for good usability are effectiveness, efficiency, and user satisfaction. Users should be able to perform effectively (based on the results), efficiently (based on the method), and be satisfied (get pleasure) [9].

8. *System Usability Scale*

John Brooke created the System Usability Scale (SUS) in 1986 to evaluate various systems or products practically. SUS was designed to address the need for simplicity and speed in assessing systems that have been created and can be used in multiple contexts and procedures other than websites, such as operating systems, hardware, software, and applications [10].

9. *Likert Scale*

The Likert scale is used as an evaluation scale because it provides an answer scale value for quantitative analysis. Likert can be evaluated as follows [11]:

1. Strongly Agree (SS) is given a score of 5
2. Agree (S) is given a score of 4
3. Neutral (N) scored 3
4. Disagree (TS) is given a score of 2
5. Strongly Disagree (STS) was given a score of 1

Survey research using a Likert scale is done as a questionnaire, multiple-choice questionnaire, or checklist [10].

III. METHODOLOGY

1. *Overview of Research Objects*

The general description of the object of research is a description that explains the situation and condition of the thing closely related to the investigation. In determining the object of research, prior observations were made to select the correct object in a study.

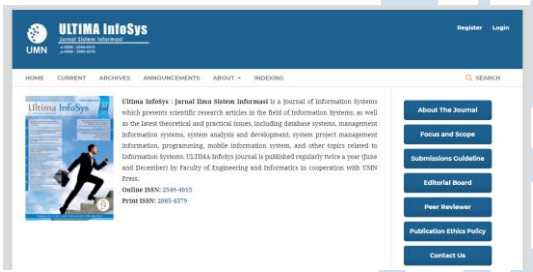


Fig. 2. Ultima InfoSys Website Display

The object of this research is the Ultima InfoSys website, Universitas Multimedia Nusantara. Ultima InfoSys provides access to search journals and to enter information systems journals that present scientific research articles in the field of information systems, as well as the latest theoretical and practical issues, including database systems, management information systems, system analysis, and development, project management information systems, programming, mobile information systems, and other topics related to information systems as shown in Fig. 2 above.

The factor that will be the focus of this research is usability, namely the extent to which the site can be used by the user comfortably and satisfactorily in terms of use based on the results of the questionnaire that the user will conduct.

2. *Research Method*

In conducting research, there is a path to solving the problem. The following is the distribution of the flowchart or research framework, as shown in Figure 3 below.

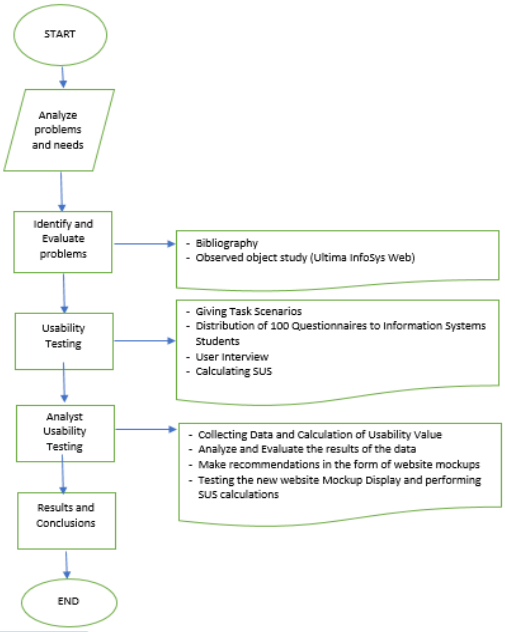


Fig. 3. Framework of Thinking

Through the research flow that has been made, there are four stages in solving problems, namely, the stage of analyzing problems and needs, the stage of identifying and evaluating problems, the usability testing stage, which is testing usability, the usability testing analysis stage, and the last stage is the conclusion and suggestion stage. A detailed explanation of the four stages is as follows:

1. Stage of Identifying and Evaluating Problems
2. Usability Testing Stage
3. Usability Testing Analysis Phase
4. Results and Conclusions

3. *Research Variables*

In this study, there are two variables, namely, the dependent variable and the independent variable.

1. The independent variable in this study is the Standard Usability Scale questionnaire. This study refers to the SUS Likert scale, each using a scale of 1-5 category answers. With the results of the SUS questionnaire, the average score for the SUS standardization of the application will be obtained.

2. The dependent variable in this study is the five components of Usability Testing (learnability, efficiency, memorability, error, and satisfaction). The results of usability testing influence the five components.

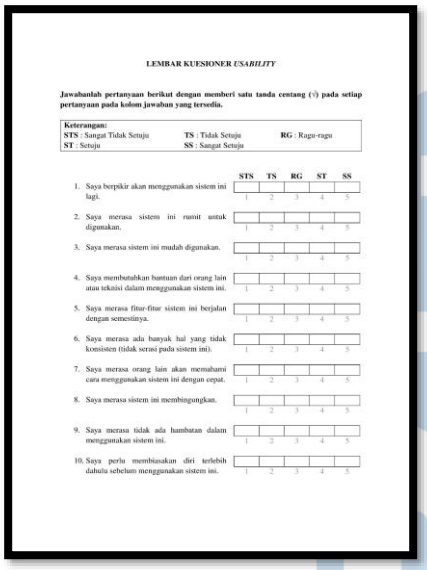
4. *Data Collection Techniques*

1. Interview Method

This study collected data from interviews with 20 UMN information system students through social media Lines. Interviews were conducted as a benchmark in research problems to find out experience on the Ultima InfoSys web.

2. Questionnaire Method

The SUS questionnaire was distributed to determine and measure the value of user satisfaction in using the Ultima InfoSys web. SUS is a standard benchmark of a questionnaire that measures user satisfaction in using the web or application. The SUS questionnaire consists of 10 different questions, as shown in Figure 4 below.



LEMBAR KUESIONER *USABILITY*

Jawabanlah pertanyaan berikut dengan memberi satu tanda centang (√) pada setiap pertanyaan pada kolom jawaban yang tersedia.

Keterangan:
STS : Sangat Tidak Setuju **TS** : Tidak Setuju **RG** : Ragu-ragu
ST : Setuju **SS** : Sangat Setuju

	STS	TS	RG	ST	SS
1. Saya berpikir akan menggunakan sistem ini lagi.	1	2	3	4	5
2. Saya merasa sistem ini rumit untuk digunakan.	1	2	3	4	5
3. Saya merasa sistem ini mudah digunakan.	1	2	3	4	5
4. Saya membutuhkan bantuan dari orang lain atau teknisi dalam menggunakan sistem ini.	1	2	3	4	5
5. Saya merasa fitur-fitur sistem ini berjalan dengan semestinya.	1	2	3	4	5
6. Saya merasa ada banyak hal yang tidak konsisten (tidak serasi pada sistem ini).	1	2	3	4	5
7. Saya merasa orang lain akan memahami cara menggunakan sistem ini dengan cepat.	1	2	3	4	5
8. Saya merasa sistem ini membingungkan.	1	2	3	4	5
9. Saya merasa tidak ada hambatan dalam menggunakan sistem ini.	1	2	3	4	5
10. Saya perlu membiasakan diri terlebih dahulu sebelum menggunakan sistem ini.	1	2	3	4	5

Fig. 4. SUS questionnaire

After collecting data from 20 respondents, the data is calculated by the following rules:

- For each odd-numbered question, the value of each question received from the user will be deducted by 1.
- For each question with an even number, the final score is obtained from 5 deductions from the question value obtained from the user.
- The SUS score is obtained from the sum of the scores for each question which is then multiplied by 2.5.
- The scoring rule applies to 1 respondent. For further calculations, the SUS score of each respondent is sought for the average score by adding up all scores and dividing by the number of respondents.

3. Usability Testing

Usability testing is done by instructing the respondent to conduct testing, which is done by introducing the respondent to perform several task scenarios that have been prepared. A usability test requires a task scenario. Task scenarios describe stories and contexts for why certain users or groups visit a website or application. [2].

Faulkner argues that five people will only find 55% of usability problems; to get 90% of usability problems, a minimum of 15 people is needed, and to get 95% of usability problems, a minimum of 20 users is required. [3]

This task is selected based on standard pages often opened on the Ultima InfoSys web. The subjects and parts that are evaluated in usability testing are:

- User reactions when entering the Ultima InfoSys web.
- View the Ultima InfoSys web UI display.
- See the features available on the Ultima InfoSys web.
- Login or Register to the Ultima InfoSys web account.

The measurement is seen from the success or failure of the user in carrying out the task scenario and the length of time in carrying out the task.

5. *Data Analysis Techniques*

The evaluation technique is a process of determining goals, design, implementation, and the desired impact, making decisions, supporting accountability, and providing information that can be used to increase understanding of the phenomenon.

1. Usability Evaluation

At this stage, the usability evaluation of the Ultima InfoSys website will be carried out. The review will be based on the results of a SUS questionnaire and usability testing carried out by 20 students assigned to perform task scenarios on the Ultima InfoSys website. This evaluation was carried out to determine what to do with the Ultima InfoSys web in terms of usability and user interface.

2. User Interface Improvement

After completing an assessment based on SUS on the Ultima InfoSys website, recommendations will be made. In recommending the user interface, it will be based on the problems faced by users or respondents when accessing the website. The issues contained on the website will fall into several different categories. The order of categorization is done by looking at the problems on the website

pages, such as the features on the website. Categorization can also be in color, language, layout, etc.

3. User Interface Test

This stage is carried out after completing the creation of new UI improvements. The following is in carrying out testing of the new UI.

- Testing the user interface by asking 20 students who had previously done usability testing to try to work on a task scenario on the new user interface.
- After that, the user will fill out the SUS questionnaire after trying the task scenario on the new UI.
- Then, the calculation is carried out again using SUS.

After the calculations, a comparison between the old UI and the new UI improvements is made.

IV. Result and Discussion

1. *Problem Identification*

After conducting the analysis and needs in the research, the next step is to identify the problem by conducting interviews with users and questionnaires.

1. Interview with users

Interviews were conducted with 20 information system students using Line's social media on 9-10 October 2021. Due to the current corona pandemic and the difficulty of meeting users for direct interviews, Line's social media was used to communicate. The results of the discussions found things that information system students usually do in accessing the Ultima InfoSys web:

- Log in to enter the journal (submission)
- Download the journal template
- Looking for journal reference sources for the thesis

2. Questionnaire

Usage satisfaction questionnaires were distributed using google forms through online media on 9 – 23 October 2021. Respondents who participated in filling out the questionnaires amounted to 100 respondents with specific criteria, namely UMN information system students. The questionnaire results distributed to student users of the UMN information system are used as benchmarks for usability evaluation and display based on the respondent's user experience on the Ultima InfoSys web.

2. *Analysis and Recommendations Display and Features*

To provide convenience in recommending user interface improvements, the Ultima InfoSys website was carried out with an analysis of the appearance and features of the Ultima InfoSys website. Analysis research based on the results of interviews with 20 students.

3. *Ultima InfoSys Homepage*

The picture on the right shows a display of the latest Ultima InfoSys web start page, created using Balsamiq mockup 3. The main features or usability of the Ultima InfoSys web are shown directly on the main page. That is where users can directly search for the journal they want to find. Make a search box that looks very clear and contains words in the form of action information, as shown in Figure 5 below.

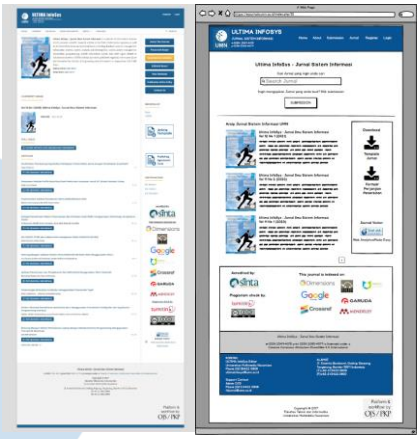


Fig. 5. Homepage Comparison

In addition, another prominent feature is journal submission. Make a submission button on the initial web page display because this feature is one of the main ones. This is to make it easier for users to directly connect to the submission page without having to bother looking for the submission page on the previous profile page. Then create a different layout from the previous one, with menus and essential features.

There is an information system archive display below the display where users can immediately see a collection of journal archives. On the right is a feature to download templates and forms and a feature to view users who access the Ultima InfoSys web. Then there is a footer under the archive view, which contains the institutions used by the Ultima InfoSys web. Under the display of the institution, there is writing in the form of information that this website has been licensed. Underneath it is a written report in the form of web contact and UMN address. And at the bottom, a copyright exists as in the previous view. The language used is Indonesian.

4. *Login Page*

Fig. 6. Login Page Comparison

In the picture on the right, there is a display of the latest Ultima InfoSys web login page. By creating a new layout, text and text input are centered on making it look neater and not leaving the display empty in the previous view, as shown in Figure 6 above.

5. *Register Page*

Fig. 7. Register Page Comparison

In the picture on the right, there is a display of the latest Ultima InfoSys web registration page. Creating a new layout to make it look neater and not leave an unobstructed view of the previous picture. There is also a feature on the right, a button for submissions, to make it easier for users to submit. Then select the critical data and use a language that the user understands. In general, the register display that has been created looks like a standard register display, as shown in Figure 7 above.

6. *Search Page*

Fig. 8. Search Page Comparison

In the picture on the right, there is a display of the latest Ultima InfoSys web search page. By creating new layouts that are easier for users. Such as the layout of the search box that is visible coupled with the information words of action. There is an additional filter feature to search for journals by searching for journals by category. And also improved the filter to search for journals by year to make it easier and less complicated than the previous filter, which used the published after and published before filters. The journals are produced in boxes to make them look neater than the previous display, as shown in Figure 8 above.

7. *Submission Page*

Fig. 9. New Submission Page

In fig.9, there is a display of the latest Ultima InfoSys web submission page. By making it as simple as possible to make it easier for users to carry out journal submission activities. There are writings and terms and writings in red indicating that this information is critical to the user. The user must fill in the checkbox that the user must check as one of the conditions to fill in the journal data. If the conditions are limited, the user can fill in further data, such as article components, titles, and abstracts. Then, create a journal upload button for uploading. Underneath is a comment field that users can write if something is to be conveyed. After that, there is a submit button at the very bottom of the end.

8. *Jurnal Page*

Fig. 10. New Jurnal Page

In fig.10, there is a display of the latest Ultima InfoSys web journal page that has been created. The menu and journal pages were added because previously, there was no menu containing journal collections. There are only a few recent journals. Because the primary use of this web is to search for journals and make submissions to enter periodicals, this journal page was created to make it easier to view a collection of journals, and users do not need to use search to search. This page is more or less the same as the search page, but what distinguishes it is the collection of journals that existed before the search was carried out.

9. *The Results of the Ultima InfoSys Web Usability Testing Analysis*

TABLE I. Table of Responses to the Main Page

Category Web	Web Ultima InfoSys
Appearance	• **Unattractive appearance** Reason: There are only a lot of posts and menu features. • **Simple display** Reason: The primary reaction when viewing this website is that it is straightforward and user-friendly, but some features or options are complex. •**Confusing** Reason: The display is too simple, so finding the journal is confusing and complicated. And there is no option on the main page that goes directly to submission.
Layout	• **Unattractive design** Reason: The design is too ordinary and plain. It should be given more pictures. • **Less Layout** Reason: The search button doesn't show enough to be able to search for journals. • **Added Submission Menu** Reason: To make it easier for users to submit journals. • **Added a Menu to view a collection of Journals** Reason: To make it easier to find journals if we don't use the search box.
Information Presentation	• **Difficult to find information on what to do on the Ultima InfoSys web** Reason: The initial appearance is very confusing because only articles or writings tell you this is an information system journal website, even though we can search for journals and submit journals.
User Convenience	• **Difficult to use** Reason: Confused about submitting and looking for journals •**Neutral** Reason: Directly or visible, it feels comfortable and user-friendly. But some make users uncomfortable without features that make it easier to use the web, such as searching for journals and journal submissions. • **Less user friendly** Reason: Less user-friendly when searching for journals in the search box because there is only a filter feature based on author and publish date.
Language Usage	• **Made in the Indonesian Language** Reason: The language on the Ultima InfoSys web uses English, and there is no option to change the language to Indonesian. Therefore, users who do not understand English well challenging difficult to understand and are confused with the features available on the Ultima InfoSys web.

Based on the summary taken from the respondents and entered into the table, many respondents find it challenging to use the Ultima InfoSys web because many features or options are not on the main page,

which will make it easier for users to search or submit. Respondents feel comfortable and less comfortable using the website because they see a simple but not user-friendly interface. Based on the use of language used only in English makes it difficult for users who do not understand English to understand the features on the web. Therefore, the Ultima InfoSys website must develop in terms of appearance, improve features or options to make it easier for users, and create a website using Indonesian or make two language choices, Indonesian and English.

10. *Results of SUS Questionnaire Analysis (Before-After)*

Testing the analysis using the System Usability Scale (SUS) method. According to Laura Faulkner's theory, to get 95% of the problems, 20 users are needed. Then 20 respondents were taken from information system students from 100 respondents who had filled out the questionnaire and had used the Ultima InfoSys web.[12] Ten questions were given in the questionnaire, consisting of 5 positive and five negative questions. And with the selection of 5 answers using a Likert scale, namely, strongly disagree, disagree, neutral, agree, strongly agree. The following ten questions were given:

1. I will often use the Ultima InfoSys web.
2. I found many difficulties in accessing the Ultima InfoSys web.
3. The Ultima InfoSys web is easy to use.
4. I need help from technical/other people when using the Ultima InfoSys web.
5. I found that various functions in the Ultima InfoSys web were well integrated.
6. I think there are too many discrepancies in the Ultima InfoSys web.
7. I feel that students will find it easy to learn the Ultima InfoSys web very quickly.
8. I find the Ultima InfoSys web very complicated to use.
9. I feel there are no obstacles when using the Ultima InfoSys web.
10. I need to learn many things before I can use the Ultima InfoSys web.

TABLE II. Calculation of SUS before a recommendation

	Skor Hasil Hitung (Data Contoh)										Jumlah	Nilai
	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10		(Jumlah x 2.5)
R1	2	2	3	1	4	2	2	2	2	0	20	50
R2	2	2	2	1	4	1	2	2	2	0	18	45
R3	2	1	2	2	2	2	2	1	2	0	16	40
R4	2	3	3	1	3	2	2	2	3	0	21	52,5
R5	2	2	1	1	3	2	2	3	1	1	18	45
R6	2	1	1	2	3	2	3	2	2	2	20	50
R7	1	1	2	2	4	2	2	2	2	1	19	47,5
R8	2	2	3	2	4	2	3	1	1	2	22	55
R9	3	2	2	2	4	1	2	2	4	2	24	60
R10	2	2	3	2	2	2	2	2	2	2	21	52,5
R11	2	2	1	1	1	1	2	3	2	1	16	40
R12	1	3	1	1	2	2	3	2	2	0	17	42,5
R13	1	2	2	1	2	2	3	3	2	1	19	47,5
R14	0	1	2	2	4	2	2	3	2	1	19	47,5
R15	2	1	2	2	3	1	3	3	2	2	21	52,5
R16	2	2	2	1	3	1	3	3	2	2	21	52,5
R17	2	2	3	2	3	2	3	4	4	2	27	67,5
R18	1	2	3	1	3	2	3	3	2	2	22	55
R19	1	1	3	1	3	2	3	2	2	2	20	50
R20	1	2	2	0	3	2	3	3	2	3	21	52,5
	Skor Rata-rata (Hasil Akhir)											50,25

Table II shows that the score for the questionnaire after usability testing is 50.25 with a rating of 'ok', and it is still in the below-average category because, according to Jeff Sauro's research, the average SUS score is 68, as seen in Table II in the SUS assessment. This means that the score obtained by the current version of the Ultima InfoSys web is below the global average SUS score, so the usability value cannot be said to have met the usability standard.

TABLE III. Calculation of SUS after a recommendation

	Skor Hasil Hitung (Data Contoh)										Jumlah	Nilai
	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10		(Jumlah x 2.5)
R1	2	4	4	4	4	4	4	3	3	36	90	
R2	2	4	3	3	4	4	4	3	2	4	33	82,5
R3	2	3	4	4	4	3	4	3	2	3	32	80
R4	2	4	4	4	4	4	4	4	3	4	37	92,5
R5	2	4	4	4	4	4	4	4	3	3	36	90
R6	2	3	4	4	3	3	4	2	3	3	31	77,5
R7	3	3	3	3	4	2	4	3	3	4	32	80
R8	3	3	3	3	4	3	3	3	3	2	30	75
R9	3	4	4	4	4	3	4	4	4	3	37	92,5
R10	2	3	3	4	4	2	3	4	2	3	30	75
R11	2	4	4	4	4	4	4	3	3	2	34	85
R12	2	3	3	4	3	3	4	2	3	3	30	75
R13	2	3	3	3	3	3	3	4	3	3	30	75
R14	3	4	3	4	4	2	3	3	4	2	32	80
R15	2	3	3	4	3	3	3	3	3	3	30	75
R16	2	3	4	4	3	2	3	3	4	3	31	77,5
R17	2	4	3	4	4	3	4	4	3	2	33	82,5
R18	3	3	3	4	4	3	4	3	3	2	32	80
R19	2	4	4	3	4	4	3	4	3	3	34	85
R20	2	4	4	4	5	3	3	3	3	2	33	82,5
	Skor Rata-rata (Hasil Akhir)											81,625

The value obtained from the results of the usability testing questionnaire on the recommendation mockup that has been made gets a value of 81,625, which shows that the mockup has entered the SUS standard, according to Jeff Sauro's research, which is where the SUS standard is 68. The recommended mockup is above average, ranks well, and is acceptable to users.

V. CONCLUSION

Based on the evaluation that has been done, a mockup of recommendations for the Ultima InfoSys website is made. The results of responses from respondents for mockup recommendations get better answers than the current Ultima InfoSys web display. The mockup score was 81,265, which means that the recommended mockup that has been made is liked by users and is better than the current Ultima InfoSys web view. Suggestions for the future are that an evaluation can be carried out on the Ultima InfoSys web, which is carried out by the development team. This is to improve the website's quality, get users' comfort, and improve the web's appearance.

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Measuring Technology Readiness Index (TRI) of Management Information System Adoption in Higher Education

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***Abstract*— The Laboratory of Software Engineering and Information Systems at Sriwijaya University is one of the services or learning media for students provided by Sriwijaya University. In order to support operational activities and good laboratory governance, a good management information system is needed. However, the adoption of new technology has some dificulties. It is necessary to know the level of readiness to accept new technology and one method to measure the level of readiness to accept new technology is the Technology Readiness Index (TRI). This research was conducted by distributing questionnaires to lecturers, structural laboratories and regular students of the 2018-2019 fasilkom. Data was processed using the Technology Readiness Index method by dividing the number of statements per variable by the variable weight. Then, the average total score for each statement is multiplied by the variable weight and the TRI value is obtained by adding up the scores of all variables. The results of this study found that the level of user readiness is included in High Technology Readiness with a score of 3.76. The Optimism value contributes the largest value to the total TRI value of the other variables, namely 1.010018. Then followed by Innovativeness of 0.986842, Discomfort of 0.917793 and Insecurity of 0.848009.**

Index Terms—E-Readiness; IT Adoption; Technology Readiness Index (TRI).

I. INTRODUCTION

Nowadays, information technology has become part of everyday life. Almost all aspects of life are closely related to information technology. This can happen because of the many uses of the application of technology

Information, for example retrieving, storing, manipulating, displaying, sending data that makes operational activities more effective and efficient. Many people feel that information has become one of the basic commodities and even information is something that can be traded at this time. Advances in information technology also lead us to the era of globalization more quickly.

All parties feel the impact of advances in information technology. Many organizations are competing to apply information technology in order to increase the effectiveness, efficiency and productivity of their organization. Sriwijaya University is one of the tertiary institutions that has used information technology in almost all activities of its academic community. It is hoped that by applying technology in all of its services, Sriwijaya University can become a World Class University.

One of the services or practicum learning media for students provided by Sriwijaya University is the Software Engineering and Information Systems Laboratory of Sriwijaya University[2]. However, management activities that are there have not been computerized so that they are not effective and efficient. In order to support operational activities and good laboratory governance, a good management information system is needed. The laboratory management information system that is built is expected to enable the Software Engineering Laboratory and University Information Systems to implement ISO/IEC 17025 (International Organization for standardization / International Electrotechnical Commission)[2].

However, implementing new information technology is not easy to do. To be able to adopt a new

information technology, very careful preparation is needed so that the implementation of the new system can work properly[5]. Information System Implementation is a very complex process, not only because of the many different aspects of updating that need to be considered at the same time, but also because of the impact of the new system on the organization[8]. It is necessary to know the level of readiness to accept new technology before adopting a new technology. One method to measure the level of readiness for acceptance of new technology is the Technology Readiness Index (TRI)[4]. Technology Readiness (TR) is a person's tendency to accept and utilize technology in their work or daily life. Meanwhile, the Technology Readiness Index (TRI) is an index for measuring user readiness in adopting new technologies [10].

Based on the problems above, the author aims to evaluate the level of readiness for the adoption of Laboratory Management Information System technology using the Technology Readiness Index (TRI), which refers to previous research[1]. The results of this study are expected to provide information and evaluation for Sriwijaya University to successfully adopt the Management Information System for Software Engineering Laboratory and Information Systems for Sriwijaya University.

II. Literature Review

A. *IT Adoption Readiness*

Technology Readiness can be defined as readiness to apply technology that is intended to help a job[11]. The Technology Readiness method is used to find out the level of openness of users towards new information technology. Nowadays, information technology has a vital role in the world of work, especially those that interact directly with technology[6], and user readiness factors play a greater role in influencing the success of an Information Systems project compared to user involvement in an Information Systems project[9]

B. *Technology Readiness Index (TRI)*

The Technology Readiness Index (TRI) was originally developed on 2000[4]. The level of readiness is a person's tendency to utilize and use technology to achieve goals in their work and daily life. Meanwhile, the Technology Readiness Index (TRI) is an index for measuring user readiness in adopting new technologies. There are four indicators to measure the level of user readiness in adopting new technology, namely optimism, innovativeness, discomfort, and insecurity[4]. While the three categories of technology readiness index are

- Low Technology Readiness, TRI is greater than or equal to 2.89
- Medium Technology Readiness, TRI is in between 2.90 and 3.51
- High Technology Readiness, TRI is greater than 3.51.

III. Methodology

This research was conducted using a survey method. Through this method, data collection that occurred in the past or the present includes beliefs, opinions, characteristics, attitudes, and variable relationships to test hypotheses related to sociological and psychological variables from samples drawn from certain populations. The data obtained from the results of this survey were then analyzed and measured to what extent the level of readiness of the system users was.

The following Figure 1 presents information about the research method. We conducted literature study evolving IT adoption, e-readiness, and several method to measure index of IT adoption readiness including TRI. The next step is to design a questionnaire based on the TRI framework. then tested the validity and reliability of the questionnaire. when the calculation is valid, the questionnaire is ready to be distributed.

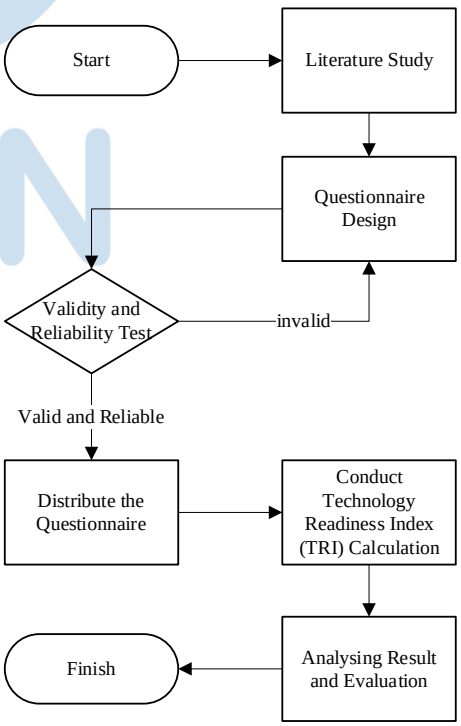

Fig. 1. Research Method

In this case, the technology that will be adopted and the readiness of its users will be measured is a Laboratory Management Information System (SIMLAB) located at the Laboratory of Software Engineering and Information Systems, Sriwijaya University. While the target users to be studied include laboratory administrators, lecturers and students in the second and third year.

Sampling was carried out selectively using a quota sampling technique. The preparation of the questionnaire will be based on each variable of the Technology Readiness Index[4]. The number of indicators in the research conducted on privious study in total was 36 indicators, namely 10 indicators of optimism variables, 7 indicators of innovation variables, 10 indicators of discomfort variables, and 9 indicators of insecurity variables. However, in a different study, not all indicators were used, but were adapted to the research topic[3]. So that the questionnaire statements that have been adjusted to this study shown in Table I.

TABLE I. QUESTION INSTRUMENTS

ID	Questions
Optimism (OPT)	
OPT1	I prefer to use SIMLAB because previously all processes were done manually
OPT2	SIMLAB is more comfortable to use because it is a new technology
OPT3	I like to use SIMLAB because it suits my needs
OPT4	SIMLAB makes my work or activities more efficient
OPT5	I was given more freedom at work
OPT6	By using SIMLAB, I don't miss any information
OPT7	I feel confident that SIMLAB will do what I tell it to do
Innovativeness (INN)	
INN1	Usually, I look for more details about a new technology
INN2	I can use and access SIMLAB without the help of others
INN3	Usually, I use the latest technology to help with my work
INN4	I feel that I don't have many problems using SIMLAB compared to other colleagues
Discomfort (DIS)	
DIS1	I feel that SIMLAB complicates my work
DIS2	I feel that SIMLAB is only aimed at people who master technology
DIS3	The guide to using SIMLAB is difficult to understand
DIS4	I feel embarrassed when I have problems using SIMLAB in front of other people
DIS5	I believe more in human work than SIMLAB
Insecurity (INS)	
INS1	I'm worried that other people can see the data I enter
INS2	I'm not sure the data will be processed until the destination
INS3	I prefer to interact with humans compared to SIMLAB
INS4	I always double-check the data entered so that there are no errors

IV. RESULT AND DISCUSSION

A. *Validity and Realibility Test*

The prepared questionnaire was then distributed to 30 respondents for instrument testing in the form of validity and reliability tests to find out whether the questionnaire was appropriate. The next step is distributing questionnaires to predetermined respondents. Table II shows the result of testing has been done.

TABLE II. VALIDITY AND REALIBILITY TEST

ID	VALIDITY TEST		REALIBILITY TEST	
	R COUNT	RESULT	R COUNT	RESULT
OPT1	0.179	INVALID	VARIABLE IS EXCLUDED	
OPT2	0.703	VALID	0,712	RELIABLE
OPT3	0,489	VALID	0,718	RELIABLE
OPT4	0,532	VALID	0,716	RELIABLE
OPT5	0,637	VALID	0,708	RELIABLE
OPT6	0,520	VALID	0,716	RELIABLE
OPT7	0,662	VALID	0,712	RELIABLE
INN1	0,393	VALID	0,723	RELIABLE
INN2	0,323	INVALID	VARIABLE IS EXCLUDED	
INN3	0,495	VALID	0,717	RELIABLE
INN4	0,568	VALID	0,715	RELIABLE
DIS1	0,507	VALID	0,717	RELIABLE
DIS2	0,301	INVALID	VARIABLE IS EXCLUDED	
DIS3	0,554	VALID	0,716	RELIABLE
DIS4	0,439	VALID	0,720	RELIABLE
DIS5	0,634	VALID	0,712	RELIABLE
INS1	0,323	INVALID	VARIABLE IS EXCLUDED	
INS2	0,615	VALID	0.715	RELIABLE
INS3	0,419	VALID	0,719	RELIABLE
INS4	0.411	VALID	0,721	RELIABLE

Four statement items whose R Count values are below the table R values and considered as invalid (OPT1, INN2, DIS2, INS1) so that these four invalid items are excluded. While at section of realibility test, all statement items have a value above 0.60, so all statement items can be said to be reliable. After all the instruments are valid and reliable, the questionnaire is feasible to distribute with a predetermined sample.

B. *Respondents*

The total population in this study was 553. The number of samples was taken as much as 20% of the total population[7]. So, the sample quota in this study is 111 respondents.

Grouped by occupation, majority of respondents came from students with a percentage of 93.8%, the second was the laboratory structure with a percentage of 3.5% and the last were lecturers with a percentage of 2.7%. Whereas according to the origin of the department, most of the respondents came from the Information Systems major with a percentage of 78.6%, followed by the Informatics Engineering major with a percentage of 12.5% and the last was the Computer Systems major with a percentage of 8.9% briefly presented in Figure 2 and Figure 3.

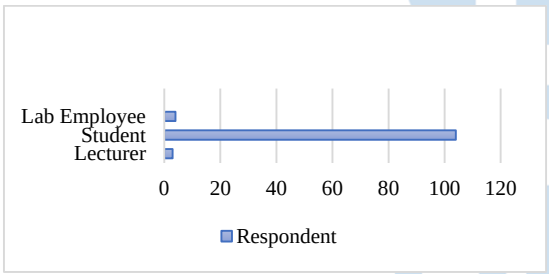

Fig. 2. The respondents grouped by occupation

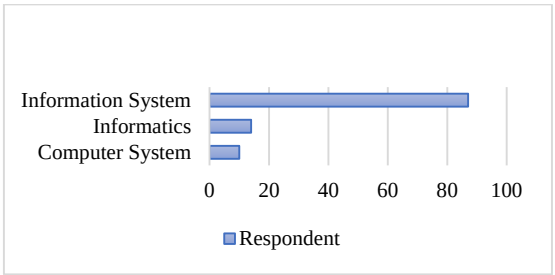

Fig. 3. The respondents grouped by department

C. *Measuring Technology Readiness Index*

Furthermore, calculations are performed using the TRI method. Each variable will be evaluated to find out what is needed to improve the readiness of the users of this Laboratory Management Information System (SIMLAB). The first step is to determine the weight of the statement. Each variable is worth 25% then each variable is divided by the number of statements in that variable.

$$\text{OPT} = \frac{25\,\%}{6} = 4{,}16\,\%$$

$$\text{INN} = \frac{25\,\%}{3} = 8{,}33\,\%$$

$$\text{DIS} = \frac{25\,\%}{4} = 6{,}25\,\%$$

$$\text{INS} = \frac{25\,\%}{3} = 8{,}33\,\%$$

TABLE III. QUESTION WEIG

Variable	Variable weight	Question	Question Weight
OPT	25%	OPT2, OPT3, OPT4, OPT5, OPT6, OPT7	4,16%
INN	25%	INN1, INN3, INN4	8,33%
DIS	25%	DIS1, DIS3, DIS4, DIS5	6,25%
INS	25%	INS2, INS3, INS4	8,33%

From Table III we can infer the weight for each statement. The statement on the Optimism variable is 4.16%, Innovativeness is 8.33%, Discomfort is 6.25% and for Insecurity is 8.33%.

After knowing the weight of each statement, then the average value of each statement is multiplied by the weight of the statement.

$$\text{OPT2} = \frac{464}{111} \text{ x } 4{,}16\% = 0.17$$

$$\text{OPT3} = \frac{441}{111} \text{ x } 4{,}16\% = 0.16$$

$$\text{OPT4} = \frac{467}{111} \text{ x } 4{,}16\% = 0.17$$

$$\text{OPT5} = \frac{442}{111} \text{ x } 4{,}16\% = 0.16$$

$$OPT6 = \frac{449}{111} \text{ x } 4{,}16\% = 0.16$$

$$OPT7 = \frac{436}{111} \text{ x } 4{,}16\% = 0.16$$

$$INN1 = \frac{425}{111} \text{ x } 8{,}33\% = 0.31$$

$$INN3 = \frac{452}{111} \text{ x } 8{,}33\% = 0.33$$

$$INN4 = \frac{438}{111} \text{ x } 8{,}33\% = 0.32$$

$$DIS1 = \frac{435}{111} \text{ x } 6{,}25\% = 0.24$$

$$DIS3 = \frac{405}{111} \text{ x } 6{,}25\% = 0.22$$

$$DIS4 = \frac{401}{111} \text{ x } 6{,}25\% = 0.22$$

$$DIS5 = \frac{389}{111} \text{ x } 6{,}25\% = 0.21$$

$$INS2 = \frac{396}{111} \text{ x } 8{,}33\% = 0.29$$

$$INS3 = \frac{387}{111} \text{ x } 8{,}33\% = 0.29$$

$$INS4 = \frac{347}{111} \text{ x } 8{,}33\% = 0.26$$

OPT = OPT2+ OPT3 + OPT4 + OPT5 + OPT 6
= 0.17 + 0,16 + 0,17 = 0,16 + 0,16 + 0,16
= 1,01

INN = INN1 + INN3 + INN4
= 0,31 + 0,33 + 0,32
= 0,98

DIS = DIS1 + DIS3 + DIS4 + DIS5
= 0,24 + 0,22 + 0,22 + 0,21
= 0,91

INS = INS2 + INS3 + INS4
= 0,29 + 0,29 + 0,26
= 0,84

Technology Readiness Index = OPT + INN + DIS + INS
= 1,01 + 0,98 + 0,91 + 0,84
= 3,76

The TRI value obtained is 3.76. This shows that TRI is greater than 3.51 which means the level of readiness for SIMLAB adoption is in the High Technology Readiness category.

The Optimism value contributes the largest value to the total TRI value of other variables, namely 1.01. The highest optimism value among other variables indicates that respondents believe this information system can have a positive impact on laboratory management. The second largest value is Innovativeness of 0.98. This means that users have high innovative nature, are happy to accept new technology and easily adapt to new technology. Discomfort and Insecurity variable values are the variables with the lowest portion, namely 0.91 for Discomfort and 0.84 for Insecurity. This shows that users feel uncomfortable using this SIMLAB and users also feel insecure in providing information.

V. CONCLUSION

The Readiness of Information System users of the Software Engineering Laboratory and Information Systems is classified as High Technology Readiness. The application of a laboratory information system is very likely to be carried out as a future improvement. This research suggests several things that can be done to increase the Technology Readiness of users of this Laboratory Information System, namely providing explanations to users about functions, advantages compared to previous conventional management and guidelines for using this Laboratory Information System, conducting Usability Testing for a better experience using Lab Information Systems . So that users are comfortable and not confused in using this Laboratory Information System. In addition, the implementation of restrictions on data access in the Laboratory Information System should be more organized which allows each role or user to have different authorities.

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Implementation of Simple Additive Weighting on Decision Support System for Accoustic Guitar with Web-Based

(Study Case: Chaniago Sport)

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***Abstract*—The acoustic guitar is one of the most popular musical instruments because music itself is a universal language that everyone can understand. Acoustic guitars are available in many choices such as wood types, brands, prices, and many sizes. Many people who want to buy a guitar are often confused when they have to choose an acoustic guitar that suits their needs, this happens because there are many aspects of an acoustic guitar that must be considered as already mentioned. The demands of work and the busyness of today's society This makes many people unable to choose and see the acoustic guitar according to their needs in music stores. Therefore, this system was created as an acoustic guitar recommendation system, so that people can choose an acoustic guitar that suits their needs and buy an acoustic guitar online based on people's preferences. The recommendations given by this system are obtained from calculations using the simple additive weighting method or known as the weighted addition method. This simple additive weighting method has been tested in this study and can be implemented correctly and as needed. End-user satisfaction is also obtained using the end-user computing satisfaction (EUCS) method so that the recommendation system that has been successfully built can be said to be very good for users in providing acoustic guitar recommendations.**

Key words — Accoustic Guitar, EUCS, SAW, Recommendation System, Web.

I. INTRODUCTION

The guitar is one of the many types of stringed instruments played by picking. The guitar consists of the main body parts and the neck as a place for the strings to be attached generally six. Traditional guitar shaped of various types of wood and the strings they are made of of nylon or steel(string). In general, there are 2 types of guitars namely: acoustic and classical. The acoustic guitar is a guitar that part of the body is hollow / hollow (hollow body) and has used for a long time. Acoustic guitar is generally played as a solo instrument using a fingerstyle technique that comprehensive, but there are also people who play it together with other instruments because there is no patented way of playing an instrument such as a guitar acoustic tar, every acoustic guitar player has his choice each playing the guitar [1].

Choosing a quality acoustic guitar and in accordance with the wishes is not easy, especially for a beginner. Based on interviews with experts, namely Chanigao Sport. Chaniago Sport is a music shop that has been around since 2005, the shop sells acoustic guitar instruments, some guitar accessories and sells some sports equipment. Chaniago Sport is located in the Kutabumi area, Tangerang, Pasar Kemis, 15560. Based on interviews conducted with the Chaniago Sport music shop voters, the first problem that is often experienced by ordinary people in choosing an acoustic guitar lies in determining the needs for using the guitar, for example the criteria/aspects what is in the guitar, starting from the purchase price, type of wood, brand, size of the guitar and the necessary needs such as "Is the guitar used to learn to play guitar, whether to take it for recreation and become an entertainment musical instrument, and many more". Second, buyers are also

faced with many choices of acoustic guitars with various brands and shapes today. It is possible for a beginner to be able to search for information through the internet, or ask a more experienced acoustic guitar user directly. However, this is less efficient, because it takes a lot of time and money to get information about an acoustic guitar that suits your needs. [2]

Based on this background to reduce one's mistakes in choosing an acoustic guitar that is not in accordance with the wishes and needs, a Decision Support System (DSS) is needed using methods such as simple additive weighting. Based on previous research conducted by Ila Fitrotin Rosyidah and Agus Winarno [3], the reason for choosing the SAW method is because this method has advantages such as being easy to understand, more flexible, being able to solve complex problems and conducting learning based on human knowledge and experience in solving a problem.

Previous research conducted by Handayani, Rizki [4] also concluded that the *Simple Additive Weighting* (SAW) method is a method that can be used in decision support systems in various solutions to multi-criteria decision-making problems. this method can be dynamic in terms of criteria and preference weights in decision making so that the criteria and preference weights can be changed according to the provisions in the current developments.

The system that will be created is expected to provide convenience and be able to make guitar buyers more aware of their needs in choosing an acoustic guitar. This system aims to provide recommendations to users according to the desired needs. This decision support system is an application program that has been computerized to help prospective buyers to get a guitar that fits the required criteria. The user will select the desired criteria and the system will process it. Then based on the data that has been processed by the system, it will produce an output in the form of a conclusion what type of guitar is suitable and desired by the buyer.

II. Literature Review

System design begins with making a side application work flowchart normal users and admins, use case diagrams, fol- lowed by making ERD database, then wireframe the website view.

A. *Use Case Diagram*

Use Case Diagram is an image that represents the things an actor can do in completing a job.

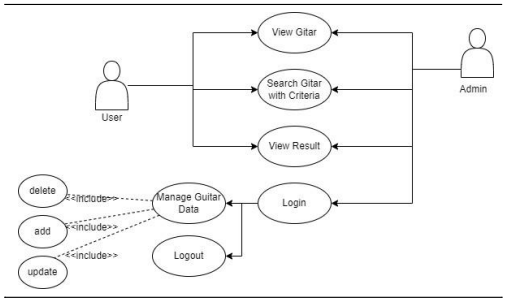


Fig. 1. Use Case Diagram

Figure 1 shows the use case diagram of a decision support system acoustic guitar selection. Users can view guitar data available on the system, search for guitars with the criteria that have been provided and see the results of recommendations both from all existing data and results based on the inputted criteria filters. The admin actor can login, make changes to guitar data in the database such as adding, changing certain guitar data and deleting data, then the admin can also log out from the admin page and the admin can also do all the things the user can do.

B. *Data flow Diagram*

Data Flow Diagram is a diagram that shows the flow and data relationships between each entity and existing processes. In this section, we will explain the Data Flow Diagram on the recommendation system for choosing an acoustic guitar in the Chaniago Sport case study. The process of presenting information will be simplified by using a simple visual display of data flow diagrams. The information provided can be used to describe the data flow. There are three levels of DFD in this study, namely DFD-Level 0 (Context Diagram), DFD-Level 1, and DFD-Level 2. The following is an explanation:

Figure 2 shows that there are 2 entities namely user and admin then there is 1 process, namely SAW Guitar, in this context diagram the user entity will send a guitar recommendation request to the SAW Guitar process and the process will return results in the form of guitar recommendations desired by the user, then on the right there is an admin entity that is useful for setting up existing guitar data. The SAW Guitar process is a Simple Additive Weighting method.

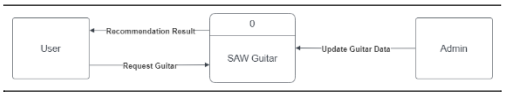


Fig. 2. Data Flow Diagram Level 0

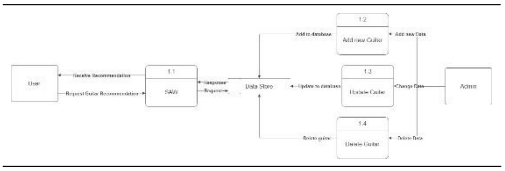


Fig. 3. Data Flow Diagram Level 1

Figure 3 contains the process of Add new guitar, update guitar, and delete guitar, each process is a process that can only be done by an admin entity that aims to manage guitar data in the existing database. The data in the database will be used to carry out the SAW guitar process so that users can get the results of current guitar recommendations.

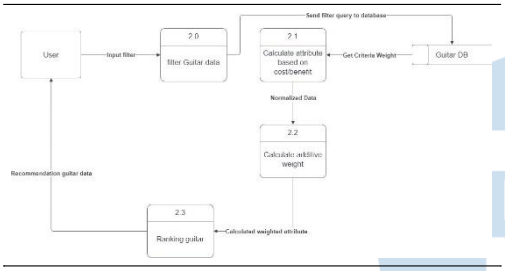


Fig. 4. Data Flow Diagram Level 2

Figure 4 here is explained in more detail about the SAW guitar process that occurs. Starting from the user who sends the desired guitar data filter process (in this process the user can also perform a filter without a specific filter which will make the data displayed is the data of all guitars owned). From the filter that has been determined, the guitar data filter process will generate a query into the database so that the normalized data is only the desired guitar data, from the normalization results obtained, the calculation of criteria based on attribute costs and benefits will be carried out in the calculate attribute based on cost process. benefit, the results that will be obtained in this process will be arranged to determine the existing guitar rankings to be given to the user.

C. Flowchart

Flowchart is a diagram that represents the workflow/process. Under these are flowcharts of each feature in the program. Program workflow made as short as possible with the aim that users can easily use and understand the program created.

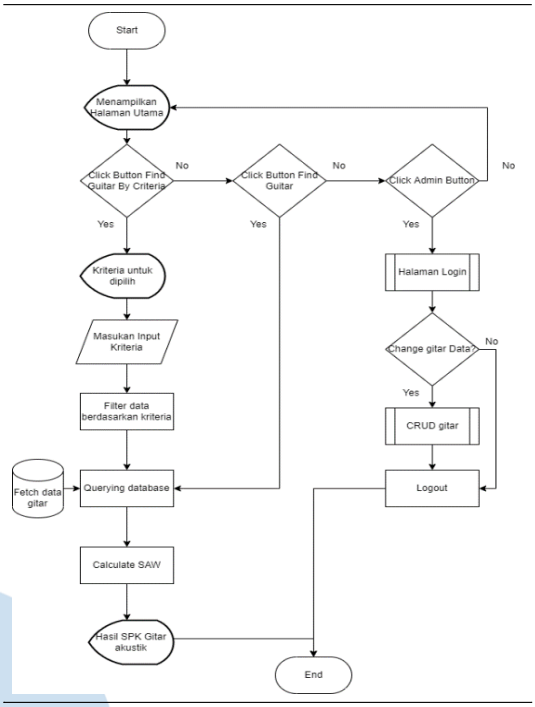


Fig. 5. Main Flowchart

Figure 5 shows the main flowchart of the acoustic guitar se- lection decision support system which describes the workflow of the entire program, this main flowchart is also a workflow for ordinary users or admin users. First of the program will display the main screen which will have 3 main buttons to carry out the next process, namely a button to go to the admin menu, a button to search for guitar recommendations based on filtered criteria and a button to search for guitar recommendations without filters. If the user selects the button to view guitar recommendations with a filter, the user will be taken to the next page, which is a page that shows the form to fill out the criteria that the user wants after the form is submitted, the filter will perform a query request based on the criteria entered and the Simple Additive Weighting calculation process will be done based on the data in the filter and then will be displayed on the next page.

If the user selects the button to search for a guitar without a filter, the user will be immediately taken to the results page obtained from all the data in the database and after that the Simple Additive Weighting calculation is performed and then displayed to the user.

The last button is a button for the admin, this button will take the user to the login page to be asked for a username and password, if the user has entered the username and password correctly then the user will

enter the admin dashboard where there can create, read, update, delete data guitars in the database.

D. ERD

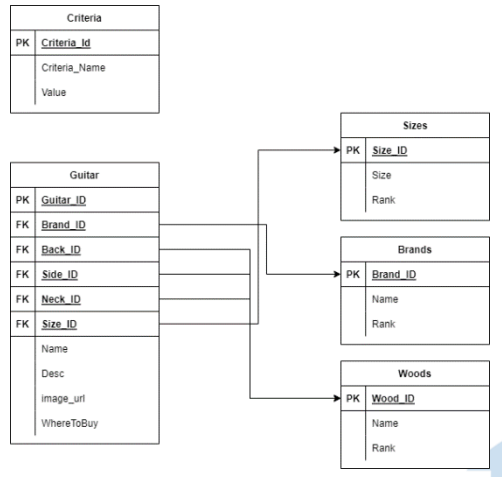


Fig. 6. Entity Relational Diagram

Figure 6 is an ERD image for the data in the database, first there is a Guitar table which has 5 foreign keys, namely Brand ID, Back ID, Side ID, Neck ID, Size ID. Brand ID refers to the Brands table, there is information about the existing guitar brands and the rating of each brand, then there are foreign keys Back ID, Side ID, Neck ID which point to the same table, namely the woods table, in the woods table there is information about the types of wood on the guitar and the rating of these woods, and the last is size ID in the size table there is information about the size of the guitar and the size rating. It should be noted here that Back, Side, Neck are the main woods that are often considered in buying guitars based on interviews with sources, therefore the three columns both refer to the woods table. The last one is the Criteria table, this table does not have any relation because this table was created only to store weight values for Simple Additive Weighting calculations in the future.

E. Wireframe

1) Wireframe Landing Page: Landing Page is the first page that will be seen by the user when the website is opened for the first time.

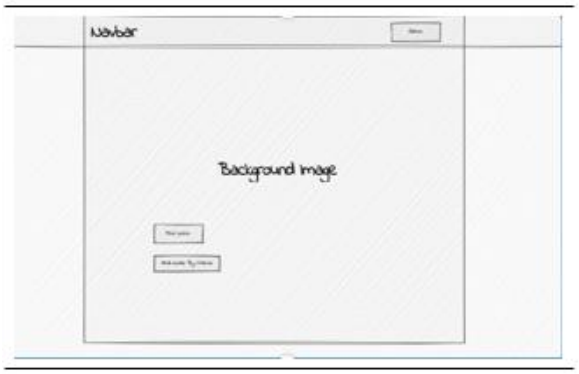


Fig. 7. Wireframe Landing Page

In figure 7 on this page, there are only 3 main buttons that will navigate the user to other pages, namely a button to view all guitar recommendations, a button to view guitar recommendations based on the selected filter and finally a button to enter the admin page.

2) Wireframe Select criteria: The select criteria page is a page to display the form to get the guitar criteria that the user wants then the results will be used as filters in the query to the database and the results will be calculated using the Simple Additive Weighting method. In figure 8 there are 4 input fields to receive input from the user.

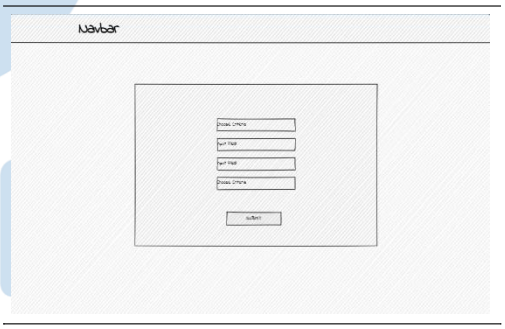


Fig. 8. Wireframe Page filter acoustic guitar

3) Wireframe Recommendation Results: The recommendation results page is a page that shows the results of the Simple Additive Weighting method either using the criteria selected by the user on the criteria select page or not.

Figure 9 shows that the guitar results displayed are in the form of cards that can be issued for more information about the guitar if clicked

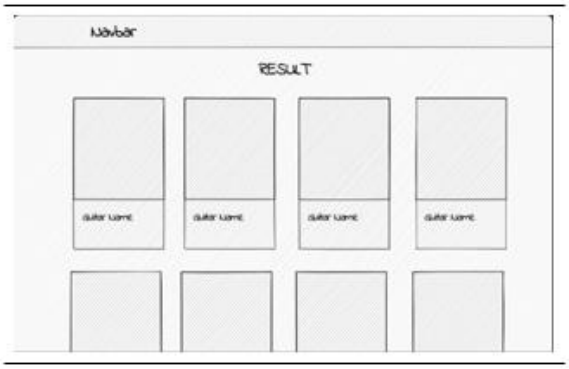


Fig. 9. Wireframe Page guitar results

4) *Wireframe Admin Page:* The admin page is there to manage guitar data in the database. Based on the 10-page figure, it has a table that contains information about the guitar and there are 2 buttons on the right, the button is a button to change data and delete data, while the button above is a button to add new guitar data. And there is a logout button in the navbar to logout as admin.

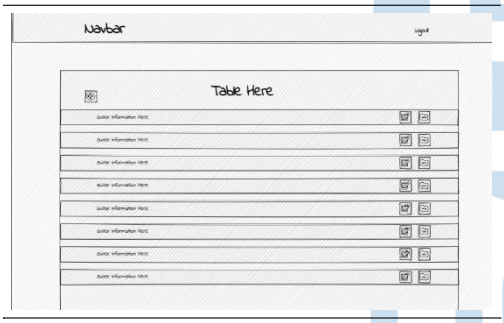


Fig. 10. Wireframe admin page

III. Results and Discussion

Implementation is carried out based on use case diagrams, dfd, flowcharts, erd, and wireframes that have been made previously.

A. Website

1) *Landing Page:* Figure 11 is the result of the Landing Page implementation on an acoustic guitar purchase decision support system, on this page there are 4 buttons, a button to view guitar recommendations without a filter, a button to view guitar recommendations with a filter and in the navigation there is a button to go to the admin menu and to the website for writer information.

Fig. 11. Landing Page

2) *Page Filter Form Data Guitar:* Figure 12 is the result of the implementation of the page where to filter the data of the acoustic guitar purchasing decision support system. On this page the user will be asked to input to find out what kind of guitar criteria he wants, there are inputs to enter the desired guitar brand, the required price range, does the user care about the quality of the wood, does the user care about the size of the guitar, does the user care about the size of the guitar? the popularity of the acoustic guitar brand, does the user care about the price of the guitar. The series of questions in the filter form are obtained from the conclusions from interviews with experts, namely the owner of the Chaniago Sport music store and these questions are expected to be able to help the system to determine the acoustic guitar according to what the user wants.

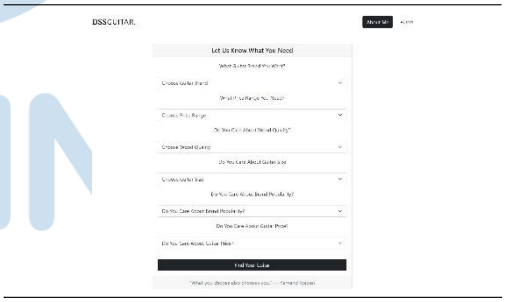


Fig. 12. Filter Form Guitar Page

Figure 13 is the validation result on the guitar form filter page if the user submits it without entering any input.

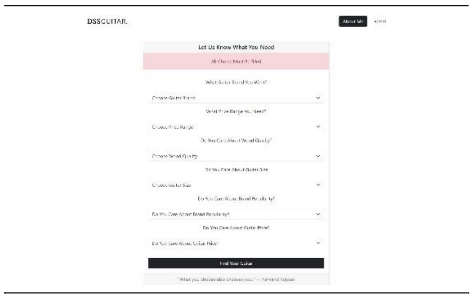


Fig. 13. Validation Filter Form Guitar

3) Guitar Recommended Results Page: Figure 14 is the result of the implementation of the page where to display the recommendation results. On this page each guitar is displayed in the form of a card that will display a capital when clicked (figure 15), and in that modal there will be clearer information about the acoustic guitar such as price, brand, type of wood on the back, sides, neck, guitar size, description, and a link where to buy the guitar, at the very bottom there is also a pagination where to go to the next page.

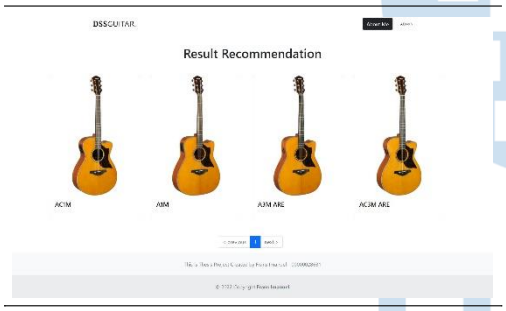


Fig. 14. Guitar Recommended Results Page

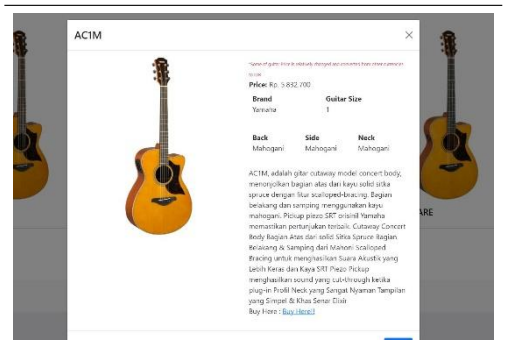


Fig. 15. Recommendation Result Modal

4) Login Admin Page: Figure 16 is the result of the implementation for admin login, on this page there is a place to input username and password, and figure 17 is the result of implementation for validation which is done if the username/password does not exist/wrong.

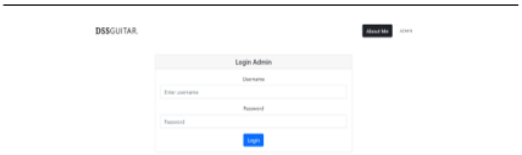


Fig. 16. Login Admin Page

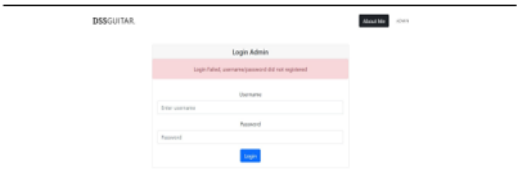


Fig. 17. Validation of recommendation results

5) Page Admin: Figure 18 is the result of the implementation of the admin page, on this page the admin can view acoustic guitar details, can add acoustic guitar data, change existing data and delete data.

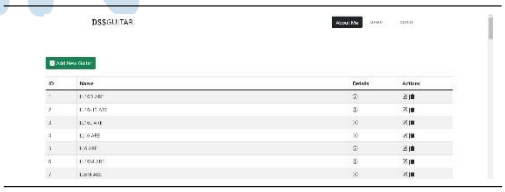


Fig. 18. Admin Page

6) Guitar Data Detail View: In figure 19 is a modal that shows details about the guitar when the details button (*i*) is clicked.

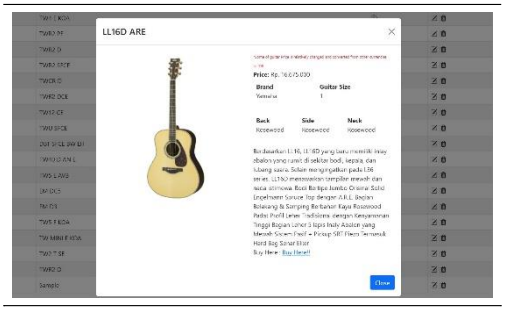


Fig. 19. Details Page

7) Display Add Guitar Data: In figure 20 and figure 21 are modals that are shown if the button to add data is clicked, this button will open a modal to enter new information that you want to add, such as the name of the acoustic guitar, the price of the acoustic guitar, the type of guitar brand, the size of the guitar, type of back, side and neck wood, image links, links to where to buy online, and descriptions of acoustic guitars. If the data entered is correct without any problems then an alert will appear as in figure 22, and if it fails an alert in figure 23 will appear.

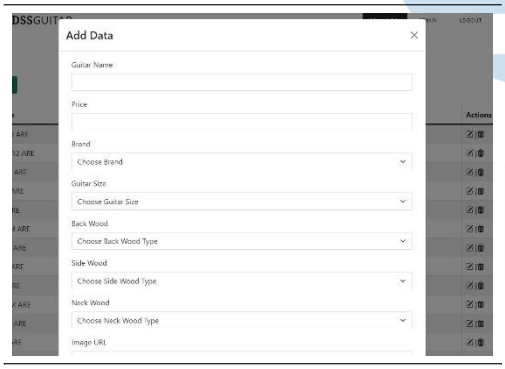


Fig. 20. Add Data Page 1

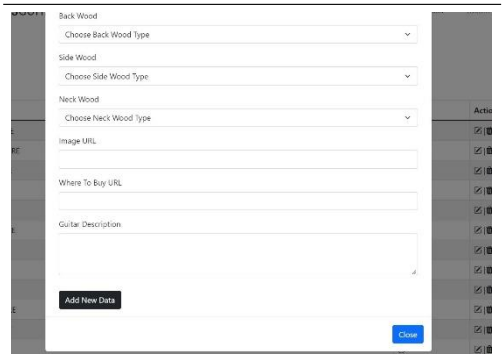


Fig. 21. Add Data Page 2

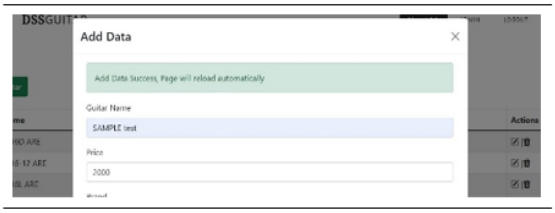


Fig. 22. Validation Successfully Added Data

Fig. 23. Validation Failed Added Data

8) Update Guitar Data View: In figure 24 and figure 25 are modals that are shown if the button to change data is clicked, this button will open a modal to enter the information you want to change, such as the name of the acoustic guitar, the price of the acoustic guitar, the type of the guitar brand, the size of the guitar, the type of guitar. Wood back, sides and neck, image links, online purchase links, and acoustic guitar descriptions. If the changed data is correct without any problems, an alert will appear as shown in figure 26, and if it fails an alert in figure 27 will appear.

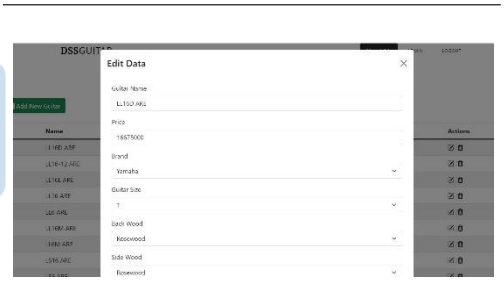


Fig. 24. Details Page 1

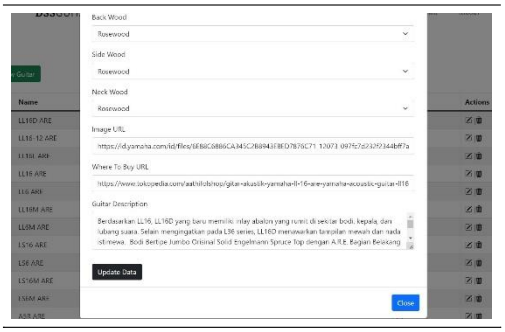


Fig. 25. Details Page 2

Fig. 26. Validation Successfully Added Data

Fig. 27. Validation Successfully Added Data

9) Delete Guitar Data View: In figure 28 is a modal that will appear if the delete button is clicked, this modal will display a question to the admin to ask if the admin is sure you want to delete the guitar data, and if the delete button is clicked then the next display is figure 29.

Fig. 28. Admin Page Delete Guitar

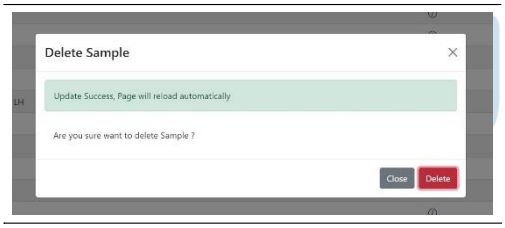
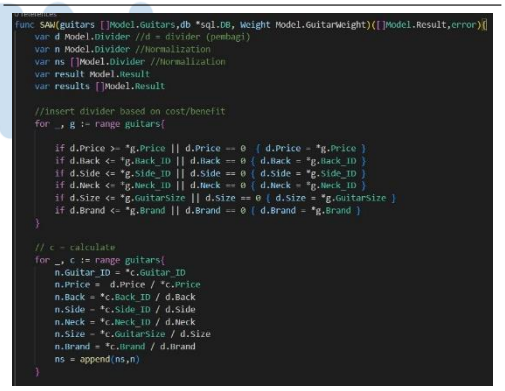


Fig. 29. Admin Page Delete Guitar Successfully

B. Simple Additive Weighting

The implementation of Simple Additive Weighting is done using the Go programming language, the following is a code snippet from the implementation. In figure 30 there is a function named SAW which accepts 3 inputs parameters and will produce 2 output parameters, the input parameter consists of guitars which is a data type struct which stores all information about the guitar that has been filtered based on the form that has been filled in by the user, the second is an instance pointer. To access the database and the third is the weight of the criteria that the user has selected in the form. Whereas in the output parameter there is an array of struct Result which contains information about the guitar IDs that have become the final sorted result and finally there is an error, if there is an error, an error will return the error message, but if there is no error it will return nil (null in the golang programming language).

In the next line there is a variable declaration. The variable d is used to hold the smallest value for the cost attribute and the largest value for the benefit attribute, this is implemented in the previous line of code in the for-range loop below it. The variables n and ns are variables used to store the results of the normalized matrix, this is done at the bottom of figure 30, and the results and results variables are used to store the final results of the guitar ranking system. In the previous section, figure 30, it was explained how to implement Simple additive weighting to determine the divisor value for the cost, benefit and code attributes to get the matrix normalization results, then in figure 31 the code is used to get the weight value for each criterion from the database (if you don't do the filter process) / initialize the weight value obtained from the user if you use the available filters. The query process is carried out and the results obtained are stored in a folder with the name of each key and the name of the weight. And finally at the very bottom there is a for-range to determine the ranking results of previous acoustic guitars by multiplying the normalized matrix results and the weights obtained from the database/user input for each weight



```
func SAW(guitars []Model.Guitars,db *sql.DB, Weight Model.GuitarWeight)([]Model.Result,error){
    var d Model.Divider //d = divider (pembagi)
    var n Model.Divider //Normalization
    var ns []Model.Divider //Normalization
    var result Model.Result
    var results []Model.Result

    //insert divider based on cost/benefit
    for _, g := range guitars{

        if d.Price >= *g.Price || d.Price == 0  { d.Price = *g.Price }
        if d.Back <= *g.Back_ID || d.Back == 0 { d.Back = *g.Back_ID }
        if d.Side <= *g.Side_ID || d.Side == 0 { d.Side = *g.Side_ID }
        if d.Neck <= *g.Neck_ID || d.Neck == 0 { d.Neck = *g.Neck_ID }
        if d.Size <= *g.GuitarSize || d.Size == 0 { d.Size = *g.GuitarSize }
        if d.Brand <= *g.Brand || d.Brand == 0 { d.Brand = *g.Brand }
    }

    // c = calculate
    for _, c := range guitars{
        n.Guitar_ID = *c.Guitar_ID
        n.Price =  d.Price / *c.Price
        n.Back = *c.Back_ID / d.Back
        n.Side = *c.Side_ID / d.Side
        n.Neck = *c.Neck_ID / d.Neck
        n.Size = *c.GuitarSize / d.Size
        n.Brand = *c.Brand / d.Brand
        ns = append(ns,n)
    }
```

Fig. 30. Code Snippets simple additive weighting 1

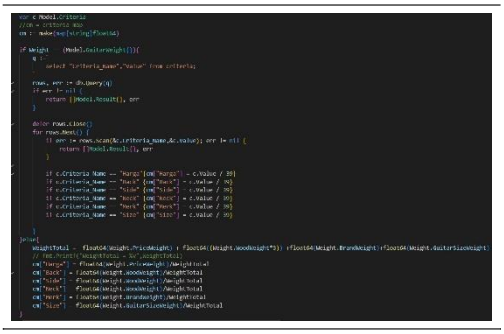


Fig. 31. Code Snippets simple additive weighting 2

Finally, in figure 32, the sorting process is carried out on the value whose result is larger to the smaller one and then returns.

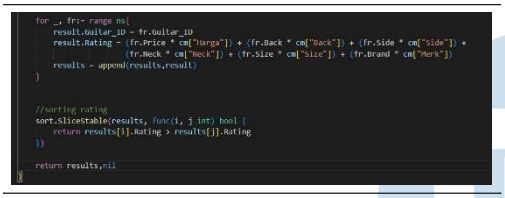


Fig. 32. Code Snippets simple additive weighting 3

IV. Evaluation

The evaluation was carried out by distributing question- naires to 32 respondents using the EUCS model and the Likert scale. After getting the results of the index for each EUCS component, the calculation of the success of the system is carried out. The following is the calculation of system success:

System Success Rate:

$$Hasil = \frac{85.625 + 84.6875 + 86.25 + 85.3125 + 85.3125}{5}$$

$$= 85.4375 => 85\%$$

From these results it can be concluded that the respondents strongly agree that the acoustic guitar recommendation system has been successful in recommending an acoustic guitar.

IV. Conclusion

Based on the research that has been successfully carried out, there are several suggestions from researchers that can be used as a reference or reference in the development of an acoustic guitar recommendation system that has been successfully designed and built as well as for further research. The suggestions described are as follows.

1. This research can be developed by implementing other methods such as the AHP method, TOPSIS, weighted product, and others, so that the approach taken for further research can be different
2. The addition of other criteria to add to the consider- action of this recommendation system, for example the appropriate brand of guitar strings and others
3. Based on the suggestions obtained in the guitar recommendation system questionnaire, it would be better if it had additional guitar brands with affordable entry levels or case studies of other music stores that had local guitars such as Mandalika, Cowboy, GL, Taylor, Cort, and others were added

The recommendation system about guitars can also be made wider, such as combining acoustic guitar topics with other guitars such as the ukulele/electric.

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The Development of Web-based Sales Reporting Information Systems using Rapid Application Development Method

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***Abstract*—Many studies can be used as references regarding the application of information systems in companies that can optimize business processes. Information Systems can be designed according to the needs of each company. Concerning the company, PT Artindo Pratama Sejahtera is a private company engaged in paint production. One of the problems in business processes at the company is when the sales report activity from the salesperson to the warehouse admin section needs to be recorded in the database because it still uses the short message/chat application media. In addition, the short messages/chats often pile up. Based on the literature review that has been done from previous research, these problems can be overcome by implementing an information system. The purpose and contribution of this research are to optimize business processes in reporting activities so that they become integrated. The output of this research is a website-based Sales Reporting Information System. Before the Information System was implemented at PT Artindo Pratama Sejahtera, functionality testing was carried out by system users using the User Acceptance Test (UAT) method with the black box testing model and obtaining results according to company needs so that they could overcome the problems described earlier.**

Index Terms—*Information System; Sales; Rapid Application Development; Reporting; Website*.

I. INTRODUCTION

According to the information from the official website company profile PT Artindo Pratama Sejahtera, this company is a private company engaged in the production of paint and has 185 employees divided into several sections/divisions, namely: the production department totalling 50 people, then staff (finance, accounting, administration, and warehouse admin) totalling 40, then 65 salespersons and 30 other people are drivers. [1]. At this company, there are several salespersons, and each salesperson has to offer the company's products to stores that target the company, such as in the Tangerang area and several other cities in the vicinity. For the business process to run optimally following the specified targets, it is necessary to monitor each salesperson. The problem currently happening to PT Artindo Pratama Sejahtera is that the sales report process from a Salesperson to the Warehouse Admin section needs to be read optimally and piles up because it is done via a short message/chat application..

As technology develops, business processes in a company are very dependent on technology and based on previous research. An information system can be used to measure employee performance in the form of a website [2]. Research focuses on the Analysis and Design of web-based information systems using UML Diagram designs. It has been successfully made into a web-based information system equipped with a website content management system (CMS) to manage website content [3]. Furthermore, according to research by Susianawati [4], applying an information system in a company for the reporting process can help improve the company's performance, especially in sales. Then, according to research by Rumbiak [5], the appearance of information systems tested using usability testing is also an essential factor so that an information system can be understood and used by users.

Based on the problems described above and the study literature that has been carried out, it can be concluded that these problems can be overcome by optimizing business processes in sales reporting activities using an information system to improve the business processes. The outcome and contribution of

this research is a web-based information system that the warehouse admin can use to optimize sales reporting.

II. METHOD

The Proposed Information System Development will be carried out using the Rapid Application Development (RAD) method because it provides faster development and quality results [6]. The RAD method is easier to implement because development focuses on each development requirement at a time and requires less time. Apart from that, the stages in RAD are structured, and software development can be carried out in a short time with an emphasis on short cycles; more specifically, the software being developed can know the results without waiting a long time [7]. Figure 1 shows the cycles/stages in implementing the RAD method.

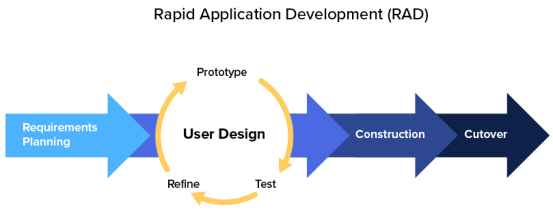

Fig 1. RAD Method

Based on Figure 1, we can see the steps to implement the RAD method, starting with requirements planning, user design, construction, and cutover. The following is a brief explanation of each stage:

a) Requirements Planning:

At the requirement gathering stage, interviews will be conducted to seek user information, design system preparations, and determine what features will be used in the application. Users and analysts will discuss to identify system objectives and be oriented towards solving business problems.

b) User Design:

All the requirements described in the analysis stage will be described in more detail at this stage. From the conditions obtained, it will be transformed into Unified Modelling Language (UML) Diagram in the form of use case diagrams that can describe the main functions of the system to be created and explain the relationship between system users later [8].

c) Construction:

At this stage, the main focus is system development. In the RAD method, users must continue to participate and can suggest changes or improvements as the report progresses. The developer's job is system development, coding, and system testing.

d) Cutover:

Finally, at the last stage in the implementation of RAD, the functional system is tested using the User Acceptance Test (UAT) method [9] with the black-box testing model [10] and will be transferred to the new system and continued with user training. In addition, a comparison will be made between RAD and traditional methods, and as a result, the new system should be able to be implemented in the company

III. RESULT AND DISCUSSION

A. Analysis

The requirements planning is the first stage in the RAD method. At this stage, requirements gathering is done by looking for information from the user, designing the system preparation, conducting interviews, and determining what kind of features will be used in the system. Users and analysts discuss to identify the purpose of the system and oriented toward solving business problems. To make the requirements analysis phase can be understood more clearly, the explanation of the analysis between the current system versus the proposed system will be shown in the form of a comparison table which can be seen in table 1.

Table 1. Analysis of the current system vs the proposed system

No	Type of Analysis	Weakness of current System	Proposed System
1	Performance	Searching the production report data requires a long time, so that the operation will be delayed and not run optimally.	Searching sales report data is done faster than the current systems using the main feature.
2	Economics	Requires cost to print a report using a paper.	Does not use a lot of cost because it uses an system and displayed on the monitor, the production report data is stored in the database.
3	Security	System security is not optimal because it still uses	The security of the proposed online system becomes

		spreadsheet application to process data and no authentication to access the data, so that the sales report data can be seen by unauthorized user.	more optimal due to the authentication and limitation of system user access rights so that the sales report data can be stored properly in the database.
4	Efficiency	It still takes a long time in the process of making a sales report data report.	More efficient because it can directly get sales report according to the specified date and period.

B. UML Diagram

All users (Salesperson, Warehouse Admin, and Sales Manager) can access the system through the login page and access the dashboard. The primary function of the Salesperson actor is shown to be able to access the Input Product Sales, Input Transaction Sales, View Target Sales, View Report Sales, and Print Report Sales. The following actor is the Warehouse Admin, whose primary function is to access the Add Product, Manage Product, and Approve outgoing goods. Furthermore, the Sales Manager actor is shown that he can only perform View Target Sales, View Report Sales, and Print Report Sales. The use case diagram on figure 2 will describe the primary function of the proposed system.

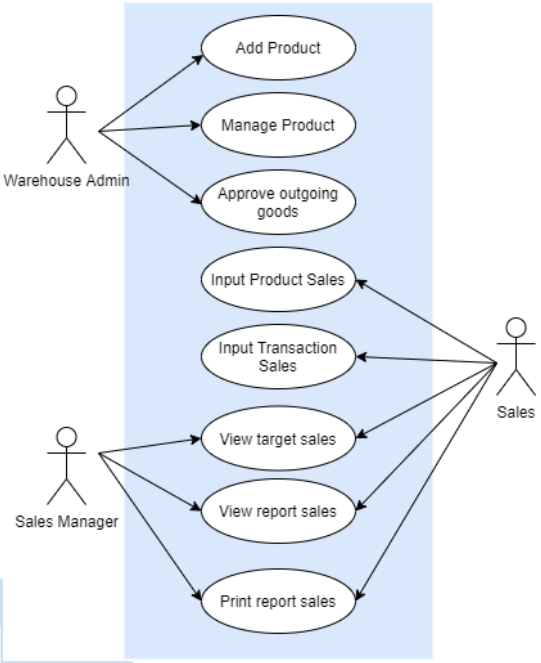

Figure 2. Use Case Diagram

Based on the proposed Use Case Diagram, it will be derived into Activity Diagram in Figure 3:

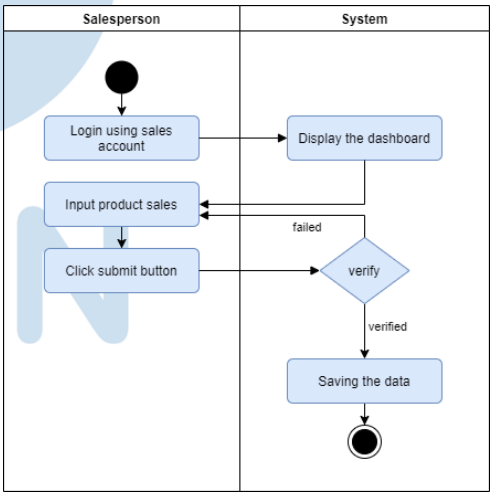

Figure 3. Activity Diagram

Based on the activity diagram image above, we can see user activity, namely salesperson, when they want to input product sales. The process begins by logging in using the salesperson account and each password, and then the system will display the salesperson system dashboard to be able to input sales product input activities and submit them. After the user submits, the system will provide a response in the form of verification to review whether the data entered is correct or not. If everything is correct, the final step in this activity is to save the data.

C. Construction

At this stage, research will be focused on system development. In the RAD method, the users participate and can suggest changes or improvements during system development. The developer's task here is to design, code, and test the system. The system interface design will be carried out using a Figma based on Use Cases and Activity Diagrams. In contrast, coding will be carried out using VS Cove tools as a text editor for the use of the PHP programming language. From Figure 4 to Figure 6, the system user interface will be displayed:

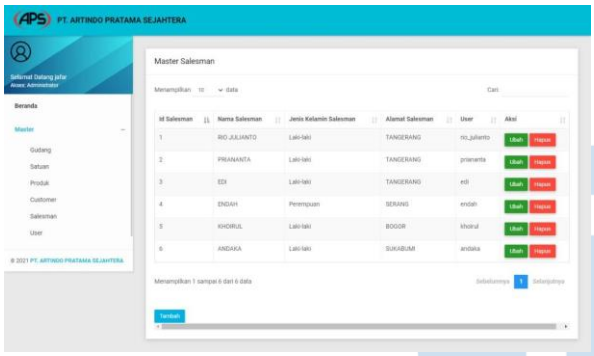

Figure 4. Salesperson (master data) interface

Figure 4 below is the master salesperson data display. Based on the interface from figure 4, the information system can be accessed via a browser (Google Chrome, Mozilla Firefox, Safari, and other browsers) with URL (localhost). In this view, there are several attributes, namely: id and name of the salesman, which functions to find out the ID number and name of the salesman that is inputted as well as the gender and address of the salesman and user, in operation the function consists of an edit and delete buttons which function to change and delete master salesman data, and has a search submenu, displays data, a button to return to the previous page and a button to go to the next page and an add button that aims to add master salesman data.

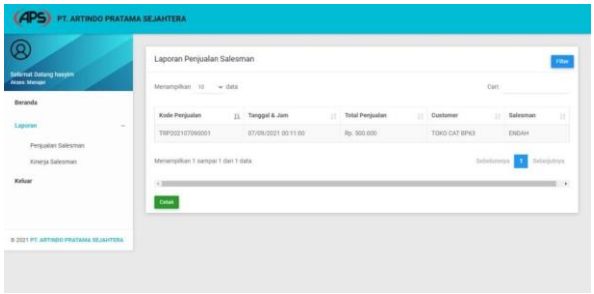

Figure 5. Transaction sales report interface

From the Figure 5, The following is a display of the sales report, which has the following functions: sales id which aims to find out the sales id and date & time, which helps know the date & time of the sale, total sales and the custom functions to find out the total number of sales received by the customer and the name of the salesperson which functions to find out the salesman who inputted data, the previous and next submenus, search and the print button which functions to print the salesman's sales report.

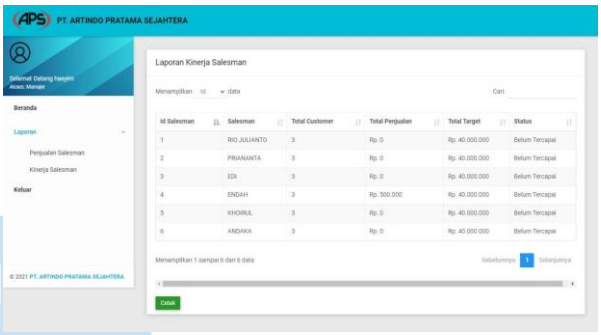

Figure 6. Sales target report interface

From the Figure 6, the following is a display of the salesman's performance report, which has the following functions: id and name of the salesperson, which aims to find out the id and name of the salesman, total customers and total sales to find out the number of customers obtained as well as total sales and total targets function to find out the marks achieved by the salesman, as well as the previous and next submenus, search and the print button which functions to print the salesman's performance report.

The system interface described above can be accessed via localhost on a limited basis on company PCs. Based on the test results, which will be explained in the next stage, the system will be hosted so that it can be accessed widely and at any time.

D. Cutover

This User Acceptance Test (UAT) function is to find out the responders' responses to this design, so a test is carried out by giving 10 question questionnaires related to system functions to 38 responders who are a salesperson that will be using this system, which helpful for answering these questions. The questionnaire is given in the form of a google form and is assessed by the respondents online. The indicators that will become the benchmark can be seen in the table 2:

Table 2. Indicator of each Question's

Indicator	Score	Description
A	5	Excellent
B	4	Very good
C	3	Good
D	2	Bad
E	1	Very Bad

Based on the questions that have been determined to measure the results of system testing, five indicators are determined, namely A, B, C, D, and E, along with their scores and descriptions according to the description in table 2. If the results of the UAT that has been carried out get a lot of score on indicator A, it could be interpreted that the system that has been created has succeeded in answering the needs of the company in accordance with the analysis carried out. Conversely, if the E indicator is the most chosen, then the system created can be categorized as a system that is not suitable for use.

Table 3. UAT Questionnaire

No	Question's	Indicator				
		A	B	C	D	E
1	Is the information system interface display easy to see?	10	26	2	0	0
2	Is the information system menu interface easy to understand?	11	24	3	0	0
3	Does this information system have the appropriate features?	11	18	8	0	0
4	Can this information system search (filter) the desired data?	13	17	5	3	0
5	Can this information system design be easy to manage transactions?	14	17	6	1	0
6	Can a pop-up system help the Interface of this information system?	13	22	3	0	0
7	Is this information system design easy to download transaction reports?	9	17	8	2	2
8	Does this information system help in measuring performance?	14	18	5	1	0
9	Is the design of this information system easy to operate?	15	21	2	0	0
10	Is this information system following the expectation of the company?	13	22	3	0	0

Table 3 showed the 38 salespeople as the respondents and gave scores for each indicator, and then the scores were accumulated to get the cumulative or average score. The results show that most respondents gave high scores on indicators A and B, then for indicator C, there was a moderate score, while for indicators D and E, there were very low scores.

Table 4. Percentage of UAT Questionnaire

Indicator				
A	B	C	D	E
26%	69%	5%	0	0
29%	63%	8%	0	0
30%	49%	21%	0	0
34%	45%	13%	8%	0
37%	45%	16%	2%	0
34%	58%	8%	0	0
24%	45%	21%	5%	5%
37%	47%	13%	3%	0
40%	55%	5%	0	0
58%	34%	8%	0	0

Apart from being in the form of a table of numbers, the results of the UAT test were also converted into percentages to make it easier to understand and process the calculations at a later stage. After carrying out the UAT test and obtaining a score from each indicator, each indicator will be multiplied by the score given to find out the results of the percentage score and average. The results of this calculation will describe the success of the system design against the expectations of the company's needs that have been described in the first stage of this RAD method.

Table 5. Total's of questionnaire answer

No	Question's	Indicator					Total
		A*5	B*4	C*3	D*2	E*1	
1	Is the information system interface display easy to see?	50	104	6	0	0	160
2	Is the information system menu interface easy to understand?	55	96	9	0	0	160
3	Does this information system have the appropriate features?	55	72	24	0	0	151
4	Can this information system search (filter) the desired data?	65	68	15	6	0	154
5	Can this information system design be easy to manage transactions?	70	68	18	2	0	158
6	Can a pop-up system help the Interface of this information system?	65	88	9	0	0	162
7	Is this information system design easy to download transaction reports?	45	68	24	4	2	143

8	Does this information system help in measuring performance?	70	72	15	2	0	159
9	Is the design of this information system easy to operate?	75	84	6	0	0	165
10	Is this information system following the expectation of the company?	65	88	9	0	0	162

An overview of the results from table 5 will be displayed in a brief calculation in table 6. The tests carried out will produce a score to calculate the average value and percentage for each question:

Table 6. Calculations from the questionnaire answer

Question	Average Value	Percentage of Value
#1	160/38 = 4.2	4.2/5x100 = 84%
#2	160/38 = 4.2	4.2/5x100 = 84%
#3	151/38 = 3.9	3.9/5x100 = 79%
#4	154/38 = 4.05	4.05/5x100 = 81%
#5	158/38 = 4.1	4.1/5x100 = 83%
#6	162/38 = 4.2	4.2/5x100 = 85%
#7	143/38 = 3.7	3.7/5x100 = 75%
#8	159/38 = 4.1	4.1/5x100 = 83%
#9	165/38 = 4.3	4.3/5x100 = 86%
#10	162/38 = 4.2	4.2/5x100 = 85%

Finally, the total percentage of UAT has been obtained and can represent the user's assessment of the system. The results of the assessment can be seen in the table, producing a fairly high score on each question which is an assessment indicator in the UAT test shown in table 7:

Table 7. Total of Percentages

Description	Percentages Score
Question #1	84%
Question #2	84%
Question #3	79%
Question #4	81%
Question #5	83%
Question #6	85%
Question #7	75%
Question #8	83%
Question #9	86%
Question #10	85%
Overall Average	82.5%

.

IV. Conclusion

Research has been carried out to develop an information system based on the need for digitization in the sales reporting business process at PT Artindo Pratama, a paint manufacturer and distributor company in Indonesia. The Rapid Application Development method has been successfully implemented in the design of a Web Sales Reporting Information System. System testing results produce an average overall score of 82.5%, with a very good score. The sales division can use the system that has been generated to carry out sales reporting activities. The novelty produced in this study is applying the RAD method in designing information systems and testing using UAT to produce the required information system quickly with excellent results. The results of this study also contribute to the company, especially the sales division, in sales force reporting activities.

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AUTHOR GUIDELINES

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The organization of the submitted article consists of Title, Abstract, Index Terms, Introduction, Method, Result and Discussion, Conclusion, Appendix (if any), Acknowledgment (if any), and References.

- Title
  The maximum words count on the title is 12 words (including the subtitle if available)
- Abstract
  Abstract consists of 150-250 words. The abstract should contain logical argumentation of the research taken, problem-solving methodology, research results, and a brief conclusion.
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  Introduction commonly contains the background, purpose of the research, problem identification, research methodology, and state of the art conducted by the authors which describe implicitly.
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- Conclusion
  Explicitly describes the research's results been taken. Future works or suggestion could be explained after it
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- **Periodicals**
  J.K. Author, “Name of paper,” Abbrev. Title of Periodical, vol. x, no. x, pp. xxx-xxx, Sept. 2013.

- **Book**
  J.K. Author, “Title of chapter in the book,” in Title of His Published Book, xth ed. City of Publisher, Country or Nation: Abbrev. Of Publisher, year, ch. x, sec. x, pp xxx-xxx.

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- **Published Conference Proceedings**
  J.K. Author, “Title of paper,” in Unabbreviated Name of Conf., City of Conf., Abbrev. State (if given), year, pp. xxx-xxx.

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- **Patents**
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  J.K. Author, “Title of paper,” unpublished. J.K. Author, “Title of paper,” Abbrev. Title of Journal, in press.

- **On-line Sources**
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Number the equations consecutively. Equation numbers, within parentheses, are to position flush right, as in (1), using a right tab stop.

$$\int_0^{r_2} F(r,\phi)\, dr\, d\phi = [\sigma r_2 / (2\mu_0)] \qquad (1)$$

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- The word "data" is plural, not singular.
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Place figures and tables at the top and bottom of columns. Avoid placing them in the middle of columns. Large figures and tables may span across both columns. Figure captions should be below the figures; table heads should appear above the tables. Insert figures and tables after they are cited in the text. Use the abbreviation "Fig. 1," even at the beginning of a sentence.

TABLE I. TABLE STYLES

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	Table column subhead	***Subhead***	***Subhead***
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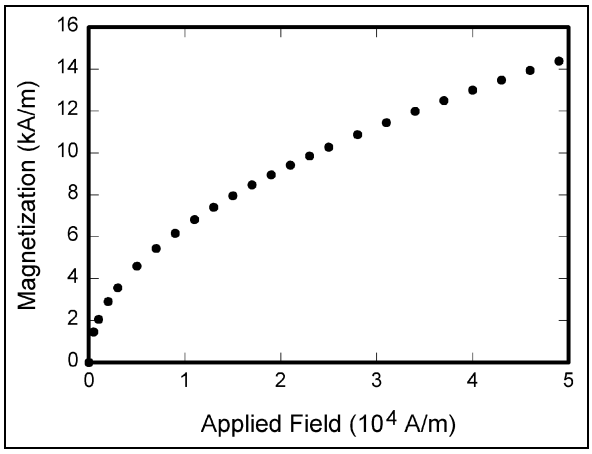

Fig. 1. Example of a figure caption

V. Conclusion

A conclusion section is not required. Although a conclusion may review the main points of the paper, do not replicate the abstract as the conclusion. A conclusion might elaborate on the importance of the work or suggest applications and extensions.

Appendix

Appendixes, if needed, appear before the acknowledgment.

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References

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[1] G. Eason, B. Noble, and I.N. Sneddon, "On certain integrals of Lipschitz-Hankel type involving products of Bessel functions," Phil. Trans. Roy. Soc. London, vol. A247, pp. 529-551, April 1955. (*references*)

[2] J. Clerk Maxwell, A Treatise on Electricity and Magnetism, 3rd ed., vol. 2. Oxford: Clarendon, 1892, pp.68-73.

[3] I.S. Jacobs and C.P. Bean, "Fine particles, thin films and exchange anisotropy," in Magnetism, vol. III, G.T. Rado and H. Suhl, Eds. New York: Academic, 1963, pp. 271-350.

[4] K. Elissa, "Title of paper if known," unpublished.

[5] R. Nicole, "Title of paper with only first word capitalized," J. Name Stand. Abbrev., in press.

[6] Y. Yorozu, M. Hirano, K. Oka, and Y. Tagawa, "Electron spectroscopy studies on magneto-optical media and plastic substrate interface," IEEE Transl. J. Magn. Japan, vol. 2, pp. 740-741, August 1987 [Digests 9th Annual Conf. Magnetics Japan, p. 301, 1982].

[7] M. Young, The Technical Writer's Handbook. Mill Valley, CA: University Science, 1989.

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