CocoLytics: A Mobile Web Application for Coco Lumber Production and Inventory Monitoring with Data Analytics

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Chapter I

INTRODUCTION

Project Context

Here palm lumber industry, such as coconut lumber production, continues to be a significant source of income for the construction, furniture, and livelihood industries in specific provinces across the country. Coconut timber is weak due to being a softwood (compared to top hardwoods), and it has been used extensively in affordable housing, small commercial properties, and craft industries. Also, beyond the economic worth, there are thousands of small to medium-scale enterprises (SMEs) that are supported by the sector, as well as jobs in communities where coconut is produced. Although significant, the production practices of many coconut lumber operations continued to be conventional, particularly in terms of production monitoring, inventory management, and daily operation records.

Manuals are still being used in most coconut lumber companies, a pen and paper-based system with no standard format on how they keep logs of the raw material input vs. processing/finishing time/drying period/logging VA stock returns & dispatch notes or reports. These methods have served us well in

the past, but they are proving insufficient given modern production challenges. Manual intervention is slow, error-prone, and can lead to data loss, miscalculation, or late bouncing. These inefficiencies have a negative impact on production planning, inventory accuracy, and business performance as a whole, which prevents compensation from making the right decision at the right time.

Legacy monitoring slows getting to accurate operational insight by limiting visibility into the organization. What is more, manual bookkeeping does not often provide an accurate current state of raw materials availability, lumber cutting effectiveness, drying process dynamics (time and humidity), wood storage situation, and outgoing deliveries. Consequently, managers have difficulties determining current work-in-progress stock levels, forecasting future demand, pinpointing bottlenecks on the shop floor, and timely addressing breakdowns and maintenance. Smith (2020) and Koh & Hassim (2021) highlight that some industries are left with a higher operational cost, low inventory accuracy, as well as a lower level of customer satisfaction caused by the delayed response and even wrong data reporting, which tends to be inconsistent in nature.

Moreover, recent inventory models, including Dyshkantiuk et al. (2020), promote the digital platforms that can offer real-

time transparency in data, automated tracking, and minimize operational risk. These systems allow businesses to drive better accuracy, improve accountability, and make insight-based decisions. The risk that the coconut lumber companies face without digital transformation is inefficiency in operation, resulting in over-trading, under-trading, misuse of resources, and missed profitable market opportunities.

To overcome some of these challenges, the present study presents CocoLytics, a comprehensive web and mobile-based data analytics system specifically meant for coconut lumber production and inventory. CocoLytics' goal is to digitize and optimize the entire production process, starting with raw material intake and cutting performance up to drying, storage, and distribution. Through the real-time recording and updating of information, the solution will improve operational visibility, giving all parties in the supply chain access to real-time status updates at every stage of production from one central operating platform.

CocoLytics combines analyses and visualization dashboards with automated reporting to help managers and decision makers spot trends, find inefficiencies, and optimize production workflows. Key performance indicators such as production yield, inventory turns, drying efficiency, and delivery sbklu7e

schedules can be evaluated instantly. These functions allow managers to act, rather than react, which in turn increases operational effectiveness and resource utilization.

And the solution uses predictive analysis to help with demand and inventory planning. CocoLytics allows you to make predictions of inventory needs and schedule productions based on what is likely to sell because it examines historical production and sales as input data, which can result in overproduction or out-of-stock. Such predictive capabilities are important to limit waste, lower holding costs, and obviate customer dissatisfaction. Kambala (2020) and Foris et al. (2020) demonstrate the effectiveness of web-oriented approaches to improve visibility, scalability, and processing speed, stressing that system usability and performance are principal factors for user acceptance and satisfaction.

Trust and systems' reliability must also be taken into account when seeking to introduce digital technologies in long-established industries. Augustine and Adnan (2020) stressed the need to handle data securely, maintain consistency, and ensure that systems are reliable in order to gain trust from users. All these requirements are addressed by CocoLytics in a secure way through authentication, role-based access control, and

standardized reports (8^), bringing integrity and accountability of the data among different levels within an organization.

To sum it all up, CocoLytics is here to revolutionize the age-old coconut lumber industry with automation and live monitoring, and data-based inferences for production and inventory management. The included analytics, mobile access capabilities, auto documentation, and predictive models that the proposed system leverages create a structure for increased efficiency, transparency, and productivity. This study contributes to an emerging literature on digital transformation in resource-based sectors, illustrating how a well-fitted technology solution can improve operational efficiency and promote sustainability within the industry.

Objectives of the Study

Generally, this study aims to design and develop "CocoLytics," a centralized web and mobile system that enhances production monitoring, inventory tracking, and data analytics for coco lumber operations.

Specifically, it aims to:

1. Develop a centralized real-time platform for tracking coco lumber production and inventory levels from raw materials to finished outputs.

2. Integrate data analytics and visualization tools that offer insights on production efficiency, stock movement, demand patterns, and material wastage.

3. Automate reporting and documentation processes, including daily production logs, stock balances, and sales dispatches, to reduce human error and increase transparency.

4. Implement alert and notification mechanisms for low inventory, overstock, production irregularities, and supply delays to support proactive decision-making.

5. Provide a secure role-based access system to ensure controlled and specialized use for administrators,

warehouse personnel, production supervisors, and sales staff.

6. Develop predictive analytics models for forecasting inventory needs, optimizing schedules, and minimizing shortages or excess materials(evaluate the system).

Scope and Limitation of the Study

CocoLytics' efforts are dedicated to a digital monitoring and analytics platform tailored for Coco logging and stock management. The applications to be built will support different users, namely administrators, supervisors, storekeepers,, and sales staff, offering them real-time tracking tools with reporting as well as decision aids. Product features such as production monitoring, stock level tracking, automatic logs analytics dashboards, predictive modelling, and an alert system are what make the platform.

However, the system has several limitations. CocoLytics has been developed specifically for coco lumber operations and should not be applied to other lumber or agricultural products, unless modified accordingly. There are no financial accounting modules, point of sale transactions, payroll systems, or machinery maintenance scheduling in the software. Furthermore, although the portal allows multiuser access, it does not allow staff

accounts to delete important records in order to maintain data integrity. You will need access to the internet for the real-time syncing of data between devices; this could potentially be a con if you live in an area with limited connectivity. Furthermore, the accuracy of the prediction model could be influenced by the availability and quality of historical production data.

Significance of the Study

This study provides a valuable impact on different stakeholders:

Coco Lumber Enterprises. The system modernizes production and inventory processes, reduces delays, and supports more accurate operational planning.

Supervisors and Warehouse Staff. Workers gain reliable tools for daily monitoring, reporting, and decision-making, improving work efficiency and reducing manual workloads.

Customers. Improved inventory accuracy results in more reliable availability of products and faster processing of orders.

The Researchers. The study enhances technical competencies in system development, data analytics, and process optimization.

FutureResearchers. The project serves as a reference for studies exploring digital transformation in agricultural manufacturing and resource-based industries.

IndustryInsights. By demonstrating the benefits of transitioning from manual to analytics-driven systems, CocoLytics offers a framework that can guide modernization efforts in other traditional production sectors.

Conceptual Framework

This study's framework examines the connections between input, process, and output, all of which contribute to the desired results. The input phase includes various important factors that form the basis for analysis. The process involves strategically working through data and methods to turn inputs into a complete result. The output represents the outcome of the study, which includes the findings and conclusions. This framework ensures a systematic approach to achieving the study's objectives by clearly linking each phase to the overall research goals.
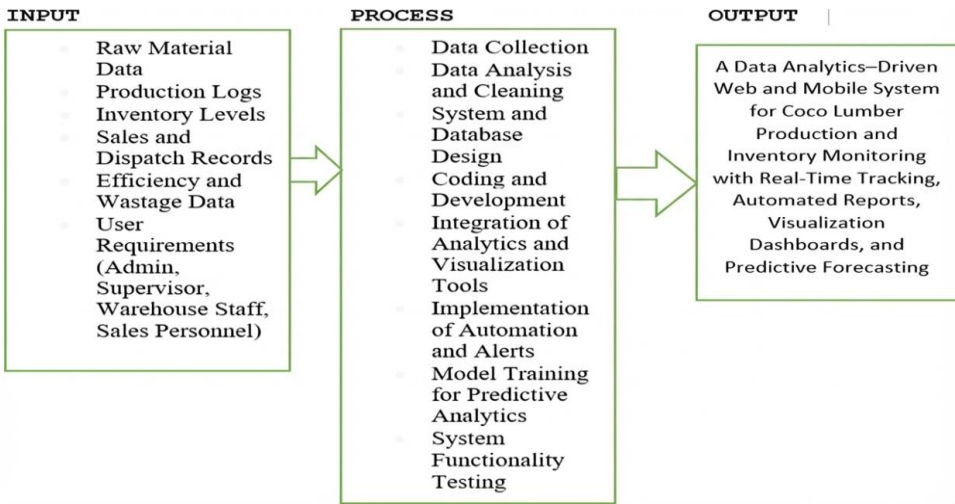
INPUT	PROCESS	OUTPUT
Raw Material Data Production Logs Inventory Levels Sales and Dispatch Records Efficiency and Wastage Data User Requirements (Admin, Supervisor, Warehouse Staff, Sales Personnel)	Data Collection Data Analysis and Cleaning System and Database Design Coding and Development Integration of Analytics and Visualization Tools Implementation of Automation and Alerts Model Training for Predictive Analytics System Functionality Testing	A Data Analytics–Driven Web and Mobile System for Coco Lumber Production and Inventory Monitoring with Real-Time Tracking, Automated Reports, Visualization Dashboards, and Predictive Forecasting

Figure 1. Conceptual Framework

Figure 1 presents the IPO model of the study's conceptual framework, centered on the development of CocoLytics, a data analytics-driven production and inventory monitoring system for coco lumber operations. The input consists of essential data—such as raw material logs, production outputs, stock levels, dispatch records, and user requirements—needed to design a system that reflects the real workflow of the coconut lumber processing.

The process stage begins with data collection and analysis to identify operational needs and inefficiencies. This is followed by system and database design, coding, and the integration of analytics tools for visualization and forecasting. Automation features, such as alerts and report generation, are also implemented. The system is then tested for functionality, accuracy, and usability.

The output is CocoLytics, a centralized web and mobile platform that provides real-time monitoring of production and inventory, automated documentation, analytical dashboards, notification systems, and predictive models for forecasting demand and optimizing production. This ensures improved

operational efficiency, transparency, and data-driven decision-making.

Definition of Terms

To ensure clarity and consistency, the following terms are defined as they are used throughout the study:

Analytics Dashboard.A visual interface that displays charts, graphs, and summary data to help users quickly understand production trends, inventory levels, and performance indicators.

Automation. The use of technology to perform repetitive operational tasks, such as generating reports or updating inventory, without manual intervention.

CocoLytics. The proposed web and mobile-based system is designed to monitor cocoa lumber production, manage inventory, and provide data analytics for informed decision-making.

Coco Lumber.A type of lumber produced from coconut trees, commonly used in construction, furniture making, and rural development projects.

Data Analytics. The process of collecting, analyzing, and interpreting production and inventory data to derive meaningful insights and support operational decisions.

Dispatch Records. Data logs documenting the movement of finished coco lumber products from the warehouse to buyers or delivery locations.

Inventory Monitoring. The tracking of available raw materials, semi-processed lumber, and finished products to maintain accurate stock levels and prevent shortages or overstock situations.

Predictive Analytics. The use of statistical and machine learning models to forecast future inventory demand, production needs, or market trends based on historical data.

Production Monitoring. The real-time tracking of the entire coco lumber production process, including cutting, drying, grading, and storage.

Raw Materials. Unprocessed coconut logs or components are used as the initial input for coco lumber production.

Role-Based Access. A security mechanism that provides different levels of system access depending on the user's role (e.g., administrator, supervisor, warehouse staff, sales personnel).

Stock Movement. The flow of materials or products from one stage to another (e.g., raw materials to cutting, finished products to warehouse storage).

System Notifications. Automated alerts informing users of low inventory levels, production delays, supply issues, or other important operational updates.

Web and Mobile Platform. A digital system accessible through both web browsers and mobile devices, providing users with flexibility in monitoring and managing operations.

Review of Related Literature (Foreign)

Data Analytics Driven Web and Mobile System for Coco Lumber Production and Inventory Monitoring

Increasingly, coconut wood and other non-conventional timber materials are being considered in many countries as the world becomes more aware of environmental protection, deforestation, and sustainable construction. The physical, chemical, and mechanical properties of coconut lumber are now being studied for its potential uses in timber structures, panels, and as reinforcement to matrix materials. Digital systems, data analytics, and advanced manufacturing processes are coming together to serve the demand for production efficiency, quality assurance, and supply chain optimization of coconut-derived end-products. In their study, they used a web and mobile system for the control of CC lumber production and stock in real time based on data to support sustainable buildings.

Wood is still an important resource for human society today, despite technological advances and the proliferation of substitutes. Recent research indicates that wood utilization should be improved because of rising environmental issues and greenhouse gas emissions. Material flow analysis (MFA), such as

wood flow analysis, has proven to be a powerful tool for mapping the dynamics of wood flow throughout supply chains, facilitating sustainable forest resources management and environmental decision making. Wood cascading, substitution effects, and energy recovery are some of the strategy tools that have been indicated in research for achieving higher efficiency in using wood, as well as longer life cycles of products and lower CO_2 emissions (Wang & Haller, 2024). In their research, a website and Android application were used for collecting MFA data in order to monitor output of cocoa lumber and stock position, which enables a computerized system approach to facilitate resource management efficiently.

Wang and Haller (2024) emphasized that utilizing standardized procedures, as well as consistent data collection, is essential to improve the reliability of wood-flow analysis and comparability between these, serving as additional evidence for possible innovations in timber management and construction activities. This expanding scope of research highlights the possibility of not only reducing environmental impacts but also contributing to improvement in the economic and structural efficiency within wood-based industries by exploiting resources related to timber. In their study, the authors used a web and mobile analytics software system to monitor data of cocoa lumber

production to enhance accurate deployment when an informed decision is taken.

Brischke, Haase, Bächle, and Bollmus (2023) discuss the statistical analysis of data on wood durability and effects for the standardization classification according to native European species. Their study is based on ML data of laboratory agar plate tests, where they investigate the effect of different statistical treatments for durability classes towards the EN 350 and EN 113-2 classifications. The latter refines measures of location, scatter's and concentration indicators to enhance their comparability and reliability for wood durability rating. Results indicate that wood durability differs among and within sapwood, heartwood, and juvenile wood, as well as between species; however, existing standards offer minimal assistance on sampling strategies and statistical analysis. They employed a Web and mobile-based systems for tracking and analysis of the durability data for the coco lumber inventory system, which enables automated statistical analysis, quality evaluation.

Performance assessment of coconut wood comes in Fathi, Hasanagić, Bjelić, and Bahmani (2023) through physical, chemical, and durability properties. They show that the density of coconut wood varies widely, while it has a very high moisture content with low shrinkage and swelling properties. Its chemical

composition is also studied, and its high contents of holocellulose and lignin that affect its structural properties are reported. It examines the susceptibility of the material to decay and termite attacks, and assesses how well anti-termite preservation is efficient, revealing that treated coconut wood has better durability and can suit structure or industrial applications. The authors web- and mobile-enabled a database of physical and chemical characteristics for real-time evaluation of treatment efficacy, and quality control.

Introducing Coconut Palm Wood: Applications and Product Potential for Asia Pacific Rooke (2025) analyzes the possibility of coconut timber as an alternative for the use of conventional wood-based products in the Asia-Pacific region. The research explores the utilization of coconut trees other than their fruit and leaf products, in particular stems which have been used for construction work, boat building, and various wood products. It focuses to the possibilities for bulk use of coconut timber in overcoming scarcity and exorbitant cost of conventional timber as well as putting up with old, unproductive palms. The findings show also a lasting versatile low cost and alternative to the use of upcountry/mountain hardwood for housing and construction. In this research, an Internet and mobile based system was developed

to monitor inventory levels and manage the production of coco lumber for sustainable large scale consumption.

Bawono, Bawono, Anggoro and Jamari (2025) discuss the possibility of using coconut coir fibers for preparation of boards in place of wood-based panels (WBPs) in order to overcome menace and sustainability issues related with deforestation. The authors investigated mechanical and chemical properties of coir fiber, such as tensile strength, lignin content, density, water absorption; pre-treatments and adhesive systems used for the production of WBPs were examined. They gain insights into the limitations of existing commercial take-up, including problems associated with using bio-adhesives and process conditions. The results suggest that coir fiber could be a potential substitute to wood in respect of both tensile strength and density, although its high water uptake as well as limitation in adhesion require special treatment for an industrial application. In their study, production and stock data of coir fiber were controlled in a web /mobile-based system providing online analysis for raw materials as well as process efficiency.

Jia, Paudel, Lim, Srivaro (2025) analyse the prediction of the embedment strength of coconut wood for dowel-type timber connections using empirical and statistical models. Their paper investigates the mechanical performance of coconut wood

considering different dowel diameters and loading directions through single variety, multivariate, linear and nonlinear regression analysis. The study develops analytical formulas specifically for the coconut wood with reference to non-existing building code of the material. Prediction of embedment strength Single factor linear models give the best prediction for parallel-to-grain loading, but multivariate non-linear models are more reliable sources of predictions for perpendicular-to-grain loading. Web- and mobile-based systems for the integration of empirical data and statistics from coco lumber were developed in their study to allow for predicting structural performance.

Tawasil, Aminudin, Abdul Shukor Lim, Nik Soh Leng Ling and Ahmad [20] investigated the physical and mechanical properties of hybrid particleboards manufactured from agricultural waste by utilizing different amounts of sawdust and coconut fiber which were compounded with different board thicknesses. They evaluate the thickness swelling, water absorption, modulus of rupture, modulus of elasticity and internal bonding by laboratory tests. The results indicate that in general performance improves with the increase in coconut fiber content, and 100% coconut fibers material of 20 mm thickness shows the best overall properties. The study also successfully establishes evidence that boards meet common standards provided sawdust contents do not exceed 50%

of a mix, revealing optimum combinations to improve the strength and lower water uptake, thus supporting the sustainable use of materials in construction. This study deployed a web- and mobile-based system to track and manage board composition and performance, providing inventory check-in/check-out monitoring as well as production efficiency tracking.

Trisunaryanti, Wijaya, Triyono, Adriani and Larasati (2021) study hierarchical porous carbon (HPC) from coconut lumber sawdust as support for a Ni-based catalyst in hydrotreating of Callophyllum inophyllum oil (CIO). They synthesized six types of HPCs with different carbonization temperatures and K_2CO_3/Coke weight ratios in order to select the best adsorptive capacity for catalysis. The catalyst HPC3-700 synthesized at 700 °C with a K_2CO_3/Coke ratio of 3 exhibited the maximum iodine value and therefore chosen to be applied in hydro treating tests. The CIO hydro treating over Ni/HPC3-700 led to the production of more than 74% liquid after annealing at 550 °C for 2 h, among which ~65% are hydrocarbons; indicative of efficient deoxygenation. In their study, a web and mobile process monitoring system which captured the sources of sawdust's as well as the uses of by-products in coco lumbers production was employed.

Khanashyam et al., (2024) study the impact of packaging on quality retention and shelf-life extension in coconut-based

products. They examine the effects of packaging and storage conditions on the freshness, safety, and consumer acceptability of coconut fruit as well as water, meat, oil and other coconut products. The paper also addresses the harmonization of traditional and cutting-edge food processing systems with packaging approaches to minimize product shelf-life. Findings suggest well designed packaging support product quality, convenience and sustainability. In this study, web and mobile systems were employed to link packaging with coco lumber inventory management for improved tracking of products and lifecycle analysis.

Suib, Yulianti, Shaleha, and Dari Laila (2024) study the influence of digital marketing assistance in the increasing village community economy which is aided by coconut product sales. They examine how training and direct assistance in e-commerce, production management, or online marketing strengthen local skills and understanding. The study produces a practical model to increase the sales volume of coconut products in Sentul Village Gading District Probolinggo Regency. The findings indicate that the community's capacity to control digital marketing and production as well as online sales of coconut products have been significantly strengthened, with a positive effect on increasing product sales performance, while also

raising economic conditions. In the present work, a web and mobile-based system was developed that linked production monitoring to sales and inventory data, providing a data-driven management process of coco lumber and coco products.

(2024)convectional coconut product processing and preservation 274 used in the raw form for making food item, whereas yield high Market price if stored for several months Further interesting aspect apart from traditional thermal India as an additive to it. In the present study, their high enzymatic activity and degree of moisture found in fresh coconut water and kernel are considered as obstacles to preserving product quality that have been analyzed. The results indicate that these technologies can effectively enhance the short-term shelf life of coconut products without compromising on nutritional quality. They used a web based mobile system to make an inventory monitoring and preservation, preservation data and quality of products for the coco lumber. Improving Predictive Maintenance and Storage Management using Web and Mobile Technology 73 improve predictive maintenance by quickly listing all resources needed/old for the maintenance of items that are below par.

Nasir, Hansen, Mohammadpanah and Sassani explore how the sawmilling sector might move from conventional automation to smart data-driven manufacturing. They review topics such as the

application of AI, sensing technology, machine vision and nondestructive evaluation in log breakdown, kiln drying and lumber grading. They also point out the difficulty of the industry in employing big data analytics to its full potential despite extremely high efficiency and quality improvements, which could be achieved by these technologies. The researchers in (Palmiano et al., 2017) adopted the web and mobile technologies for production, log tracking, and inventory management in operating of the coco lumber processing aiming at making operations more efficient as well as data-driven decision-making.

Worku (2025) studied the effects of log taper, log length and sawing system on lumber volume recovery of Cupressus lusitanica sawn at Injibara Sawmill, Salamega Wereda, Ethiopia. Their study uses 240 logs to contrast recovery variations among three log lengths and two sawing methods, and at the same time measures log volume, lumber volume, as well as statistics analysis. Results show that small taper logs result in a higher recovery than medium and large taper. Results show that there is no statistically significant difference between live sawing and cant sawing in recovery efficiency, whereas shorter logs yield a better volume recovery than longer logs. Log processing information was collected in a web and mobile system to maximize

lumber recovery and inventory, enhancing both yield and efficiency.

Duchesne and Tong and Coursolle examine acoustic velocity (Va) at the tree, stem, log, lumber levels in their relationships with bending stiffness (MOE) and strength (MOR) of lumber. Their research examined the fit of these relationships across a range of measurement scales and evaluated how tree and log features informed model performance. Results show that there are strong relationships between log acoustic velocity and stem acoustic velocity and between lumber acoustic velocities and log acoustic velocities, with weak or no relationships in lumber properties versus tree-levels for the respective woods. 88 Another study used a web and mobile system that combined acoustic measurements with inventory, production monitoring, for relative grading of coco lumber.

Arazo, Tizo, Aguinaldo and Calonia (2017) study the possibility of developing plastic lumber from recycled high density polyethylene, coconut husk and waste paper as an alternative construction material. Two material mixtures were tested and their physical properties, specific weight, compressive strength, flexural strength and tensile strength were studied. The plastic lumber produced in this scale averaged above minimum acceptable values of physical properties by

commercialized plastic lumber and confirmed to have a better structural performance from recycled materials. Web-based and mobile systems were adopted in this study to monitor material inputs, quality of production and inventory levels for sustainable and efficient coco lumber production.

New research by Nissar et al. (2025) report that coconut coir fiber composites are considered to be prospective sustainable construction materials since they are biodegradable, inexpensive and have good mechanical strength, providing very suitable properties for the development of coco lumber. Their overview highlights the high lignin content of coir which allows for binder-free board fabrication with better thermal insulation, acoustical performance and fire retardant properties (that supports basophilic and climate responsive architectural design). A web and mobile based system to manage the production of borrowed stock is designed, that includes inventory management and quality control which can be adopted for sustainable manufacture of coir lumber.

Lucejko et al. (2020) stress that lignin is of utmost importance for the structural stability of wood, and therefore its chemical decomposition exerts a significant effect on long-term durability and performance properties of wooden materials. Their work shows that advanced analytical approaches including

pyrolysis-mass spectrometry can reveal modifications in lignin composition (decomposition, oxidation) directly related to the strength and decay resistance of wood. In the present investigation, lignin composition data have been incorporated into a web and mobile knowledge system to monitor coconut lumber production and performance for predictive analysis and long-term material stability.

Rejuvenation of lining as emerging pathways to convert decomposed wood into value-added materials. According to their work, controlled delignification not only retains cellulose framework but facilitates intensive treatments such as densification and polymer infiltration which leads to significantly stronger and more flexible materials. Web-based and mobile monitoring systems were employed to monitor delignification processes and inventory, thereby maintaining quality control for treated coconut lumber in their study.

Wang/Haller (2024) calculated future wood consumption in Germany with material flow analysis, showing that the national demand will exceed 4 sustainable supply from forest land by a large amount soon, demanding efficient resource allocation. According to their analysis, residential construction and energy infrastructure will continue to be the largest wood consumers, highlighting the need for ecological housing design and

engineered wood products. Research was conducted by integrating production data, inventory levels and demand forecasting for coco lumber using a web-based and mobile system that provided an avenue to practice sustainable management of resources.

Rademacher et al. (2021) that the Wood Image Analysis and Dataset (WIAD) presents a considerable contribution towards automatizing and reproducibility for wood analysis as it combines visual computing algorithms on ring detection and subsequent Anatomical Feature Recognition. Their work focuses on the possibility of using crowdsourcing and community science for producing of training data, making algorithms perform better and datasets more robust. These approaches offer a standardized solution for digital preservation, data lineage and metadata tracking that support unsupervised research methods, particularly in the context of sustaining shared cocoa lumber production and inventory monitoring systems via web and mobile analytics applications

Review of Related Literature (Local)

Data Analytics Driven Web and Mobile System for Coco Lumber Production and Inventory Monitoring

Tough time managing production and inventory Production is one of the challenging for small to medium enterprises in Philippines, particularly in lumber industry. And many still rely on manual processes that can result in errors, delays and inefficiencies. It's here where digital platforms, data analysis can play a role in improving this process. Real time lumber production and inventory web & mobile system could also save you money, time and provide accurate information. Unfortunately everyone's product is not similar enough to have one standard package. This system may also improve customer service and confidence in the workflow (Villareal, 2024). 1.4 Joseph Coco Lumber In this study conducted by Villareal (2024) a web and mobile system was developed to monitor production and inventory at Joseph Coco Lumber where real-time data analysis is used to simplify operations of the company as well minimize errors in daily transactions.

This research explores the development of a web-based system for Joseph Coco Lumber, situated in Upper Tulay, Minglanilla to have an accurate and convenient method of paying bills. In the short term, Villareal (2024) examines errors, slow transactions

and what is at stake for an ideal digital. The case study creates a model for automating the payment process and increases accuracy by making things more efficient. It also touches on the effect of IT tools and customer experience and internal process dependability. The system thus eliminates the human factor, enabling a safer and simpler financial process while enhancing business operations. By this the investigation proves how by means of integrating data analytics into a web and mobile system, can consequently improve the inventory and financial management of Coco lumber production.

The operations, market strategies and growth prospects of A and A Lanao Coco Lumber a microenterprise in Region 10 engaged in coconut lum- ber was explored by Ali, Bagood, Ditucalan & Grabador (2024). The study analyzed the company strengths of quality product, cost efficiency and accessibility while identifying challenges such as reliance on raw materials and market competition. The research also looked at business growth, training and implications for job creation in the local area and sustainability initiatives. The study also captured insights on opportunities for product diversification, digital marketing and improvements in the supply chain. The results revealed that the firm has established a loyal patronage, efficiently operates its dual outlets and is poised for sustained growth in the construction industry of Mindanao. In their study, employee web

and mobile systems exist to monitor production, inventory levels and also market trends, offering a data-driven perspective for operational enhancements or strategies.

Elisterio (2021) underscored the complexities of the Philippine coconut value chain, inclusive of limited information sharing, price variability for copra, and aging palms that stymie production and industry progress. The study noted that some 51m of its total 340m coconut trees are aging and need to be replaced, providing an opportunity to use these senile trees for the production of coconut lumber. Stimulating relationships between farmers, governments and the processing industry is also recommended to improve production techniques and increase the quality of raw material produced to help ensure sustainable use. These results are particularly significant for cocoa lumber research as they provide an alternative and reliable source of timber supply while promoting economic and environmental benefits. By and large, the findings of Elisterio supports approaches to be able to use coconut by-products for building constructions in a curriculum that aligns with industry innovation as well as sustainable architecture. Elisterio also examined the supply response of coconut in the Philippines, finding that factors such as number of fruit-bearing trees, fertilizer cost, rainfall, and temperature significantly affect production.

The study showed that senile coconut trees largely contribute to the total volume of supply. This underscores the importance of making use of these mature trees as source of coconut lumber. Significant positive associations with rainfall and potassium chloride price indicate that resource use and input availability play a decisive role in influencing coconut yield. This is of particular interest to the coco lumber study since they suggest a renewable supply from planting and senile tree utilization. Overall, Elisterio's research supports the economic and environmental value of converting underutilized coconut trees into high-end building materials for sustainable design. In this study data analytics in web and mobile system for monitoring the age of trees, production potential and inventory level of coco lumber from senile trees was presented.

Manicad, Martin and Cardenas (2023) reported on the chemical and physical characteristics of lubeg wood (Syzygium lineatum), demonstrating that its high lignin and alpha-caupolose contents, moderate relative density as well as strength-moisture relationship are the main factors responsible for the durability of this species. The work showed that Lubeg wood has low volumetric shrinkage and homogeneous moisture content throughout the different sections of the tree, which makes it useful for use in construction, furniture industry and millwork.

The authors pointed out the possibilities of Lubeg as a potential renewable feedstock for pulp, paper and biofuels. The current study of alternative tropical woods is especially significant to coconut lumber research, as the chemical and mechanical properties of such wood can be used to provide insight into impressive high-strength and environmentally friendly composites based on coconut. In general, the study encourages the environmentally friendly and sustainable use of relatively unknown fast-growing species for durable and multifunctional building material. The data logging including physical and chemical properties were monitored on a web and mobile based data analytics system, to inventory stocked logs of coconut & alternative woods during production cycle and for tracking their utilization.

Domestic studies of wood-based furniture industry in the Philippines conducted by Sison, Jalac, Dinglasan, Navarro, Palisoc and Torres (2022), indicate that implementing Value Analysis and Value Engineering (VA/VE) has proven to be successful for identifying inefficiencies due to poor lay-out design. The study has investigated workflow conditions in which it was found that an adage of 40.07 % production time is not utilized properly as a result of the unnecessary motions, and improper machine location that causes profit lost for a year of 24,212.10. Using ProModel simulation software, a standard process

layout has been developed that resulted in increased productivity and efficiency.

It also created alternate plant layouts, that minimized the distance between processes and improved the use of labor. Outcomes indicated that some changes on productivity, time and profit can be made by applying systematic layout planning and VA/VE in local furniture manufacturing. A web and mobile monitoring system was utilized to acquire real-time workflow data for inventory management enabling data-driven modification of process layout and resource consumption.

The importance of the Philippines forest products industry in livelihood support and regional economies is established albeit it is still stifled due to depletion of resources, regulatory constraints and uneven technology development (Limbaro, Tor, & Ateş, 2024).

Production and trading pattern studies show that, although processing centers in Caraga and Northern Mindanao indicate strong the capacity of the sector to develop its resources and expertise domestically (Achilles, 2014), it still largely depends on fast-growing exotic species like Falcata, Gmelina, Mahogany etc produced due to restrictions they face on native wood harvesting. Studies on trade balances also indicate a chronic gap, as the Philippines exports raw or semi-processed

wood but imports more processed value-added products ESP to add relatively little value domestically (Maryudi et al. 2012).

All these analyses help to identify more clearly the structural disadvantages, mainly in innovation and the sustainable management of resources, that make this industry less competitive. In general, results underline the importance of strategic measures in terms of efficiency and sustainability, with respect to policy making to improve sector performance toward both targets, economic and environmental. The analysts employed a web and mobile analytics platform to monitor production yields, resource use, and trade flows for coco lumber and uncover efficiency gaps and policy implications.

Automated wood identification has become an important part of sustainable forest management, law enforcement and the wood working industry. Mendoza et al. (2022) established an image-based woods classification system and utilized artificial neural networks to recognize 20 target wood species in the Philippines. The model was based on a large database of high-resolution images of macroscopic transverse sections with real samples and achieved an average F1 score of 87.9%, indicating a high accuracy and robustness.

The evaluation of the wood identification interface, which is a web application, was conducted through a System Usability Survey (SUS) with 27 DENR personnel who are foresters, forest

Rangers and forest technicians. Most participants gave the application a score of "good" or "excellent," with an average SUS of 75.6 (grade B), and all were willing to recommend the application, highlighting its usefulness and importance.

Respondents recommended future enhancements such as populating other commercially processed wood species endemic to the Philippines, making an offline version for implementation in the field and conducting follow-on training sessions. Such improvements would enable more accessibility, accuracy and effectiveness of the tool in such illegal logging fighting measure as ensuring legal wood utilization and academic research in learning achievement by wood identification etc. The authors integrated that system into a web and mobile platform, which included the tracking of coco lumber inventory and production flow; species identification was complemented by operational monitoring in their study.

Meanwhile, identifying the efficacy of plant- and fruit- derived f ire retardants to be used as fir e retardant treatment for coconut lumber was conducted by Mallillin, Bolivar, De Castro, Kim, Sanchez, Singian, Santos, Valle, Calamlam & Gamboa (2022) using commercial fire retardant s and boron-based solutions. In the study it was found that mango-based fire retardants lowered mass loss and avocado- based fire retardants were useful in lowering smoke density attributed to better char

yield. The work studied the effectiveness of organic species, PA as polyphenols, N and P as nitrogen and phosphorus on developments from cellulose for fire resistant use. Here, in some measurements smoke suppression and char selective values the performances of bio based fire retardants were found to be equivalent to or better than that offered by commercial flame retardant.

The confounding effects such as humidity, temperature and airflow were also pointed out to change the extent of significance therefore future research should plan for a standardized flammability test." Treatment records, batch performance and treated coconut lumber inventory were recorded using a web-based and mobile system.

Medium Rivera, Emmanuel and Rivera (2024) studied the rapid improvement of the synthetic variety coconut by merging conventional breeding with microsatellite marker (SSR). The research focuses on the genetic structure, level of heterozygosity and stability of yield in coconut population raised from selected tall varieties and their hybrids. Here it describes an adjusted breeding plan to obtain well-heterozygous base and advanced generation (F1-F5) polychromous families characterized by higher genetic diversity.

The results contribute to the assertion of DNA-markers efficiency for superior parental palms and genotypes selection

at early growth. Results of the study demonstrated that Syn1 populations exhibit greater heterozygosity compared with Syn0 and their parent genotypes, resulting in better genetic diversity and potential for stable, high yielding coconut cultivars. The genetic and yield information were combined in a web and mobile analytics system to predict the coconut lumber output, while tracking stock of high yielding coconuts.

SYNTHESIS

Coconut lumber has been studied by many researchers in some recent years due to the world's increasing deforestation problem and environmental damages, also most particularly of wood as a natural resource. Coconut trees grow abundantly in tropical nations, and researchers and industry leaders consider them to be an affordable and renewable resource when properly utilized. The above cited researches indicate that coconut lumber, along with digital technologies and data analytics can facilitate production efficiency, quality control and inventory optimization.

There are a few examples of research about the fundamental properties of coconut wood. Fathi et al. (2023) investigate the physical and chemical qualities of coconut wood, in terms its density, moisture content, and resistance. They reported that

coconut wood possesses a high moisture contents; however, it exhibits low shrinkage and swelling and is stable after the suitable drying. Untreated, coconut wood is susceptible to rot and insects. Their research demonstrated preservation treatments provide enhanced durability to be used in construction and the industrial sector. Similarly, Rooke (2025) describes how cola-nut wood has been employed in housing and construction throughout the Asia-Pacific region. The study emphasized that coconut wood is strong, cheap and an "excellent" alternative to traditional timber in locations where it was expensive or scarce.

Other scholars investigated the measurement of wood quality and durability. Brischke et al. (2023) to evaluate the impact of statistical approaches on wood durability classification. Even though they conducted their study on European wood types, what was revealed from it, was that correct data measuring and analyses are crucial. These notions are applicable to coconut lumber; the more accurate the data, the better producers can identify quality wood on a more consistent basis, particularly when it is stored and processed in digital systems.

The use of coconut waste and by-products is another significant research hot spot. Tawasil et al. (2021) investigated coconut fiber and sawdust particleboards. They determined that the strength and water resistance of boards was improved at higher coconut fiber content. Bawono et al. (2025) investigated

the composites of coconut coir fiber in wood-based panels and stated that coir has particular strengths distinct from wood and still few different levels for its reducing level of soaking. These findings indicate that waste from coconuts can be converted into valuable products and not just dumped in landfill.

A few scientists investigated the utilization prospects for value addition of coconut by-products. Trisunaryanti et al. (2021) produced catalytic materials using coconut sawdust. According to them, coconut by-products also can be converted into high-value industrial goods, and could contribute in sustainable and waste-free industrial production.

Much of the literature emphasizes the involvement of web-based and mobile systems in coconut lumber trading. Wang and Haller (2024) employed Material Flow Analysis to analyze the process by which wood flows through the various stages in production and consumption. They found that the digital systems make it easier to keep tabs on materials, minimizing waste and planning for future demand. As demand for wood mounts, such systems are needed to ensure that alternative materials (such as coconut lumber) are managed properly.

Nasir et al. (2024) who studied the smart and data driven manufacturing for wood industry. Their research found that sensors, machine vision and data analytics can make production systems more efficient and improve the quality of products. In

the case of coconut lumber, these technologies assist producers in ensuring process control and enhancing decision making. Duchesne et al. also found that analyzing acoustic data with digital tools to predict wood strength made grading more precise.

Several other researches were based on the prediction of structural properties of coconut wood. Jia et al. (2025) developed models to predict the performance of coconut wood connections. Their work is significant since there are no universally-accepted construction standards for coconut wood. Their models aid engineers and builders in using coconut lumber with greater safety and assurance.

In addition to technical results, some research highlighted the economic and social value of computer-based systems. Suib et al. (2024) that assisting farmers in rural regions to exploit digital marketing and online marketing enhance sales of coconut products. Linking production data to inventory and sales systems enabled communities to earn more money and use resources more efficiently. Khanashyam et al. (2024) and Prithviraj et al. (2024); the digital control reduces too storage losses and maintains product quality.

In general, the explored research works have suggested that coconut lumber is a viable green substitute for wood applicable to several uses. In conjunction with web and mobile systems, data analytics and appropriate treatment methodologies coconut

lumber production can be made more efficient, dependable and environmentally friendly. These findings, taken together, demonstrate for the first time that using coconut lumber integrated with digital monitoring technologies can bring both economic value and environmental health to our industries, communities and planet.

CHAPTER III

METHODOLOGY

This chapter details the research design, development methodology, and technical framework used to create the CocoLytics web and mobile system. It outlines the systematic approach taken to transform project requirements into a functional analytics-driven platform for coco lumber production and inventory monitoring.

Development Method

The study employed the Agile Development Methodology to ensure flexibility, iterative progress, and continuous stakeholder feedback throughout the project lifecycle. Agile was selected for its adaptability to changing requirements and its focus on delivering functional software increments.

Figure 2. Agile Model

Figure 2 illustrates the Agile Development Methodology adopted for the CocoLytics project, which prioritizes adaptability, iterative progress, and stakeholder collaboration as its foundational principles. This approach breaks down the entire development process into a series of manageable cycles called sprints, each spanning two to three weeks. During every sprint, the cross-functional team engages in concurrent activities: planning specific features, refining requirements, designing user interfaces and system components, coding functional modules, and conducting continuous testing (both unit and integration). At the end of each sprint, a working and potentially shippable product increment—such as a functional production logging module or a basic inventory dashboard—is delivered. This allows for consistent demonstration to and feedback from project stakeholders, including potential end-users like warehouse supervisors and administrators. By incorporating this feedback directly into the next planning cycle, the methodology ensures the system evolves in close alignment with actual user needs and operational realities. This iterative and incremental model is particularly suited to CocoLytics, as it enables the timely delivery of core functionalities while maintaining the flexibility to refine analytics features, adjust reporting formats, or incorporate new tracking requirements based on ongoing user input, thereby

maximizing the system's relevance and effectiveness upon final deployment.

1. **Requirement Gathering and Analysis:** This initial phase involved conducting interviews and surveys with stakeholders in the cocoa lumber industry, including business owners, production supervisors, and warehouse personnel. The goal was to understand their existing manual workflows, pinpoint inefficiencies in production tracking and inventory management, and define the functional and non-functional requirements for CocoLytics. Data collected informed the system's features, such as real-time tracking parameters, report formats, and user roles.

2. **System Design:** Based on the gathered requirements, this phase focused on creating the system's architectural blueprint. This included designing the User Interface (UI) and User Experience (UX) wireframes for both web and mobile views, planning the database schema to efficiently store production logs, inventory data, and user information, and outlining the system architecture (frontend, backend, analytics engine). Tools like Figma and draw.io were used for prototyping and diagramming.

3. **Development and Coding:** In this phase, the design was translated into a working system. The development stack included React.js or Vue.js for the responsive frontend web application, React Native for the cross-platform mobile app, Node.js with Express.js for the backend API, and MySQL or PostgreSQL for the relational database. The analytics and visualization components were integrated using libraries like Chart.js or D3.js. Predictive features were implemented using Python (with scikit-learn) via a separate API or integrated scripts.

4. **Testing and Integration:** Each developed module and the integrated system underwent rigorous testing. This included Unit Testing (for individual functions), Integration Testing (to ensure modules work together), System Testing (to verify the entire system meets specifications), and User Acceptance Testing (UAT). UAT involved target end-users to validate the system's usability, functionality, and alignment with their operational needs. Feedback from this phase was used to refine the system in the next iteration.

5. **Deployment:** The completed and tested system was deployed to a live environment. This involved configuring a cloud server (e.g., AWS, DigitalOcean, or a local server), setting up the database, deploying the backend API and frontend application, and ensuring domain and security configurations (SSL certificates) were in place. The mobile application was prepared for distribution via app stores or enterprise channels.

6. **Review and Maintenance:** Post-deployment, a review period was established to monitor system performance, gather user feedback on live operations, and identify any bugs or areas for enhancement. This phase ensures the system remains reliable and evolves to meet future needs.

Gantt Chart

To ensure the successful execution of each plan following the system's creation, the project is being developed in accordance with the Gantt chart.

PROJECT TIMELINE (Oct 2025 - Dec 2026)

	Oct 2025	Nov 2025	Dec 2025	Jan-Jun 2026	Jul-Dec 2026
PHASE 1 Research & Planning	████				
PHASE 2 System Design		████			
PHASE 3 Testing			████		
PHASE 4 Deployment					
PHASE 4 Thesis Finalization					

Requirement Specifications

The proposed CocoLytics system will require adequate training for end-users to ensure effective utilization. Users must be trained on the software interface, system capabilities, and operational requirements. Additionally, comprehensive training materials—including user manuals, quick reference guides, and instructional videos—will be provided to facilitate rapid adaptation. The training program will emphasize key functionalities to ensure that administrative staff, production supervisors, warehouse personnel, and sales teams can operate the system efficiently and effectively in their daily operations.

Functional Requirements

The functional requirements define the specific tasks and operations the system must perform to meet user needs. These encompass administrative controls, production monitoring features, inventory management tools, and analytical capabilities available through both web and mobile interfaces. By explicitly specifying these requirements, the development process is systematically guided to ensure all essential functionality is delivered efficiently and effectively

Table 2: Functional Requirements of the CocoLytics System

Feature/Module	Requirement Description
User Management	The system shall provide role-based access control (Admin, Supervisor, Warehouse Staff, Sales) with defined permissions for viewing, adding, editing, and managing data within thein respective operational scope.
Production Monitoring	Users shall be able to log and track raw material intake, cutting outputs, drying batch status, grading results, and final product storage in real-time through both web and mobile interfaces.
Inventory Tracking	The system shall automatically update and display stock levels of raw materials, work-in-progress, and finished goods based on production and dispatch transactions.

Automated Reporting	The system shall automatically generate and allow export of standard reports (daily production logs, stock balance sheets, sales dispatch summaries) in PDF and Excel formats.
Alert & Notification System	The system shall send automated alerts (via in-app notifications and/or email) for predefined events such as low stock levels, production delays, pending drying batches, and overstock situations.
Predictive Forecasting	The system shall utilize historical production and sales data to run predictive models, providing forecasts for future inventory requirements and identifying potential production bottlenecks.
Mobile Accessibility & Offline Sync	All core tracking features shall be accessible via a mobile application, allowing data entry and viewing in areas with limited connectivity, with automatic synchronization when internet access is restored.

Table 2 shows the key features of the proposed system and explains how it can streamline tasks for users. Each feature is designed to improve operational efficiency by providing simple and effective solutions. The system's intuitive tools help supervisors and staff quickly monitor and manage production and

inventory, making their daily workflows more efficient and data-driven.

Hardware Interface

The hardware components of the project are within the requirements to ensure the system functions at its optimum. The relationship and interdependence between software and hardware must be checked at all times since they work in tandem to ensure the developed system works perfectly and faultlessly. The web application shall be viewable on any device with a modern web browser and an internet connection. The mobile application will be compatible with Android (version 8.0 and above) and iOS (version 13 and above) devices.

Software Interface

The system features an administration software interface designed for easy navigation by staff. Simplicity also ensures smooth use of the website and mobile app by users. The interface is a critical element for success, as it adequately captures the interplay of complex relationships and operations between the system, database, and operating system. The tools used in this project include: React.js for the frontend web application, React Native for the mobile application, Node.js with Express.js for the backend API, MySQL for the database, and Chart.js for data visualization.

Security Requirements

The system is password-protected, limiting the number of login attempts. After a certain number of failed attempts, the system will require a waiting period or account recovery process, helping prevent brute-force attacks. It implements industry-standard security practices, including encrypted passwords (bcrypt), secure session management, input validation, and role-based access control. These security measures ensure that user data and system operations are protected from potential threats and vulnerabilities.

Technical Background

The technical background lays the foundation for the development of the system, highlighting crucial prerequisites. This work made use of standard powered devices with major software requirements.

Hardware Specifications

The hardware used by the researchers is listed here. The list includes the types of hardware, along with details such as memory and storage capacity. These specifications are essential for ensuring optimal performance and compatibility with the system requirements.

Table 3: Hardware Specifications

Component	Minimum Specifications	Recommended Specifications
Memory (RAM)	8 GB RAM	16 GB RAM or higher
Processor	Intel Core i5 / AMD Ryzen 5	Intel Core i7 / AMD Ryzen 7
Storage	256 GB Solid-State Drive (SSD)	512 GB SSD or higher
Network	Stable broadband connection (25 Mbps)	High-speed broadband (100 Mbps)

Table 3 displays detailed specifications, including component size, memory capacity, and storage. These specifications are critical for ensuring system performance, with the recommended values designed to support more demanding applications and enhance the overall development experience.

Software Specifications

This section provides a listing of all software tools used in the research. Specifications are given concerning the software itself, as well as stipulating minimum and recommended system requirements.

Table 4: Software Specifications

Component	Minimum Specifications	Recommended Specifications
Operating System	Windows 10 / macOS Catalina	Windows 11 / macOS Monterey or later
Web Browser	Chrome 90+, Firefox 88+	Latest version of Chrome/Firefox/Edge
Database Server	MySQL 5.7	MySQL 8.0 or later
Node.js Runtime	Version 16.x	Latest LTS Version (18.x or higher)
Code Editor	Visual Studio Code 1.96.2	Latest version of Visual Studio Code

Table 4 outlines the software specifications required for the system. To ensure optimal performance and productivity, the researchers implemented the latest stable versions of the operating systems and software where possible. The recommended specifications provide better compatibility and efficiency, ensuring smoother development and operation.

System Analysis and Design

This involved a step-by-step system creation process. At each level, the design and the coding were regularly checked to avoid mistakes. This helped in planning subsequent tasks, thereby making the whole process more seamless.

System Overview

The CocoLytics system was planned by collecting all information about the features and functions needed by stakeholders in the coconut lumber industry. This ensured the system would meet its targets according to user needs. The navigation was designed so that the interface would be easy to follow. To access the system, users visit the web URL or open the mobile app, which presents a login screen. Authorized users can then access dashboards, production logs, inventory views,

and reports. The characteristics of the target users were considered during the development of the visual design, usability, and simplicity. A stable and clear framework was established for developing the platform and securing data integrity.

System Architecture

This part of the study outlines the system This part of the study outlines the system flow of functions. It illustrates how tasks are completed successfully, showing the progress throughout the process.
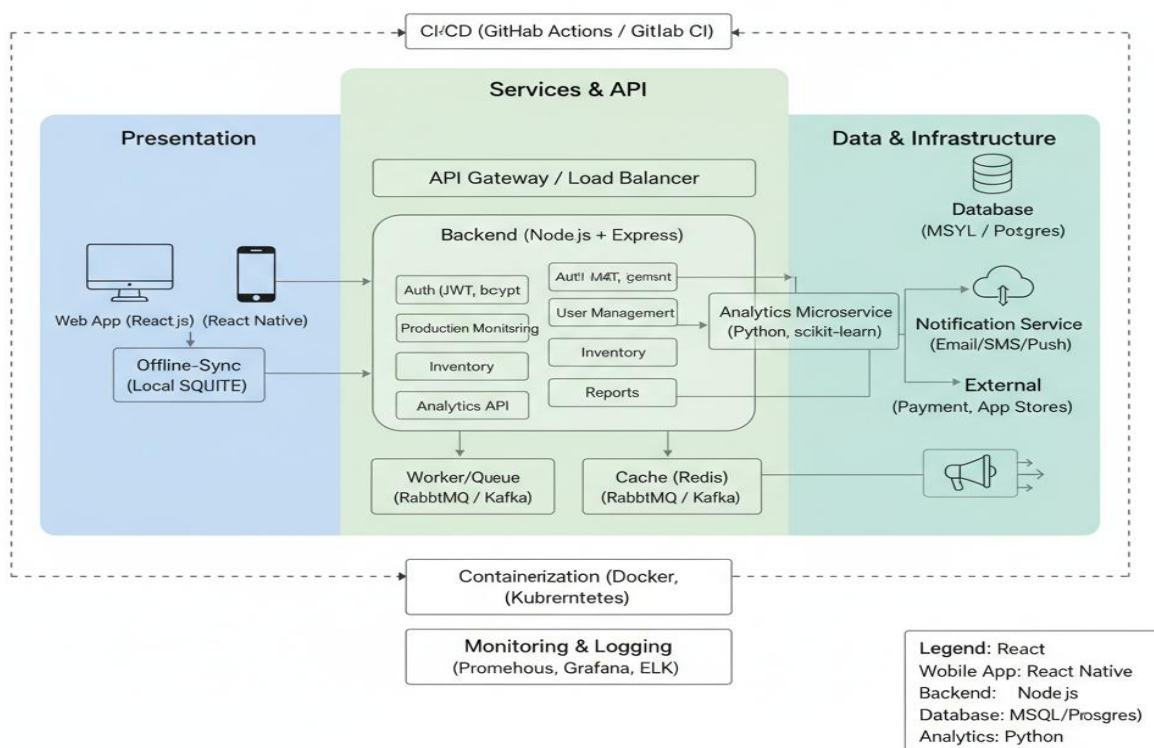

CocoLytics System Architecture

Figure 4. System Architecture

This figure illustrates the system architecture of CocoLytics. It outlines the interactions between various components, including end-users, data analysts, administrators, and the analytics dashboard. The diagram depicts how users access insights through the web and mobile interfaces, which communicate with backend services to process inventory, user management, and analytics data. The analytics microservice generates reports using Python and scikit-learn, while the database (MySQL/Postgres) maintains records of metrics and logs, ensuring seamless data flow, caching via Redis/RabbitMQ/Kafka, and reliable notifications for real-time updates.

Use Case Diagram

This section shows how different people use the system and explains what each person can do. The figures point out the specific tasks each user type can carry out in the system.
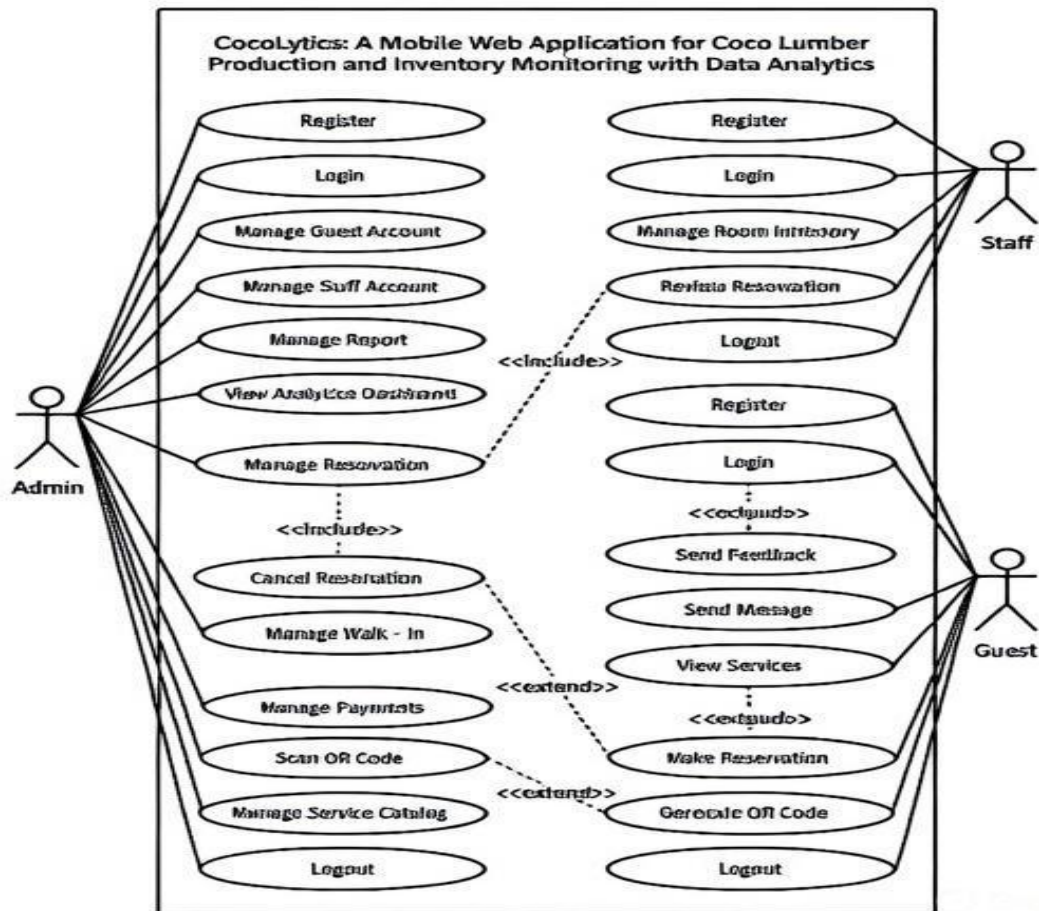

Figu

Figure 5 illustrates the interaction among the three main actors of the **Cocolytics: A Mobile Web Application for Coco Lumber Production and Inventory Monitoring with Data Analytics**, the **Admin**, **Staff**, and **Guest**. Each actor has a distinct role that contributes to the efficient operation of the system. The **Admin** is responsible for managing the overall system, including user accounts, reports, analytics dashboards, reservations, payments, and service catalogs. The **Staff** supports daily operational tasks such as managing room or inventory availability, handling reservations, and processing transactions. Meanwhile, the **Guest** interacts with the system to register, log in, view available services, make reservations, send feedback or messages, and access generated QR codes. Together, these interactions ensure effective monitoring, streamlined operations, and data-driven decision-making within the Cocolytics system.

Activity Diagram

The activity diagram models the major workflows of **CocoLytics: A Mobile Web Application for Coco Lumber Production and Inventory Monitoring with Data Analytics.** These workflows include monitoring lumber production activities, tracking available inventory stocks, recording production outputs, updating inventory counts, adjusting stock levels in cases of corrections or discrepancies, and synchronizing inventory status with real-time production and analytics data.
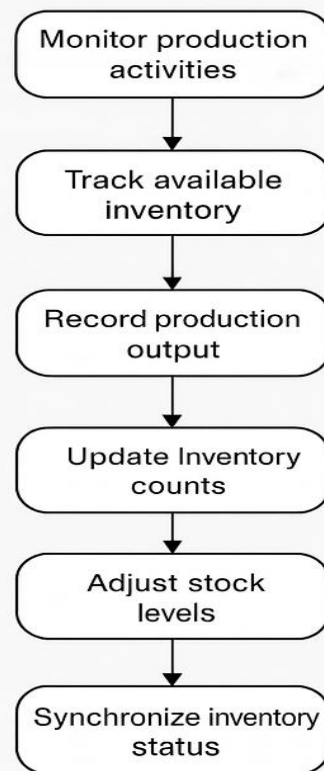
Figure 6. Activity Diagram

    This figure presents an activity diagram that illustrates the core workflows within the CocoLytics system, highlighting the interactions among users, system processes, administrators, and staff. It depicts how users log in to the system, access dashboards, view production and inventory data, and analyze reports generated through data analytics. The system dynamically manages inventory records, updates production statuses, and ensures data accuracy in real time. Administrators oversee system operations through analytical dashboards, manage inventory and production records, create and manage staff accounts, and monitor overall performance metrics. Meanwhile, staff members support daily production logging and assist in updating inventory information. The diagram emphasizes seamless coordination among user roles, centralized inventory monitoring, and streamlined processes to support efficient coco lumber production management.

Data Flow Diagram (DFD)

This section presents the **Data Flow Diagram (DFD) of CocoLytics: A Mobile Web Application for Coco Lumber Production and Inventory Monitoring with Data Analytics**. The DFD illustrates how data flows within the CocoLytics system, showing how production and inventory data are entered, processed, stored, and generated as outputs. It also demonstrates the interaction of data among various system functions, including production logging, inventory management, and analytics processing, making the overall data flow within the mobile web application easier to understand.

Context Diagram

The context diagram provides a high-level overview of the **CocoLytics system**, emphasizing its interactions with external entities such as administrators, staff, and system users. It illustrates how users input production and inventory data into the system and how CocoLytics processes this information to produce reports, analytics, notifications, and inventory updates. This overview clearly defines the system's boundaries, core functionalities, and its role in supporting efficient cocoa lumber production monitoring, inventory control, and data-driven decision-making.
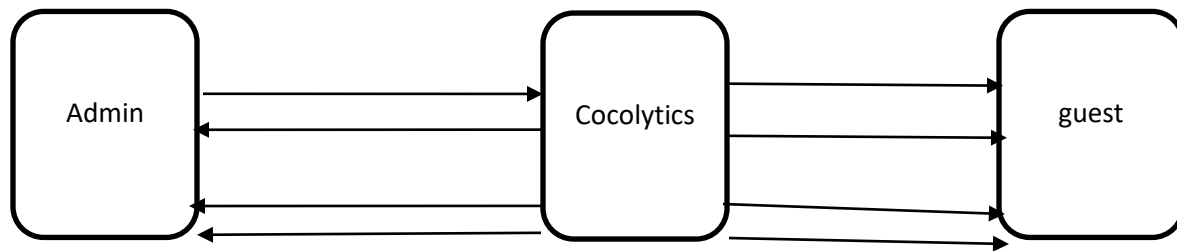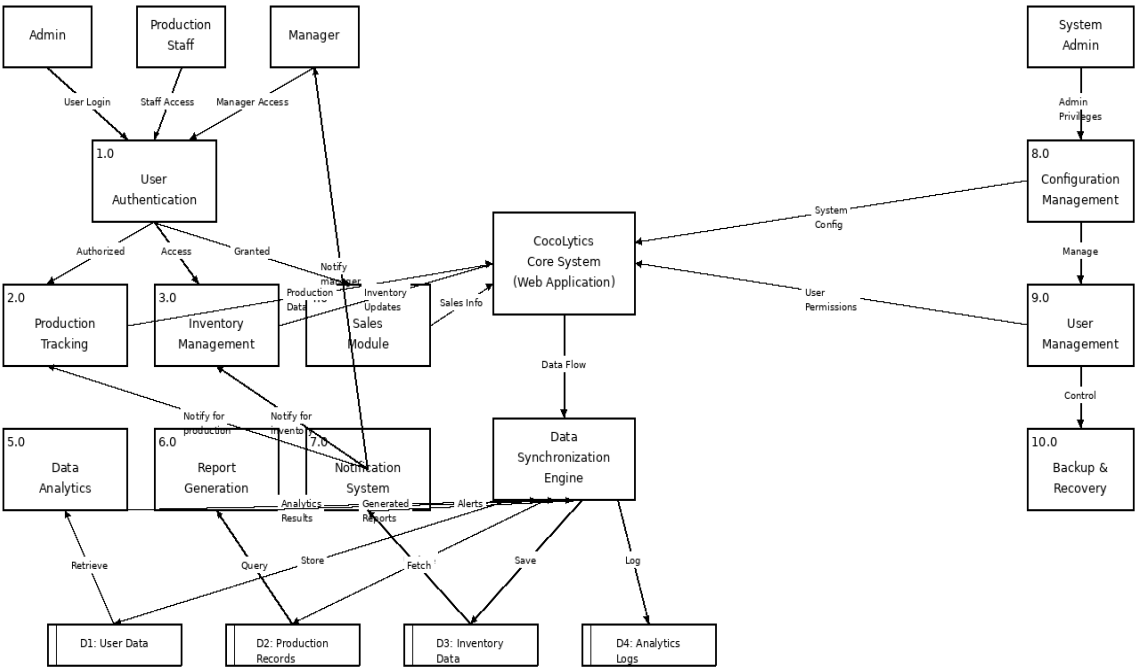
Figure 7. Context Diagram

The diagram illustrates how the CocoLytics mobile web application operates. It presents the core processes involved in the co-co lumber and inventory monitoring. The diagram emphasizes efficient data handling and the integration of analytics to support production and inventory management.

Diagram 0

Diagram 0 provides a high-level overview of the CocoLytics system. It shows the overall workflow, data flow, and interactions between users and system components. The diagram

helps clarify the sequence of operations and how data analytics supports decision-making within the system.

This architecture diagram represents the complete CocoLytics data ecosystem. It illustrates how the Coco lumber production and inventory monitoring system interfaces with external stakeholders, demonstrating the flow of real-time data between all components. This visualization clarifies the operational relationships and data interactions essential for efficient lumber production management.

Database Schema

      This foundational system design phase was crucial for the CocoLytics platform development. It mapped the core production monitoring and inventory management entities that form the system's backbone. This phase detailed the attributes and relationships between the coco lumber batches, inventory logs, user roles, and analytics data. It established the essential data framework for the entire monitoring solution.
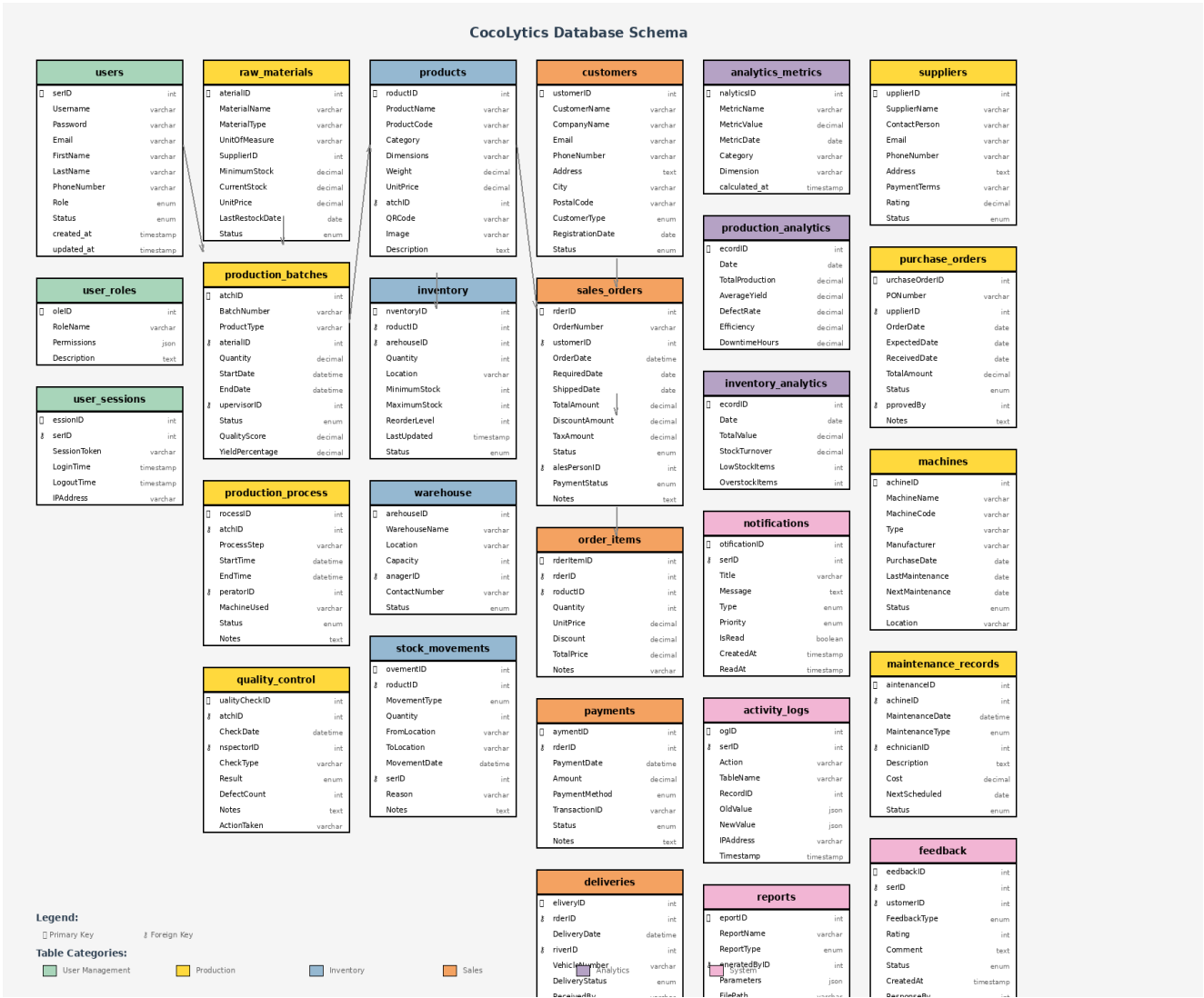

CocoLytics Database Schema

Figure 9. Database Schema

The CocoLytics: A Mobile Web Application for Coco Lumber P roduction and Inventory Monitoring with Data Analytics database schema physically stores data in tables with columns mapped to p roduction monitoring details, linked via indices to enable fast lookups and retrieval of lumber inventory data. This design ensu res that key information, such as coco lumber batches, productio n metrics, inventory levels, quality assessments, and supply cha in tracking, is efficiently organized and easily accessible. The schema uses primary and foreign keys to establish relationships between tables, maintaining data integrity and supporting compl ex analytical queries. Additionally, the database schema is engi neered to be scalable, ensuring it can handle increasing volumes of production data and inventory records as the Coco Lumber ope rations expand.

Testing and Evaluation

Testing validates whether our CocoLytics system functions optimally under various operational conditions. We conduct frequ ent testing to assess system functionality, performance metrics, and reliability across different production scenarios. This pro cess identifies issues, bottlenecks, and areas for improvement i

n the coco lumber monitoring workflow. For this project, we impl emented comprehensive hands-on testing that thoroughly examined all system modules and integrations. Rigorous testing forms the foundation for refining our solution toward operational excellen ce.

We continuously refine the system through iterative testing cycl es to achieve optimal performance and maintain leading-edge moni toring capabilities.

Respondents of the Study

The respondents included cocoa lumber production managers, inventory supervisors, field technicians, and IT professionals with expertise in agricultural monitoring systems. This diverse group provides valuable insights into the system's performance i n real production environments, user experience for daily operat ions, and technical robustness. Their feedback ensures a compreh ensive understanding of how CocoLytics supports cocoa lumber pro duction efficiency, inventory accuracy, and data-driven decision -making.

Table 5. Respondents of the Study

Respondents	Total	Percentage
Coco Farmers / Producers	29	55.77%
Inventory&Production Staff	11	21.15%
Operations Manager	2	3.85%
IT / AgriTech Expert	10	19.23%
Total	**52**	**100%**

Table 5 shows the respondents of the study, detailing the total count and percentage for each category. Coco farmers/producers make up the largest group at 55.77%, followed by inventory and production staff at 21.15%, IT/AgriTech experts at 19.23%, and operations managers at 3.85%. The total number of respondents is 52.

Likert Scale

The researchers surveyed selected respondents using a Likert-scale questionnaire to evaluate the CocoLytics project's effectiveness. This assessment measured the system's impact on

users' production monitoring experiences and perceptions, providing valuable insights into its usability, accuracy, and overall performance in the cocoa lumber management.

Table 6. Likert Scale

Scale	Range	Verbal Interpretation
4	3.50-4.00	Strongly Agree
3	2.50-3.49	Agree
2	1.50-2.49	Disagree
1	1.00-1.49	Strongly Disagree

Table 6 presents the Likert Scale used to assess survey responses. It categorizes responses into four levels, ranging from "Strongly Agree" to "Strongly Disagree," with corresponding numerical values. This scale helps quantify participants' attitudes and opinions toward CocoLytics, providing a clear method for interpreting survey data.

Implementation Plan

The CocoLytics system will be turned over to the farm administrators and production staff, who shall then manage and maintain the system with the support of the project developers, together with all system documentation. There is no ongoing maintenance obligation on the part of the researchers. However, the client can contact the developers for any technical inquiries or system-related matters.

Developers will conduct training sessions and workshops on the CocoLytics system before actual deployment, ensuring end-users are prepared and equipped to use it effectively. Upon successful implementation, continuous monitoring of the system shall be performed to ensure smooth operations and identify any future maintenance needs over time.

Table 7. Implementation Plan

Activities	Target Date	Progress Note
Discussion with Client (Farm/Cooperative)	April 2024	Accomplished
Deployment Agreement&Setup	August 2024	Accomplished
System Deployment&Monitoring Period	June 2024	Accomplished
Training for End-Users (Farmers&Staff)	August 2024	Accomplished
System Evaluation&Feedback Collection	September 2024	Accomplished

Table 7 outlines the CocoLytics implementation plan, listing key activities, their target completion dates, and current progress. Each activity is tracked to ensure timely completion, with all tasks marked as "Accomplished." The table provides a clear overview of the project's timeline and major milestones.

Let me know if you'd like the wording adjusted further, the respondent categories renamed, or if you need a Gantt chart-style timeline instead.

Likert Scale Evaluation

Researchers employed a Likert-scale questionnaire to assess CocoLytics' effectiveness in real-world coconut lumber production environments. This evaluation measured the system's impact on production monitoring efficiency, inventory accuracy, data analytics utility, and mobile application usability, providing actionable insights for continuous improvement.

Implementation Plan

The CocoLytics mobile web application will be formally transferred to the Coco lumber production administrators and operational staff, who will assume responsibility for daily management and maintenance. Complete system documentation, including data analytics protocols and inventory monitoring procedures, will be provided. While ongoing maintenance is not included in research obligations, technical support channels remain available for system-related inquiries.

Developers will conduct comprehensive training sessions focusing on production data entry, inventory tracking workflows, analytics dashboard navigation, and mobile application utilization. Post-implementation monitoring will ensure system stability and identify optimization opportunities for long-term operational efficiency.

REFERENCES

FOREIGN LITERATURE

Arazo, R. O., Tizo, M. S., Aguinaldo, G. T., & Calonia, J. B. (2023, July). Plastic lumber: Wood lumber substitute using HDPE, coconut husk, and waste paper. In Proceedings of the NOMCARRD Regional Symposium on R&D Highlights.

Bawono, N. M. H., Bawono, B., Anggoro, P. W., & Jamari, J. (2025). Study of the application of coconut coir fiber-based wood-based panels. Materials Today: Proceedings, 17, 100588.

Brischke, C., Haase, F., Bächle, L., & Bollmus, S. (2023). Statistical analysis of wood durability data and its effect on a standardised classification scheme. Standards, 3(2), 210-226.

Duchesne, I., Tong, Q., & Coursolle, C. (2025). Acoustic velocity at the tree, log, and lumber levels and their relationship with lumber bending properties. Canadian Journal of Forest Research, 55, 1-15.

Fathi, L., Hasanagić, R., Bjelić, A., & Bahmani, M. (2023). Performance of coconut wood in timber structures: A review of its properties and applications. IOP Conference Series: Materials Science and Engineering, 1298(1), 012014.

Jia, L., Paudel, V., Lim, H., & Srivaro, S. (2025, June). *Empirical formula predicting the embedment strength of coconut wood*. In Proceedings of the World Conference on Timber Engineering 2025.

Khanashyam, A. C., Shanker, M. A., Calicut, K. S., & Nasution, Z. (2024). Role of packaging in the preservation of coconut

products. In Preservation and authentication of coconut products (pp. 231-248). Springer, Cham.

Lucejko, J. J., Tamburini, D., Modugno, F., Ribechini, E., & Colombini, M. P. (2020). Analytical pyrolysis and mass spectrometry to characterise lignin in archaeological wood. Applied Sciences.

Nasir, V., Hansen, E. N., Mohammadpanah, A., & Sassani, F. (2024). Intelligent lumber production (Sawmill 4.0): Opportunities, challenges, and pathways to adoption. In Integrated systems: Data-driven engineering (pp. 213-231). Springer.

Nissar, M., Chethan, K. N., Birjerane, Y. A., Patil, S., Shetty, S., & Das, A. (2025, September 26). Coconut coir fiber composites for sustainable architecture: A comprehensive review of properties, processing, and applications. Journal of Composites Science.

Prithviraj, V., Nayana, N. P., Prabha, K., & Pandiselvam, R. (2024). Conventional technologies for the preservation of coconut products. In Preservation and authentication of coconut products (pp. 1-20). Springer, Cham.

Rademacher, T., et al. (2021). The Wood Image Analysis and Dataset (WIAD): Open-access visual analysis tools to advance the ecological data revolution. Methods in Ecology and Evolution, 12(12), 2379-2387.

Rooke, A. (2025). Feasibility study of establishing a coconut lumber processing plant in the Pomio District of East Britain. Sribd Inc.

Suib, M. S., Yulianti, Shaleha, S. H., & Dari Laila, R. I. W. (2024). Digital marketing assistance for coconut products to improve the economy of village communities. Ihsan Niat Journal, 1(1).

Tawasil, D. N. b., et al. (2021). Coconut fibre and sawdust as green building materials. Buildings, 11(6), 256.

Terzopoulou, P., Vouvoudi, E. C., & Achilias, D. S. (2025). Delignification as a key strategy for advanced wood-based materials. Forests.

Trisunaryanti, W., et al. (2021). Green synthesis of hierarchical porous carbon prepared from coconut lumber sawdust. Results in Engineering, 11, 100258.

Wang, R., & Haller, P. (2024). Enhancing wood efficiency through comprehensive wood flow analysis. Forest Ecosystems, 11, 100179.

Wang, R., & Haller, P. (2024). Dynamic wood consumption forecast in Germany from 2020 to 2050. Forests, 15(11), 1943.

Worku, S. (2025). Effect of log taper and length on lumber volume recovery. Debre Markos University.

LOCAL LITERATURE

Ali, S. H. F. S., Bagood, C. K., Ditucalan, L. S., & Grabador, J. L. S. (2024). Operations management report: A and A Lanao

Coco Lumber. Final project, Operations Management (TQM), 1st Semester, S.Y. 2024-2025.

Elisterio, J. M. Q. (2021). Supply response of coconut in the Philippines (Bachelor's thesis, University of the Philippines, Los Baños, College of Economics and Management).

Limbaro, G. R. A., Tor, Ö., & Ateş, S. (2025). The industry of forest-based products in the Philippines. Artvin Çoruh University Journal of Forestry Faculty, 26(1), 154-165.

Mallillin, H. L. B., Bolivar, J. G. B., De Castro, N. A. C., Kim, S. E., Sanchez, I. A. A., Singian, A. A. F., Santos, Z. M. L., Valle, E. J. G., Calamlam, J. M. M., & Gamboa, G. B. (2022). Bio-based fire retardant for coco lumber using Aloe barbadensis Miller (aloe vera), Mangifera indica (mango), or Persea americana (avocado) and boron additives. Yaar Science and Technology SINAYA: A Philippine Journal for Senior High School Teachers and Students, 1(3), 94-130.

Manicad, M. C. Z., Martin, H. T., & Cardenas, O. P. (2023). Analysis of wood proximate chemical and physical properties of the Lubeg (Syzygium lineatum) tree species in Apayao, Philippines. Innovations in Biological Science, 9.

Mendoza, R. C., Jacildo, A. J., Madrid, V. R. M., Mercado, R. D. C., Romano, A. D., Cantalejo, A. P. G., Urriza, L. M. C., Daracan, V. C., & Manalo, R. D. (2022). Automated classification of selected Philippine wood species using image analysis and artificial neural networks. Philippine Journal of Science, 151(4), 1435–1445.

Moreno, M. L., Kuwornu, J. K. M., & Szabo, S. (2020). Overview and constraints of the coconut supply chain in the Philippines. International Journal of Fruit Science, 20(sup2), S524–S541.

Rivera, R. L., Emmanuel, E. E., & Rivera, S. M. (2024). Accelerated development of coconut synthetic variety using classical breeding methods and microsatellite marker technology. Philippine Coconut Authority Research Journal, ISSN 3028-1393.

Sison, J. P. E., Jalac, P. I. D., Dinglasan, J. M. N., Navarro, M. M., Palisoc, A. A., & Torres, M. B. A. (2022). Process value analysis for a wood-based furniture company in the Philippines using the VA/VE approach. In *Proceedings of the International Conference on Industrial Engineering and Operations Management*. IEOM Society International.

Villareal, J. M. (2024). Web-based for Joseph Coco Lumber Management System in Upper Tulay, Minglanilla. Student project, Cebu Technological University, Information Technology 3. Cebu Technological University.