A WEB-BASED SUSTAINABLE DEVELOPMENT GOALS MONITORING SYSTEM FOR THE SUSTAINABLE DEVELOPMENT OFFICE OF BATANGAS STATE UNIVERSITY

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CHAPTER 1

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Background of the Study

Sustainable Development was a vital goal for humanity, but measured progress toward it was a complex challenge that requires standardized data collection methods and metrics. Given the multifaceted nature of sustainable development, there was no one-size-fits-all approach to tracking progress toward Sustainable Development Goals.

Sustainability initiatives of the Batangas State University (BatstateU – TNEU) have been formalized through the establishment of the Center for Sustainable Development (CSD). The goal of this center is to promote awareness about sustainability and sustainable development, encourage internal stakeholders to instill sustainable development in the daily operations of the university, and monitor and report sustainability practices and accomplishments of Batangas State University. The CSD had a crucial role in integrating sustainability into the university's core functions of instruction, research, innovation, and extension services, as well as general administrative and support services functions. BatstateU – TNEU aims to facilitate sustainability efforts and promote the achievement of the SDGs by 2030 through the CSD. As the National Engineering University, responsibility was recognized by BatstateU – TNEU to lead the way in sustainable development practices and contribute to the achievement of the SDGs.

The study would provide an overview of the Sustainable Development Office's initiative at Batangas State University, focusing on integrating sustainability into the

university's core functions of instruction, research, innovation, and extension services. It would also examine the general administrative and support services functions of the university's strategic plan for 2019 - 2029, which outlines four key strategies for university management: financial sustainability, risk management, disaster resilience, and efficient administrative and financial services.

The strategy of financial sustainability involves generating revenue, managing costs, and allocating resources efficiently to ensure the university's financial viability. Risk management aims to identify and mitigate potential risks that may impact the university's operations and sustainability. Disaster resilience focuses on preparedness and sustainability in the face of natural or man-made disasters. Efficient administrative and financial services involve streamlining processes and leveraging technology to provide excellent service while reducing costs.

These strategies were crucial for the university's long-term viability and ability to fulfill its mission and goals. By addressing these areas, the study would contribute to the university's efforts in achieving its strategic plan and ensuring sustainable growth and management of resources. It would also provide insights and recommendations on how to effectively integrate sustainability into the university's functions and improve administrative and support services to promote efficient and sustainable operations.

However, the Sustainable Development Office of Batangas State University faces significant challenges in gathering comprehensive data on the accomplishments of each office due to time constraints and the need for travel. The distance between different

campuses and offices can make it difficult and time-consuming for the office to collect data effectively, which can hinder progress toward sustainable development. Additionally, the time constraint in requesting narrative reports from charge officers also poses a problem as they often fail to meet deadlines. This further delays the collection of data needed for tracking progress toward sustainability initiatives. Lastly, the challenge of coordinating with various offices to track the progress and impact of sustainability initiatives could make it challenging for the sustainable development office of Batangas State University to identify areas of improvement and success and make data-driven decisions for sustainable development. Addressing these challenges, including the time constraints due to distance and limited availability of time, was crucial for the Sustainable Development Office to obtain accurate and comprehensive data for its sustainability initiatives.

The project aimed to develop an efficient and reliable monitoring dashboard to prevent a lack of standardized data collection methods and metrics that could contribute to SDG 17's objective of creating inclusive, safe, resilient, and sustainable environments worldwide in cities and human settlements. By providing a standardized method for collecting and analyzing sustainability data, the dashboard could aid in creating effective policies and initiatives that could contribute to achieving SDG 17 and promoting sustainable development.

Moreover, the dashboard could facilitate communication and collaboration between stakeholders, including governments, the private sector, civil society, academia, and

international organizations. By promoting knowledge-sharing and the formation of partnerships, the dashboard could assist in connecting these stakeholders toward achieving SDG 17's objectives.

Objectives of the Study

The main objective of this study was to design and develop a monitoring system that was reliable and efficient to prevent a lack of standardized data collection methods and metrics and contribute to the achievement of the Sustainable Development Goal (SDG) 17.

Specifically, this study aims to:

1. Develop a user-friendly web-based dashboard for efficient and convenient documentation and monitoring of sustainability accomplishments.
2. Develop a data visualization module that monitors the progress toward Sustainable Development Goals (SDGs) and highlights areas of improvement and success.
3. Provided a notification alert that improved the coordination and collaboration between different offices in tracking and monitoring the progress and impact of sustainability initiatives toward achieving Sustainable Development Goals.

Significance of the Study

The study on developing a web-based monitoring dashboard for sustainable development had significant implications for demonstrating and communicating initiatives toward achieving sustainable development goals (SDGs). The development of

a web-based dashboard for sustainable development had significant implications for demonstrating and communicating initiatives toward achieving sustainable development goals (SDGs).

Furthermore, this study could contribute to the advancement of sustainable development goal (SDG) 17, which seeks to create inclusive, safe, resilient, and sustainable environments worldwide in cities and human settlements. By developing a web-based dashboard that was an efficient and reliable dashboard to prevent a lack of standardized data collection methods and metrics.

Another significant aspect of the study was that the web-based dashboard could serve as a platform for recording and tracking accomplishments related to sustainability in areas such as research, teaching and learning, operation, and community engagement. It would enable the showcasing of achievements, monitoring of progress, and identification of areas that needed improvement.

The development of a web-based monitoring dashboard for sustainable development had significant implications for the IT field. It involves leveraging technology and expertise to create a platform for recording, tracking, and showcasing sustainability accomplishments, promoting sustainable practices, and driving innovation in data management and analysis.

Scope and Limitations of the Study

This study imparts a web-based monitoring dashboard to provide a platform for the Sustainable Development Office of Batangas State University to record and track their accomplishments about sustainability, which would cover sustainable practices in terms of research, teaching, learning, operation, and community engagement.

This project commits to Sustainable Development Goals (SDG) 17, which supports the partnership and cooperation with the Batangas State University together with all offices in the campuses to promote the collaboration efforts, achieving one goal, and innovation.

This study benefits the administrator of the Sustainable Development Office to gather data on time accurately, and it is easy to monitor and comply with the requirements or reports needed toward the sustainable development goal, also it reduces the cost of traveling and other expenses. This will have fewer resources, and lastly for tracking the accomplishment of the campus offices. In addition, this study also benefits Offices in the BatstateU – TNEU for an easy way to comply with their accomplishment toward SDG, and reports of the activities that they held on their campuses, this project could back up all the data that they submit. This study is a benefit for all the users for effective monitoring and storing of the data for reporting on sustainable development.

This study is limited to each office in BatstateU – TNEU are limited to opening or viewing the file uploaded in the dashboard, but they can upload their reports once the data

is uploaded in the particular dashboard, they are prohibited from editing the file. For the admin to have access to most of the features of the dashboard.

Overall, this study focused on the development and implementation of a web-based dashboard that provides a platform for Batangas State University's Sustainable Development Office and BatstateU – TNEU campuses to record and track their sustainability practices. By aligning with SDG 17, the project promotes collaboration, innovation, and partnership toward sustainable development. The dashboard's benefits include accurate data collection, monitoring compliance, and reducing reporting costs. While the dashboard has limitations, its implementation is an essential step toward promoting sustainability practices and achieving SDGs in the university system.

Definition of Term

This section aims to provide operational and conceptual definitions of key terms related to the sustainable development goals dashboard using definitions from relevant literature and industry standards. The goal was to establish a shared understanding of the terminology.

Sustainable Development Goals (SDGs). are a set of 17 goals adopted by the United Nations to end poverty, protect the planet, and ensure peace and prosperity for all. The SDGs, also known as the Global Goals, aim to create a more sustainable and equitable world for present and future generations. (Burnside 2023). In this study, the word SDGs was the main topic of the study.

Dashboard. A dashboard is an information management tool that receives data from a linked database to provide data visualizations. It typically offers high-level information in one view that end users can use to answer a single question. In many cases, they can be configured to provide specific information to the end user and how this information is visualized. E.g., Numbers, charts, or graphs. (Adjust, 2023). In this study, the purpose of this dashboard was to visualize and monitor the progress, showcase the accomplishments, and identify areas for improvement.

Constraints. Something that controls what you do by keeping you within particular limits. (Cambridge University 2023), In this study, the constraints were used in the system which was one of the problems faced by the client.

Hashing algorithms. are one-way programs, so the text can't be unscrambled and decoded by anyone else. Hashing protects data at rest, so even if someone gains access to your server, the items stored there remain unreadable. (Okta, 2023). In this study, hashing algorithms were under technical background to ensure that the data was stored in a scrambled state, so it was harder to steal. Also, hashing has been used to secure the password storage of all resources.

Repository. is a receptacle or place where things are deposited, stored, or offered for sale (Dictionary.com, 2023). In this study, the repository was one of its key features, allowing all users in various offices located on BatStateU-TNEU to easily upload and store all necessary data in the repository.

Schema. is an abstract design that represents the storage of your data in a database. It describes both the organization of data and the relationships between tables in a given database. (Kopecky, 2020). In this study, the word schema was used to describe the based solution for modeling data and this could be considered as the table on SQL.

United Nations. An international organization founded (1945) at the end of World War II to maintain international peace and security, develop friendly relations among nations on equal terms, and encourage international cooperation in solving intractable human problems. A number of its agencies have been awarded the Nobel Prize for Peace, and the UN was the co-recipient, with Kofi Annan, of the prize in 2001. The term originally referred to the countries that opposed the Axis powers. (Britannica, 2021). In this study, it was noted that the United Nations was responsible for the establishment of sustainable development goals (SDGs).

World Health Organization (WHO). specialized agency of the United Nations (UN) established in 1948 to further international cooperation for improved public health conditions. Although it inherited specific tasks relating to epidemic control, quarantine measures, and drug standardization from the Health Organization of the League of Nations (set up in 1923) and the International Office of Public Health in Paris (established in 1907), WHO was given a broad mandate under its constitution to promote the attainment of “the highest possible level of health” by all peoples. (Britannica, 2023). In this study, the word World Health Organization (WHO) was one of the organizations that was discussed in the related study.

CRUD Operation. CRUD refers to the four basic operations a software application should be able to perform – Create, Read, Update, and Delete. In such apps, users must be able to create data, have access to the data in the UI by reading the data, update or edit the data, and delete the data. (Chris K., 2022). In this study, crud was utilized in the development part of the system

United Nations Educational, Scientific and Cultural Organization (UNESCO). It is a specialized agency of the United Nations (UN) that was outlined in a constitution signed on November 16, 1945. The constitution, which entered into force in 1946, called for the promotion of international collaboration in education, science, and culture. The agency's permanent headquarters are in Paris, France (Britannica, 2023). In this study, UNESCO was an organization that was mentioned in the related study.

CHAPTER II

REVIEW OF RELATED SYSTEMS AND STUDIES

This chapter presents the technical background of the study, the various systems, studies, and other literature that have a significant impact on the study, and also illustrates the conceptual framework of the study.

Technical Background

The development of the Sustainable Development Dashboard for Batangas State University aims to provide a clear visual representation of data, tracking the progress, performance, and impact of the university's sustainability efforts. The initiatives include research, community outreach, and stakeholder engagement. The system offers a repository as one of its key features, allowing all users in various offices located on Batangas State University campuses to easily upload and store all necessary data in the repository. In addition, the repository includes version-controlled features that allow users to manage and track changes, also allowing the users to log, save, and easily roll back to previous versions of the uploaded. Furthermore, the system also offers a dashboard, which is another key feature. The dashboard provides a real-time graphical representation used to monitor, measure, and analyze relevant data accurately, and display a summary of information extracted from the repository. To meet the system requirements and achieve its objectives, the dashboard used a combination of web development technologies, including frontend languages, backend languages, and databases.

In the development of the frontend part of the system, the three languages used were HyperText Markup Language (HTML), Cascading Style Sheets (CSS), and JavaScript (JS). The HTML serves as the skeletal structure and building block of a website and defines the contents such as text, images, video, audio or any multimedia to be displayed on the web browser. The CSS is responsible for defining the style of every HTML element or content of the system. It provides different properties, such as color, font, spacing (such as margin and padding), position, layout (such as grid and flexbox), and animation (such as transitions and keyframes) to create a visually appealing system and improve user experience. Lastly, JavaScript is a scripting language used to make interactive and dynamic features for HTML elements, providing functionality to the system. Moreover, the ReactJS Framework was used in the development of interactive user interfaces and components of the dashboard. It is an open-source JavaScript library and uses a component-based approach where each component is reusable and ensures faster rendering times, avoids redundancy, improves code organization and maintenance, and easy integration with other tools and libraries. In styling the user interface, Sass was used. Sass was used as a preprocessor scripting language. Sass is written in the SCSS file format and is fully compatible with all CSS versions. Sass generates a CSS file the system can utilize when changes are saved. Utilizing variables, nested rules, mixins, and functions is one of the advantages of using Sass, which makes it simpler to organize CSS syntax.

On the other hand, the back-end development of the system utilizes a variety of languages and tools, including Express JS, Node.js, Vite, React.js, Tailwind CSS, Chart.js, React Router DOM, and other supporting tools, and PostgreSQL. The back end plays a

vital role in the development of the dashboard, particularly in terms of data validation and storing and retrieving data from the database.

ExpressJS is a back-end web application framework for building RESTful APIs with Node.js. It simplifies the process of managing servers and APIs to ensure the pulling and pushing of data on the database is secured, and defining routes for web applications, making it easier to build complex web applications.

Vite streamlines the front-end development process by offering efficient tooling for building modern web applications. React.js, a widely used open-source library, facilitates the creation of reusable and interactive components, ensuring faster rendering, efficient code organization, and seamless integration with other tools and libraries.

Tailwind CSS enhances the styling of our user interface, providing a utility-first approach that simplifies the creation of visually appealing and responsive designs. Chart.js empowers us to display data graphically, improving data visualization for users. React Router DOM enables smooth navigation within the application, enhancing the overall user experience. Additionally, we leverage Netlify, Versel, and REST API for deployment and integration, ensuring our front end seamlessly interacts with the backend.

PostgreSQL is a widely used relational database management system that serves as a database for our system and is efficient in storing and managing data. PostgreSQL is widely regarded as having the strongest, continuous, and reliable performance with which to store data. To provide easy understanding and use of the web application, data saved and collected in PostgreSQL shall be based on a structured format.

Bcrypt is a Node.js library that hashes and encrypts users' passwords using a hashing algorithm, providing an additional level of security for data stored in the database. This makes it very difficult for attackers or hackers to penetrate the security measures.

Node.js is an open-source and cross-platform JavaScript runtime environment used to easily build fast and scalable network applications. One of the advantages of using Node.js is the vast array of installable libraries available, such as Mongoose, Bcrypt, Express, and many more. These libraries can be used to create robust, reliable, and scalable projects.

Last but not least, Visual Studio Code (VS Code) was utilized for building and debugging web applications. The advantage of using VS Code is that it supports all programming languages, including those used in the development of the dashboard. Additionally, it offers many libraries that make website development more efficient, such as Prettier, which helps organize the code in terms of tab spaces, which is useful for nested code such as loops or if-else statements. Another useful library is Emmet, which provides abbreviations that help type the code much faster. Furthermore, all files that are necessary for the development of the dashboard can be easily organized on the app. Lastly, it also has a terminal that can be used to set up all necessary libraries such as setting up ReactJS, installing Bcrypt, and ExpressJS, as well as using it to initiate the servers.

Related Studies and Systems

There are numerous related systems and studies gathered to be used as technical references for the development of the web-based portal system.

Local Related Studies

According to a study by the World Health Organization (2019), The system concluded that countries had made progress in strengthening their health information systems (HIS) for monitoring the SDGs and UHC, but data gaps remain. Assessing the current status of health service coverage, financial protection, availability and readiness, social environmental factors, health outcomes and quality of health services continues to be unfeasible in many countries in the Region due to limited availability and timeliness of data. Data quality and collection methods used for various data sources are unknown or not shared; thus, reported estimates may be inaccurate and inconsistent. In connection with the study, the study outlines the data quality and collection methods used in the system to ensure the confidentiality of the resource data. However, it should be noted that the study does not center around the health information system

Based on the study of Francisco et al. (2021), this paper aims to systematically review the current state of the national implementation of SDGs regarding the utilization of accessible and clean energy resources, development of manufacturing industries, and improvements in infrastructures and innovations. It focused on discussing the challenges faced by each sector, plans and opportunities set by the national government, and the progress report based on the SDG Watch systematically collated by the Philippine Statistics Authority as the official storehouse data of SDG indicators in the country. In

relation to the SDG Dashboard which collects and stores data from different sources for reporting and monitoring purposes. This study also emphasizes the need to address the challenges faced by different sectors in achieving the SDGs, which can be identified and addressed through the use of data and analytics provided by the SDG dashboard.

In the study of Bissio (2019) The ‘silo approach’ of pursuing each goal independently is stretched to its limit by the official Global Indicators Framework trying to count for each target, but lacking data or even an agreed methodology for more than half of them. On the other hand, the attempt to reduce progress towards the SDGs to a single number ends up ignoring the many trade-offs between well- being associated with material consumption and planetary boundaries. This study aims to reduce the process of gathering data to prevent the lack of data and delay of report, However, the dashboard focuses on ensuring the processes and transactions of data are faster.

According to the study of Gutierrez et al. (2021), this study primarily addresses concerns about the compatibility of existing indicators with local objectives and perceptions, with the aim of identifying local indicators that evaluate the sustainability of destinations in the Philippines. This study contributes to the existing development research through the identification of local sustainability indicators that are hinged on local understanding and perceptions of sustainability. In relation to this study, its findings emphasize the importance of considering local perspectives and priorities when creating sustainability indicators.

According to the study of Lacerna et al. (2022), The gathered data reveals that there are various activities on children's protection, ways on how these are disseminated, and

challenges in coordinating with the communities. For instance, some themes that emerged in the analysis are curfew for minors, community-based education on children's protection, patrolling, utilization of print media, social media consumption, poor quality and lack of materials, and lack of effort from the authority. In relation to the study, ensure the accomplishments of all campuses and gather data to monitor the progress, and the study focuses on the protection of all the data in one database.

Based on the study of Cerio (2018), The study employs a mix of quantitative and qualitative methods following the convergent parallel mixed method design. Additionally, the study used the Multidimensional Poverty Assessment Tool (MPAT) and in-depth interviews in collecting the data. The study found the dashboard approach as an effective way of providing substantial data and information in understanding the status of deprivation per dimension and subdimensions of poverty or well-being. This study can be applied to developing SDG dashboard systems, as the approach can be adapted to collect and report data on SDG progress in a comprehensive and systematic manner using Power BI.

According to Reyes et al. (2019), this paper aims to examine where the Philippines stand with respect to the targets and goals of the SDGs. Baseline data and recent historical data on SDG indicators were considered to assess the progress of the Philippines, and to identify statistical challenges and opportunities, such as data availability and granularity, in monitoring progress toward the achievement of the SDGs. In relation to the study, Dashboard aims to collect and report data on SDG progress in all the offices in BatStateU-TNEU, providing a comprehensive and

systematic approach to tracking the activity progress towards sustainable development goals.

According to the study of Vizmanos et al. (2019), In particular, this VNR report examines where the country stands in several SDGs, analyzing baseline data and recent historical data on SDG indicators, as well as other supporting indicators and identifying challenges and constraints. Based on the study, the SDG dashboard system will collect data, analyze to identify challenges, and store data from various offices to provide a comprehensive view of SDG progress, However, both of the systems are essential tools in promoting sustainable development and achieving the SDGs.

According to the study of Amron (2019) Information on local rice accessions is stored in a system called Agrobiodiversity Information System (AgrobIS) to solve issues on conservation. However, due to the in- comprehensiveness of the search function embedded in the system, it is lack of data filtering feature to obtain specific accessions. In relation to the SDG, the dashboard system is designed to collect and store data from different offices in a centralized database, allowing for easy access and filtering of information to report on progress towards achieving SDGs.

Based on the study by Diokno-Sicat et al. (2021), said that it is important to create an information system to easily monitor the progress of LGUs in the localization of the PDP and other national development goals. She added that there are ongoing efforts to implement an electronic local development investment program system where data will be inputted and summarized. The study assessed the effectiveness of the result matrices in the government's localization efforts. It also examined how government efforts fared

in ensuring that plans at the provincial and NCR levels stay aligned with national development goals. The national government developed the results matrices to ensure that local development plans are aligned with the PDP. These are used in provinces and the National Capital Region (NCR) to show how LGUs contribute to national development, monitor their progress, and inform oversight agencies of their priorities and needs. The results showed high compliance among LGUs, with 97.4 percent for provinces and 94.1 percent for NCR. It also revealed that different provinces, and consequently, regions, have different priority areas. The study found that most key respondents from the DILG and LGUs believe in the relevance of the matrices and their usefulness in identifying priority investment areas and monitoring and evaluating progress. In relation to the study, it also shows how they contribute to national development and monitor their progress in sustainable development. In contrast, the study uses result matrices to monitor local government contribution.

Foreign Related Studies

According to the study of Papadimitriou et al. (2019), the audit aims to contribute to ensuring the transparency of the SDG Index methodology and the reliability of the results. The report touches upon data quality issues, the conceptual and statistical coherence of the framework, and the impact of modeling assumptions on the results. Despite the universal and diverse nature of the SDGs, which makes aggregating them into a single measure challenging from a statistical point of view, the SDG Index is a remarkable effort to synthesize the 17 SDGs into a single measure. The index ranks are robust enough, allowing meaningful conclusions to be drawn from the index. In this

study. It also aims to address all 17 SDGs and uphold transparency in presenting the processed results on the dashboard. However, the scope of the study will be limited to BatStateU-TNEU.

Based on the study of Garwood et al. (2022), their objective is to create an SDG Dashboard that is used to identify trends and insights in data while revealing changes in activity and work progress. This study introduces a dashboard technique that collects, reports, and shares global business schools' fulfillment of the United Nations Sustainable Development Goals (SDGs), the SDG Dashboard. With this tool, business schools can share experiences to promote sustainable change and advance the work being done internationally within schools. The SDG Dashboard allows users to drill down into the data, revealing global impact patterns while highlighting the breadth of work being done. This dynamic dashboard is an agent for collaborations in all topics outlined in the United Nations Sustainable Development Goals, which are: sustainable economic growth, responsible consumption, and production, availability for decent work, poverty eradication, cleaner energy, environmental conservation, and the foray of issues concerning overall inequality and quality education. In this study, the researchers created a dashboard that consolidates data from various offices and monitors progress toward sustainable development.

The study of Paz et al. (2021) aims to verify the performance of 217 Brazilian municipalities from 31 indicators segmented in the three dimensions of sustainability (economic, environmental, and social), selected from the literature review, to contribute to the sustainable investment strategy of organizations. They used the multi-criteria

decision-making method, Technique for Order Preference by Similarity to Ideal Solution (TOPSIS), and proposed an analytical sustainability dashboard. The main results of this paper were the sustainable performance rankings of the municipalities and the dashboard with three analytical panels that contributed to identifying the points of improvement of each municipality, consequently contributing to the investment strategy in these locations. In this study, the dashboard will also contribute to sustainable development and can be utilized to improve decision-making.

According to the study of Lafortune et al. (2018), they include detailed SDG Dashboards to help identify implementation priorities for the SDGs. The report also provides a ranking of countries by the aggregate SDG Index of overall performance. This year's report includes several improvements and additions in comparison to previous versions. It incorporates trend data for the first time. They need to accelerate progress toward achieving goals, including Goal 12 (Sustainable Consumption and Production) and Goal 13 (Climate Action). Conflicts are leading to reversals in SDG progress. Most developing countries have experienced significant progress towards ending extreme poverty in all its forms, including income poverty, undernourishment, access to health and education services, and access to basic infrastructure. Achievement gaps are greatest towards universal completion of secondary education. They show that further efforts are needed to protect biodiversity and support sustainable production and consumption. High- income countries generate negative SDG spillover effects. High-income countries generate significant environmental, economic, and security spillover effects that undermine other countries' efforts to achieve the SDGs. In this study, the dashboard will

facilitate a better understanding of the progress made by the university toward sustainable development by presenting accurate and clear visualizations of relevant data.

Based on the study by Cambridge University Press (2020), the report shows all countries need to strengthen the resilience of their health systems and prevention programs. Some countries have outperformed others in containing the Covid-19 pandemic, yet all remain at serious risk. The report frames the implementation of the SDGs in terms of six broad transformations. The authors examine country performance on the SDGs for 193 countries using a wide array of indicators, and calculate future trajectories, presenting a number of best practices to achieve the historic Agenda 2030. In contrast to the study, the development of the dashboard did not include any considerations related to Covid-19.

The study of Sachs et al. (2018), presents a revised and updated assessment of countries' distance to achieving Sustainable Development Goals (SDGs). It includes detailed SDG Dashboards to help identify implementation priorities for the SDGs. The report also provides a ranking of countries by the aggregate SDG Index of overall performance. This year's report includes several improvements and additions in comparison to previous versions. It incorporates trend data for the first time. New indicators have been added to accurately cover the SDGs and associated targets with a special focus on "leave no one behind" for OECD member states. The 2018 SDG Index and Dashboard report presents regional dashboards of SDG achievement and trends toward the goals. Country-level data on SDG implementation is consolidated in two-page country profiles for every UN member state, available in the "Country Profiles"

section. Data profiles for each SDG Indicator are presented online. In this study, the dashboard can provide comprehensive and precise information about the progress made toward achieving the SDGs.

The study of Sachs et al. (2018), presents a revised and updated assessment of countries' distance to achieving Sustainable Development Goals (SDGs). It includes detailed SDG Dashboards to help identify implementation priorities for the SDGs. The report also provides a ranking of countries by the aggregate SDG Index of overall performance. This year's report includes several improvements and additions in comparison to previous versions. It incorporates trend data for the first time. New indicators have been added to accurately cover the SDGs and associated targets with a special focus on "leave no one behind" for OECD member states. The 2018 SDG Index and Dashboard report presents regional dashboards of SDG achievement and trends toward the goals. Country-level data on SDG implementation is consolidated in two-page country profiles for every UN member state, available in the "Country Profiles" section. Data profiles for each SDG Indicator are presented online. In this study, the dashboard can provide comprehensive and precise information about the progress made toward achieving the SDGs.

According to the study of Morales et al. (2021), the present research proposes a new method to analyze the sustainable development goals (SDGs) index using ordered weighted average (OWA) operators. To develop this method, five experts evaluated and designated the relative importance of each of the 17 SDGs defined by

the United Nations (UN), and with the use of the OWA and prioritized OWA (POWA) operators, rankings were generated. With the results, it is possible to visualize that the ranking of countries can change depending on the weights related to each SDG because the OWA and POWA operator methods can capture the uncertainty of the phenomenon. In connection to the study, it highlights the significance of the 17 Sustainable Development Goals (SDGs), but it does not utilize weighted average operators for the purpose of establishing, assessing, and shaping the relative importance of each of these SDGs.

Based on the study of Bidarbakhtnia (2019), provides an overview of various existing methodologies for assessing progress toward the SDGs. It provides guidance on how to choose an appropriate method that is fit for the purpose of analysis. The paper also recommends an approach for measuring SDG progress that accounts for progress among the furthest left behind groups in order to fulfill the leave no-one behind ambition of the 2030 agenda. Applying the new approach to data from countries in the Asia-Pacific region shows that, when disaggregated statistics are available, the inclusive measurement can significantly change the progress narrative and our understanding of priorities for SDGs implementation. In comparison with this study, the Sustainable Development Office is also committed to assessing the sustainable development progress of the university through a 10- year strategic plan. One goal is to expand the activities and improves in regards to 17 SDG. for consolidating data from different offices into one database for reporting purposes. Using an inclusive approach in the dashboard can help stakeholders to

better understand the progress towards SDGs and identify the areas where interventions are needed to ensure that no one is left behind.

The study of Chatzistamoulou and Koundouri (2020), aims to present chapter SDGs patterns that are defined in terms of the country's performance on the Sustainable Development Goals Index provided by the United Nations Index and Dashboards. The latter index is adopted to analyze how sustainable development, based on the average performance of the seventeen Sustainable Development Goals, has evolved during the last four years both at the global as well as at the European level in order to explore whether any patterns emerge. In comparison with the study, the dashboard aims to present the university's performance toward sustainable development provided by the United Nations.

According to the study Kynčlová et al. (2020), introduce the SDG-9 index as a measure of the country's progress towards achieving industry-related targets of Sustainable Development Goal 9 (SDG-9). The SDG-9 index represents a comprehensive but straightforward approach to assessing the extent to which countries have industrialized while promoting social inclusiveness and minimizing natural resource use and environmental impacts. The selection of indicators is based on the global indicator framework for the Goals and targets of the 2030 Agenda adopted by the United Nations General Assembly. In relation to the study, SDG-9 is also promoting social inclusiveness and environmental impacts. Furthermore, the study will not be focusing only on SDG-9 but on all 17 SDGs.

Based on the study by the World Health Organization (2019), the system concluded that countries had made progress in strengthening their health information systems (HIS) for monitoring the SDGs and UHC, but data gaps remain. Assessing the current status of health service coverage, financial protection, availability and readiness, social environmental factors, health outcomes and quality of health services continues to be unfeasible in many countries in the Region due to limited availability and timeliness of data. Data quality and collection methods used for various sources are unknown or not shared; thus, reported estimates may be inaccurate and inconsistent. In connection with the study, the study outlines the data quality and collection methods used in the system to ensure the confidentiality of the resource data. However, it should be noted that the study does not center around the health information system.

In the study of Moyer and Hedden (2019), the objective is to achieve 17 broad development goals. The SDGs are a central component of many national development plans and foreign aid strategies. While the SDGs have become a central aspect of development planning. This study explores a dynamic “middle-of- the-road” baseline global development scenario using an integrated assessment model to evaluate progress toward target values on nine indicators related to six human development SDGs. In relation to the study, the study aims to address all 17 SDGs as part of achieving sustainable development goals. However, it does not analyze the dynamic middle-of-the-road baseline global development.

According to the study of Purcell et al. (2019), the purpose is to deliver against the sustainable development goals (SDGs), working with faculty, staff, and students, as well as their wider stakeholder community and alumni body. They play a critical role in helping shape new ways for the world, educating global citizens, and delivering knowledge and innovation into society. Universities can be engines of societal transformation. Using a multiple case study approach, this study aims to explore different ways of strategizing sustainability toward delivering the SDGs in a university setting with an example from the UK, Bulgaria (Europe), and the USA. In this study, the process also requires the involvement of various stakeholders, including universities, which can play a critical role in promoting sustainability through research, education, and innovation. However, the progress of sustainable development is a broader process that involves assessing progress toward achieving the SDGs across multiple sectors and industries.

Based on the study by the United Nations Santiago (2018), represents a planning and follow-up tool for the countries at the national and local levels. With their long-term approach, they offer support for each country on its path towards sustained, inclusive, and environmentally friendly development, through the formulation of public policies and budgets, monitoring, and evaluation instruments. The 17 Sustainable Development Goals (SDGs) associated with the agenda help the region's countries to gauge the starting point from which they set out towards this new, collective vision of sustainable development set forth in the 2030 Agenda and to analyze and craft the means of its implementation. This new road map presents a historic opportunity for Latin America

and the Caribbean, since it addresses some of the region's most urgent priorities, such as ending extreme poverty, reducing inequality in all its dimensions, promoting inclusive economic growth with decent work for all, creating sustainable cities and addressing climate change. In this study, one of the goals is to develop a dashboard that can serve as a tool to help the university achieve its 10-year strategic plan. The dashboard is intended to provide relevant data and key performance indicators to assist university leadership in monitoring progress toward the strategic plan's goals and objectives.

The study of Sousa et al. (2021), the main objective of this paper is to present a systematic literature review (SLR) on MCDM methods supporting decisions focusing on the achievement of UN Sustainable Development Goals (SDGs) and the implementation of the 2030 Agenda for Sustainable Development in regional, national, or local contexts. In this regard, 143 published scientific articles from 2016 to 2020 were retrieved from the Scopus database, selected, and reviewed. They were categorized according to the decision problem associated with SDG issues, the MCDM methodological approach, including the use (or not) of fuzzy set theory, sensitivity analysis, multistakeholder approaches, the context of MCDM applications, and the MCDM classification. In this study, the researchers emphasize the importance of utilizing effective methods and tools to achieve UN Sustainable Development Goals (SDGs) and the implementation of the 2030 Agenda for Sustainable Development.

According to the study of Chau et al. (2020), aims to progress toward achieving the SDGs are essential to track global efforts towards sustainable development and guide policy development and implementation. However, systematic methods for assessing spatiotemporal progress toward achieving the SDGs are lacking. Here we develop and test systematic methods to quantify progress towards the 17 SDGs at national and subnational levels in China. Our analyses indicate that China's SDG Index score increased nationally from 2000 to 2015. Every province also increased its SDG Index score over this period. There were large spatiotemporal variations across regions. This study suggests the need to track the spatiotemporal dynamics of progress toward SDGs globally and in other nations. In this study, the researchers will track the university's efforts toward sustainable development.

Based on the study of Wu et al (2020), suggests that cloud-based services that integrate crowdsourcing and public EO data products provide cost-effective solutions for monitoring and tracking the SDGs, particularly for low-income countries. The study also discusses the challenges of using cloud services and big data for SDG monitoring. Validation and quality control of public EO data are very important; otherwise, the user will be unable to assess the quality of the data or use it with confidence. In this study, the researchers will create an efficient and reliable dashboard to prevent a lack of standardized data collection methods and metrics. for monitoring and tracking sustainable development achievements.

The study of Strong et al. (2020), highlights the common principles and practices of each Inter-agency group and the progress made toward SDG 3 targets using seven health indicators as examples. The indicators provide examples of best practices for modeling estimates and projections using standard methods, transparent data collection, and country consultations. The study presents the United Nations (UN) Inter-agency groups' efforts to support countries to report on SDG health indicators, project progress towards 2030 targets, and build country accountability for action. In relation to the study, the researchers will highlight progress made toward all 17 SDGs through transparent data collection.

According to the study of Sachs et al. (2021), the objective is to report and convey a commitment to sustainable development, to communicate our environmental, social, and economic performance, and to demonstrate our commitment to communicate to our stakeholders in an open, honest, and transparent fashion. In this study, it is stated that the report aims to convey a commitment to sustainable development, communicate environmental, social, and economic performance, and demonstrate a commitment to stakeholders in an open, honest, and transparent manner. Additionally, the study outlines four key strategies for university management: financial sustainability, risk management, disaster resilience, and efficient administrative and financial services.

Based on the study of Funda et al. (2020), aims to examine the assessment of internal indicators on the balanced sustainability scorecard in the banking system in North Cyprus, which is one of the sustainable performance evaluation methods.

Moreover, it aims to evaluate and reveal the effects of innovation performance, organizational culture, intrapreneurship, and the efficiency and effectiveness of the accounting information system on overall business performance in terms of the performance scorecard to achieve sustainable balanced scorecard systems. In relation to the study, it focuses on evaluating sustainability performance and identifying factors that contribute to sustainability goals. Furthermore, they differ in terms of their scope, level of specificity, and the indicators used to measure progress.

According to the study by Eurostat (2020), aims for the continuous improvement of the quality of life for current and future generations. The Eurostat monitoring report, based on the EU set of sustainable development indicators, provides an objective, statistical picture of progress towards the goals and objectives of the EU sustainable development strategy. The statistics cover various issues related to sustainable development and will contribute to raising awareness of the opportunities and challenges ahead. Quantitative rules applied consistently across indicators and visualized through weather symbols, provide a relative assessment of whether Europe is moving in the right direction, and at a sufficient pace, given the objectives and targets defined in the strategy. In relation to the study, also progresses aim to provide an objective, statistical picture of progress toward sustainable development goals.

Based on the study of Wei et al. (2022), presents an assessment method for measuring the progress of SDGs at the local level. It takes the case of the YREZ in

China. The local SDGs indicator framework is developed based on the availability of good data and alignment with the global indicator framework (SGIF), including 60 indicators covering 17 goals. The local SDGs index and three target indexes are aggregated using the entropy-weighting method. The results show that: all eleven provinces in the YREZ face significant challenges in achieving the SDGs, the local SDGs index is not only correlated with economic development but also with other factors, such as environmental protection and social development; even the wealthiest provinces also face major challenges in meeting several goals of the SDGs, and some poor provinces have achieved good performance in some goals. In this study, the goal of tracking accomplishments and progress with sustainability share similarities in that they both aim to measure progress toward sustainable development goals. However, the study focuses on a specific region in China, and tracking accomplishments and progress with sustainability can be applied in various contexts and locations.

According to the study of Kostetckaia and Hametner (2020), the present study combines the two topics by linking the analysis of synergies and trade-offs between the SDGs in the European Union (EU) member states with a longitudinal assessment of these countries' progress towards the goals. SDG interlinkages are assessed through Spearman's rank order correlation, while progress is calculated according to Eurostat's progress measure. Using regression analysis, we find a significant negative relationship between countries' progress and the shares of trade- offs among SDG indicators and a moderate positive relationship between progress

and synergies, suggesting that trade-offs have a bigger influence on the pace of countries' progress toward the goals than synergies. The study also provides a comprehensive understanding of progress toward the SDGs and can inform policy decisions on how best to achieve sustainable development. Furthermore, it differs in that it also analyzes the interlinkages between the SDGs and how trade-offs and synergies between the goals can affect countries' progress. The approach is applied to the evaluation of the SDGs in EU27 during the period 2010–2020 using the Eurostat SDG dataset.

Based on the study of Urbina-Ferretjans (2019), this new approach incorporates elements of universalism and productivism with a new economic rationale for social policy provision which emphasizes the productive potential of social policy while preserving the objectives of social protection and equity. Through documentary analysis of social policy narratives, the chapter also discusses the extent to which these new ideational and normative changes in international development coincide with perspectives and practices advocated by South South cooperation players. This chapter claims that the scholarly analysis of these issues needs to combine elements from the hitherto separate agendas of social policy as well as development studies, in order to capture the breadth of current global development phenomena. This study, also highlights the importance of combining elements from social policy and development studies to capture the current global development phenomena.

In the study of Vladyslav (2019), the aim of the research is to determine the role of monitoring and evaluation in the system of sustainable development of the territory. The methods used in this study are general scientific techniques and methods – analysis, logical access method, monographic and other methods. Some international standards for sustainable development have been adopted today. Monitoring and targeted indicator ratings are measures that promote sustainable development. Aims should be set to manage the sustainable development process and evaluate the effectiveness of the tools used to achieve it. Sustainable development indicators are necessary to establish the degree of responsibility of their values to the criteria for sustainable development. In relation to the study, it also involves identifying goals for improvement and making necessary changes to achieve sustainability objectives. Furthermore, it involves a more systematic approach with the use of specific indicators and measures to evaluate progress toward sustainable development goals.

According to the Parra-Domínguez et al. (2022), aims to incorporate criteria on the technology used in the reporting system, specifically in collecting the different types of data and generating other interfaces. The methods described here are carried out on a specific case study, a Smart City, showing the different types of data that exist and the possible interfaces that allow objective monitoring of the achievement of the SDGs. The main conclusions of this research establish the importance of incorporating and sizing the technology needed to develop the criteria for monitoring the SDGs. There is a need for convergence between the correct,

objective, and universal provision of this type of sustainability information and the technology used for the collection and presentation of the data. In this study, there is also a need for effective monitoring and tracking of accomplishments toward sustainability goals, which also requires the use of appropriate tools and systems to collect, analyze and report on data. However, the study emphasizes the role of technology in collecting and presenting data to enable objective monitoring of the SDGs.

Based on the study by UNESCO (2021), this document offers robust and easy-to-use guidelines. These include detailed technical guidelines for countries that have not participated in PISA, TIMSS, or ICCS on collecting the data necessary to produce the information that will allow them to measure and monitor Indicators 4.7.4 and 4.7.5. More importantly, by following these guidelines countries will be able to produce information comparable with that of the 60 countries for which this data already exists. In relation to this study, it also focused on collecting data to measure and monitor specific SDG indicators, namely SDG 4.7.4 and 4.7.5 and the study can contribute to a better understanding of the progress made towards achieving SDG 4 and its associated targets.

According to the study of Baumgart et al. (2021), satellite-based Earth observation, positioning, navigation, and communication services are used in an array of sectors ranging from monitoring environmental conditions and changes to supporting search and rescue missions. In order to illustrate contributions to the SDGs, space agencies and other institutions have aligned their projects to the SDG

framework. This study attempts a more holistic, aggregate mapping of such alignments to gauge which SDGs benefit the most from space-based projects and technologies, as opposed to those benefiting the least. In this study, it assesses the effectiveness of space-based projects and technologies in contributing to the SDGs. Furthermore, it is not primarily focused on highlighting successful projects, but on providing an overall understanding of the impact of space-based projects and technologies on the SDGs.

Based on the study by Eurostat (2021), aims to achieve a continuous improvement in citizens' quality of life and well-being, without compromising the well-being of future generations. This involves the pursuit of economic progress while safeguarding the natural environment and promoting social justice. For these reasons, sustainable development is a fundamental and overarching objective of the EU, and the progress towards the goals agreed at the UN level is regularly monitored and reported. In relation to the study, monitoring progress toward the SDGs is crucial for identifying areas that need improvement and recognizing achievements made toward sustainable development.

According to study of Shields and Shelleman (2020), this study introduces the concept and potential application of sustainability dashboards by SMEs as an aid to meet growing demands for sustainability management and reporting. It suggests how dashboards can be integrated into SMEs' planning and control systems to facilitate data visualization for sustainable decision-making. The paper highlights benefits including low cost and discusses practical implications, such as using

dashboards beyond sustainability management and the need for policymakers to provide better access to training and software for SMEs. In relation to the study, the study uses the dashboard to manage and report all 17 SDGs to meet the growing sustainability demands. And it also provides easier access to data, facilitates data visualization for sustainable decision-making, and reduces time and cost.

Related Systems

According to a study by PSA Board (2021), as the official repository of the Philippine SDG indicators, the PSA announces the release of the updated SDG Watch, which reports the baseline data, target data, and latest data, providing information on the available data for tracking the progress of the Philippines in achieving the SDGs based on the initial list of Philippine SDG indicators. Tracking the progress in achieving the SDGs in the Philippines is a necessary measure to provide useful inputs for evidence-based planning, decision-making, and program development geared toward achieving the 2030 agenda. For this purpose, the PSA adopted the United Nations Economic and Social Commission for Asia and the Pacific (UNESCAP) SDG measures namely, UNESCAP's Anticipated Progress Approach and UNESCAP's Current Status Index, and the Time Distance Measure developed by Prof. Pavle Sicherl (University of Ljubljana, Sweden), as approved through PSA Board Resolution No. 5, Series of 2020. These measures provide information on how we should move forward to ensure the achievement of the SDGs and make use of the baseline, previous and latest data for each of the indicators, as well as the numerical targets determined through the consultative workshops

organized by the National Economic and Development Authority (NEDA) and Philippine Institute for Development Studies (PIDS) together with accountable agencies and relevant stakeholders. In monitoring the SDGs and their corresponding targets, the UN Statistical Commission established an Inter-Agency and Expert Group on SDG Indicators (IAEG-SDG), which developed the SDG global indicator framework consisting of 232 unique indicators. In this study, the system is also a repository of all data that is input into the dashboard. It aims to track the progress of the Philippines in achieving the SDGs by providing updated information on the baseline, target, and latest data for each of the indicators. The information can then be used as inputs for evidence-based planning, decision-making, and program development toward achieving the 2030 agenda. However, the system focuses on the contributions of space-based projects and technologies to the SDGs and has a more specific focus on tracking progress in the Philippines using established measures and indicators. The system involves the use of a web-based dashboard to provide easier access to data and reduce time and cost in managing data collection. In the study of IISD (2020), the focus area is guided by five core priorities Climate, Resources, Economies, Act Together, and Engage which together form our CREATE strategy and guide our actions. They will lead to a stronger, more sustainable future. The Global SDG Indicator Platform offers people the chance to explore indicators for the 17 Sustainable Development Goals (or SDGs) across the planet. The platform not only gives users an engaging experience while answering, "Are we there yet?" regarding development but also highlights the importance of

data availability in guiding policy decisions. The platform incorporates approximately 100 data indicators used to measure progress toward the SDGs. The site and its companion report include information for each indicator, such as the indicator's custodian organization, rationale, limitations, and data sources. By setting the platform's "dashboard" feature to compare countries with similar conditions and trends, users can uncover examples where best practices may be found—and where actions on one goal may help or hinder achieving other goals. In this study, systems utilize data indicators to measure progress, identify areas for improvement, and promote transparency and data-driven decision-making. In contrast, the proposed web-based dashboard is specific to SDOs and aims to reduce time and costs in managing and collecting data. It also focuses on recording and tracking the accomplishments of SDOs in terms of sustainability performance.

The study by AIM2Flourish (2021), The SDG Dashboard is creating to collaborative data reporting and analytics platform for global business schools to share their best practice impacts on the United Nations Sustainable Development Goals and transform business education into a force for good. The SDG Dashboard is managed by a team at the Haub School of Business at Saint Joseph's University. The SDG Dashboard is a new reporting, visualization, and data analytics tool for The Principles of Responsible Management Education (PRME) members and other global business schools to showcase their contributions toward advancing the 17 United Nations Sustainable Development Goals. Aligned with the PRME Principles, the SDG Dashboard shares business schools' SDG-related best practices

in Teaching, Research, Partnerships, Dialogue, and Organizational Practices. The purpose of the SDG Dashboard is to provide a shareable, robust, and useful resource for business schools to enhance their impact on fulfilling the SDGs. In relation to the study, the propose web-based dashboard is serve as useful tools for promoting sustainability and advancing the SDGs. Offer unique features and benefits that can help universities and central for development to report their sustainability accomplishments. However, the proposed dashboard for SDOs at Batangas State University and its extension campuses is more specific and tailored to the university context. The web-based dashboard is intended to be used by Batangas State University and its extension campuses to track and report their sustainability accomplishments, whereas the SDG Dashboard has a broader target audience.

The study of iTech Mission (2018), has developed a dashboard that enables users to explore data from global data sources to visualize progress towards the SDGs. A social enterprise has launched the 'SDG Interactive Data Dashboard' for monitoring progress towards the SDGs. The tool uses data from the UN Statistics Division's (UNSD) SDG Global Database, in a way that allows users to explore and visualize data to analyze progress. Users can adapt the SDG Interactive Data Dashboard to monitor their country's progress on the SDGs, and explore trends on particular SDGs, indicators, and/or targets. To explore a particular Goal or target, the Dashboard's tools enable users to create graphs, bubble or rank charts, tree maps or tables, among other outputs. Users can choose to display SDG indicators using different metrics, such as by number, percent, total, or kilometers, depending on the

indicator type. A monitoring tool displays a given target and its indicators and provides information on the data value, unit, and trend. By clicking on the value, users can view trends over time toward the target. Users can also choose to track and monitor data on the SDGs that are most important to them, or to create country profiles. In this study, the proposed system allows the user to visualize the progress toward the SDGs. Users can also choose to track and monitor data on the dashboard. Furthermore, the dashboard is specifically designed for universities, its aim is to provide a centralized location for collating all sustainability practices and promoting them.

The study of Sachs et al. (2022), adopted by all member states of the United Nations, describes a universal agenda that applies to and must be implemented by all countries. Sound metrics and data are critical for turning the SDGs into practical tools for problem-solving. The Sustainable Development Report (formerly the SDG Index & Dashboards) is the first worldwide study to assess where each country stands with regard to achieving the Sustainable Development Goals. Unlike its predecessor the Millennium Development Goals, the SDGs set standards not only for emerging and developing countries but also for the industrialized nations. Governments and civil society alike can utilize the Sustainable Development Report to identify priorities for action, understand key implementation challenges, track progress, ensure accountability, and identify gaps that must be closed in order to achieve the SDGs by 2030. In relation to the study, the proposed dashboard for SDOs provides a tool for monitoring progress towards the SDGs and identifying areas for improvement. However, the web-based dashboard for SDOs may focus more on specific sustainability practices and more geared towards internal

use by the university.

In the study of Ritchie et al. (2018) developed the SDG Tracker, an open- access project that allows users to track the latest data across all 17 SDGs. The SDG Tracker serves as an interactive hub where users can explore and monitor progress across all SDG indicators for which data is available. The resource is regularly updated with the latest data from official, high-quality sources, including the UN, World Bank, World Health Organization, Institute for Health Metrics and Evaluation, WHO JMP, UNESCO, and UN Food and Agriculture Organization. SDG Tracker users can view progress at the global, regional, and country levels, and by clicking on a specific country, they can see a time series of how a given metric has changed over time. Additionally, users can compare progress across neighboring countries, regions, and the world. By constantly updating their metrics in real-time, the SDG Tracker aims to provide the most up-to-date resource available to track progress towards achieving the SDGs by 2030. In this study, the web-based dashboard can easily explore of the user and monitor progress across all the SDGs. The system is also regularly updated within the hour and provides the most up-to- date resources. Furthermore, all the resources that will appear on the dashboard come from the data uploaded by the offices.

The study by VU Amsterdam (2023) measures societal impact based on the 17 Sustainable Development Goals (SDGs). It provides a clear demonstration of what Vrije Universiteit Amsterdam represents: a university with a focus on society. It enables us to see the research publications that relate to the Global Goals, how open and freely available these are to society, and what (non-)governmental organizations make use of

these publications in their policy. Now is the SDG classifier and SDG badges, where you can dynamically generate an SDG wheel based on a text fragment in 104 languages, and code to embed on a web page. In addition to showing academic impact, the tool indicates whether the research is openly accessible. It also shows the extent to which policymakers reference the research. Reviews show that many of these publications are mentioned in policy documents related to poverty reduction, health and wellness, and sustainable energy. To have an even greater impact, it is important that research is openly accessible. This helps us to contribute even more to addressing societal challenges. In relation to the study, the proposed system is also a study that assesses each university's progress toward the SDGs. Aims to contribute to achieving the SDGs by providing data-driven insights and promoting transparency. However, the dashboard is more focused on tracking and monitoring progress within the university, while the VU Amsterdam study is more focused on measuring the impact of research on society as a whole.

The study by Trade Development Bank (2021), the aim of this document is to set out the kind of development impact TDB intends to achieve and to codify the processes to monitor and report on whether these impacts are being achieved. This will allow TDB to demonstrate to shareholders and stakeholders the extent to which it is adhering to its commitment to sustainable development. This information will be published in an annual sustainability report, alongside the annual report. TDB has always reported financial results and has recently begun to report on sustainable development impact, it has neither comprehensively monitored nor reported on

this impact. The Board of Directors and management are committed to operationalizing the sustainability framework, which includes a system for impact assessment monitoring. The system will guide TDB to better collect and analyze data and information to demonstrate its development results to its stakeholders. Measuring sustainable development impact accomplishes a number of objectives. In this study, the proposed system is also to monitor, collect, and analyze data information committed to operationalizing the sustainability framework. Furthermore, the dashboard for universities aims to provide a web-based dashboard to record and track sustainability accomplishments with a focus on specific sustainability practices. The dashboard allows universities to showcase their accomplishments, monitor progress, and identify areas for improvement.

The study by ISEAL Alliance (2023), Sustainability systems are market- based tools designed to address the most pressing social and environmental challenges of our time. They give people the power to make an impact. They provide a range of resources to support the development and use of credible and effective sustainability systems. Credibility Principles provide the foundation, while Codes of Good Practice define the technical requirements to develop and improve systems. They offer guidance materials to support credible claims management, and resources such as our Sustainability Benchmarking Good Practice Guide for organizations that are evaluating sustainability initiatives. And they also support the continued improvement of sustainability systems through our membership activities. In relation to the study, the proposed system provides a range of resources to support the progress of sustainability and use credible resources.

However, the source of the web-based dashboard is in the offices that upload the data.

Based on the study by Subcommittee (2019), aims to provide a comprehensive roadmap that will serve as a guide for us to achieve the future we want—a future where everybody is able to have food on their tables with their families, a future where employment is attainable to everyone, a future where citizens do not live on less than USD1.25, and a future where our natural resources are taken care of. As a result, the UN, along with 193 countries of different backgrounds and cultures, adopted the 2030 Agenda for Sustainable Development, with 17 Sustainable Development Goals at its core. The SDGs are a comprehensive set of goals recognizing the connections between the people and the planet, comprising 169 targets, integrated and indivisible to balance the three dimensions of sustainable development: the economic, social, and environmental. The Commission on Audit emphasized the critical role of the NEDA in the long-term implementation of the SDGs. This resulted in the recommendation to create the Subcommittee on SDGs under the Development Budget Coordination Committee to ensure that programs related to the goals will be tagged, monitored, and funded by a centralized coordinating body fully committed to the 17 goals. This shows a commitment to align the Philippine government's policies to the 17 SDGs, ensuring we follow the roadmap to our desired future. In this study, a web-based dashboard for the SDO for University is a tool that provides a visual representation of data related to the SDGS progress of Batangas State University and extension campuses. Furthermore, the dashboard is specific to the University and is a tool for sustainable development.

Conceptual Framework

A conceptual framework is a technique for showing the major ideas and connections existing in a given process or system. It offers a visual depiction that aids stakeholders in understanding the system or process under the study's general structure, parts, and flow. A conceptual framework provides a concise summary of the aims of the research or project, as well as the approaches and techniques employed to attain them, acting as a guide for researchers or practitioners. This tool could help to guarantee that everyone was on the same page and working toward the same goals, which made it particularly valuable in complicated or interdisciplinary projects with numerous stakeholders. Figure 1, illustrates the conceptual framework of the study. The framework includes three components: input, process, and output.

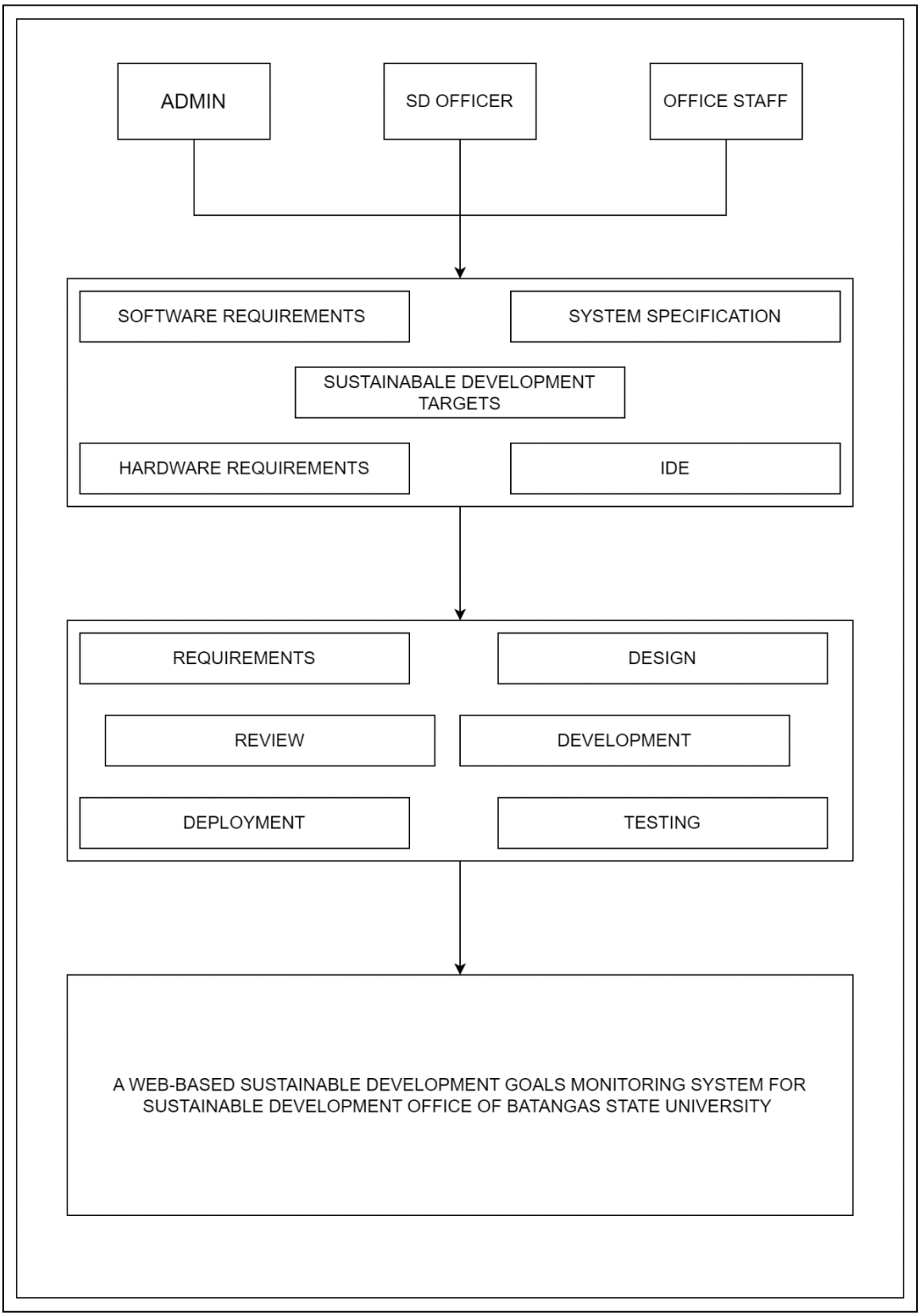

ADMIN
SD OFFICER
OFFICE STAFF
SOFTWARE REQUIREMENTS
SYSTEM SPECIFICATION
SUSTAINABALE DEVELOPMENT TARGETS
HARDWARE REQUIREMENTS
IDE
REQUIREMENTS
DESIGN
REVIEW
DEVELOPMENT
DEPLOYMENT
TESTING
A WEB-BASED SUSTAINABLE DEVELOPMENT GOALS MONITORING SYSTEM FOR SUSTAINABLE DEVELOPMENT OFFICE OF BATANGAS STATE UNIVERSITY

Figure 1. Conceptual Framework

Figure 1 provides a comprehensive overview of the entities involved in the system. Entities shall include the admin, SD officer, and the offices. Users were required to provide their corrected and valid credentials in order to guarantee safe access to the system. The system shall also take account of different software development requirements, in addition to user management. These requirements shall cover the necessary instruments, frameworks, and technologies to develop and maintain this system in an efficient manner. Also, the system considered hardware requirements in order to ensure that necessary computing resources and infrastructure were available for the purpose of supporting its functionality and performance, for integrated development environment (ide) was a software application that gave the system comprehensive tools and features to design, debug or test the software. System specification laid down the technological details, performance expectations, and functionality requirements for the system in order to achieve its objectives and standards. Lastly, sustainable development targets were essential in order to promote environmental good practices and contribute towards achieving sustainable development goals.

In addition, the system shall be guided by a methodology that ensures the best possible functionality and performance. This methodology covers a range of phases, including requirements, design, review, development, deployment, and testing. This means that the system was based on a systematic approach requirement to identify user needs, design to planned architecture and user interface, review to ensure structure and alignment,

development of code and implementation, deployment to prepare for production and testing to verify functionality, and corrected problems.

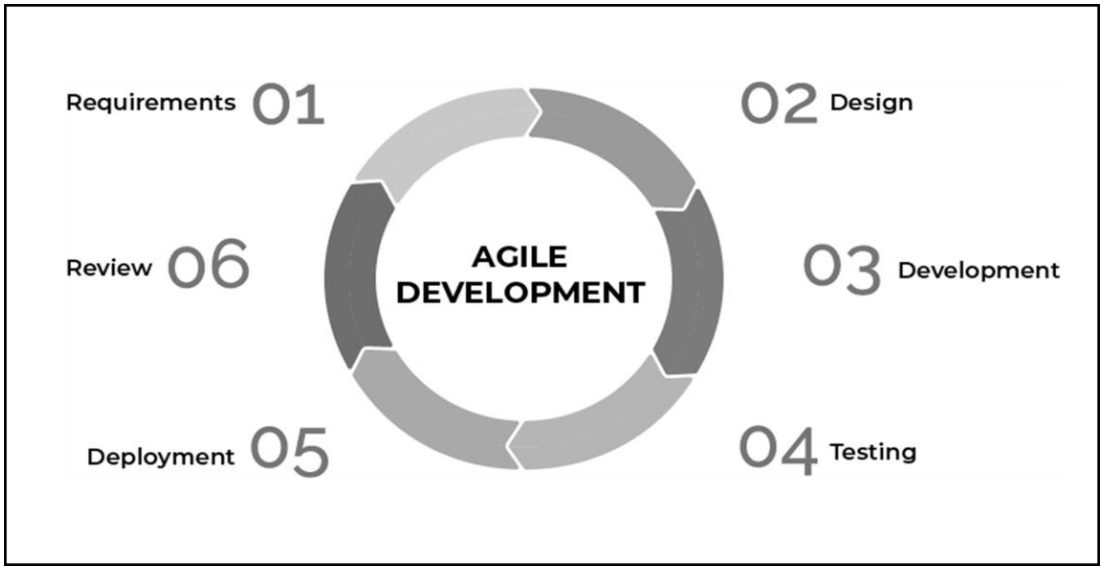
Overall, the figure highlights the importance of accurate data collection, management, and version control in monitoring progress toward sustainable development goals. By utilizing a system that could collect and manage data from officers and users, and providing version-controlled features, the sustainable development office could ensure that the data collected was accurate and reliable, making it easier to track progress and make informed decisions toward achieving sustainable development at the university.

CHAPTER III

DESIGN AND METHODOLOGY

Software Development Model

The researchers used an agile method to make the project more convenient and an easier process. Throughout the entire project, a well-structured planned process was organized using the software development methodology. In order to develop the system and accomplish the study's goals, the researchers used the agile development methodology as a guide.



Source: https://agiletech.vn/wp-content/uploads/2020/08/agile-software-development-life-cycle-agile- methodology-01.png

Figure 2. Agile Development Model

Figure 2 illustrates the Agile Development Model. As an alternative to conventional techniques, the researchers employed a model like this one and all the phases had an essential part in the system of Sustainable Development Office project monitoring system. Because the client had access to several data interactions, this

paradigm enables ongoing adjustments to be made. Because of this, the researchers considered the value of each task while concentrating on a particular collection of tasks.

Analysis of the Existing System

The Sustainable Development Office (SDO) of Batangas State University Campus aims to track, assess, and report on the sustainability efforts and accomplishments of BatstateU – TNEU. This involves tracking the progress of sustainability goals, identifying areas for development, and communicating achievements with the larger community. By doing so, the office wants to foster a culture of constant improvement for the benefit of the university and the surrounding community's future sustainability.

During the previous process, the Sustainable Development Office (SDO) was assigned the task of creating a narrative report that necessitated the collection of information from BatstateU – TNEU campuses. However, the process encountered significant challenges due to the considerable distance and limited time frame. Batangas State University Campus was situated far away from the SDO's main location or headquarters, making it difficult to effectively manage time and resources. Consequently, the timely acquisition of the required information within the expected timeline became challenging.

Fishbone Analysis

A fishbone analysis is a method that identifies the various factors that contribute to a particular problem or outcome, such as the creation of a manual process. The developers created a functioning method that was successful and efficient after carefully examining the necessary parameters to pinpoint the precision needed by the client for the delay of complying reports.

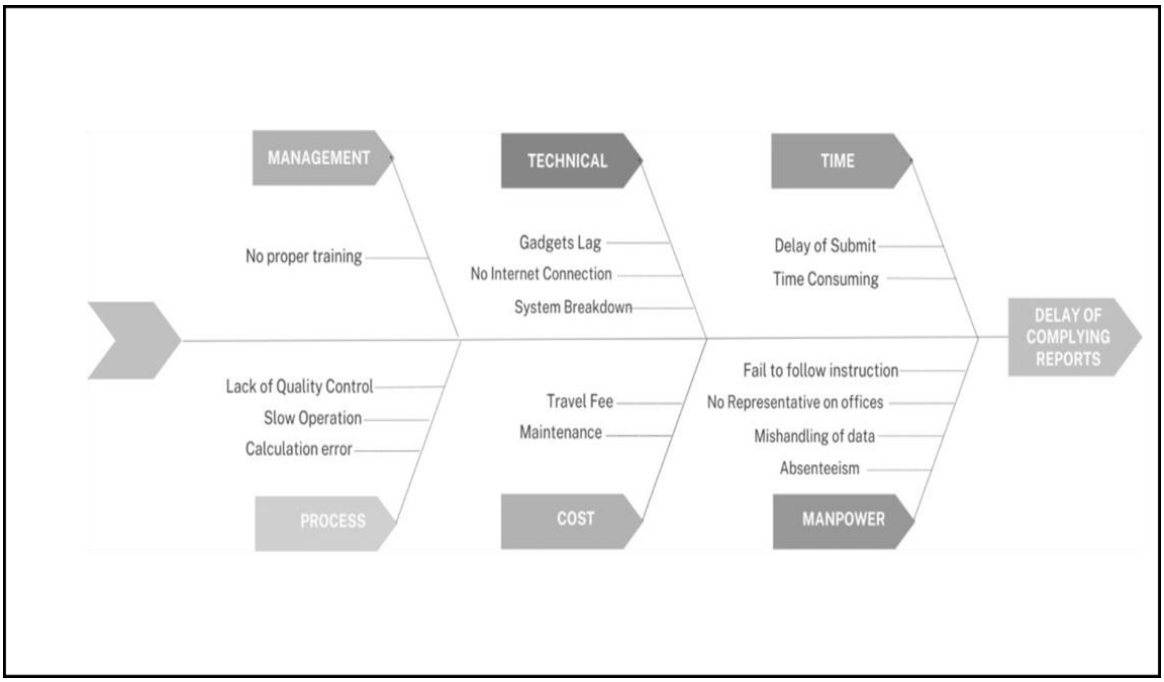


Figure 3. ***Fishbone Diagram***

Used this figure shows the client encounter. The key issues that impact compliance with all the data needed for reporting were management, technical, time, process, cost, and manpower. To help client, improve their data collection, a web-based method was developed. It could help to reduce the time it takes to comply with reports and improve overall organizational performance by using this proposed system. It may also be useful to ensure that the necessary information is gathered and reported on time, which could

have important implications for client operations and decision-making processes. In technical terms, it could be envisaged to integrate this system with existing software or hardware systems to reduce the need for manual data entry and streamline reporting processes. In addition, it would reduce the risk of errors and ensure that data were accurate and consistent across different systems. This would save the client time and money by reducing the need for paper reports, as well as decreasing the number of resources needed to manually enter data and process them. Furthermore, manual data gathering and reporting processes could be time-consuming and require a significant amount of manpower, which could be a drain on resources and reduce overall productivity. Last but not least, by using a dashboard, the system could provide real-time access to data, making it easier for users to monitor progress and identify potential issues early. Overall, improving the process for data gathering and reporting on the dashboard could significantly reduce delays in complying with reporting requirements, leading to better overall performance for the organization.

System Boundary

The system boundary illustrates the various components involved in constructing the studied, as well as the collaborative roles and obligations in ensuring the system's rules and credibility.

The sustainable development goals monitoring system was designed to operate effectively despite various challenges and difficulties that may arise during real-time monitoring. The proponent also recognized the significance of external factors and conditions in the system's environment.

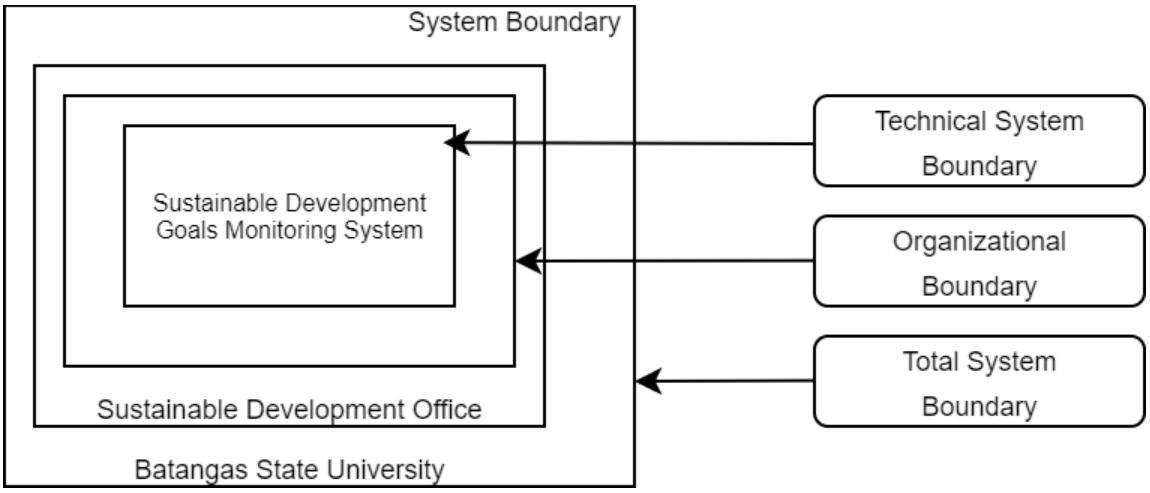


Figure 4. System Boundary

Based on the figure 4, the system of the SDG Dashboard for Batangas State University campuses encompasses all the processes involved in collecting and reporting data related to sustainable development goals. The system includes various data sources, such as reports, and other relevant data, which are collected and processed using the SDG Dashboard. The system boundary also includes the reporting of this data in the form of reports, graphs, and other visualizations. The SDG Dashboard system boundary starts with the data collection process, which involves gathering data from various sources external stakeholders. This data is then stored in the system's database and processed to produce reports that provide valuable insights into the university's progress towards achieving its sustainable development goals.

Hardware Requirements

Hardware requirements define the minimum specification of a personal computer or laptop needed to provide adequate performance for the services and applications running on the server. The minimum specification consists of 3 internal hardware requirements

which include Random Access Memory (RAM), Central Processing Unit (CPU), and Hard Disk Drive (HDD). The table shown below is the list of minimum requirements.

Table 1. Hardware Requirements

Name of Internal Hardware	Specification
Central Processing Unit	Intel i3 core 3.00ghz or Dual Core
Hard Disk Driver	At least 50 GB free space
Random Access Memory	4GB – 6GB (Laptop or Desktop)

Table 1 displays the hardware requirements for the system specification needed. That would support the deployment of the system. This requirement that the developers used was efficient and effective for the system that was developed. In relation to this, the proponents specified these requirements as a central processing unit, hard disk driver, and random-access memory. In terms of the central processing unit, the requirement was Intel i3 core 3. 00ghz whereas the proponents recommend dual core. On the other hand, the minimum requirement for a hard disk drive was at least 50 GB of free space. Meanwhile, the minimum and recommended requirement for random access memory was 4. GB – 6 GB for laptop or desktop.

Software Requirements Specification

The specifications of all software that include functional and non-functional requirements as part of the documentation that contains the System Requirements for software. The first defines the system's procedures, data storage, and programming language necessary to use it whereas the categories set out its performance

characteristics which include reliability, availability, and usability. The 56 documents consider the end user's familiarity with software and includes, in particular, both technical and non-technical aspects of software design.

Software Requirements

Software requirements are used commonly to have access to the user to the system by providing specifications that are used to operate the computers or laptops. This software was referred to as an application that could be used to run on the device and categorized. The proponents specified these requirements as operating system, language, database, and IDE.

Table 2. Software Requirements

Requirements	Specification
Operating System	Windows 7 or Newer Linux and macOS
Language	HTML, CSS, JavaScript, React JS, ExpressJS, and SCSS
Databases	PostgreSQL
IDE	VS Code

Table 2 shows the software requirements that would describe the intended purposes of the system. The requirements must be Windows 7 or newer; it could also be Linux or Mac. The programming language that the developers would use was HTML for content and structure on how each content was aligned, CSS for the design and for JavaScript to give function to components, React JS, ExpressJs, and lastly SCSS. PostgreSQL had been the database used for the system and for the ide, the developers used a VS Code.

Functional Requirements

This section discusses the functional requirements. This communication enables stakeholders to express their requirements and expectations clearly, leading to the creation of a sustainable development goals monitoring system that meets their demands precisely.

1. Admin
    1.1. View, Add, and Update Accounts
    1.2. View Dashboard
    1.3. View, Add, Update Questions
2. Sd officer
    2.1. View, Add, and Update Accounts
    2.2. View Dashboard
    2.3. View Records
    2.4. Send Notifications
    2.5. Evaluate Records
3. Office Staff
    3.1. Upload data
    3.2. View Targets
    3.3. Update Data
    3.4. View Records
    3.5. View notifications

Non-functional Requirements

The non-functional requirements of the Sustainable Development Office project monitoring system referred to the system's attributes that were not directly related to its functionality but were essential for its effectiveness and usability. These requirements include reliability, scalability, performance, maintainability, and security.

1. **Reliability**
    1.1. The system must be able to provide precise details about the information in the system.
    1.2. The system must be reliable on any computer device.
    1.3. The system should have a reliable backup and recovery mechanism to prevent data loss in the event of a system failure or other disaster.
2. **Scalability**
    2.1. The system must be able to explain how it works and why it was designed.
    2.2. The system must be able to cope with changes in user demands or data volumes that do not affect their reliability and performance, by increasing or reducing them as necessary.
    2.3. The system should be able to handle a large volume of data from multiple sources and users without compromising its performance.
3. **Performance**
    3.1. The system was accessible to all offices in BatStateU-TNEU
    3.2. The interface was user-friendly
4. **Maintainability**

4.1. The system must have the capacity to compile the user's long-term validity

4.2. The system must ensure data quality through validation checks and handling of error

5. **Security**

5.1. To prevent unwanted access to the data, the system must be able to offer users a password to log in

Constraints

Constraints could be thought of as limitations or restrictions that could affect the development process of a software system. The required technology stack was determined based on considerations such as usability, performance, and security.

Table 3. Considered Design and Technology Stacks

Options	Minimum Requirements
	HTML SCSS/CSS Bootstrap JavaScript ExpressJS ReactJS MongoDB
Design A	HTML CSS JavaScript / JQuery PHP SQL
Design B	XAMPP

	HTML CSS
	Node.JS
	Vite React.JS Tailwind CSS
Design C	Chart JS
	React Router Dom
	ExpressJS
	PG
	Cors
	PostgreSQL

Table 3 shows 3 different options for developing and designing the dashboard. The first is Design A which encompasses a well-rounded technology stack for web application development. It combines HTML, CSS, and JavaScript on the front end, bolstered by Bootstrap for responsive design. Express.js powers the backend, handling server-side operations, while React.js serves as the framework for constructing the user interface. MongoDB, a NoSQL database, ensures efficient data storage and retrieval.

This comprehensive technology stack enables the creation of a responsive, dynamic, and contemporary web application. On the other hand, Design B utilizes a technology stack comprising HTML, CSS, JavaScript/jQuery, PHP, SQL, and XAMPP. These technologies collectively enable the development of dynamic and data-driven web applications. HTML, CSS, and JavaScript handle the front-end structure, styling, and interactivity. jQuery simplifies JavaScript tasks. PHP empowers server-side processing, while SQL manages and manipulates data. XAMPP provides a comprehensive local development environment. Together, this technology stack supports the creation of responsive, interactive, and efficient web applications. Design C aligns closely with

Design A in terms of its technology stack, with a few notable differences. In Design C, we've chosen to utilize a modern and efficient set of technologies, including Node.js as the runtime environment, Vite for frontend development, React.js for the front-end framework, Tailwind CSS for styling, Chart JS for data visualization, React Router Dom and Express.js on the server side. Additionally, PG and Cors for supporting back end and replaced MongoDB with PostgreSQL as our database system, which offers robust relational data management capabilities. This updated stack combines the best features of each technology to create a powerful and flexible foundation for the Dashboard, ensuring efficient development and scalability.

Usability constraints are certain limitations or restrictions that must be considered to ensure that the application is easy to use and interact with. It includes things like making sure the application is accessible for users with disabilities, ensuring that it's easy to navigate and use, and making sure it's efficient and performs well.

Performance constraints can be a big challenge when creating software, especially when working with large amounts of data or complex algorithms that require quick processing times. This is especially important, as many applications need to handle vast amounts of data and perform complex calculations in real- time. These performance constraints can impact the speed, efficiency, and scalability of the scalability of the application, which can in turn affect how users perceive it and how satisfied they are with it.

Security constraints essential considerations in software development, as data privacy and protection against cyber-attacks are becoming increasingly important in our

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Table 4. Design Factors

Factor	Weight
Usability	20%
Performace	20%
Security	15%
Maintainability	15%

Ensuring the success of a system is crucial, and guiding the design process involves studying all of the considered factors, such as usability, reliability, user-friendliness,

security, and maintainability. The results of this study contributed to enhancing the rationality and applicability of the development planned.

Table 5. Evaluation of Programming Languages

Design	Usability	Reliability	Security	Maintainability
Design A	4	3	4	4
Design B	3	3	2	3
Design C	4	4	4	4

Design C stands out as the preferred choice for building web applications due to its excellent performance in usability, security, and maintainability. It offers a highly intuitive and user-friendly experience, ensuring smooth navigation and interaction for users. Design C also prioritizes robust security measures to protect user data and maintain the confidentiality and integrity of the application. Additionally, it emphasizes maintainability, enabling easier management and future updates. In comparison, Design A and Design B had lower ratings in these key factors, making Design C the optimal choice for a web application that excels in user experience, security, and long-term management.

Multiple Design

The Sustainable Development Office monitoring system consists primarily of database-driven modules that were used to store, process, and present data. These modules had been utilized by stakeholders, including the offices from Batangas State University, as well as the Sustainable Development Office. To cater to the needs of both user groups,

the monitoring system includes a total of eight (8) modules, which are illustrated in Figure 5 using a blocked diagram.

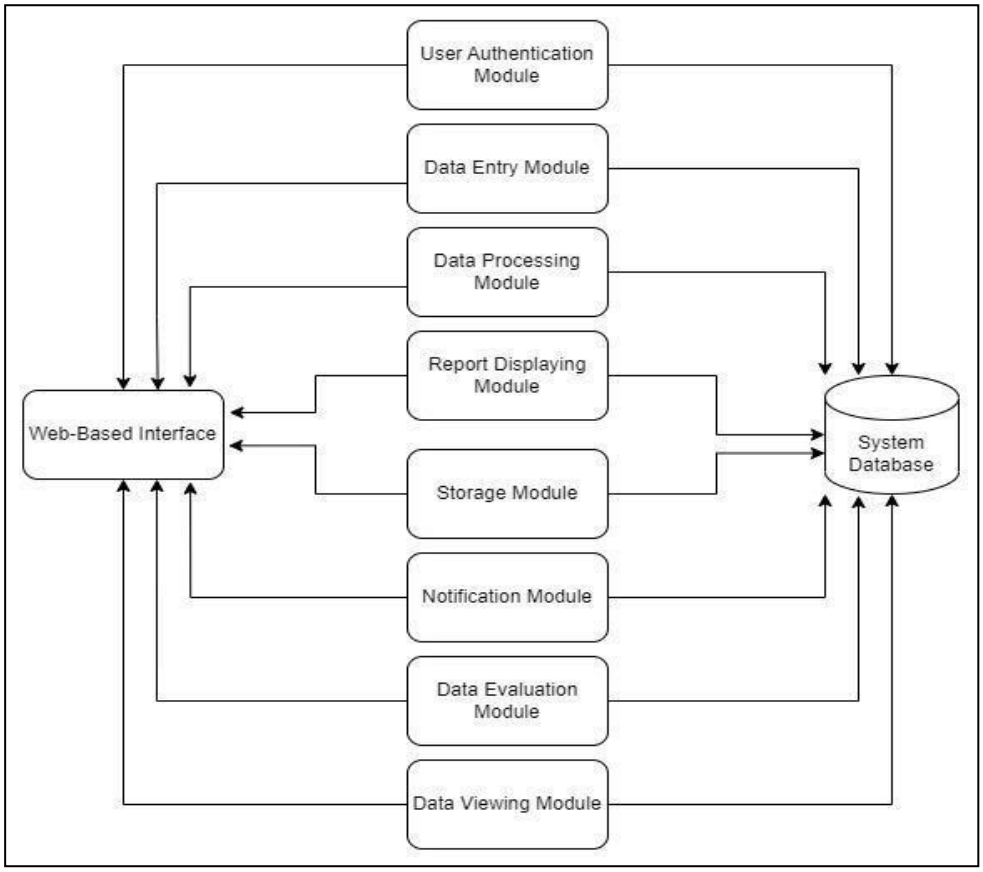

Figure 5. System Modules

As observed in the block diagram, the dashboard has eight (8) modules. Each module is created and designed according to the functions described below

1. The user authentication module is responsible for authenticating the user's identity by verifying their credentials, such as their username and password. Its primary function is to grant access to the system if the credentials are valid. Once authenticated, the user may be granted access

to certain features and databased on their roles or permissions on the system.

2. Data entry module is a component of a system that allows users to input data, either manually or imported from external sources. The entered data is then processed by other system modules and can be displayed on a dashboard, which provides a visual representation of the processed data and insights to the user. The data entry module is a critical element in any system that requires user input of data, such as data management or analysis systems.

3. Data processing modules were responsible for performing crud (create, read, update, delete) operations on stored databases, processing and computing the data, and automating certain processes. The resulting data was then displayed on a dashboard in the form of graphs and charts, providing a visual representation of the processed information. These modules played a crucial role in any system that requires manipulation and analysis of large amounts of data, such as data management or analysis system.

4. The report displaying module was a crucial component. Its main purpose was to present all pertinent data that had been processed by the system, in a manner that was easily understood by the user through the dashboard. The module was capable of generating a variety of reports,

including summaries, detailed reports, and exception reports that were tailored to the user's specific requirements.

5. The storage module is an integral component of any system that requires data input and management. It was responsible for storing the data that had been inputted, ensuring that it was secure and accessible. The module includes a version-controlled system that safeguards against data loss, allowing users to access and recover previous versions of the data if necessary.

6. The notification module was responsible for providing feedback to users regarding data input accuracy and reminding them to input data within a certain timeframe. It also disseminates important information or announcements to different offices or users.

7. The data evaluation module was responsible for verifying and validating data that was stored in the system. Before processing the data, the module checks for accuracy and consistency to ensure that it meets the system's requirements. Once the data had been evaluated and verified, the module could provide feedback or notifications to users who input the data to inform them of any errors or issues that may need have be addressed.

8. The data viewing module provides users with access to raw and unprocessed data, enabling them to check their progress or contributions

to the system. It includes features such as filtering and sorting, as well as the ability to export or download the data for further analysis.

Security

The Sustainable Development Office Dashboard was designed with security in mind and specific measures were taken to ensure its safety and reliability. The development team implemented a Role-Based Action Control method for authentication and authorization. This method was chosen for its effectiveness in providing secure access control to the dashboard's features and functionality. By utilizing this method, the development team aimed to safeguard the dashboard against unauthorized access and potential security threats.

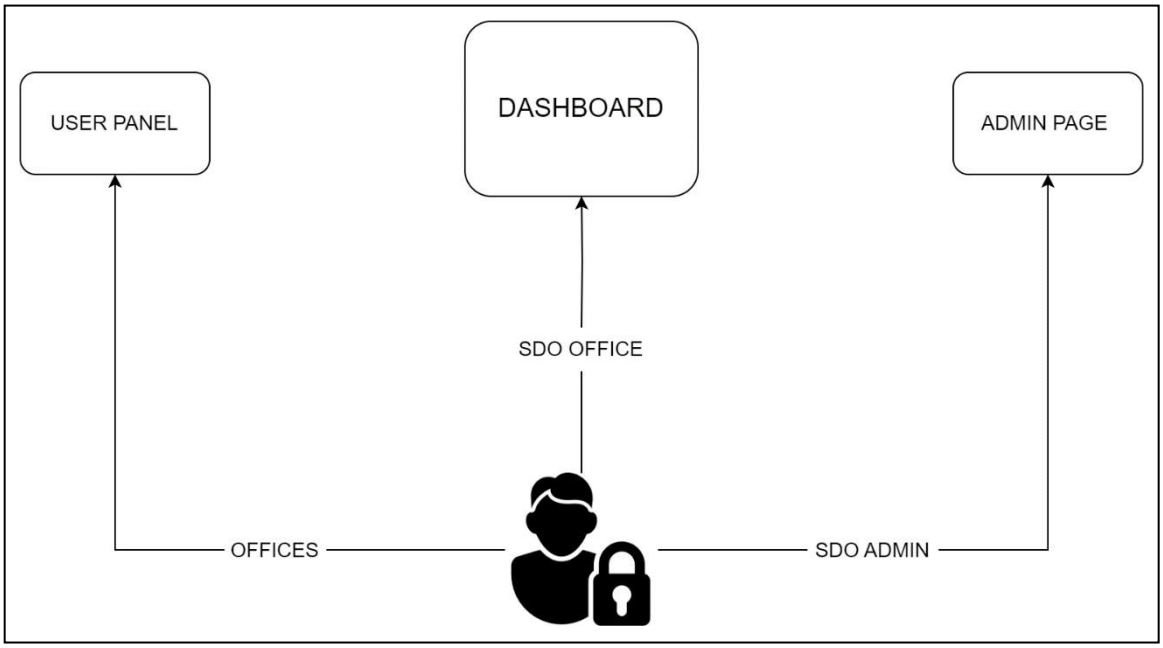

Figure 6. Role Based Action Model

The system's model ensures that users are authorized and granted access based on

their designated roles, achieved through the use of RBAC. This mechanism limits users, including those in SDO, and BatstateU – TNEU campuses offices, to accessing only the relevant resources and functionalities necessary for their job responsibilities. As a result, the security and integrity of the system are maintained by preventing unauthorized access or data breaches.

Trade-Offs

It is important to balance the advantages of more accurate, timely and easily accessible data with the costs involved in developing and maintaining such a system as well as protecting users' privacy when setting up an SDG Dashboard for Data Collection and Reporting. In order to ensure data accuracy and the functionality of the system, the SDG Dashboard requires significant upfront investment and ongoing maintenance in order to streamline the data collection and reporting processes. Moreover, given the greater complexity of these systems which may require special training and technical expertise to be applied effectively, there might also be trade- offs with regard to user accessibility. Furthermore, resources and expert knowledge to safeguard sensitive information as well as compliance with data protection legislation may be needed in order to ensure the security of personal data and user privacy.

System Design / Architecture

To illustrate how information was conveyed through symbols in the sustainable development goal monitoring system, figure 7 visually depicts the procedures involved in collecting, processing, storing, and sharing data within the system and between its

components. With this, there was an easy understanding of the flow of data and the system itself.

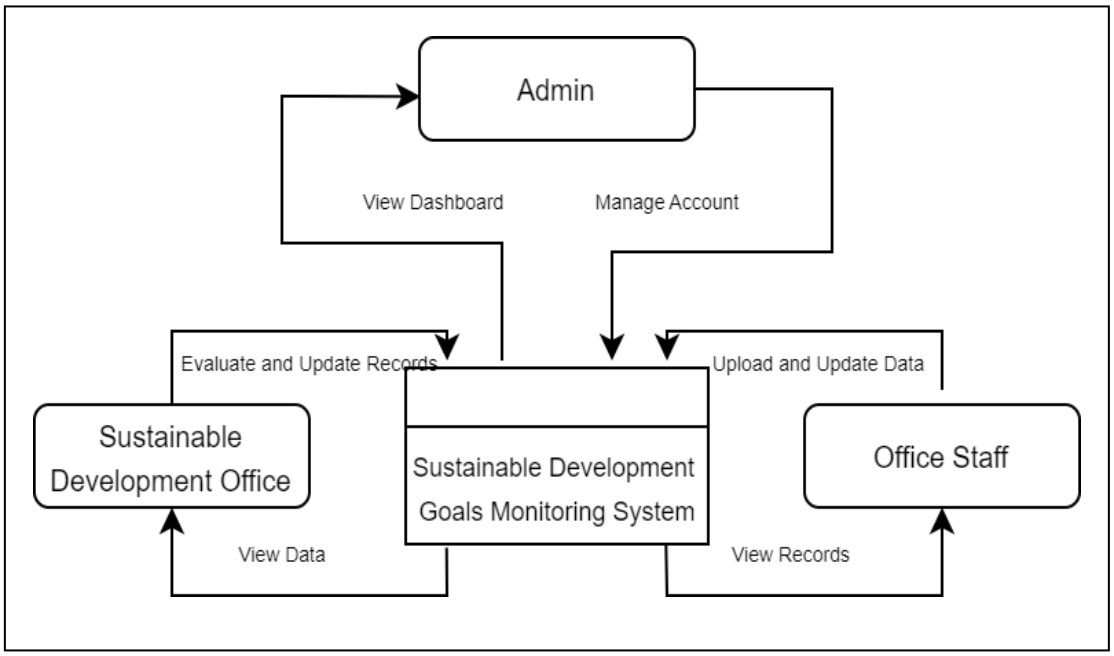

Figure 7. Context Diagram

The figure above provides a brief illustration of how the Admin, SD officer and office staff interact within the system. The admin was responsible for managing all accounts and had the privilege of accessing the dashboard. Likewise, the SD officer was empowered to evaluate and update records, with access to view the data uploaded by the office staff. On the other hand, the office staff was capable of uploading and updating data, and they were granted the ability to view their own records stored in the system.

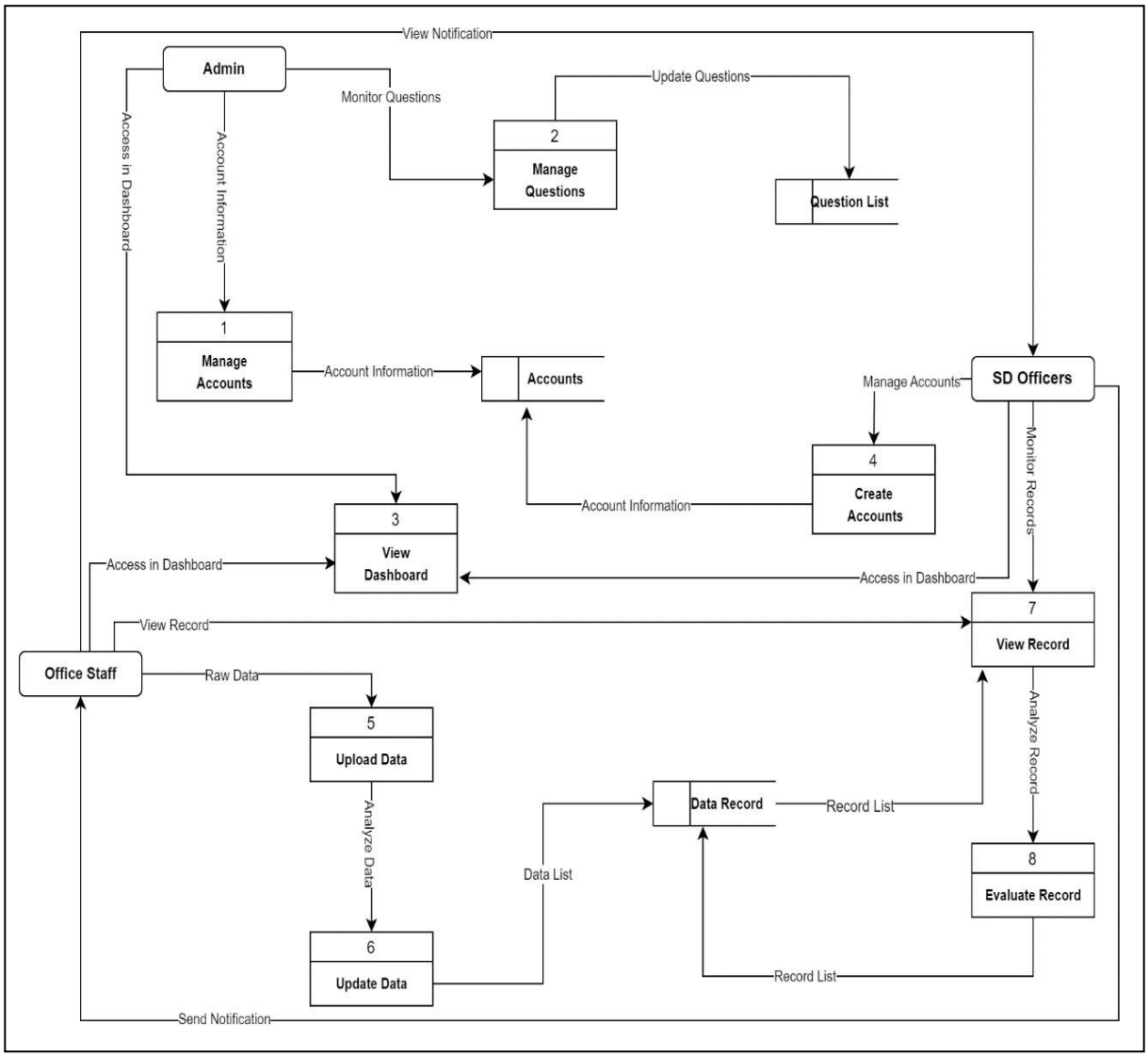

Figure 8. Level 0 Diagram

Figure 8 shows the Level 0 DFD of the system. It illustrates the interface between the developed system and the users in a concrete way. Furthermore, data flow diagrams, abbreviated as Level 0 diagrams, were used to show major processes. The level 0 diagram process flowed and how data flowed from the user to the database, as well as the entities involved in the process. This system visually illustrates the flow of actions for the admin in managing user accounts and accessing the account database. For the SD officer, it

showcases the processes of creating an account, saving it directly to the database, evaluating records, and sending notifications to the office staff. The office staff could observe the flow of actions for uploading data, updating data, and saving it directly to the data records database. It also demonstrates how the office staff received notifications from the SD officer.

Link Architecture

Figure 8 illustrates the link architecture, which outlines the roles and functions of different users such as SDO and Offices. This diagram serves as a foundation for constructing the system's flow and how information is exchanged between the two users.

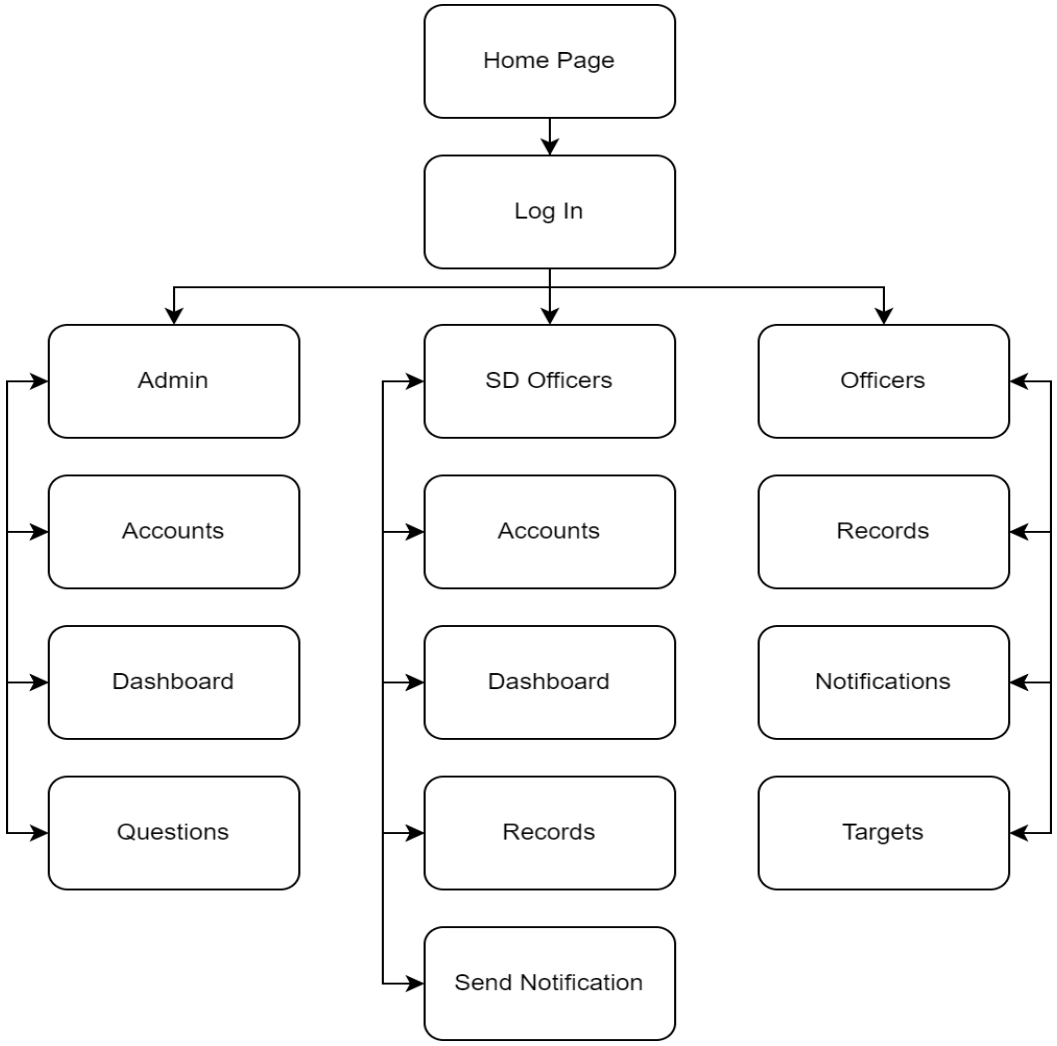

Figure 9. Link Architecture

The figure illustrates the link architecture, that presents the SDO role and function to the system. The SDO's role is to keep the dashboard organized and accessible to the user. Also, the SDO is responsible for checking and verifying all the data uploaded by the Offices. On the other hand, the offices are responsible for inputting a report on the dashboard that is related to the SDG.

Use Case Diagram

The use case diagram provides an overview of the possible interactions between the identified actors and the system. It describes what the sustainable

development goal monitoring system did and how the users would utilize it.

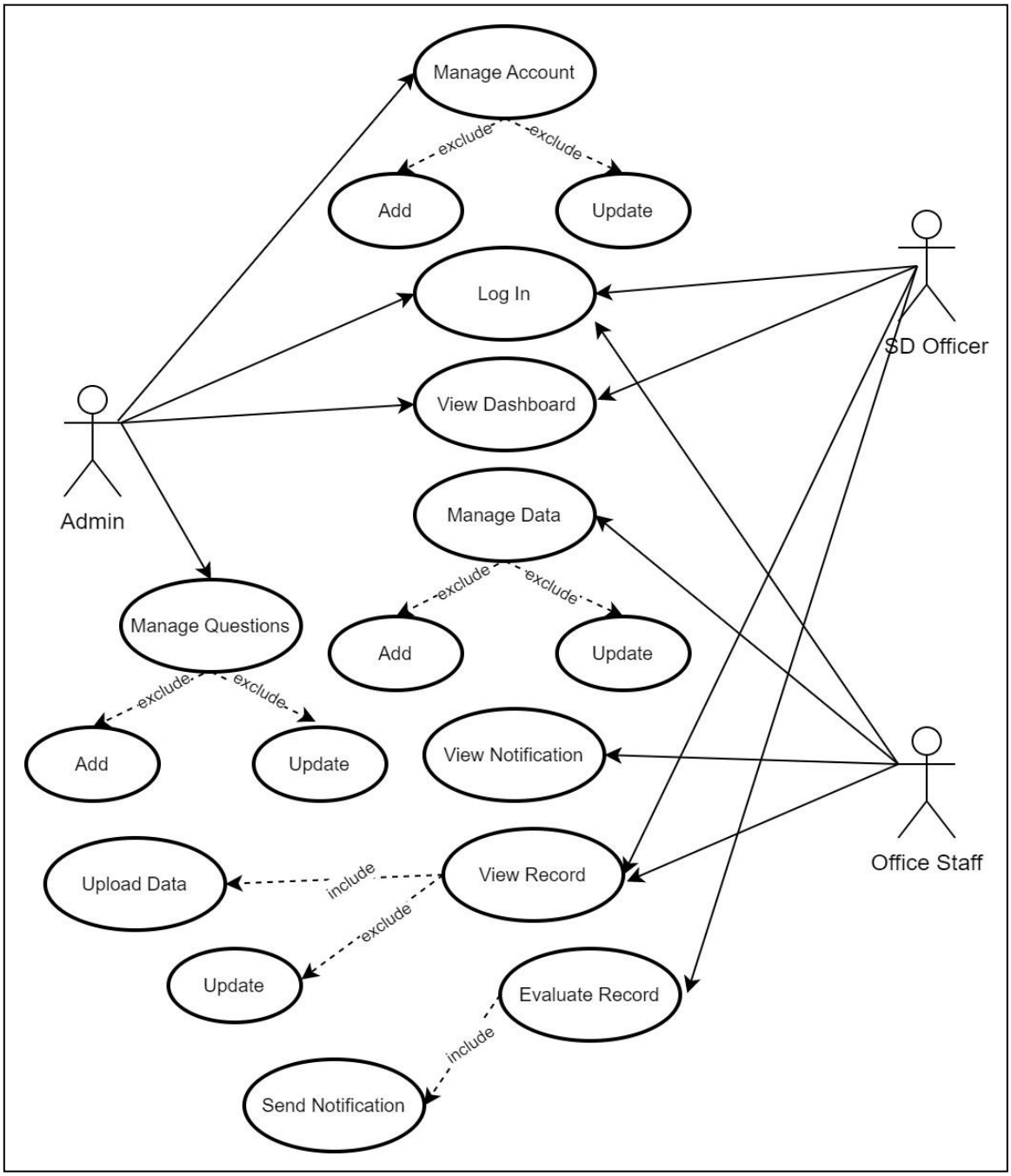

Figure 10. Use Cases

In Figure 10, there were three users and proposers of the system: the admin, the SD Officer, and the Office Staff. The admin had the capability to manage all the accounts

within the system, including those created by the SD Officer for the Office Staff. They also had the authority to access the dashboard and control the questions that the office staff could use as references when uploading data. The SD Officer had the ability to log in to the system and create accounts for the Office Staff. They could also view the dashboard, and records, evaluate the data, and send notifications to the office staff confirming the validation of their uploaded data.

On the other hand, the Office Staff could log in to the system and manage the data by adding or updating it. They could view their records within the system and receive notifications when the data they had uploaded was validated.

Sequence Diagram

The sequence diagram of the study serves as the system's flow of processes that have been performed by the declared objects, namely the SD Officer and the office staff. Based on the diagram, the sequences were organized according to time, progressing as a user navigates a page. With this, users were guided in understanding the order of operations when operating the system.

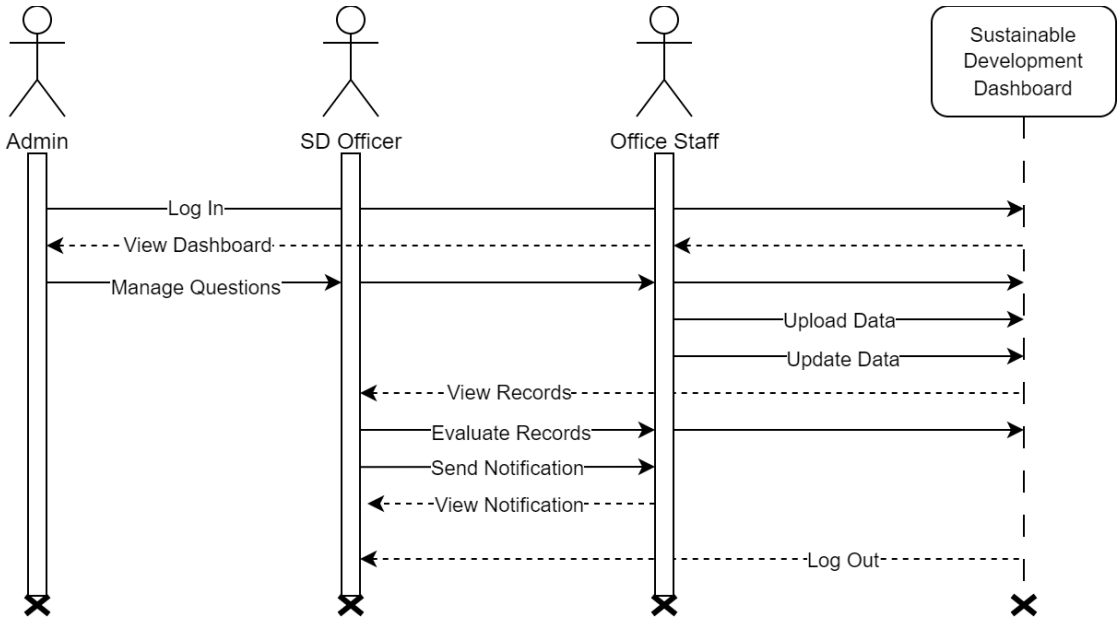

Figure 11. Sequence Diagram

Figure 11 depicts a sequence diagram involving three actors: the Admin, the SD Officer, and the Office Staff. All three actors could log in to the system. The admin's role was to maintain a user-friendly dashboard and manage the questions related to the section where the office staff uploads data. The admin had the authority to oversee all system functionalities. Both the SD Officer and Office staff could view the records. The Office Staff was responsible for uploading and updating data. Once the data is uploaded, the SD Officer evaluates the records and sends a notification to the Office Staff indicating whether the uploaded data is valid or not. If the data was deemed invalid, the Office Staff received a notification from the SD Officer, and the records were not saved in the system. Both the SD Officer and Office Staff could log out of the system when necessary.

Database Design

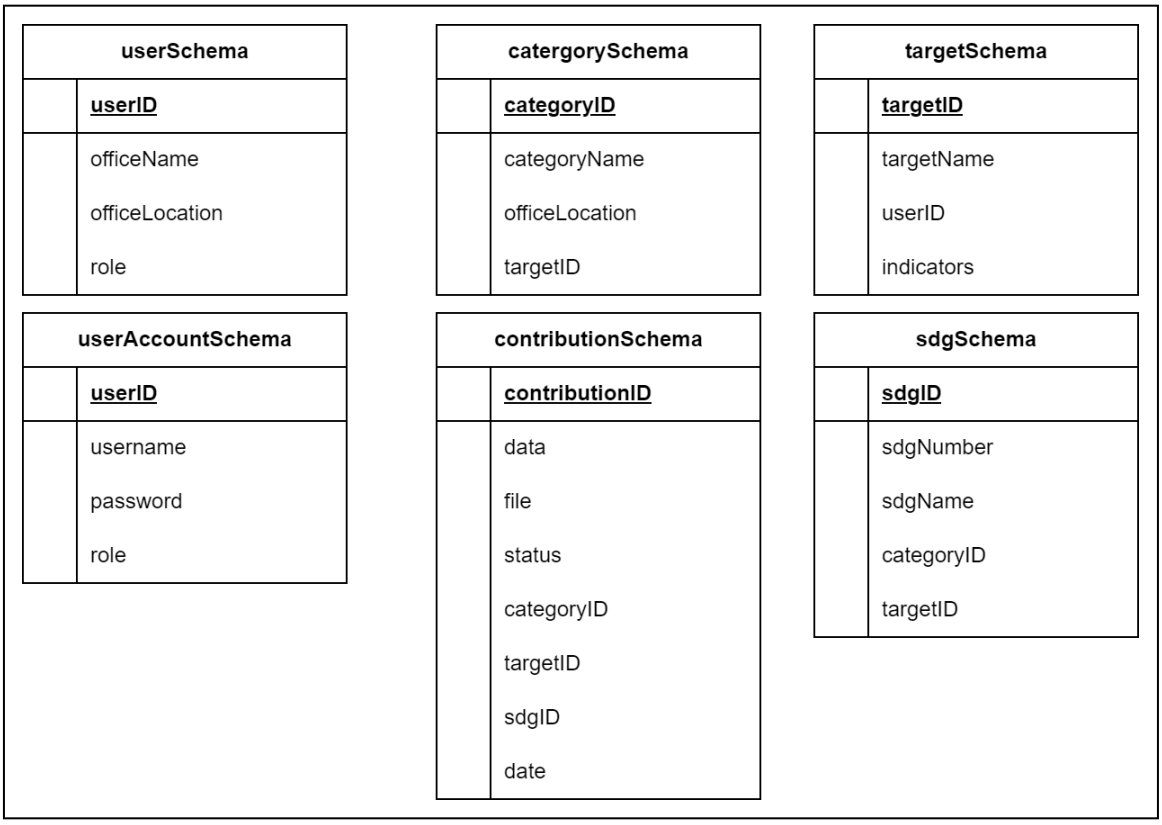

Figure 12. Database Design

In Figure 12, the proponents implemented six different schemas to effectively organize and manage the data. The first schema, "Office and Role," serves as a central repository for storing information about all the offices and their respective roles within the system. This schema allows for easy identification and association of users with their corresponding offices and roles. The second schema, "User Account," focuses on storing user account information. It provides a structured format for capturing details such as usernames, passwords, and other relevant account data. This schema facilitates secure and efficient management of user accounts across various offices.

To categorize and classify different aspects of the project, the proponents implemented the "Category" schema. It enables the organization of project-related information into distinct categories, allowing for easier navigation and retrieval of data. The "Target" schema played a vital role in tracking and monitoring the objectives set by the offices of Batangas State University. It provides a mechanism to define and store the necessary targets that have been accomplished by each office within the project. This schema helps in measuring progress and ensuring that the goals are met.

In alignment with the sustainable development goals (SDGs), the proponents had implemented the "SDG" schema. This schema allows users to indicate their contributions towards specific SDGs. It captures the information about the SDGs users had contributed to, creating awareness and accountability towards sustainable development. Finally, the "contribution" schema was designed to store the contributions made by each campus or office. It serves as a repository for recording and tracking the specific contributions made within the project, providing valuable insights into the overall progress and impact of the project

One notable aspect of the design was that it deviates from traditional relational databases by adopting a NoSQL approach. Unlike relational databases, NoSQL databases such as PostgreSQL did not rely on a fixed schema or enforce the use of primary keys and foreign keys to establish relationships between tables. Instead, NoSQL databases

offered a flexible, schema-less structure that allows for dynamic data modeling and scalability.

Software

The proponents selected the Windows Operating System as the software used in this study. This system software was responsible for managing computer hardware, and software resources, and providing essential services for computer programs. In essence, it serves as an interface between the user and the hardware of the computer, facilitating communication and managing the execution of various types of programs. The monitoring system for sustainable development objectives was created to be compatible with any Windows-based device, ensuring broad compatibility. Ideally, it should work with Mac, Linux, Windows 7, or newer versions of these operating systems. It means that users may access and utilize the monitoring system used on any device as long as it is suitable.

Furthermore, the proponents designated the client-side script as JavaScript since scripts written in this language could be embedded in HTML pages. Additionally, proponents believed that JavaScript provides many options and makes interactive and dynamic features for HTML elements, providing functionality to the system. Moreover, the React JS framework was used in the development of interactive user interfaces and components of the dashboard. It used a component-based approach where each component was reusable, ensured faster rendering times, avoided redundancy, and

improved code organization and maintenance. Consequently, sass was used as a preprocessor scripting language and it was also written in the CSS file format and was fully compatible with all CSS versions. The sass generates a CSS file the system could utilize when changes are saved. Since it could communicate with PostgreSQL databases, it was used as the database of the system where data was stored and managed.

Web Platform

The proponents utilize a web platform that enhances technology collaboration. This requires using web browser capabilities that were the primary tool to access and view a website. In order to interact with the platform, and access its features, functions, and content, users could use any compatible web browser. The researcher used VS code, a comprehensive set of tools and functionality that helped to write, edit, and debug codes. In collaboration, one could achieve productivity through a web browser and Visual Studio Code, easy to interact with the website platform, it made a friendly user interface and ensured the efficient workflow for the development.

Database

The database used by the researchers is PostgreSQL, a highly flexible and powerful relational database management system. PostgreSQL's robust indexing capabilities and structured data storage, involving tables, attributes, and dimensions, provide an organized and reliable approach to managing project data while ensuring data integrity. The SQL language integrated into PostgreSQL plays an essential role in establishing and

maintaining relationships within the system. It supports data integrity constraints, joins, transactions, and data modeling, all of which are crucial for maintaining data consistency and facilitating complex data queries. PostgreSQL's transaction support ensures that operations affecting multiple related tables occur reliably and consistently. This comprehensive feature set makes PostgreSQL an excellent choice for a project that demands well-structured data and efficient relationship management.

Subscriptions

In order for the system to have been deployed properly on a web browser, there are necessary subscriptions needed for fulfillment that are considered the hosting and the database. For the hosting, the researchers subscribed to Netlify and Vercel which provided a database to store various data, a server and hosting for publishing the web app, and a domain for its address. Lastly, the researchers subscribed to PostgreSQL for the database of the system to maintain reliability and efficiency for storing and managing the data. Furthermore, subscriptions were essential overall and contributed to the successful operation and function of the system.

Data Gathering

Primary sources of information include the offices of each department. The collected information would then be categorized into two types namely Direct Data, and Indirect Data. Direct assessment refers to an approach that involves collecting data by having user directly demonstrate their knowledge, skills, or behaviors. The data would be based on offices that upload raw data or report in the dashboard. On the other hand, the primary

source of an indirect assessment of the findings is the progress of each SDG, monitoring of sustainability achievements, and visual representation of data highlighting areas of improvement and success through collected reports all of this is visualized on the dashboard.

Deployment Plan

The deployment plan for the system is shown in Table 3. This is the step-by- step guide used to ensure that the final step shall be performed.

Table 6. Deployment Plan

Task Name	Duration	Baseline Start	Expected Start	Actual Start	Expected Finish
Data Gathering	15 days	03/12/21	03/10/21	03/12/21	03/27/21
Analysis	15 days	03/28/21	03/28/21	03/28/21	04/12/21
Planning	20 days	04/14/21	04/13/21	04/14/21	05/04/21
Designing	21 days	05/05/21	05/05/21	05/05/21	05/24/21
Development	182 days	06/01/21	06/01/21	06/01/21	11/30/21
Testing	10 days	12/01/21	12/01/21	12/01/21	12/11/21
Quality Assurance	10 days	12/12/21	12/13/2021	12/12/21	12/22/21
Release	1 day	12/22/21	12/22/21	21/22/21	12/23/21

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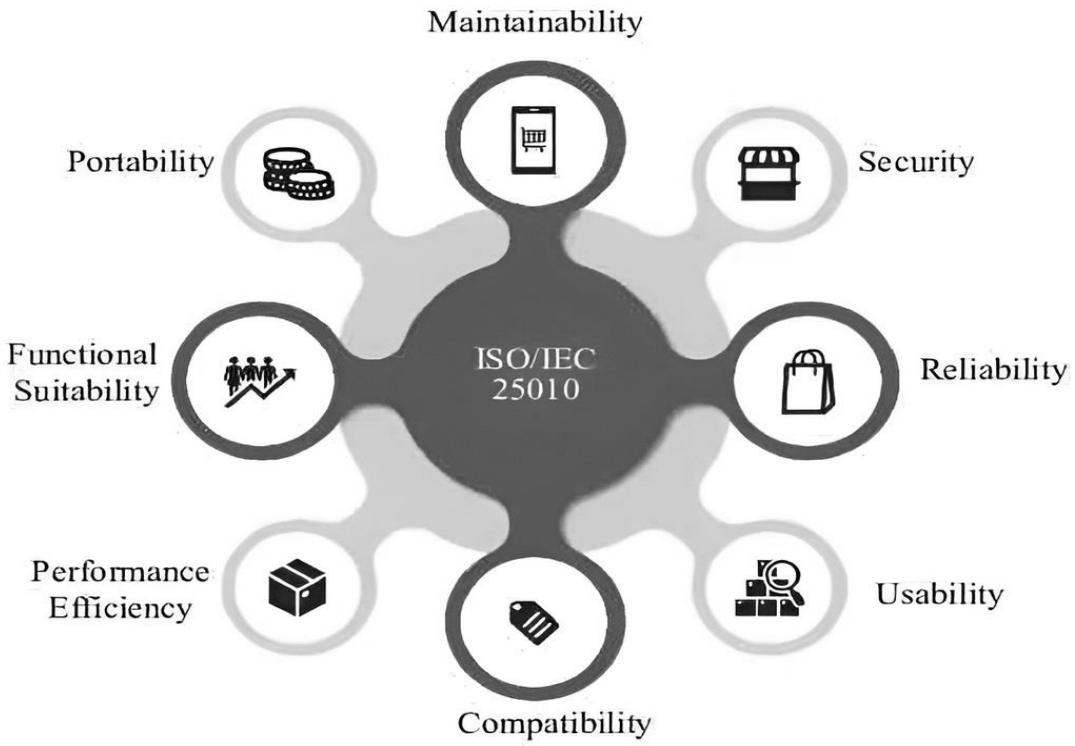
Planning	20 days	04/14/21	04/13/21	04/14/21	05/04/21
Designing	21 days	05/05/21	05/05/21	05/05/21	05/24/21
Development	182 days	06/01/21	06/01/21	06/01/21	11/30/21
Testing	10 days	12/01/21	12/01/21	12/01/21	12/11/21
Quality Assurance	10 days	12/12/21	12/13/2021	12/12/21	12/22/21
Release	1 day	12/22/21	12/22/21	21/22/21	12/23/21

The development plan is based on the scrum process diagram that includes several sprints that are scheduled to be a guide in the development of the system. The table shows how long it will take, baseline start, expected start indicates when to start, actual start when the task actually started, and finally expected finish of the tasks. This includes data gathering, analysis, planning, designing, development, testing, quality

assurance, and release.

Testing

The researchers used the ISO 25010 this serve the evaluation of the system quality was guided by a set of criteria that determined its performance. The system expected to function properly and meet the specific requirements and functionalities.



Source: https://www.researchgate.net/figure/ISO-IEC-25010-Software-Quality Model_fig1_363736843

Figure 28. ISO 25010: 2011

Figure 11. ISO 25010 The standard ISO 25010 provides for the definition of eight key

quality characteristics in software products. Maintainability, which deals with the ease of modification, repair and adjustment of software, is a one of the keys characteristics. Security, includes the protection of software systems and their data from unauthorized access. The third characteristic is reliability, which refers to the ability of a software product to operate its expected functions with accuracy and consistency over time. Usability ensure that users are able to use the software in an easy and effective way for achieving their objectives. Compatibility is an indication of system's ability to work and be compatible with different systems, platforms or environments. Performance efficiency focuses on optimizing resource usage to ensure the software performs effectively. Lastly is the portability the ability to easily migrate and adapt to a variety of platforms. Furthermore, ensures that the deployment and use of software is successfully achieved.

Testing Procedures

Testing procedures are essential for assessing the quality and efficiency of a system and determining if it meets the expected requirements. They encompass a comprehensive set of activities designed to verify various aspects of the system in terms of performance and functionality. These procedures aim to ensure that the system can consistently deliver a smooth and responsive user experience, even during periods of peak usage. The steps involved in testing procedures include:

Maintainability Testing

This test was executed to ensure the system's ability to be easily maintained and supported in its life cycle. The aim of maintaining ability tests is to ensure that system

can be continuously updated, improved and maintained by the development team or other stakeholders. This test was executed to ensure that the various declared functions.

Security Testing

This test was executed to ensure to protect the system from unauthorized access and other potential security risks.

Reliability

This test was executed to check to assess any potential issues or weaknesses that may give rise to system malfunctions, crashes and errors in order to make sure the system is capable of meeting scheduled reliability requirements.

Usability Testing

This test was executed to ensure that systems are user friendly and intuitive. Users are capable of navigating and interacting with this system as well as assessing their overall satisfaction and ease of use.

Compatibility Testing

This test was executed to ensure whether the compatibility of a system or application with different operating systems, browsers, devices and other system components shall be determined. To make sure that you are perfectly compatible, this test looks at the system's performance and functions in different configurations.

Performance Efficiency Testing

This test was executed to examine whether the system can meet performance and expectation levels in terms of speed, processing time and efficiency. For the

purpose of identifying any performance constraints or limitations, it shall assess factors like response time, processing capacity and resource consumption.

Functional Suitability Testing

This test was executed to ensure that the system is perfectly and permanently in compliance with the relevant operational requirements. The aim is to determine whether the functionality of a system may be impaired by deficiencies, errors or inconsistencies that might put its intended purpose.

Portability Testing

This test was executed to examine the assess the capability of a software system to be easily transferred and adapted to different environments or platforms. It is aimed at identifying all compatibility problems or dependency issues that could affect the system's portability.

Maintenance

Maintenance procedures are crucial for assessing and maintaining the quality and efficiency of a system, ensuring that it continues to meet the expected requirements. These procedures involve a set of activities focused on verifying and sustaining different aspects of the system's performance and functionality. The primary goal is to ensure that the system consistently delivers a smooth and responsive user experience, even during peak usage. The steps involved in maintenance procedures typically include:

Regular Monitoring. This is conducted to regularly monitor the system's performance in order to identify areas where problems occur or which parts need

improvement. This step involves ongoing assessment and evaluation to gain insights into the system's behavior and ensure its optimal functioning.

Troubleshooting. It is performed whenever there is a system issue, encompassing both hardware and software aspects. It follows a structured procedure of identifying, analyzing, and resolving problems with the aim of restoring the system's functionality and performance.

System Updates are performed promptly to assist stakeholders whenever there is a necessary software update that could potentially cause delays in their processes. The purpose of these updates is to ensure that the software stays current with the latest features, security patches, bug fixes, and performance improvements.

Risk Management Plan

Risk encompasses potential events that can transpire unexpectedly, exerting a substantial influence on desired outcomes or objectives. These uncertainties encompass both threats and opportunities, necessitating proactive management to mitigate unfavorable consequences and leverage advantageous outcomes. Hence, the presence of a comprehensive risk management plan becomes paramount in effectively identifying, assessing, and addressing risks. This ensures that organizations possess the necessary tools to navigate uncertainties, enhance resilience, and foster overall success.

Internet Loss. The loss of internet connectivity for web-based dashboards can have adverse consequences, such as restricted access, challenges with data synchronization, limitations in functionality, data vulnerability, and restrictions in offline capabilities.

These effects can impede users' ability to obtain real-time information, compromise decision-making processes, jeopardize data integrity, and limit the overall usability of the dashboard.

Human Error. Human errors pose significant risks to the dashboard as they can result in severe impacts. These errors typically arise from incorrect data entry, misconfiguration settings, and insufficient user training. When human errors occur, they have the potential to undermine the accuracy and reliability of the dashboard's data, which, in turn, can lead to flawed analysis and decision-making processes.

Incompatibility. Incompatibility is a substantial risk that arises as technology progresses and programming languages, as well as related technical tools, evolve. Each new update or release of these tools introduces uncertainty regarding their continued support and integration with the dashboard.

Security Problem. Security is a significant risk for dashboards due to the presence of sensitive information, making it crucial to address security concerns adequately. Implementing improved security measures, including encryption for sensitive data, secure authentication protocols, access controls, and user training on security best practices, can help mitigate security risks and protect the integrity of dashboard data.

System Runtime Error. It poses a risk that can disrupt the normal operations of a dashboard. These errors can significantly impact the performance, functionality, and integrity of the software. Various factors can contribute to runtime errors, including software bugs, memory issues, problems with the hosting environment, and more. Resolving these errors requires thorough debugging and analysis to identify the

underlying causes and implement appropriate fixes. By addressing runtime errors, organizations can enhance the stability and reliability of their dashboard, ensuring smooth and uninterrupted operations.

Data Loss. Data loss is a critical risk that can have detrimental effects on a dashboard. It occurs when data is unintentionally deleted or becomes corrupted due to factors such as viruses or faulty storage systems. Data loss can result in the permanent loss of valuable information, impacting the functionality and reliability of the dashboard.

Cyber Attack. It is a significant risk that can have detrimental effects on dashboards and their underlying systems. It involves malicious activities aimed at compromising the security of computer networks, systems, or data to steal or manipulate information, disrupt operations, or gain unauthorized access.

Natural Disaster. Natural disasters present a notable risk to dashboards, causing prolonged disruptions, especially in the absence of contingency plans. When a natural disaster strikes, it can result in substantial interruptions to the accessibility and functionality of the dashboard, impeding the organization's operations and decision-making processes. This can persist for one or more days, further exacerbating the impact on the organization.

Risk Matrix and Guide

A risk matrix is a valuable visual tool employed in risk management to assess and prioritize risks according to their likelihood of occurrence and potential impact. It enables organizations to categorize risks and determine which ones should be addressed as a priority for mitigation. By utilizing the risk matrix, organizations can

allocate resources effectively and develop improved risk management strategies. This aids in making informed decisions regarding risk response, such as implementing preventive measures, establishing contingency plans, or transferring risks through insurance. The risk matrix helps organizations proactively address risks, minimize their impact, and enhance overall risk management efforts, ultimately supporting the development of a robust risk management strategy.

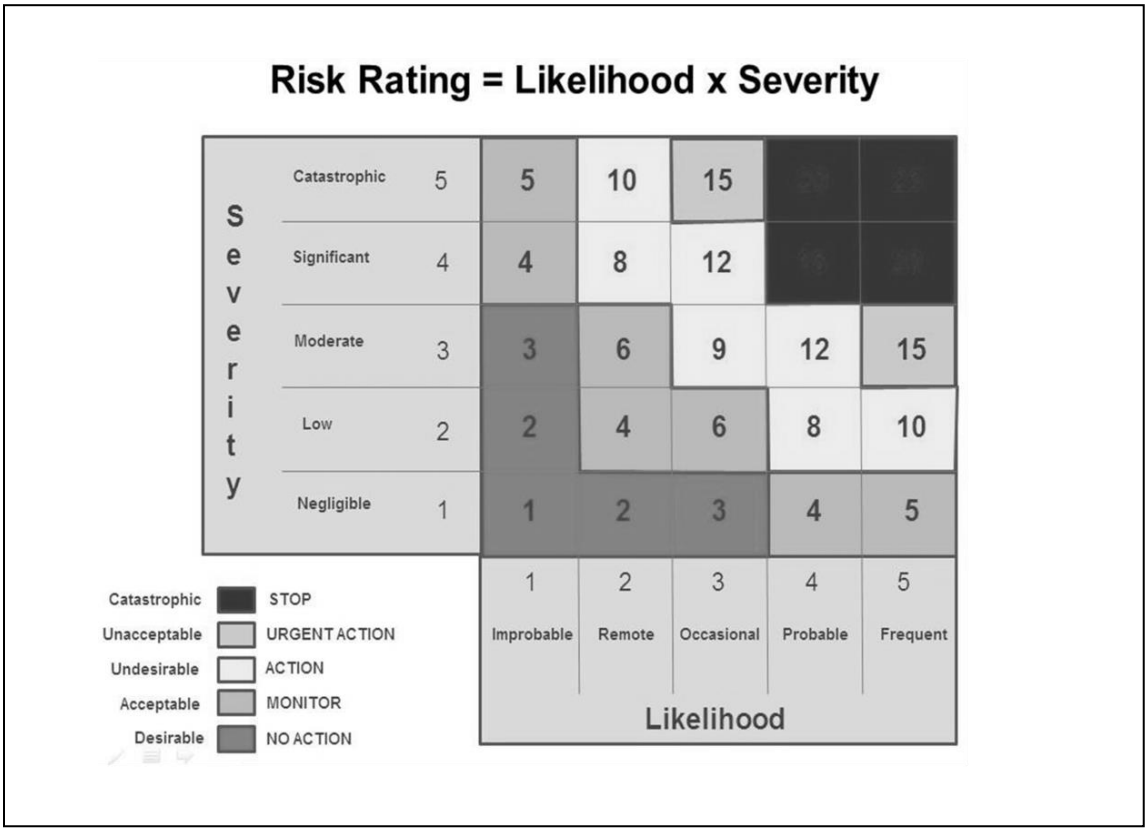


Figure 29. Risk Matrix

On the other hand, Table 4 provides a comprehensive overview of the risks that may have an influence on the dashboard, along with their corresponding risk ratings. The risk rating is determined using a formula that takes into account two key factors: the likelihood of the risk occurring and the potential impact it could

have. These factors are typically assigned numerical values and multiplied together to calculate the risk rating.

Table 7. Risk Matrix

ID	RISKS	SEVERITY	PROBABILITY	RISK RATING	RISK LEVEL
001	Internet Loss	3	3	9	Undesirable
002	Human Error	3	4	12	Undesirable
003	Incompatibility	4	2	8	Undesirable
004	Security Problem	2	2	4	Desirable
005	System Runtime Error	3	4	12	Undesirable
006	Data Loss	2	5	10	Undesirable
007	Cyber Attack	3	5	15	Unacceptable
008	Natural Disaster	3	4	12	Undesirable

Table 4 serves as a valuable resource for developers and stakeholders, presenting the recommended risk treatments for each identified risk. It offers practical guidance on implementing measures to address potential threats and reduce their impact on the system. The risk treatments proposed in the table are tailored to the specific risks and provide clear action plans for effective risk mitigation. By following these recommended treatments, the system can operate at its best, meeting user requirements and enhancing the overall user experience.

Table 8. Risk Treatment

ID	RISKS	RISK TREATMENT
001	Internet Loss	Troubleshoot by restarting both modem and router. This action can help resolve common connectivity problems and restore the internet connection
002	Human Error	Engage the services of a data analytics professional to address and resolve data related issues effectively.
003	Incompatibility	Ensure that the system meets the specific software and hardware requirements to guarantee accessibility.
004	Security Problem	Utilize reputable antivirus software programs that offer safety and protection against potential threat
005	System Runtime Error	Regularly updating computer with the latest software helps prevent known issues and vulnerabilities that can lead to runtime errors

006	Data Loss	Cloud backup services, such as Google Drive, are used for data protection and recovery of lost data. It securely stores data off-site, offers automated backups, and enables versioning and point-in-time recovery. Data protection and access will also be enhanced by Google Drive's smooth integration with the service, as well as its collaboration features and high level of security.
007	Cyber Attack	Enhance the security with strong, unique passwords, password management solutions and reliable antivirus software and Firewalls contribute to a more effective protection against cyber threats. Unauthorized access and compromise to sensitive information should be avoided.
008	Natural Disaster	Natural disaster can't control but to ensure the prevention the protocols for the recovery of data, restoring systems and communication with stakeholders in case of a disaster shall be set out. It is in order to ensure a systematic and coordinated response, minimizing interruptions and improving the recovery process.

In table 5. It shows how the proponents can manage and mitigate all identified risks

within a specific context. This includes taking action to reduce the impact of risks, transferring them to others, accepting risk with appropriate mitigation measures, or avoiding risks altogether. It may involve implementing measures to minimize risk mitigate potential impacts, such as Human error, System runtime error, Cyberthreat, Data lost, Incompatibility, Natural disaster, Bottle necking, Loss of internet and Web traffic. The objective is to find effective and efficient approaches to risk management that lead to optimal outcomes. Consequently, the responsibility falls on the risk owners, as indicated in Table 6, to promptly identify any changes and apply the prescribed countermeasures without delay.

Table 9. Risk Ownership

ID	RISK	OWNER
001	Internet Loss	Justmyr D. Gutierrez
002	Human Error	Crystal Kaye L. Ambrocio
003	Incompatibility	Justmyr D. Gutierrez
004	Security Problem	Erica Jane F. De Guzman
005	System Runtime Error	Justmyr D. Gutierrez
006	Data Loss	Erica Jane F. De Guzman
007	Cyber Attack	Justmyr D. Gutierrez
008	Natural Disaster	Crystal Kaye L. Ambrocio