POLITEKNIK UNGKU OMAR

ENHANCING PROCUREMENT DEPARTMENTEFFICIENCY THROUGH AN IOT-BASED DELIVERY ORDER TRACKING SYSTEM (DOTS)

NUR FARISA BINTI MUNSHI
(01BCT20F3033)

CIVIL ENGINEERING DEPARTMENT

SESSION 2 2022/2023

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A project report/thesis submitted in partial fulfillment of the requirement for the award of the Bachelor of Civil Engineering Technology with Honors

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STATEMENT OF AUTHENTICITY AND PROPRIETARY RIGHTS

ENHANCING PROCUREMENT DEPARTMENT EFFICIENCY THROUGH AN IOT-BASED DELIVERY ORDERTRACKING SYSTEM (DOTS)

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ABSTRACT

The construction industry has been witnessing the transformative effects of Industry 4.0, characterized by digitalization and automation. Information technology has become increasingly crucial in the daily operations of construction companies. However, challenges related to technology adoption and communication persist. To address these challenges, the development of a Delivery Order Tracking System using WIX software specifically tailored for the construction industry was undertaken. This system aims to develop delivery order tracking for site personnel and purchasing personnel, ultimately expediting the payment process. The website serves as a bridge connecting site personnel with the purchasing and procurement department, enabling seamless tracking of delivery orders from the site to procurement. An online survey, based on the Technology Acceptance Model (TAM) questionnaire, was conducted to assess the effectiveness of the Delivery Order Tracking System. The survey evaluated factors such as Perceived Ease of Use, Perceived Usefulness, Attitude Towards Using Technology, and Behavioral Intention to Use. The survey results revealed positive feedback for the website. Furthermore, a paired t-test study demonstrated that the website's usability outperformed the existing methods commonly used in the construction industry. This indicates that the Delivery Order Tracking System offers improved usability compared to traditional approaches, making it highly recommended for adoption in construction companies' purchasing departments to facilitate efficient tracking of delivery orders.

ABSTRAK

Industri pembinaan telah menyaksikan kesan transformatif Industri 4.0, yang dicirikan oleh pendigitalan dan automasi. Teknologi maklumat telah menjadi semakin penting dalam operasi harian syarikat pembinaan. Walau bagaimanapun, cabaran yang berkaitan dengan penggunaan teknologi dan komunikasi berterusan. Untuk menangani cabaran ini, pembangunan Sistem Penjejakan Pesanan Penghantaran menggunakan perisian WIX yang khusus disesuaikan untuk industri pembinaan telah dilaksanakan. Sistem ini bertujuan untuk membangunkan pengesanan pesanan penghantaran untuk kakitangan tapak dan kakitangan pembelian, akhirnya mempercepatkan proses pembayaran. Laman web ini berfungsi sebagai jambatan yang menghubungkan kakitangan tapak dengan jabatan pembelian dan perolehan, membolehkan pengesanan lancar pesanan penghantaran dari tapak ke perolehan. Satu tinjauan dalam talian, berdasarkan soal selidik Technology Acceptance Model (TAM), telah dijalankan untuk menilai keberkesanan Sistem Penjejakan Pesanan Penghantaran. Tinjauan itu menilai faktor-faktor seperti Perceived Ease of Use, Perceived Usefulness, Sikap Terhadap Penggunaan Teknologi, dan Tingkah Laku Niat untuk Menggunakan. Hasil tinjauan menunjukkan maklum balas positif untuk tapak web. Tambahan pula, kajian ujian-t berpasangan menunjukkan bahawa kebolehgunaan tapak web mengatasi prestasi kaedah sedia ada yang biasa digunakan dalam industri pembinaan. Ini menunjukkan bahawa Sistem Penjejakan Pesanan Penghantaran menawarkan kebolehgunaan yang lebih baik berbanding pendekatan tradisional, menjadikannya sangat disyorkan untuk diterima pakai di jabatan pembelian syarikat pembinaan bagi memudahkan pengesanan pesanan penghantaran yang cekap.

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CHAPTER 1

INTRODUCTION

1.0 INTRODUCTION

The process of obtaining goods and services from external sources is known as purchasing (Jenkins, 2021). It is the initial stage of materials management and involves arranging for the supply of materials, spare parts, services, or semi-finished goods needed to produce the desired product. Purchasing is crucial for market discovery, where suppliers are chosen based on their ability to offer common items at a fair price. Delegating purchasing to a specialist can lead to greater economies, as it accounts for a significant portion of anticipated capital expenditures. The term "procurement" encompasses all actions related to sourcing, purchasing, and delivering goods and services. In the manufacturing supply chain, purchasing plays a critical role as the cost of finished goods is largely composed of purchased parts and materials.

The primary goal of the buying department is to acquire the right materials in the right quantities, at the right times, for the right prices, from the right suppliers. This involves policy decisions, evaluating alternative options, and adhering to purchasing guidelines set by the company. The buyer's relationship with vendors can significantly impact the company's image. Procurement encompasses various actions performed by firms to obtain goods and services, with a focus on obtaining the right quality, quantity, timing, price, and source.

The process through which firms acquire goods and services encompasses various actions known as procurement (McKinsey, 2022). While the term "procurement" typically refers to the final stage of purchasing, it can also encompass the entire procurement process (McKinsey, 2022). Although organizations can act as both buyers and sellers, the focus is usually on the company initiating the procurement (McKinsey, 2022). Achieving "the five rights," which involve obtaining the right quality, quantity, timing, price, and source, encapsulates the essence of procurement (McKinsey, 2022). The effective management of procurement processes is crucial for firms, and one of the key ways to achieve this is by carefully setting staffing levels, adhering to administrative budgets, and preparing the workforce for current and future procurement demands. Implementing improved purchasing channels within procure- to-pay systems can also bring significant benefits to organizations, including enhanced expenditure visibility, efficient invoicing and payment processes, and increased user satisfaction. Procurement teams should focus on managing relationships and performance across multiple stakeholders while continuously improving transactional-level work. As production capacities expand, there is a growing global demand for skilled purchasing employees, making talent management an increasingly important aspect of procurement.

To effectively evaluate the flow of materials in an industry, a purchasing or procurement manager needs to determine whether the manufacturer operates on a made-to-order or made-to-stock basis (Gerald & Sam, 2007). Based on this information, the manager can then plan for the industry's material requirements and carry out material requirement planning to minimize stock levels while ensuring timely availability (Gerald & Sam, 2007). In Malaysia, the construction industry holds a significant position in the economy, contributing 3-6 percent annually to the country's gross domestic product (GDP). The success of Malaysia's socioeconomic development objectives, such as infrastructure provision, housing, and job creation, largely depends on the construction sector's performance. The construction industry not only provides a conducive environment for individuals to carry out their daily tasks but also generates numerous job opportunities, influencing the overall growth of the country's economy. In 2010, the construction sector in Malaysia contributed 5% of the GDP, reflecting its substantial impact on financial, banking, insurance, transportation, and manufacturing sectors.

Within the construction office of PTT (Pembinaan Tetap Teguh), various departments such as Procurement, Accounting, Head Resources, Project, and Quantity Surveyor are involved in procurement activities. The procurement department handles tasks such as purchasing goods and materials, cost estimation, order tracking and documentation, managing the supply base, evaluating delivery and market systems, vendor selection and negotiation, and contract management. The procurement manager ensures the procurement schedule aligns with the construction timeline to prevent project delays and oversees the timely delivery of goods within budget.

In summary, procurement plays a crucial role in the construction industry, encompassing the process of acquiring supplies and services. Efficient procurement practices are essential for enhancing project efficiency. Various procurement methods are used in the construction industry, and stakeholders should carefully analyze the project's business plan before selecting a long-term procurement strategy. Factors such as speed, cost, risks, budget, quality, and project-specific limitations need to be considered when choosing a procurement strategy. The procurement manager, responsible for material acquisitions and ensuring on-time and on-budget delivery, requires skills in quantitative analysis, negotiation, business communication, and critical thinking.

Sustainable building practices aim to create environmentally friendly structures by conserving resources, reusing materials, recycling or renewing materials, protecting nature, and promoting non-toxic and high-quality construction, according to Professor Charles J. Kibert. The construction industry's extensive resource and energy usage provides a significant opportunity to implement green technologies, energy-efficient methods, and sustainable development strategies to minimize environmental impact.

1.1 PROBLEM STATEMENT

The construction industry is a significant contributor to Malaysia's national economy, but it faces challenges related to payment issues and manual procurement management. Late payment problems have risen rapidly in recent years, affecting the

industry's reputation and project management practices. The lack of a comprehensive framework for procurement data integration and technology implementation hinders progress. Efficient payment practices are vital for project success, and issues can arise during final account preparation.

To achieve Malaysia's development goals, the construction industry must adapt quickly, but payment problems persist. The procurement department in the construction firm faces challenges in managing supplier relationships and the supply chain. Miscommunications between staff members and outdated procedures further complicate procurement. To improve construction record administration, a systematic solution is needed, such as a website accessible from anywhere.

The procurement department is currently facing challenges with the "Pembinaan Tetap Teguh" and "Pembinaan Tetap Teguh Infra" site projects and headquarters offices. To manage supplier relationships and the supply chain, the procurement department will search for past procurement documents as references. Additionally, there may be miscommunications among staff members working at the headquarters and on the site projects. The site office still relies on outdated procedures for document procurement, leading to a chaotic situation with numerous purchase documents required on construction sites. As a result, workers are unable to carry out their duties at the job location and must remain at the headquarters.

To address these issues and establish a more systematic approach on the construction site, it is necessary for the company or site office to improve the administration of the construction record system. The procurement department faces several challenges, including delays in receiving information after materials are ordered, difficulties in tracking purchases of machinery and materials, a lack of systematic monitoring in the ordering process, limitations in the site office department'sability to place orders, and the absence of a well-organized system for storing procurement documents. The most effective solution is to develop a website that can beaccessed from anywhere.

This website aligns with the principles of IR 4.0 and aims to simplify operations in the construction industry. Manual completion of the project can be challenging and prone to delays due to missing documents or an excessive number of steps required before submitting the final account closing to the customer. By utilizing electronic applications, job processes can be accelerated and streamlined.

The purpose of developing the DO Tracking System website is to provide everyone on the site and at headquarters with access to track delivery orders swiftly, thereby shortening the payment process. This website serves as a bridge connecting the site and the purchasing and procurement department, enabling seamless tracking of delivery orders from the site to the purchasing stage.

1.2 OBJECTIVES OF STUDY

The objectives of this study are to develop a website for efficient and systematic purchasing document management. There are three objectives of this study which is:

1. To identify the need for a system for efficient and timely payment in construction projects.
2. To develop a system using the WIX.com website builder for efficient and timely payment in construction projects.
3. To evaluate the effectiveness of the system used by the construction site management personnel and purchasing department personnel.

1.3 SCOPE OF STUDY

The aim of this study is to expedite the flow of information regarding the ordering of items such as materials and machinery to the headquarters (HQ), including Purchase Orders and Delivery Orders for projects. Typically, the payment processing takes three to four weeks, resulting in a time-consuming process for both the site and HQ. However, with the implementation of this website system utilized by site personnel, such as supervisors and other individuals involved in order management, the process of placing orders and receiving information has become simpler and faster. The website system was developed using the Wix.com website builder.

The project scope encompasses the headquarters located at B1-1-1, Bangunan PTT, Space U8 No.6, Persiaran Pasak Bumi Taman Bukit Jelutong, Seksyen, U8, 40150 Shah Alam, Selangor, as depicted in Figure 1.1, and the construction site at Kota Elmina (EW KE01) phase 1, as shown in Figure 1.2. The study is limited to employees from

various positions within the procurement department staff at the headquarters of Pembinaan Tetap Teguh Jentera, as well as staff members at the construction site, including project managers, site engineers, and site supervisors. Therefore, the focus of this study will be on evaluating the effectiveness of the website by the construction site management team, particularly the supervisors at the construction site.

Figure 1.1: Headquarters Location (Google Maps).

Figure 1.2: Kota Elmina Phase 1 (EW-KE01).

1.4 BACKGROUND OF STUDY

Since the advent of the digital era, which has brought significant transformations to various industries, a considerable amount of time has passed. Today, almost every business leverage computer and the Internet to streamline their operations. However, those aiming to modernize their businesses are increasingly turning to smartphones instead of traditional desktop computers. Construction management software has been available for a while, providing tools for planning, scheduling, monitoring, and communication on construction projects. It has proven to be a valuable resource for enhancing operational efficiency. To further facilitate convenience, these software solutions are now accompanied by website systems and mobile app versions.

On construction sites, information can be swiftly delivered to the right individuals. All project stakeholders, whether technical or non-technical, can easily access the software. It is worth noting that nearly 80% of smartphone users excessively check their devices throughout the day, spending more than four hours on their phones daily. As a result, supervisors and managers within organizations view mobile phones as the most effective means of communication with their team members. Therefore, it is essential to utilize website systems on construction sites. The constant flow of information required on construction sites can be accessed quickly and effortlessly by team members, leading to increased productivity and, consequently, higher earnings.

1.5 SIGNIFICANT OF THE STUDY

The execution of construction projects often leads to long working hours and delays in job completion. These challenges highlight the inability to meet established deadlines set by higher authorities. To align with the principles of the Industrial Revolution (IR) 4.0, which emphasizes digitizing industrial processes to create a flexible and comprehensive production system, it is crucial to address the shortcomings of the current system. At the construction site, many important hardcopies of delivery orders are missing or damaged due to factors like rain, pesticides, rats, and termites, often resulting from human negligence.

This study aims to assess the effectiveness of website development at both the corporate office and construction site. User-friendly websites that offer features such as

document sharing and cloud storage will be evaluated for their performance. Implementing this system at the project site can enhance user satisfaction through a user-friendly interface. Additionally, this framework enables quick and easy retrieval of files, reducing issues related to lack of transparency, clandestine procurement, and the time and cost associated with document management. The development of this website is facilitated by the Internet of Thinking (IoT) technology, enabling seamless connectivity and efficient information exchange (McKinsey, 2022).

1.6 CONCLUSION

In summary, this study addresses various issues related to information delays in construction projects. The main problem identified is the late communication of orders to the headquarters, resulting in time wasted during the payment process. With this context, the study aims to achieve three key objectives: firstly, to identify the need for an efficient and timely payment system in construction projects; secondly, to develop a system using the Wix.com website builder that enables efficient and timely payments; and finally, to evaluate the effectiveness of the system among personnel in the construction site management and purchasing departments.

The focus of this project is the development of a website that serves as a centralized platform for data collection, analysis, and summarization. The website will prioritize simplicity and utilize mathematical methods to gather data effectively. Its purpose is to facilitate tasks and streamline communication among the judging site, site supervisor, purchasing team, and delivery teams. Furthermore, the website aims to minimize paper usage for official business correspondence, opting for concise and easily manageable electronic formats to reduce paper waste within the organization. It is worth noting that this website aligns with the principles of IR 4.0, promoting the use of the Internet of Things (IoT) and digital documentation practices.

CHAPTER 2

LITERATURE REVIEW

2.0 INTRODUCTION

In the context of construction, the process of purchasing constructed facilities is commonly known as procurement. According to Khairuddin Abdul Rashid and S.S. Khairuddin (2017), procurement processes can be organized in various ways, such as sequential, parallel, or overlapping, from project initiation to completion and handover. Each approach has its own advantages and disadvantages.

Clients in the procurement process typically have goals related to completion date, rate of completion, price, and job quality. One of these objectives usually takes priority. Establishing, adopting, and implementing the best procurement system can help satisfy the client's objectives and top priority. For example, sequential processes may impact time and cost, while overlapping processes may reduce time and cost but potentially affect quality.

Khairuddin (Khairuddin Abdul Rashid & S.S. Khairuddin, 2017) developed a conceptual model for procurement procedures in construction, encompassing initiation, funding, design, statutory approval, bid invitation, construction, and risk allocation. However, this model is applicable only to projects using the conventional procurement method, which separates the design and construction processes and concludes when the

project is physically completed.

With more contemporary methods of construction procurement, the design and construction processes are becoming more integrated. Funding sources, especially for public projects, have expanded beyond clients and their funders to include private investors and even end-users through concepts like Public Private Partnership (PPP), Private Finance Initiative (PFI), and Privatization. These methods, also known as Life Cycle Costing (LCC), focus on the total costs incurred throughout the entire lifespan of the built facility. Contracts for built facilities can span 20 to 60 years and involve funding, reimbursement, income generation, design and construction, commissioning and completion, maintenance and management, service delivery, refurbishment, handover, and potentially even demolition (Khairuddin Abdul Rashid & S.S. Khairuddin, 2017).

The atmosphere within an enterprise can be likened to that of a construction project, even more so due to its diverse nature. A construction project involves a multitude of activities, financial resources, individuals with different skills and backgrounds, client objectives, contractual relationships, site requirements, risks, external and internal factors, and more. Above all, the work must be completed within the specified time, budget, and quality standards, necessitating effective and efficient management of the entire procurement process. According to Khairuddin Abdul Rashid and S.S. Khairuddin (2017), the purpose of the procurement system is to manage all procurement processes.

The three most dominant procurement systems in Malaysia are traditional or Design-Bid-Build (DBB), Design and Build (D&B) or Turnkey, and Management Contracting. The term "dominant" implies that these systems are the most commonly used. For a comprehensive examination of these systems, readers are referred to the publications of Khairuddin Abdul Rashid and S.S. Khairuddin (2017), as it falls outside the scope of this study.

2.1 ISSUES IN MANAGING DELIVERY ORDER

Site monitoring is a crucial aspect of the construction process, ensuring project progress and maintaining a smooth and on-track environment at the construction site (Project Management Institute, 2017). In construction, site monitoring is divided into two parts: tracking human activities (workers) and machinery activities (machinery tracking) on-site (Boje, Guerriero, Kubicki, & Rezgui, 2020).

To handle the vast and diverse data generated throughout the project lifecycle, which cannot be managed manually by the project team, the use of Internet of Things (IoT) technology for monitoring becomes essential (Lyle Del Vecchio, 2019). GPS, RFID, sensors, and drones are employed to capture information from human tracking and industrial equipment, forming part of the IoT system. The project team can access this information via mobile devices, tablets, and computers, facilitating time and expense management at every stage of development and enhancing the efficiency of the monitoring system (Boje et al, 2020).

Time, cost, quality, and project scope are the primary key indicators for project success in project management (Ilies, Crisan, & Muresan, 2017). In the past, many projects struggled with these indicators due to inefficient management practices and faced challenges in completing projects within the allocated time and budget.

However, with the application of IoT, project management becomes more manageable as the entire project's development can be digitally tracked using 3D models. The digitalization of 3D models enables effective utilization of project resources, monitoring of vehicle equipment, tracking of project progress, early detection of errors and conflicts, real-time reporting, and efficient management of project scheduling and cost (Boje et al, 2020).

Unpredictable weather conditions and road traffic often cause delays and changes in the project schedule, particularly in the timely delivery of construction materials (Rane, Potdar, & Rane, 2019). To address this issue, the Internet of Things (IoT) is utilized, enabling project managers and site supervisors to track the status of materials, vehicles, and machinery more effectively. By having precise information on travel routes, vehicle speed, location, and maintenance schedules, on-site operations can

be planned and coordinated more efficiently (Louis & Dunston, 2018; Joshi, 2019).

2.2 TRADITIONAL SYSTEM OF PROCUREMENT

The Traditional or Design-Bid-Build (DBB) procurement system operates on the principle of sequential execution of the seven procurement procedures, keeping the design and construction processes separate, and allocating risks to each party involved—the Client, the Contractor, and the Consultants. This approach allows for the establishment of a contract price prior to construction, grants designers complete control over the design, and assigns all construction-related risks to the contractor. However, this method often leads to longer development periods and fosters conflicts among the participants due to the allocation of risks. The conventional procurement system is predominantly used by the public sector as it fulfils the requirements for transparent procurement processes and accountability of stakeholders.

Malaysia's rapid development is significantly influenced by industries that hold increasing economic significance, such as the construction industry. To achieve the 2020 goals, Malaysia needs to enhance its growth framework, which includes the construction industry (Abdul Aziz, 2018).

In various organizations like government agencies, private sector enterprises, and educational institutions, the purchasing department plays a vital role in supporting business operations as the primary procurer of goods and services. The procurement department ensures prompt acquisition of products and services for internal clients while maintaining the financial stability of the business. They strive to obtain goods and services at the most competitive price and highest value. Therefore, the purchasing department must have a deep understanding of the complex nature of the operations it supports and the marketplaces offering the required products or services to achieve its objectives. The role of a purchasing officer extends beyond purchasing office supplies and furniture.

In today's procurement landscape, personnel must also be familiar with advanced network technology equipment, international travel requirements, and other relevant topics. The role and function of the purchasing department within an organization are determined by its size. The career prospects in the purchasing profession have been affected by outsourcing and technological advancements, and this

trend is expected to continue (Planergy, 2018).

Purchase orders (POs) hold significant financial importance in construction projects. A PO, particularly in the context of construction, is typically approved by both the buyer and the seller. The buyer, often the owner or general contractor, issues a PO to the seller, typically a general contractor or specialty contractor, to cover the project's expenses. The agreement between the parties, along with the cost and quantity of the required products or services to complete the project, is detailed in the document.

In this chapter, the researcher will provide a literature summary to identify existing knowledge on the topic. This summary not only helps to identify when a problem may have a better solution but also enables collaboration with other researchers to develop more comprehensive solutions based on previous case studies. Additionally, it emphasizes the importance of modern purchasing and documentation technology in the construction industry, particularly during the construction phase.

2.3 GREEN ELEMENT IMPLEMENTATION

Green building materials are characterized by their ability to be recycled, repaired, or reused, and their production does not cause harm to the environment. They offer an abundant and sustainable alternative to non-renewable resources, thereby minimizing negative environmental impacts. Green building materials have a positive influence on the environment and contribute to improved indoor air quality.

In addition to enhancing the aesthetics of buildings and promoting healthier indoor air quality, the use of green structural materials also has a positive environmental impact. Harmful emissions from pollutants, particularly volatile organic compounds (VOCs), can be significantly reduced, thus mitigating health risks and the potential for cancer development associated with poor indoor air quality. The study of controversies surrounding certain materials helps minimize health risks by discouraging the use of hazardous synthetic compounds, such as PVC.

Furthermore, green building materials contribute to better indoor air quality, which can help alleviate Sick Building Syndrome (SBS). By employing low-toxicity materials in construction, the risk of SBS can be reduced. Environmental contamination

is a significant concern in the manufacturing of building materials within the construction industry. For example, the production of concrete, which accounts for one-tenth of global emissions and generates 10 billion tonnes of concrete annually, has contributed to air pollution, a major source of ozone-depleting substances (Kuppusamy, 2018).

Developing a mobile platform and apps can address these challenges, offering users long-lasting solutions and numerous benefits. Advantages of such systems and apps include reducing paper usage, managing and expediting document completion, and facilitating efficient information retrieval.

2.3.1 Paper Usage Reduction

By utilizing these programs or methods, paper consumption can be significantly reduced. The computer system generates the actual documents while the user searches for attachments, thereby minimizing the need for paper printing. Consequently, the overall usage of paper decreases, contributing to tree conservation and reducing air pollution levels.

2.3.2 Eco-Friendly

This platform adheres to sustainability principles and regulations, ensuring minimal or no harm to the ecosystem or environment. Users can easily share data and information with others through this website system.

2.3.3 Work Management

Efficient work management is a primary advantage of using these website systems and platforms. Creating document forms, for instance, can be done promptly and delivered to clients on schedule. Proper work management leads to well-organized tasks, simplifies task completion for users or staff, and ultimately increases productivity.

2.3.4 Time Management

The system and apps enable users to quickly locate documents, improving productivity at work. It also facilitates timely completion of purchasing documents such as invoices and delivery orders. Effective time management involves intentionally planning and managing the allocation of time to specific tasks to enhance effectiveness, efficiency, and output. By employing efficient time management, individuals can allocate more time to other construction-related tasks.

2.4 INTERNET OF THINGS (IoT)

Numerous companies and research organizations have provided diverse projections regarding the potential impact of the Internet of Things (IoT) on the internet and the economy in the next five to ten years (CIDB, 2023). Cisco, for instance, estimated that there would be over 24 billion internet-connected objects by 2019, while Morgan Stanley projected 75 billion networked devices by 2020. Huawei, taking it a step further, forecasted 100 billion IoT connections by 2025. According to the McKinsey Global Institute, the financial influence of IoT on the global economy could range between \$3.9 trillion and \$11.1 trillion by 2025. Although specific numbers remain uncertain due to the variations in predictions, the collective outlook points to substantial growth and influence (Nakanishi, 2022).

In 1999, Kevin Ashton, a British technology pioneer, coined the term "Internet of Things" (IoT) to propose a system where physical objects could be connected to the internet through sensors (Kevin, 2013). Ashton introduced this term to emphasize the potential of using the internet to link Radio-Frequency Identification (RFID) tags in corporate supply chains for tracking and monitoring without human intervention.Today, the phrase "Internet of Things" is commonly used to describe scenarios where various objects, devices, sensors, and everyday items have internet connectivity and processing capabilities. While the concept of utilizing computers and networks to monitor and manage objects is not new, the term "Internet of Things" itself is relativelyrecent. This has been the case for many years (Reverso Context, 2022). For instance, systems for remotely monitoring electricity grid meters through telephone lines were already employed in the business world by the late 1970s. The widespread use of "machine-to-machine" (M2M) solutions for equipment monitoring and operation in corporate and industrial settings began in the 1990s with advancements in wireless technology. Unlike today's Internet Protocol (IP)-based networks and standards, many early M2M solutions operated on closed purpose-built networks and proprietary or industry-specific protocols. Table 2.1 shows the setting, description and example for IoT Application

Table 2.1: Setting for IoT Application.

"Settings" for IoT Applications (Source: McKinsey Global Institute[25])		
Setting	**Description**	**Examples**
Human	Devices attached or inside the human body	Devices (wearables and ingestibles) to monitor and maintain human health and wellness; disease management, increased fitness, higher productivity
Home	Buildings where people live	Home controllers and security systems
Retail Environments	Spaces where consumers engage in commerce	Stores, banks, restaurants, arenas – anywhere consumers consider and buy; self-checkout, in-store offers, inventory optimization
Offices	Spaces where knowledge workers work	Energy management and security in office buildings; improved productivity, including for mobile employees
Factories	Standardized production environments	Places with repetitive work routines, including hospitals and farms; operating efficiencies, optimizing equipment use and inventory
Worksites	Custom production environments	Mining, oil and gas, construction; operating efficiencies, predictive maintenance, health and safety
Vehicles	Systems inside moving vehicles	Vehicles including cars, trucks, ships, aircraft, and trains; condition-based maintenance, usage-based design, pre-sales analytics
Cities	Urban environments	Public spaces and infrastructure in urban settings; adaptive traffic control, smart meters, environmental monitoring, resource management
Outside	Between urban environments (and outside other settings)	Outside uses include railroad tracks, autonomous vehicles (outside urban locations), and flight navigation; real-time routing, connected navigation, shipment tracking

2.5 SMART COMMUNICATION

Presently, social media platforms like Facebook, WhatsApp, and Telegram have become highly popular means of communication. Utilizing social media for various communication purposes, such as exchanging opinions, sharing status updates, and conducting video calls, simply requires an internet connection. These social media platforms have evolved to offer additional features, such as the creation of discussion groups and streamlined document sharing. The concept of e-tenders has facilitated the efficient distribution of information to potential bidders, eliminating geographical barriers and ensuring swift document delivery (Rachel Burger, 2017). In terms of management, ScanMarker is an innovative digital pen that can scan printed text and transmit it to various devices, including computers, tablets, and smartphones, via Bluetooth connections (Rachel Burger, 2017). This device significantly saves typing time, supports translation in approximately 40 languages, and even converts text scans into audible output (Islam et al., 2018).

2.6 REMOTE OPERATION

The construction industry operates in complex environments, necessitating effective monitoring to ensure project smoothness and success (Miraz Mahdi, Maaruf Ali, Peter Excell, and Richard Picking, 2018). As highlighted by Burger (Rachel Burger, 2017), the Internet of Things (IoT) enables remote instruction by connecting devices to the internet, whether through wired or wireless means. Drones, easily identifiable machines, can receive instructions and autonomously monitor construction sites, ensuring employee health and safety compliance as well as tracking progress over time (Rosdiadee Nordin, 2016).

While the concept of using computers, sensors, and networks to monitor and

control objects have been in existence for some time, recent technological advancements and commercial trends have propelled the "Internet of Things" into the forefront of modern society. The IoT promises to create a fully networked "smart" society, fostering stronger connections between individuals and their surroundings, as well as between objects and their environments. The notion of an interconnected network of devices, known as the Internet of Things, has the potential to reshape people's perception of what it means to be "online."

Based on research findings, four primary categories of IoT applications dominate the landscape. In the construction industry, social media apps such as WhatsApp Telegram, and Facebook Messenger serve as IoT applications, facilitating communication and information sharing among stakeholders. Email is widely used as a means of sharing information in this business domain, with both social media apps and email receiving similar and the majority of responses. Websites are commonly utilized as reference sources for corporate profiles, activities, policies, price quotations, and other relevant information, ranking as the second most popular application. Additionally, GPRS applications like Google Maps or Waze find utility in providing efficient routes for product and document deliveries, representing the third most frequently used application.

2.7 SPEEDBRICK SERVER SOFTWARE

In Malaysia's construction sites, managers commonly rely on traditional spreadsheets for crucial tasks such as budgeting, monitoring, and material ordering. However, communication between on-site staff, site managers, and the head office often relies on phone calls and messaging services like Whatsapp. While these tools get the job done, they may not be the most efficient or streamlined. Speedbrick founder and CEO, Teoh Pui Mun, describes this system as highly manual and refers to it as a "human system."

Since its launch a year ago, Speedbrick has served more than 20 clients, including primary and secondary contractors involved in projects like Solaris Parq,

Hilton I-City, Forest City, and Sefina Mont Kiara. While many large contractors already have their supply chain management systems in place, Teoh acknowledges the challenge of convincing on-site workers to adopt software due to its complexity and compatibility with local culture. To address this, the software is designed to be user-friendly, with Teoh emphasizing that it is created with the mindset of being accessible even to a 70-year-old. Each user receives a customized dashboard that presents only the relevant information needed for them to take action.

Speedbrick has introduced Digital Procurement, a solution aimed at streamlining the purchasing process through real-time MR/PO (Material Requisition/Purchase Order) approval control. Integration with accounting software allows for continuous monitoring of the project budget. Accessible as long as devices are connected to the internet, Speedbrick's products also offer automatic remote featureupgrades, ensuring users have the latest functionalities available.

2.8 IR 4.0 IN CONSTRUCTION

The advent of the Fourth Industrial Revolution has spurred the need for changes in the construction sector to align with advancements in technology and intelligent systems. This revolution is giving rise to a physical cyber system that will transform the future of building construction. Embracing technology and enhancing knowledge and skills are crucial foundations for effectively navigating these developments. To facilitate adaptation to these changes, the Ministry of Works (Kementerian Kerja Raya or KKR) in collaboration with stakeholders in the construction sector and the Construction Industry Development Board (CIDB) is developing the Construction Strategy Plan 4.0 (2021–2050) (CIDB, 2022).

Construction Strategy Plan 4.0 (CR 4.0 - CIDB HQ, 2022) serves as a five-year short-term plan by CIDB, laying the groundwork for a comprehensive framework aimed at enhancing the capacities of the construction sector in the Fourth Industrial Revolution. This strategic plan takes into account the National 4.0 Industry Policy (Industry4WRD) or Dasar Industri 4.0 Nasional and the Shared Prosperity Vision 2030

or Wawasan Kemakmuran Bersama (WKB) 2030 (Industry4WRD). Additionally, it aligns with other government initiatives such as the National IoT Strategic Roadmap or Pelan Hala Tuju Strategik Internet of Things (IoT) Kebangsaan, Malaysia, Digital Economic Policy, and Smartcity Framework or Rangka Kerja Bandar Pintar Malaysia's (MyGOV - the Government of Malaysia's Official Portal, 2023).

The implementation of Construction Strategy Plan 4.0 relies on four key enablers: Enabler 1: Individuals, Enabler 2: Integrated Technologies, Enabler 3: Economic Development, and Enabler 4: Governance. The Fourth Industrial Revolution demands complex and dynamic changes to keep pace with future technological innovations. Effective governance and strong collaboration among various stakeholders, including the government, businesses, academia, and society, are essential to address these challenges. Each stakeholder has a crucial role to play in transforming the construction industry into a competitive and economically contributing sector.

While acknowledging the traditional understanding of the previous industrial revolutions, Industry 4.0 has emerged with its own prominence. The first industrial revolution marked a significant transformation through the development of steam machines, water and steam power, and mechanization, leading to the industrialization of society. The second industrial revolution brought about mass production and automation with the advent of electricity and assembly line manufacturing. The third industrial revolution witnessed the rise of computers, computer networks, robotics, and the birth of the Internet, revolutionizing information handling and sharing. It also ushered in e-commerce and automation.

In contrast, the fourth industrial revolution encompasses widespread mobility, the fusion of digital and physical realms (known as Cyber-Physical Systems), and the convergence of information technology and operational technology. It leverages technologies like the Internet of Things (IoT), Big Data, Cloud computing, advanced robotics, artificial intelligence (AI), and cognitive computing to enable automation and optimization in novel ways. This revolution offers ample opportunities for innovation and complete automation, propelling the sector to new heights.

2.9   THE 12 DEFINING TECHNOLOGIES

According to the Construction Strategic Plan 2021-2025 as shown in figure 2.1, the national construction industry stakeholders, led by the Malaysian Ministry of Works, are making significant progress in implementing twelve emerging technologies. These technologies are experiencing a steady adoption rate, propelling the industry's growth to its maximum potential. To ensure effective implementation, the twelve emerging technologies have been categorized into three clusters with short, medium, and long-term implementation plans.

These clusters of technologies are spearheaded by the Construction Industry Development Board (CIDB) and its subsidiaries. The interconnected nature of these technology clusters is driving the nation's vision forward, fostering synergy and collaboration among stakeholders.
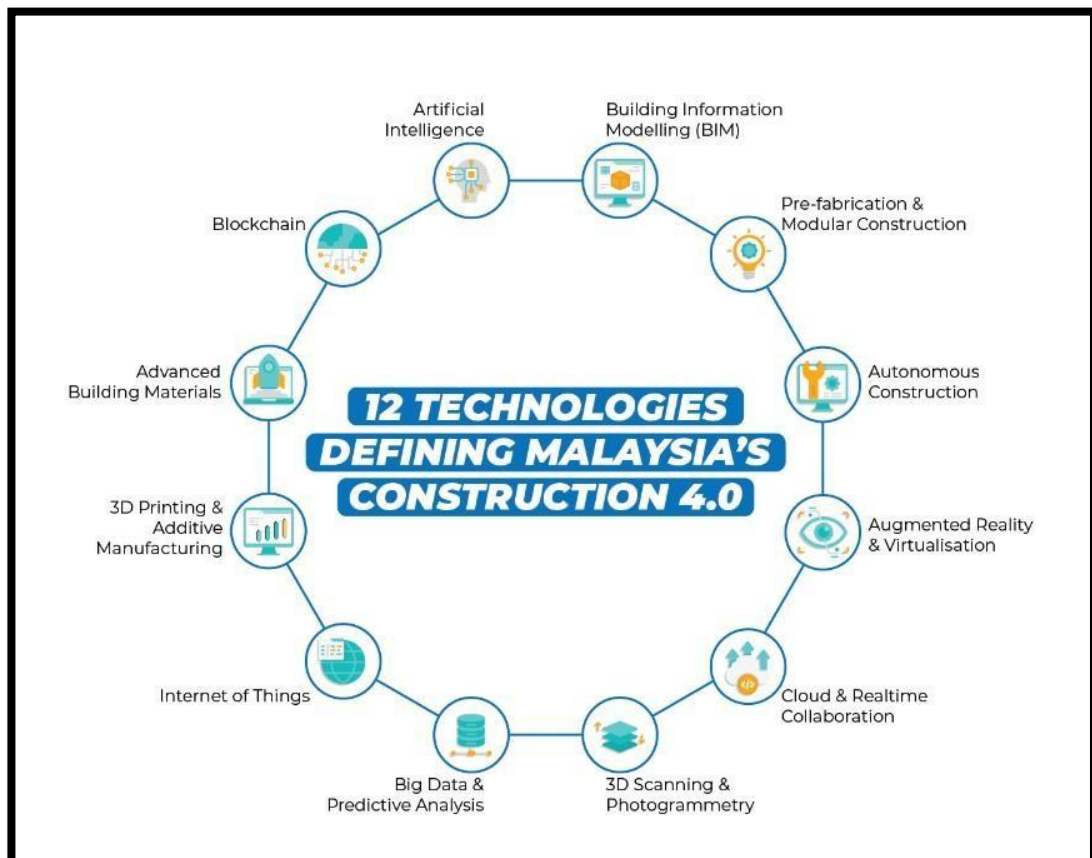
Figure 2.1: 12 Technologies Defining Malaysia's Construction 4.0.

The 12 emerging technologies in the construction industry are identified based on the Focus Group Discussion (FGD) conducted among the construction industry in Malaysia, aligning with the vision and mission of Construction 4.0 (CIDB, 2021).

2.9.1 Building Information Modelling (BIM)

An integrated approach that optimizes the lifecycle performance of buildings by centralizing fragmented disciplines of architecture, engineering, and construction (Dr. Stephen Hamil, 2021).

2.9.2 Autonomous Construction

The use of computer-controlled robots and mechanization to automate construction tasks and streamline assembly methods.

2.9.3 Augmented Reality & Virtualization

Interaction between humans and computers that enables individuals to distinguish between virtual and real-world objects, enhancing visualization and collaboration (CIDB, 2021).

2.9.4 Prefabrication & Modular Construction

A manufacturing process where building components are preassembled in a factory and then installed on-site, improving efficiency and quality control (CIDB, 2021).

2.9.5 3D Scanning and Photogrammetry

Data acquisition and mapping tools that convert photographs into 3D models, facilitating change monitoring and analysis (CIDB, 2021).

2.9.6 Big Data and Predictive Analytics

Efficient management and processing of large project data using commodity servers, enabling informed decision-making and predictive insights (Christy Abraham Joy, 2020).

2.9.7 Internet of Things (IoT)

Connectivity and sensor technology that allows objects and devices to detect and communicate surrounding environmental conditions.

2.9.8 3D Printing & Additive Manufacturing

A process that creates physical objects by depositing layers of materials based on digital models, offering customization and rapid prototyping (CIDB, 2021).

2.9.9 Cloud and Real-time Collaboration

Internet-based platforms that provide seamless information flow and extensive storage resources for construction professionals.

2.9.10 Blockchain

A distributed ledger technology that maintains records of transactions, information, and internet protocols across a network of computers, enhancing transparency and security.

2.9.11 Artificial Intelligence

Machines imitating human cognitive functions through algorithms, enabling automation of tasks traditionally performed by humans.

2.9.12 Advanced Building Materials

Integration of new technologies and processes to develop innovative or improved construction materials, enhancing performance and sustainability. These emerging technologies are poised to transform the construction industry and drive the advancements of Construction 4.0.

2.10 WIX.COM WEBSITE BUILDER

Wix is a Cloud-based platform that allows users to create websites for free (Wix, 2019). It offers a unique and user-friendly approach to website development, providing a variety of tools and features (Wix, 2019). With Wix, anyone can build a professional-looking website that is optimized for different devices and screens.

Wix goes beyond website creation (Odoo S.A, 2015). It offers a comprehensive range of options to enhance your online presence, from search engine optimization to revenue generation (Haan, 2022).

Traditionally, hiring a professional programmer to build and maintain a website can be costly. However, with Wix, anyone with a computer can create their own website for free. Additionally, Wix offers Premium Plans that provide additional benefits such as domain connection, removal of Wix ads, and online payment acceptance, catering to the needs of businesses and websites looking for advanced features.

Wix stands out with its unique designs and technologies, allowing users to create a wide range of websites. Explore the collection of website templates designed by Wix professionals, who conduct market research to include practical built-in features and the latest design trends. The App Market offers over 250 expert solutions that can be added to customize a user's website, providing effective business solutions for lead generation, traffic analysis, customer interaction, and more as shown in figure 2.2.
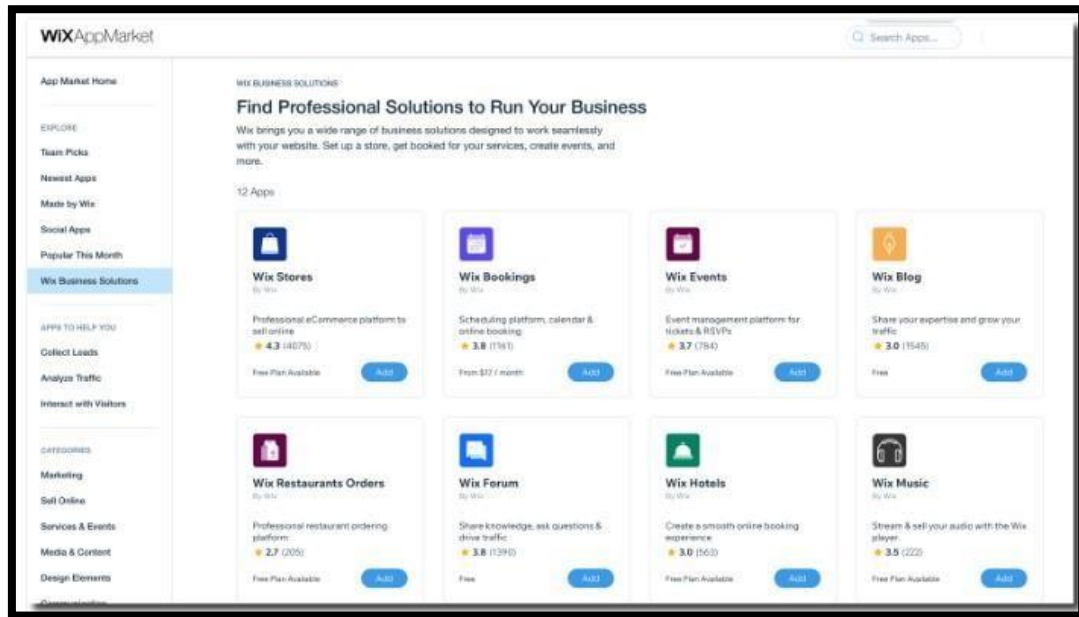
Figure 2.2: Wix.com Website Builder Desktop.

Wix is a comprehensive website builder that empowers users to create visually appealing websites, even without design or coding skills. It is highly popular among bloggers, business owners, and small companies. If users are looking to create a website without breaking the bank, Wix offers cost-effective options worth exploring (Haan, 2023).

With Wix, customers have access to a range of features that help them build a valuable and engaging online presence. This includes free and premium plans, a vast selection of design templates, integrated search engine optimization (SEO), and a wide array of sought-after services. Whether users are starting a blog, establishing an online business, or promoting their small company, Wix provides the necessary tools and resources to bring their vision to life (Haan, 2023).

Table 2.2: Pros and Cons of Using Wix.com Website Builder.

Pros	Cons
i) Easy-to-use drag-and-drop interface ii) Built-in SEO iii) 200+ App integrations available	i) Visitor analytics are not available on free or Combo plans ii) Storage limits on all plans iii) User cannot change templates once the site is live

2.10.1 Pros of Wix.com Website Builder

Wix stands out with its intuitive drag-and-drop interface, allowing users to easily add content and design their websites without any coding knowledge. With over500 customizable templates, users have a wide range of options to create a personalized website. Wix also includes built-in SEO tools to help improve site visibility in search engine results. Furthermore, users can enhance their websites with over 300 application integrations, even if they don't have coding skills. Additionally, Wix offers a free plan that provides access to most features, making it accessible to users on a budget.

2.10.2 Cons of Wix.com Website Builder

While Wix offers many benefits, there are a few drawbacks to consider. Notably, Google Analytics is unavailable on the free and Combo plans, limiting users' ability to track website traffic. Storage limitations are present in most Wix plans, which may require users to upgrade to a more expensive plan as their website grows. The free plan includes Wix ads and does not allow for a custom domain name, instead using a mysite.wix.com domain. For e-commerce activities, upgrading is necessary as the free plan does not support accepting payments. Wix's e-commerce plans start at RM 116 per month. When choosing templates, users should make careful selections as changing templates after launching a site is not possible. While minor design tweaks can be made, a major site design overhaul would require starting from scratch (Harris, 2023).

2.11 WIX CORE FEATURES

2.11.1 Website Builder and Templates

Wix offers three editors for website creation, each with unique advantages. The Wix Artificial Design Intelligence (ADI) editor is perfect for beginners, guiding users through a few questions to quickly create a simple website. The default Wix editor allows users to choose from over 500 customizable templates and modify them using the intuitive drag-and-drop editor. For designers, the Editor X provides advanced features like responsive design, custom breakpoints, and precise controls. With over 800 design templates available, users can easily create stunning websites without coding knowledge (Wix.com, 2020).

2.11.2 Blogging

Wix provides all the necessary tools for launching, managing, and growing a successful blog. The drag-and-drop editor allows effortless text formatting, image inclusion, and post creation. Built-in features like social media integration, email marketing, and SEO optimization assist users in managing their blogs and expanding their audience (Wix.com, 2020).

2.11.3 E-Commerce

With Wix's Business and E-Commerce services, users can turn their websites into fully functional online stores. Users can sell products, accept payments, manage inventory, and utilize various marketing options to drive business growth. Wix offers different plans tailored to different business needs, including features such as product reviews, subscriptions, multi-currency support, and drop shipping (Wix.com, 2020).

2.11.4 Wix Basic Website Plans

While the free plan includes Wix branding and limited storage and bandwidth, users can upgrade to premium plans for a more polished website and additional features. The entry-level premium plans range from RM 69 to RM 193 per month and include a free SSL certificate and a personalized domain for one year (Wix.com, 2020).

2.11.5 Wix Ease of Use

Wix is designed to be user-friendly, even for those with no website building experience. Its intuitive drag-and-drop editor allows users to easily customize their websites without touching any code. Wix takes care of website hosting and security, and 24/7 customer support is available for all paid plans (Wix.com, 2020).

2.11.6 Wix Safety and Security

Wix prioritizes website safety and security by complying with industry standards, including PCI compliance for payment processing. Automatic backupsSSL certificates are included with all Wix websites. A dedicated team monitors serversto prevent potential attacks (Wix.com, 2020).

2.11.7 Wix Customer Service and Support

Wix offers 24/7 customer support for paid plans, with priority support available for VIP members. Users can access support by logging into their accounts, and the Wix Help Center provides a comprehensive knowledge base for self-service assistance (Wix.com, 2020).

2.12 ADDITIONAL TOOLS AND FUNCTIONALITY

2.12.1 App Store and Integrations

Wix AppMarket offers a wide range of apps and integrations to enhance website functionality. Users can choose from hundreds of options, including social media tools, contact forms, live chat, and integrations with popular business tools like QuickBooks, Shippo, Mailchimp, and more (Wix.com, 2020).

2.12.2 Mobile Apps

Wix provides a mobile app for managing websites on the go. Users can create and publish content, view site analytics, manage orders and customers, and run promotions. The app is available for both iOS and Android devices (Wix.com, 2020).

2.12.3 Storage

Wix Website Plans offer varying storage limits, starting from 2GB and going up to 100GB. Business and e-commerce plans provide even larger storage options, with the Business VIP plan offering unlimited storage. Users can upgrade their plan for more storage if needed (Wix.com, 2020).

2.13 CONCLUSION

The Wix platform offers exceptional creative flexibility and powerful tools that cater to the needs of businesses and entrepreneurs managing their online operations. With a range of basic and advanced features, users can customize their web presence to target specific audiences and meet their business requirements. One notable capability of Wix is the ability to enable clients to book appointments online, including the option to sell scheduled services. Additionally, Wix provides an extensive library of support resources for users to access.

Wix operates as a cloud-based and real-time collaborative platform, allowing multiple users to work simultaneously. Real-time collaborative cloud visualization plays a crucial role in ensuring accurate comprehension of the cloud environment by all team members. This alignment promotes effective synchronous and asynchronous work

(Lawyer, 2022). As more companies transition their daily operations to the cloud, the ability to collaborate as a team on cloud infrastructure becomes increasingly important. Real-time collaborative solutions simplify the collaboration process, benefiting both IT departments and non-IT decision-makers. Whether addressing unexpected security issues or planning discussions on the future state of the cloud environment, visual collaboration streamlines cooperation. For instance, presenting cloud architectural diagrams to clients as evidence of successful project completion would be a time-consuming task without a platform that enables real-time and automatic visualization.

Maintaining, updating, and troubleshooting cloud environments requires collaborative efforts from IT professionals and non-IT staff. To facilitate effective communication, it is crucial to utilize resources that can translate complex cloud concepts into a language that all stakeholders can understand. By employing visualization techniques for real-time cloud collaboration, organizations can adapt more easily to the rapidly changing digital landscape and meet the evolving needs of their customers.

CHAPTER 3

METHODOLOGY

3.0 INTRODUCTION

This chapter provides an overview of the strategies and tactics employed to ensure the organization and accessibility of papers. It covers various aspects such as the study site, sample size and population, study design, data collection, analysis, and hypotheses. Data for this study will be gathered from primary sources, including survey questionnaires, and secondary sources such as literature studies, aligning with the study's goals. Many findings and approaches from this discipline are primarily published in journals to contribute to future research and help others in the field.

Research methodology encompasses the procedures and tactics used to locate, select, process, and analyze data on a particular topic. The methodology section of a research article plays a crucial role in evaluating the overall validity and reliability of the study. The construction industry is well-known for its challenges in resource planning, risk management, and logistics, often resulting in flawed designs, project delays, cost overruns, and contract disputes (Akinosho, 2017).

This website serves as a platform for suppliers (supervisors) to enter invoices after receiving orders, stamp them, and provide confirmation through signatures. It simplifies the process for the purchasing headquarters to swiftly access the necessary information for payment processing. The website grants access to all project-related

documents or images anytime and anywhere, saving time and increasing work efficiency. It aims to address outstanding payment issues and delays in information at the headquarters office. Furthermore, it evaluates the effectiveness of the website system compared to traditional methods of resolving problems at construction sites distant from the headquarters, all in alignment with achieving the project's goals.

A series of questionnaires will be distributed to all members of the Pembinaan Tetap Teguh (PTT) procurement department team and site staff. They will provide input on how well the database managed issues at the construction site in the interactions between the offices and the relevant PTT workers. The research process is divided into four primary activities: reviewing research literature, identifying relevant documents, utilizing a design thinking process, and conducting data analysis to meet the study's aims and objectives.

3.1 RESEARCH DESIGN

A research design encompasses the plan for utilizing empirical data to address a research issue. It involves making decisions about the overall research objectives, methodology, research design type, sampling techniques or selection criteria, data collection techniques, data collection procedures, and data analysis techniques.

The design of a research study identifies the style of the study, such as experimental, survey, correlational, semi-experimental, review, sub-types,experimental design, research issue, and descriptive case study. There are three primarytypes of study designs: data gathering, measurement, and analysis. The choice of research design depends on the research challenge a business is facing, rather than the other way around. The research design phase determines which tools to use and how toutilize them.

A well-designed research study ensures the smooth execution of various research techniques, making the research as professional as possible and yielding the most information with minimal effort, time, and financial resources. Before data

collection and analysis, a research design, or plan, is essential for four research projects aimed at constructing a house more effectively, economically, and aesthetically. In some circles, this research is referred to as the "map of the house." The research design involves early planning of the procedures for gathering relevant data and the methodologies for analysis, considering the research goals and the availability of staff, time, and resources.
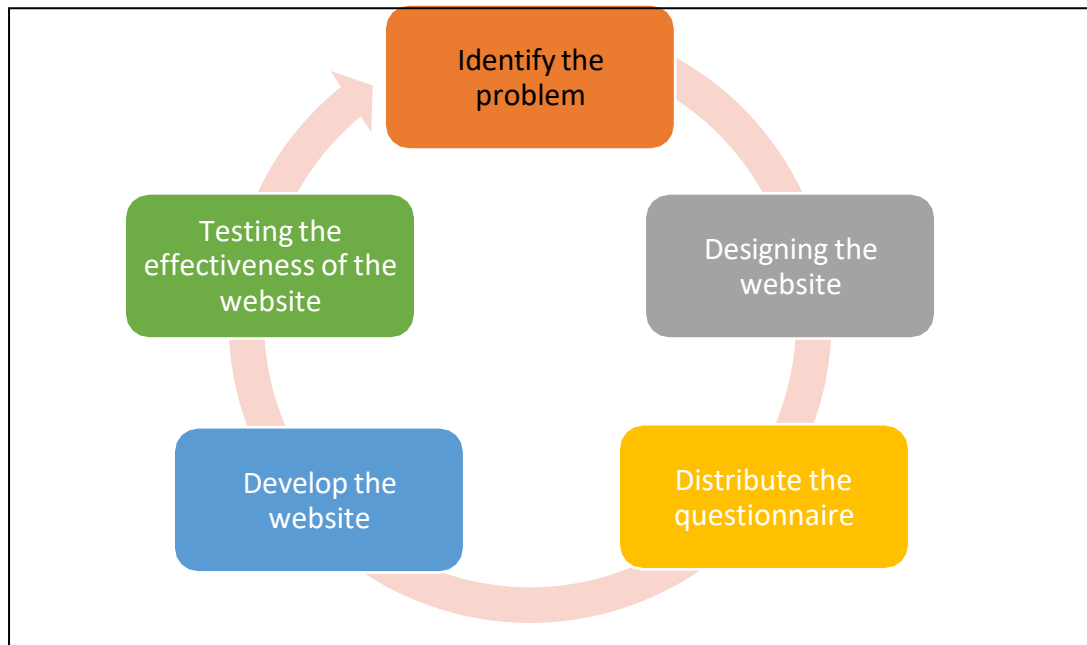
Figure 3.1: The method illustrated to create a website for key-in the delivery order.

A research design table as shown in table 3.1 below provides an overview of the key elements and components of a research study. It includes information on the research objectives, research questions or hypotheses, research methods, data collection procedures, and data analysis techniques. The table 3.1 is a concise summary that allows researchers and readers to quickly understand the design and structure of the study.

Table 3.1: Research Design.

Objectives	Method	Instrument		Analysis	Expected Outcome
To identify the need for this website for systematic, efficient, and timely payment in construction projects.	Survey	i. ii.	Quantitative Google Form and Respondents	SPSS Software - Reliability test - Frequency analysis - Descriptive analysis - Average mean (excel)	Identify the need for the website system by using a barcode for efficient and systematic procurement documentation and payment process.
To develop the website for systematic, efficient, and timely payment in construction projects.	Develop	i. ii. iii.	Website Barcode Using the Wix website creator	- Efficient website system for the procurement department.	Develop the website system for efficient and systematic procurement documentation and payment process.
To evaluate the website's effectiveness by the construction team member.	Survey	i. ii. iii. iv.	Quantitative Questionnaire Respondents Google form	SPSS Software - Reliability test - Frequency analysis - Descriptive analysis - Average mean (Excel)	Evaluate the effectiveness of the website systems by the construction team members.

3.2 DEVELOPMENT OF PROJECT

Research and development (R&D) refer to the business process of generating new information that can be utilized for the creation of innovative technologies, products, services, or systems for internal use. In this study, a research framework is established to guide the research development. The figure below illustrates the progression of the research project. The diagram depicts the sequential flow of research activities, starting with the literature review, followed by the identification of the problem statement, ideation of innovative solutions, invention of systems or products, testing, and evaluation of efficacy.

A Flow of Research Framework provides a visual representation of the sequential flow or steps involved in a research study. It illustrates the overall process and progression of the research, from the initial stages of conceptualization and problem identification to the final stages of data analysis and interpretation. The figure 3.2 describes each step or component of the research framework.
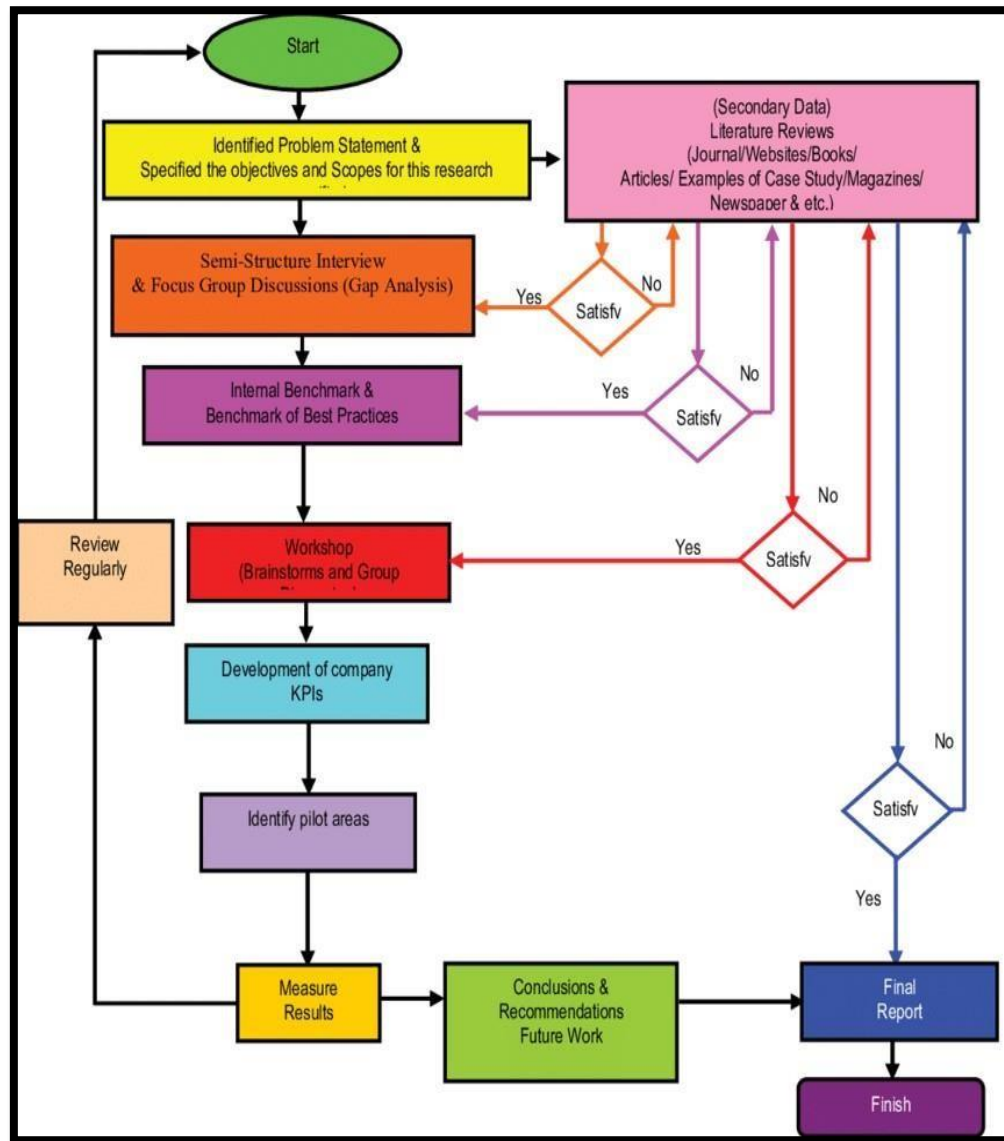
Figure 3.2: Flow of Research Framework.

A Phase of Research figure illustrates the different stages or phases involved in a research study. Each phase represents a distinct step or component of the research process, and the figure 3.3 provides a visual representation of the sequential flow of these phases. The accompanying explanation text describes each phase in detail, outlining its purpose and activities.

Figure 3.3: Phase of Research.

The development research involves the entire process of starting from scratch and reaching the completion of the Delivery Order Tracking System website. A crucial step in this process is to create a flowchart for the system to ensure the smooth execution of the project according to the initial plan.
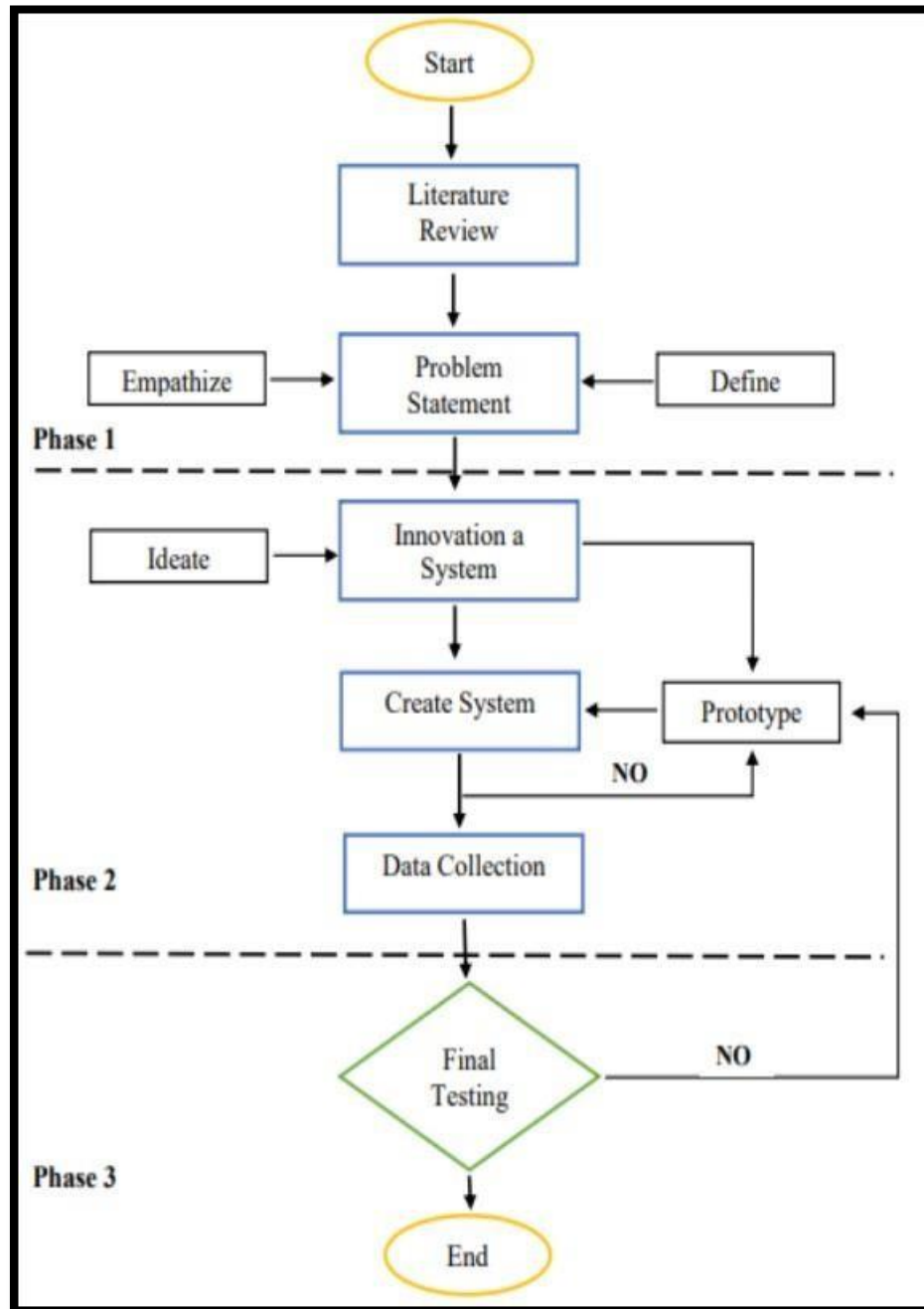
Figure 3.4: Flow of Research Phase.

This framework served as a guideline to ensure the project was executed according to plan. The study process is divided into multiple phases, as depicted in the figure 3.4.
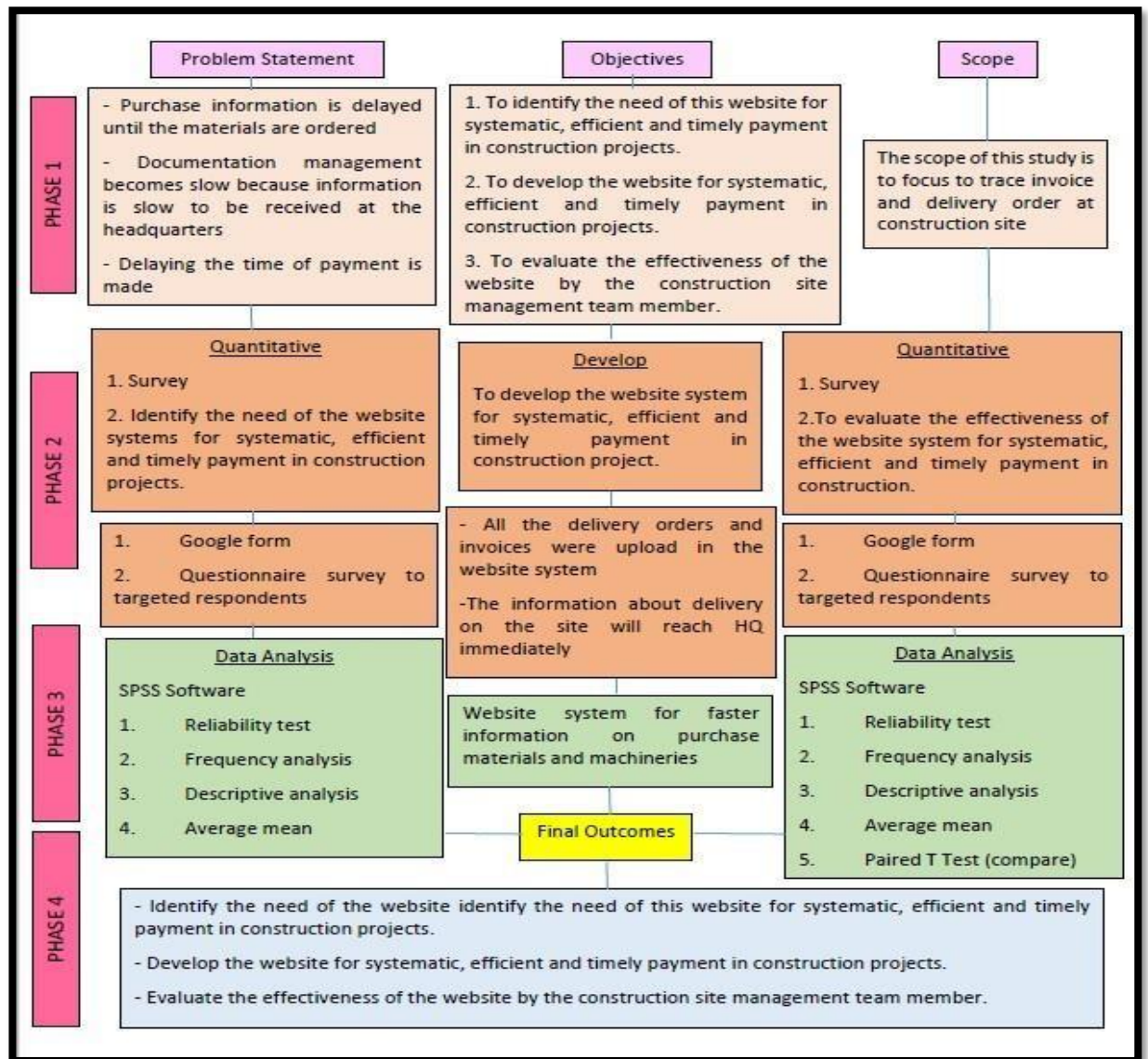
Figure 3.5: Details of Research Phase.

The detailed explanation of the research phases provides a thorough understanding of the specific activities and considerations involved at each stage. It highlights the progression of the research process, from problem identification to reporting the findings, ensuring a comprehensive overview of the research methodology and outcomes as shown in the figure 3.5.

3.3 SYSTEM DESIGN AND DEVELOPMENT

The efficient creation and execution of a web-based system rely heavily on its creation and design. A structured approach is necessary to effectively design a website

and coordinate all work activities. The system design encompasses the overall functionality of the website. This section plays a critical role in enabling users and researchers to understand the website'spurpose. It also provides explanations for the functions of each button within the website. The ultimate goal is to ensure that the website becomes user-friendly for employees to navigate.

Systems design involves defining the components of a system, such as modules, architecture, components, interfaces, and data, based on the provided requirements (The, 2023). It aims to identify and fulfill the unique needs and requirements of a company or organization. The table below outlines the steps for creating a computerized Materials Product List using Wix Software and its features. Users are required to create and maintain a website design account using Wix Software.

Table 3.2: Step to sign up and create an account by using the Wix.com website builder.
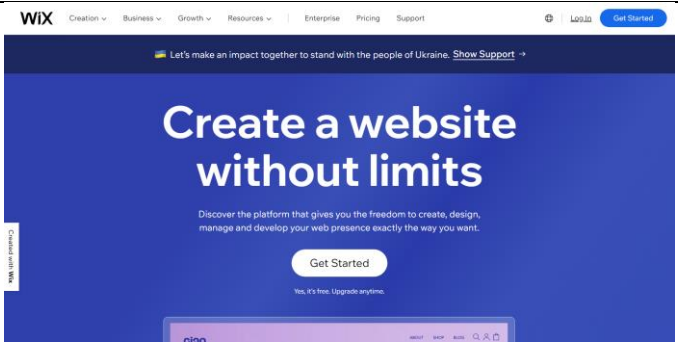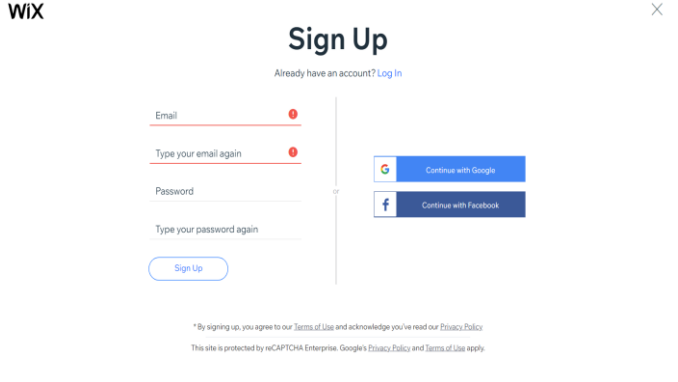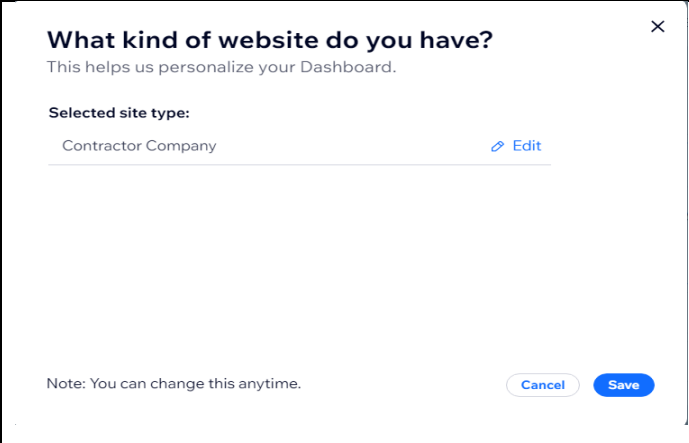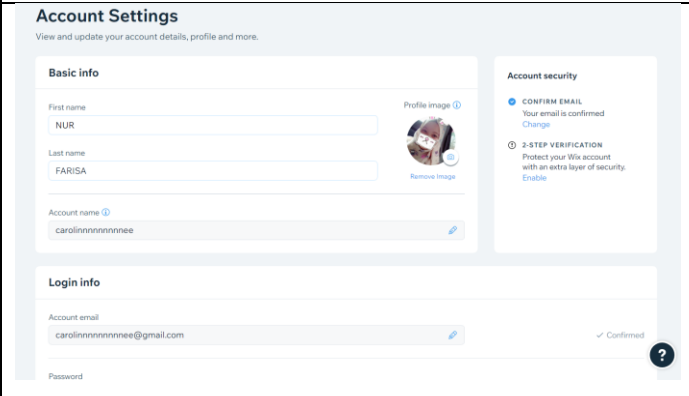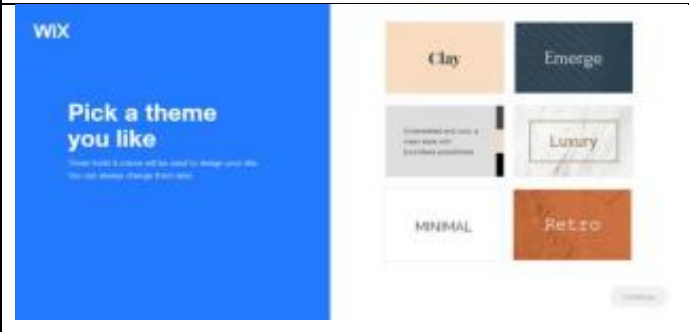
Step Picture	Step Description
	Step 1: To design the website, choose the program. The researcher has decided to use Wix Software to build the project's website.
	Step 2: Enter personal information to register for a website account. Enter the password and email.

Table 3.2: Step to sign up and create an account by using the Wix.com website builder.
(Continue)

	Step 3: Select the kind of website that will be built and used. The website has been chosen for you by a researcher.
	Step 4: Enter the name of the recipient's website. The name should be associated with the purpose of the website.
	Step 5: Edit the data that made up the website's information. The specifics will only be used for this purpose and kept private.
	Step 6: Select the website's theme. Finally, create the website by following the steps in the following section.

3.4 SYSTEM DEVELOPMENT

System development includes the processes, practices, models, and methodologies to develop new or modified systems.

3.4.1 Admin User (Design and control the dashboard of the website).

The phase of Admin User (Design and control the dashboard of the website) as shown in table 3.3 involves the design and management of the dashboard for a website. The admin user, typically a designated individual or a team, is responsible for creating an intuitive and user-friendly interface that allows for efficient control and management of the website's features and functionalities. This phase encompasses activities such as designing the layout and structure of the dashboard, implementing navigation elements, and incorporating necessary controls and settings. The admin user ensures that the dashboard provides easy access to key administrative functions, such as content management, user management, analytics, and customization options. The goal is to create a dashboard that empowers the admin user to effectively manage and monitor the website, making necessary updates and adjustments as needed. Attention is given to usability, aesthetics, and functionality to ensure a seamless and productive experience for the admin user in maintaining and controlling the website's operations.

Table 3.3: Admin User View.

This figure is the dashboard system that can monitor all the activity inside the Wix.com website builder. 	This figure is the role and permission desktop that the admin can only decide, and every user can have different roles to control and lead the function on the website.
The request user will be shown on this desktop to be approved by the admin, and only the admin can accept the request and give the user roles. 	This figure is the site invitation desktop that the admin can only invite for specific roles. This section also can be set for the required roles.
The roles can be updated and changed by the admin for new users. The admin can set the roles for every user in this Wix.com website builder. 	This figure is the manage apps desktop. The function is to update any change or activity and info related to the website.
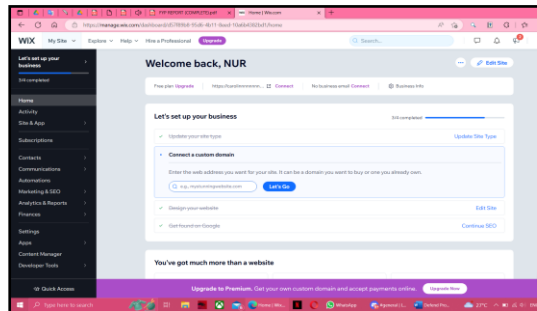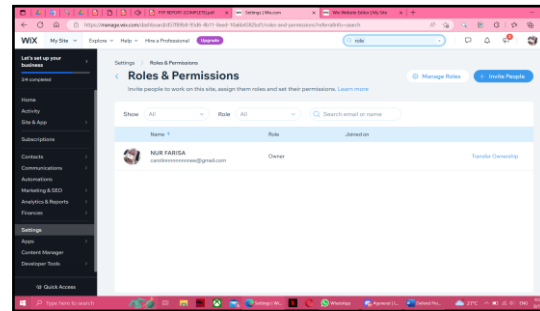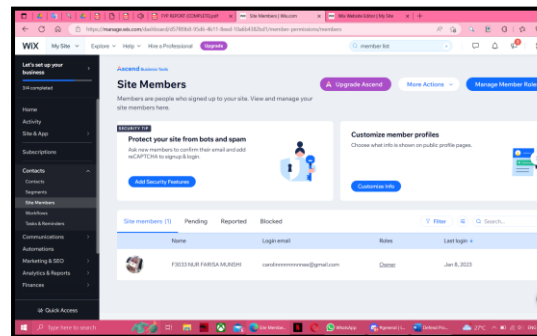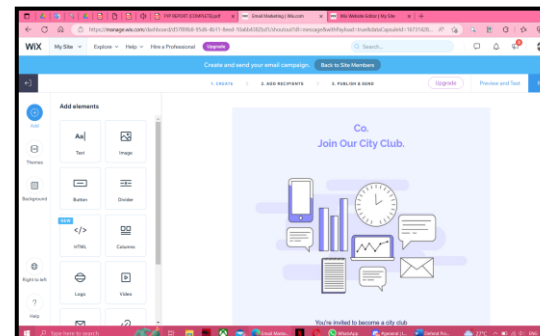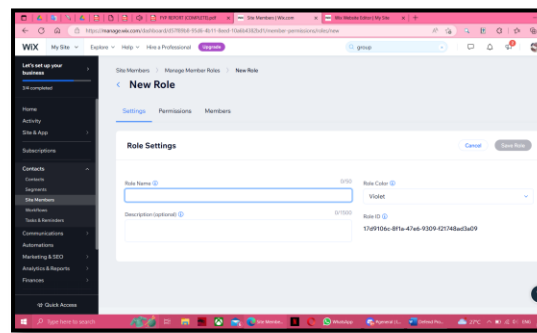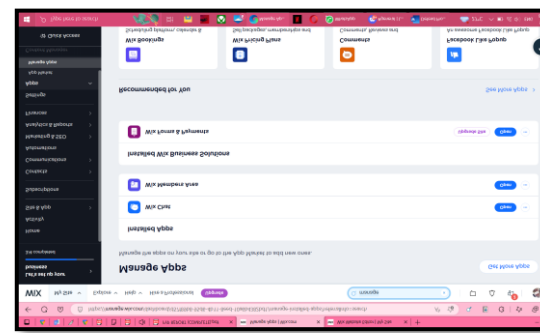
3.4.2   Public user (View and update the delivery order and the quantity in specific purchase orders).

The phase of public user (View and update the delivery order and the quantity in specific purchase orders) as shown in table 3.4 involves the interaction of public users with a system or platform to access and modify delivery orders and quantities associated with specific purchase orders. Public users, who could be customers, suppliers, or other stakeholders, are granted access to view and update information related to delivery orders and quantities within the context of specific purchase orders as shown in figure 3.5. The system provides a user-friendly interface that allows public users to easily navigate through relevant sections and locate the specific purchase orders they are interested in. Once accessed, they can view the details of the purchase order, including the delivery order status and associated quantities. Public users may have the ability to update the delivery order status and make changes to the quantities, ensuring accurate and up-to-date information. The system incorporates appropriate security measures to authenticate users and restrict access to authorized individuals or organizations. The goal is to provide public users with a seamless and efficient experience in tracking and managing delivery orders and quantities within the framework of specific purchase orders, facilitating effective communication and coordination between different stakeholders involved in the purchasing process.

Table 3.4: Function of Public User's View.
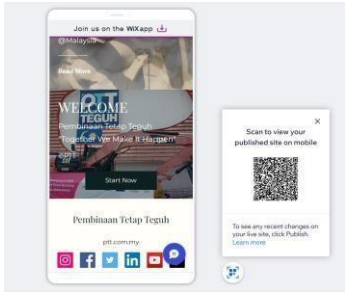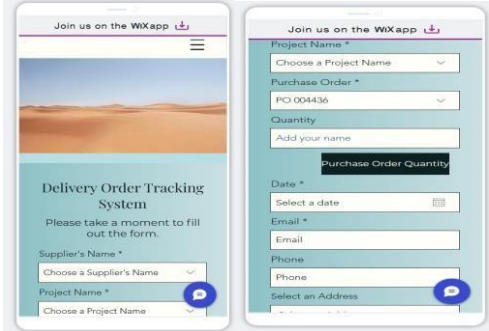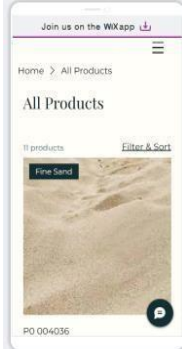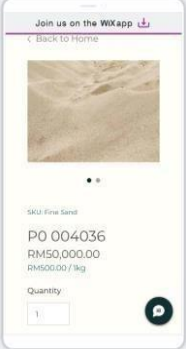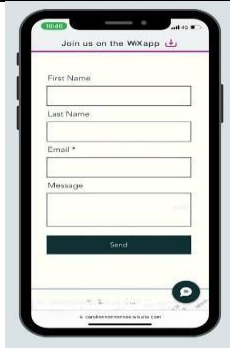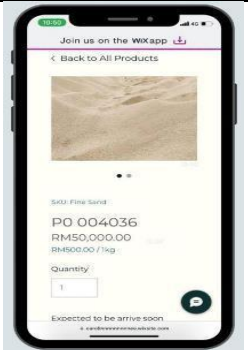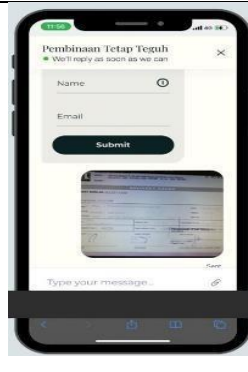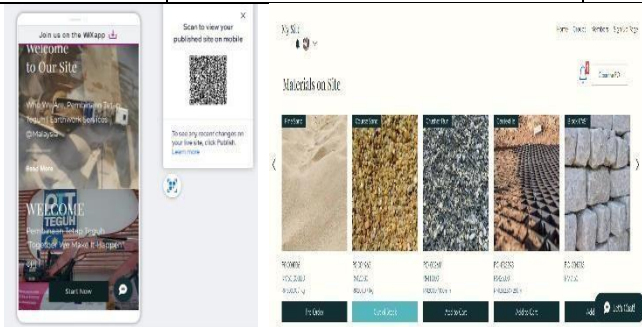
Mobile View of the DO Tracking SystemWebsite. 	Step 1: Users must first either open the DO Tracking System link or scan the barcode for thewebsite using their mobile phone to access the DO Tracking System.
	Step 2: Next, users (such as Site Supervisors) must enter pertinent data such as name, phone number, order quantity, sign and submit the Delivery Order into the designated field for a record and to proceed for the invoices and purchase order.
	Step 3: This interphase allows you to view the quantity and purchase orders that are still open. Once the purchase of goods is completed or the purchase order for a product is fulfilled, it willbe automatically closed.
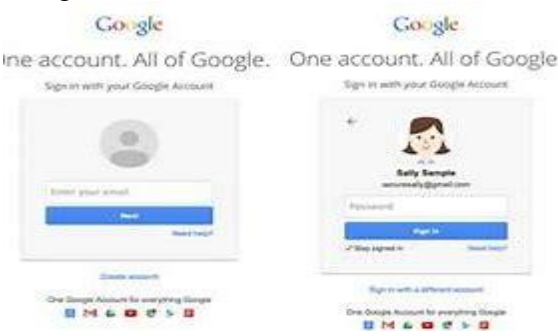
Table 3.5: Steps for public users.

1. Log in or sign up for the Delivery Order Tracking System account. Click Send to go to the next page.	2. Click start or read more to gain information about the project.	3. Choose a purchase order that is still open and that matches the material.
4. Next, users must fill the delivery order tracking systems form.	5. Users must fill all the required section and sign at the end of the form before submit the form.	6. This is the phase where all the scanned DO will upload and will be submitted.

7. Users also can use their mobile phone to transfer this website into an application by scan the QR provided. Next, this interphase allows you to view the quantity and purchase orders that are still open. Once the purchase of goods is completed or the purchase order for a product is fulfilled, it will be automatically closed.

3.4.3 Materials used to complete this DO Tracking Systems.

The phase of Materials used to complete the final year project involves the selection and utilization of various materials necessary to successfully complete a final year project as shown in the table 3.6 below. During this phase, students or researchers identify and gather the specific materials required to carry out their project objectives. These materials can include physical resources such as laboratory equipment, tools, raw materials, or specialized software applications. The selection process involves considering factors such as availability, suitability, cost, and any specific requirements outlined by the project guidelines. Once the materials are acquired, they are utilized throughout the project implementation phase to conduct experiments, perform analyses, create prototypes, or develop software applications, depending on the nature of the project. The effective and efficient utilization of the chosen materials contributes to the overall success and quality of the final year project. Adequate planning, organization, and tracking of the materials used are essential to ensure smooth progress and timely completion of the project.

Table 3.6: Materials used to complete the final year project.

Tools	Functions
Computer, laptop, and smartphone.	To create the website and access it.
Wifi and internet.	To link the computer and internet connection to develop a website.
Google account and email.	To get access to creating the website.
Data on the product must be put on the website.	To input the data on the website that has been created.

3.5 DATA ANALYSIS METHOD

The application will be tested after it is created to confirm its functionality. This application will be verified using the established procedure, the questionnaire method. Questionnaires are a standard method of gathering data for any research project (Boparai, 2018). Pre-testing the questionnaire is a fundamental method of determining whether it can first generate issues for the interviewers or the respondents, according to Ikart, E. M. (2019). As a result, questionnaire pre-testing has been valued by researchers and survey methodologists. The best practices for questionnaire design include several significant elements. These include producing pertinent information, the study aims and objectives, data gathering methods, questionnaire clarity and writing style, question structure, appearance and feel, flow, and questionnaire pre-testing (Market Research Guy, 2017; Ikart, 2018).

During the task, the implementation would take place while observing, aiming to determine the effectiveness of the application. To enhance the project's value, feasibility studies were conducted using primary and secondary sources. The primary source involved questionnaires and observation, while the secondary source relied on collected data and analysis.

The questionnaires were distributed with the intention of understanding people's perceptions and knowledge regarding our project. Additionally, they were used to collect feedback that could be utilized to improve the application. Ultimately, the goal of these questionnaires was to gather feedback from targeted users regarding their agreement or disagreement with the application's concept.

3.6 QUANTITATIVE DATA ANALYSIS METHOD

Quantitative data analysis is a rigorous method used to analyze and interpret numerical data in order to uncover patterns, relationships, and trends. It involves applying statistical techniques and mathematical calculations to data sets, allowing researchers to draw objective conclusions and make data-driven decisions. The process begins with data preparation, where the raw data collected during the research is organized, cleaned, and formatted. Descriptive statistics are then calculated to provide an overview of the data, summarizing measures such as mean, median, mode, standard

deviation, and range to describe central tendency, variability, and distribution. Inferential statistics come into play to make inferences about a larger population based on a sample, using statistical tests like t-tests, chi-square tests, ANOVA, correlation, and regression analysis to examine relationships between variables and determine significance. Hypothesis testing is performed by formulating hypotheses, selecting appropriate tests, calculating test statistics, and comparing them to critical values or p-values to draw conclusions. The interpretation of results involves considering effect size, statistical significance, and practical implications. Finally, researchers report their findings by summarizing the results and presenting them through reports, presentations, and visualizations to effectively communicate the insights to stakeholders and decision-makers. Overall, quantitative data analysis provides a structured and objective approach to analyzing numerical data, enabling researchers to derive meaningful insights and support their research hypotheses.

3.7 SURVEY (QUESTIONNAIRE)

The methods of data collection provide comprehensive instructions on gathering data from a questionnaire through the use of Google Forms. For this study, the quantitative method was selected. Utilizing this approach ensures the collection of reliable and accurate data, facilitates quick data gathering, and enables a broader scope for data analysis. All aspects, including the site, respondents, and research method, will be discussed to ensure that all project objectives can be successfully achieved. These data play a crucial role in fulfilling the goals of the project.

3.8 PROJECT LOCATION

The study will take place at the Pembinaan Tetap Teguh site and headquarters, as the researcher deems this organization to possess the most valuable insights regarding the circumstances and challenges encountered both at the construction site and within the headquarters. The respondents will consist of individuals who hold responsibility during the construction process and are actively involved in infrastructure-related matters.

3.9 RESPONDENTS

The central limit theorem establishes that as the sample size increases, the sample mean converges towards the mean of the entire population being studied, regardless of the underlying data distribution. This means that regardless of whether the data follows a normal distribution or exhibits atypical patterns, the results remain accurate. In the context of this study, a survey was designed to assess the effectiveness of a product, targeting individuals involved in structural and infrastructure work at both construction sites and headquarters. A total of 20 respondents participated in the survey, representing various roles such as project managers, site engineers, site supervisors, site clerks, and others. These respondents were selected from the pool of construction workers and were deemed suitable for providing valuable insights by answering the questionnaire.

3.10   QUESTIONNAIRE SURVEY

For this study, researchers employed a questionnaire as the primary method of data collection, utilizing Google Forms as the platform. Questionnaires serve as effective tools for gathering data when researchers possess a clear understanding of the study's requirements. To distribute the questionnaire, Google Form links will be sent out to the respondents. The questionnaire in this study is divided into two main sections: Section A and Section B. Section A primarily focuses on collecting demographic information from the respondents, while Section B is designed to gather data on the criteria of the Delivery Order Tracking Systems. The summary of information about the questionnaire were listed in Table 3.7 below.

Table 3.7: Distribution of the questionnaire items.

Section	Aspects of evaluation
A	Demography
B	Respondent's Opinion on Issues (Pre-Testing)
	Effectiveness of Delivery Order Tracking Systems (Post-Test)

A Likert scale is a commonly used type of rating scale in survey research. It consists of a series of statements or items that respondents are asked to rate based on their level of agreement, disagreement, or satisfaction. The Likert scale typically includes a range of response options, often five, that represent varying degrees of agreement or disagreement with the given statement. Each item in a Likert scale is presented as a statement expressing a particular attitude, opinion, or perception. Respondents are asked to indicate their level of agreement or disagreement with each statement by selecting the response option that best represents their viewpoint. The response options usually range from "Strongly Agree" to "Strongly Disagree," with a neutral midpoint option, "Disagree" as shown in the table 3.8 below.

Table 3.8: Likert scale items.

Level of Agreement				
Strongly Disagree	Disagree	Slightly Agree	Agree	Strongly Agree
1	2	3	4	5

3.11   TECHNOLOGY ACCEPTANCE MODEL (TAM)

The Technology Acceptance Model (TAM) is an information systems theory that explains how individuals come to accept and use technology. According to Foley Curley (1984) and Sharda, Barr, and McDonnell (1988), the acceptance and utilization of information technology can bring immediate and long-term benefits to both organizations and individuals. These benefits include improved performance, increased financial and time efficiency, and enhanced convenience. In this study, the TAM was employed to assess the validity of the survey and to shed light on the underlying mechanisms of technology acceptance. The primary objective was to forecast behavior and provide a theoretical explanation for the effective deployment of technology.

Additionally, the study aimed to identify, define, and validate variables and measurements that would strongly correlate with system utilization. Several studies were conducted to design, pre-test, and validate multi-item measures for perceived ease of use and perceived utility. These measures were developed based on previous empirical research on human behavior and information system management.

3.12 CONCLUSION

This chapter provides an overview of the research data collection procedures and their evaluation. It covers various aspects such as the research setting, participants, study methodology, data analysis, and assessment procedures. The study demonstrates the improved effectiveness of a certain technology compared to previous systems. However, it acknowledges that completing tasks within the allotted time may take longer than the current system. The technology discussed is adaptable and applicable to any project, offering practicality, simplicity, and user-friendliness. All team members, including contract departments and site employees, stand to benefit from easy access to necessary paperwork. The technology also enhances communication by providing a platform for comments and remarks from connected individuals, aimed at avoiding misunderstandings when there is no clear right or wrong. The strategies presented are tailored to address current challenges and recommend suitable methods for specific locations. The website supporting the project draws upon a wide range of accessible materials such as articles, interviews, and experiences. Additionally, the chapter mentions that a process flow for the project will be included and implemented in the working environment at the site.

CHAPTER 4

DATA ANALYSIS AND DISCUSSION

4.0 INTRODUCTION

This chapter is divided into two sections: a pre-questionnaire before utilizing the Delivery Order Tracking Systems website to determine the problem and an evaluation of the website's efficiency after using the website systems. Data analysis and findings from 19 respondents were used to determine the problem statements in the industry and the design requirements for Delivery Order Tracking Systems before the test of the system. After the Delivery Order Tracking Systems Website has been operational, data analysis and findings from 20 respondents, including site personnel and purchasing personnel, are presented to assess the website's effectiveness. This chapter illustrates and explains all of the results and information from the study that were obtained via the website's questionnaire. The outcomes of the project's goals were also covered in this chapter. It will analyze the results for the purposes and determine whether they were accomplished.

4.1 DATA COLLECTION AND FINDINGS

The respondents who participated in this study included Purchasing personnel (quantity surveyors and purchasing staff), Site personnel (project managers, engineers, and site clerks). The questionnaire was administered to these individuals, and the findings are presented in the form of tables, graphs, and figures to provide a comprehensive analysis of the study. This presentation aims to highlight the crucial information regarding the problems and challenges faced by the teams, as well as the required model to be developed for the final year project.

The questionnaire used in this study was based on Davis's (1989) Technology Acceptance Model (TAM). TAM has gained substantial influence as a framework for understanding individuals' intentions to adopt new technologies, focusing on two key factors: perceived ease of use and perceived usefulness. The primary variables assessed in this study were aligned with TAM, which included Perceived Ease of Use, Perceived Usefulness, and User Satisfaction.

To determine the appropriate sample size, Krejcie and Morgan's (1970) Table was employed. According to this table, for a population size of 30 respondents, a sample size of 28 was considered adequate. It is worth noting that De Winter's (2013) simulation study demonstrated that even petite sample sizes do not pose significant challenges. In fact, the study showed that a sample size as small as two could be used without substantial objections when employing a regular t-test.

The pre-testing and post-testing questionnaires consisted of 18 questions each, aiming to identify the existing problems in industries. From these questions, the top three problems were selected as the main problem statement to be addressed in the final year project. Respondents were asked to indicate their level of agreement regarding various issues using a scale ranging from 1 to 5.

4.2 ANALYSYS OF SURVEY (PRE-TESTING)

The questionnaire has two sections, which are section 1 and section 2. Section 1 is about the demography of the respondent. Section 2 relates to the existing industry problem, especially for the purchasing department and site clerk phase.

4.2.1 Demographic Data (Pre-Testing)

Demographic data is the respondents' background, which contains four items whichare Gender, Age range, Designation, and Work Experience.

i.   Gender (Pre-Testing)

Table 4.1 below shows the number of respondents who obtained this study. The totalnumber of respondents was about 19 persons. Table 4.1 also shows the number of respondents by gender.

Table 4.1: Gender of the respondents (Pre-Testing).

		Frequency	Percent
Gender			
Valid	Male	7	35.0
	Female	13	65.0
	Total	20	100.0

Table 4.1 shows the data for the gender of the respondents. The data shows 7 respondents (35%) are Male, and 13 (65%) are Female.

ii.   Age range (Pre-Testing)

Table 4.2 below shows the respondent age category involved in this study. The researchers divided itinto five categories of age. Thus, the percentage based on age can be seen in Table 4.2.

Table 4.2: Age range of respondents (Pre-Testing)

		Frequency	Percent
Age			
Valid	18-24 years old	3	15.0
	25-34 years old	5	25.0
	35-44 years old	7	35.0
	45-54 years old	3	15.0
	55-64 years old	2	10.0
	Total	20	100.0

Table 4.2 shows data for the age range of respondents. From the data, 3 (15%) of the respondents are between 18 to 24 years old, 5 (25%) of the respondents are between 25 to 34 years old, 7 (35%) of the respondents are between 35 to 44 years old, 3 (15%) of the respondents are between 45 to 54 years old, and 2 (10%) of the respondents are between 55 to 64 years old.

iii.   Designation (Pre-Testing)

The third item in the demographic data is the position at the procurement department and construction site, where there are various positions, such as Purchasing personnel (quantity surveyors, purchasing staff, software developers), Site personnel (project managers, engineers), and site clerks. Table 4.3 shows the percentage of the designation.

Table 4.3: Designation of the Respondent (Pre-Test)

		Position	
		Frequency	Percent
Valid	Site Personnel's	6	30.0
	Purchasing Personnel's	12	60.0
	Site Clerk	2	10.0
	Total	20	100.0

Table 4.3 shows data for the designation of respondents. From the data, 6 (30%) of the respondents are from Site personnel, 12 (60%) of the respondents are from Purchasing personnel, and 2 (10%) respondents are site clerks.

iv.   Work Experience (Pre-Testing)

The fourth item in the demographic data is the duration of the current position as shown in table 4.4, where there is the various duration of current positions of less than two years, between 2 to 5 years, between 6 to 10 years, and more than ten years.

Table 4.4 shows data for the work experience of respondents. From the data, 8 (40%) of the respondents are less than two years, 9 (45%) of the respondents is between 2 to 5 years and 3 (15%) of the respondents are between 6 to 10 years

Table 4.4: Work Experience of the Respondent (Pre-Test)

		Work Experience		
		Frequency	Percent	Valid Percent
Valid	<2 years	8	40.0	40.0
	2-5 years	9	45.0	45.0
	6-10 years	3	15.0	15.0
	Total	20	100.0	100.0

4.3 IDENTIFYING THE EXISTING PROBLEM IN INDUSTRIES (PRE-TESTING)

There are nine questions regarding which the existing problem in industries. The top problem will become the study's main problem statement that the final year project will solve. Respondents were asked to select their level of agreement on the following issues according to a scale of 1 to scale 5. Table 15 and 16 show the collection of issues data related to the current method.

Table 4.5: Level of Agreement.

Level of Agreement				
Strongly Disagree	Disagree	Slightly Agree	Agree	Strongly Agree
1	2	3	4	5

Pre-testing survey data refers to the data collected during the pre-testing phase of a survey before its official administration. The pre-testing phase involves conducting a trial run of the survey with a small sample of participants to identify and address any potential issues or challenges related to survey design, question clarity, response options, survey flow, or any other aspects of the survey instrument.

During the pre-testing phase, a smaller group of participants is selected to complete the survey. The purpose is to gather feedback on the survey questions and format, assess the comprehensibility of the instructions, and identify any difficulties or confusion experienced by participants. This feedback helps researchers or survey designers to refine and improve the survey instrument before administering it to a larger sample.

The pre-testing survey data consists of the responses obtained from the participants who completed the trial survey. This data is used to assess the quality and reliability of the survey instrument. It provides insights into how well the questions were understood, the appropriateness of the response options, and any potential issues with question wording, formatting, or sequencing.

Analyzing pre-testing survey data allows researchers to evaluate the validity and reliability of the survey instrument and identify any necessary modifications or revisions. Common analyses include examining response frequencies, checking for missing data or

data quality issues, and reviewing participants' feedback or comments on specific survey items. The findings from the pre-testing phase inform researchers about potential improvements to enhance the clarity, relevance, and effectiveness of the survey before it is administered to a larger target audience.

Overall, pre-testing survey data plays a crucial role in ensuring the quality and validity of the survey instrument by providing valuable insights and feedback from a smaller sample before conducting the main survey as shown in the table 4.6 below. It helps researchers refine the survey design and make necessary adjustments to maximize the quality and accuracy of the data collected in the actual survey administration.

Table 4.6: Pre-Testing Survey Data.

Category	Survey to Identify	Strongly Disagree (1)	Disagree (2)	Slightly Agree (3)	Agree (4)	Strongly Agree 5
Delay Payment	Do the existing method will subject some payment to suppliers always late due to Invoice & Delivery Order (DO) arrives late at HQ?	13 (65%)	4 (20%)	3 (15%)	0	0
Delay Payment	Do existing method will subject blocking materials order from suppliers due to delay payment?	14 (70%)	3 (15%)	2 (10%)	1 (5%)	0
Insufficiency to Track Order	Do existing method is difficult to follow up status purchase materials order from suppliers?	11 (55%)	6 (30%)	3 (15%)	0	0
WhatsApp Group Medium	Do existing method is posing a challenge for Purchasing Personnel's and Site Personnel to update materials on site using WhatsApp group?	16 (80%)	1 (5%)	3 (15%)	0	0

Table 4.6: Pre-Testing Survey Data (Continue)

WhatsApp Group Medium	Do existing method is inconvenient to update materials on site at Excel refer to WhatsApp medium?	14 (70%)	3 (15%)	3 (15%)	0	0
WhatsApp Group Medium	Do existing method staff miss in WhatsApp group information might cause some work to be delayed?	13 (65%)	2 (10%)	5 (25%)	0	0
WhatsApp Group Medium	Do existing method can result materials order to be delayed due to overlook information in WhatsApp group?	13 (65%)	5 (25%)	2 (10%)	0	0
WhatsApp Group Medium	Do existing method can result delivery order to be missed or not being recorded due to overlook information in WhatsApp group?	15 (75%)	3 (15%)	2 (10%)	0	0
WhatsApp Group Medium	Do existing method may cause delivery to be delayed as a result of missing information in WhatsApp groups?	15 (75%)	4 (20%)	1 (5%)	0	0

Table 4.6: Pre-Testing Survey Data (Continue)

Lack of communication	Do existing method may result in a lack of communication among staff due to duplicate ordering and missing orders?	13 (65%)	5 (25%)	1 (5%)	1 (5%)	0

4.4 RELIABILITY TEST FOR PRE-TESTING METHOD (PRE-TESTING)

Reliability analysis may be used to investigate the properties of measuring scales and the items from the scales. The reliability analysis procedure computes several commonly used scale reliability metrics and information on the correlations between scale items. Intraclass correlation coefficients can be used to calculate interrater reliability estimates.

Table 4.7 shows the reliability test of the current method used in procurement which the Cronbach's Alpha value is 0.976 indicating a high level of interpretation.

Table 4.7: Reliability Test Table.

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
0.976	0.977	10

4.5 DESCRIPTIVE TEST OF AVERAGE MEAN (PRE-TESTING)

Descriptive statistics are those that describe or characterize the characteristics of a data set. It also categorizes measurement into two types: measures of central tendency and measures of variability (or spread). Additionally, central tendency measurements describe the focal point of a data set. The dispersion of the data within a collection is defined by variability or spread measurements.

Table 4.8 shows respondent results about the issues related to the current method in the Purchasing Department. There are several constraint elements of the current

method in Purchasing Department. This data was generated by using IBM SPSS Software, version26.

Table 4.8: Issues related to the Pre-Testing Method.

	N	Mean		Std.	Variance
	Statistic	Statistic	Std. Error	Deviation	Statistic
Delay Payment	20	4.50	0.170	0.761	0.579
	20	4.50	0.199	0.889	0.789
Insufficiency to Track Order	20	4.40	0.169	0.754	0.568
WhatsApp Group Medium	20	4.65	0.167	0.745	0.555
	20	4.55	0.170	0.759	0.576
	20	4.55	0.153	0.686	0.471
	20	4.55	0.153	0.686	0.471
	20	4.65	0.150	0.671	0.450
	20	4.70	0.128	0.571	0.326
Lack of communication	20	4.50	0.185	0.827	0.684

4.6 PROJECT EVALUATION SURVEY (POST-TESTING)

20 project evaluation survey forms were distributed to be filled by the users from different locations to evaluate the feedback regarding the effectiveness of the Delivery Order Tracking Systems Website for Kota Elmina Sites. The findings are discussed according to the sections of the survey. The questionnaire has two sections: Section A and Section B. Section A is about the demographic profile. In contrast, Section B concerns the satisfaction of the Delivery Order Tracking Systems Websites.

4.6.1 Demographic Data (Post-Testing)

Demographic data is the respondents' background, which contains four items which areGender, Age range, Designation, and Work Experience.

i.   Gender (Post-Testing)

Table 4.9 shows the number of respondents who obtained this study. The total number of respondents was about 19 persons. The figure below shows the number of respondents by gender.

Table 4.9 shows the data for the gender of the respondents. The data shows 7 respondents (35%) are Male, and 13 (65%) are Female.

Table 4.9: Gender of the respondents (Post-Test).

		Frequency	Percent
	Gender		
Valid	Male	7	35.0
	Female	13	65.0
	Total	20	100.0

ii.   Age range (Post-Test)

Table 4.10 below shows the respondent age category involved in this study. The researchers divided it into five categories of age. Thus, the percentage based on agecan be seen in Table 4.10

Table 4.10: Age range of respondents (Post-Test)

		Frequency	Percent
	Age		
Valid	18-24 years old	3	15.0
	25-34 years old	5	25.0
	35-44 years old	7	35.0
	45-54 years old	3	15.0
	55-64 years old	2	10.0
	Total	20	100.0

Table 4.10 shows data for the age range of respondents. From the data, 3 (15%) of the respondents are between 18 to 24 years old, 5 (25%) of the respondents are between 25

to 34 years old, 7 (35%) of the respondents are between 35 to 44 years

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old, 3 (15%) ofthe respondents are between 45 to 54 years old, and 2 (10%) of the respondents are between 55 to 64 years old.

iii. Designation (Post-Testing)

The third item in the demographic data is the position at the procurement department and construction site, where there are various positions, such as Purchasing personnel (quantity surveyors, purchasing staff, software developers), Site personnel (project managers, engineers), and site clerks. Table 4.11 shows the percentage of the designation.

Table 4.11: Designation of the Respondent (Post-Test)

		Position	
		Frequency	Percent
Valid	Site Personnel's	6	30.0
	Purchasing Personnel's	12	60.0
	Site Clerk	2	10.0
	Total	20	100.0

Table 4.11 shows data for the designation of respondents. From the data, 6 (30%) of the respondents are from Site personnel, 12 (60%) of the respondents are from Purchasingpersonnel, and 2 (10%) respondents are site clerks.

iv. Work Experience (Post-Testing)

The fourth item in the demographic data is the duration of the current position, where there is the various duration of current positions of less than two years, between 2 to 5 years, between 6 to 10 years, and more than ten years.

Table 4.12: Work Experience of the Respondent (Post-Test)

		Work Experience		
		Frequency	Percent	Valid Percent
Valid	<2 years	8	40.0	40.0
	2-5 years	9	45.0	45.0
	6-10 years	3	15.0	15.0
	Total	20	100.0	100.0

Table 4.12 shows data for the work experience of respondents. From the data, 8 (40%) ofthe respondents are less than two years, 9 (45%) of the respondents is between 2 to 5 years and 3 (15%) of the respondents are between 6 to 10 years.

4.7 IDENTIFYING THE NEEDS OF THE DELIVERY ORDER TRACKING SYSTEMS IN INDUSTRIES (POST-TEST)

There are 18 questions regarding the need for delivery order tracking systems in industries. Respondents were asked to select their level of agreement on the following issues according to a scale of 1 to scale 5. The table 4.13 below shows the collection of issuesdata related to the current method.

Table 4.13: Post-Testing Survey Data.

Category	Survey to Identify	Strongly Disagree	Disagree	Slightly Agree	Agree	Strongly Agree
Delay Payment	New method will subject payment to be on time due to Invoice & Delivery Order (DO) arrives on time at HQ	0	0	0	3 (15%)	17 (85%)
Insufficiency to Track Order	New method is easy to know status of purchase materials order from supplier	0	0	0	4 (20%)	16 (80%)
WhatsApp Group Medium	New method is easy for Site Personnel to update materials on site using Delivery Order Tracking Systems	0	0	0	2 (10%)	18 (90%)
WhatsApp Group Medium	New method is time-saver to update delivery order and materials on site at Excel refer to Delivery Order Tracking System	0	0	0	3 (15%)	17 (85%)

Table 4.13: Post-Testing Survey Data. (Continue)

WhatsApp Group Medium	New method can result in time of delivery and payment due to notice information in WhatsApp group	0	0	0	4 (20%)	16 (80%)
WhatsApp Group Medium	New method can result order be in time due to not over notice information in WhatsApp group	0	0	0	3 (15%)	17 (85%)
WhatsApp Group Medium	New method can result materials on site be recorded due to notice information in WhatsApp group	0	0	0	2 (10%)	18 (90%)
WhatsApp Group Medium	New method can result update materials on site be in time due to notice information in WhatsApp group	0	0	0	1 (5%)	19 (95%)
Lack of communication	New method can result prevention of miscommunication among staff due to double order and miss order	0	0	0	2 (10%)	18 (90%)

4.8 RELIABILITY TEST FOR POST-TESTING

A researcher developed four categories in the questionnaire to evaluate the effectiveness of using the Delivery Order Tracking Systems website medium. The questionnaire was on the five (5) point Likert Scale, with responses ranging from Strongly Disagree to Agree Strongly. The Cronbach alpha test was conducted to determine whether thequestionnaire could reliably measure the latent variable, like the effectiveness of the Delivery Order Tracking Systems website. The acceptable reliability value is 0.6. Therefore, if the questionnaire's reliability is more than 0.6, then the questionnaire is considered reliable.

Table 4.14: Reliability test for Delivery Order Tracking Systems.

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
0.936	0.938	9

Table 4.14 shows the reliability test of the current method used in procurement which the Cronbach's Alpha value is 0.936 indicating a high level of interpretation.

4.9 DESCRIPTIVE TEST OF AVERAGE MEAN (POST-TEST)

Descriptive statistics are those that describe or characterize the characteristics of a data set. It also categorizes measurement into two types: measures of central tendency and measures of variability (or spread). Additionally, central tendency measurements describe the focal point of a data set. The dispersion of the data within acollection is described by variability or spread measurements as shown in table 4.15.

Table 4.15: The Descriptive Test average means (Post-Test).

| | N | Mean | | Std. | Variance |
				Deviation	Statistic
Delay Payment	Statistics	Statistics	Std. Error		
Insufficiency to Track Order	20	4.85	0.082	0.366	0.134
WhatsApp Group Medium	20	4.80	0.092	0.410	0.168
	20	4.90	0.069	0.308	0.095
	20	4.85	0.082	0.366	1.134
	20	4.80	0.092	0.410	0.168
	20	4.85	0.082	0.366	0.134
	20	4.90	0.069	0.308	0.095
Lack of Communication	20	4.90	0.069	0.308	0.095

Table 4.15 shows respondent results regarding the effectiveness and satisfaction of using the Delivery Order Tracking Systems. This data was generated by using IBM SPSS Software, version 26.

4.10 PAIRED SAMPLE T-TEST

In order to evaluate the effectiveness of the Delivery Order Tracking Systems in the project, a paired sample t-test was performed. The result, as shown in Table 26, respondents preferred using the Delivery Order Tracking Systems whereby all variables measured, for delay payment (Mean = 4.85), Insufficiency to Track Delivery Orders (Mean = 4.80), WhatsApp Group Medium (Mean = 4.07), and Lack of communication (Mean = 4.90).

A paired sample t-test found this difference to be significant for all variables being measured, the value of T for Delay payment is 15.82, and the value of P is < .00001. The result is significant at $p < .05$. The value of T for Insufficiency to Track Delivery Order is 16.00, and value of P is < .00001. The result is significant at $P < .05$. The value of T for the WhatsApp group medium is 19.94, and the value of P is < .00001. The result is significant at $P < .05$. The value of T for Lack of communication is 14.53,

and the value of P is < .00001. The result is significant at P < .05. From this data; it means that using the Delivery Order Tracking Systems was more effective compared with the current method. To evaluate the effectiveness of the Delivery Order Tracking Systems in the project, apaired sample t-test was performed. Results as shown in the Table 4.16.

Table 4.16: Paired Sample T-test.

Pair	Paired Different	T	Significant
	Mean		(Two-Tailed)
Delay Payment	3.35	15.82	15.82
Insufficiency To Track Delivery	3.20	16.00	16.00
Order			
WhatsApp Group Medium	2.68	19.94	19.94
Lack of Communication	3.50	14.53	14.53

4.11 RESULT ANALYSIS

4.11.1 Agreement Level of mean score

Mean is an essential concept in mathematics and statistics. The Mean is the averageor the most common value in a collection of numbers. Statistics, it measures the centraltendency of a probability distribution along median and mode. It is also referred to as an expected value.

i.   5 Points Likert Scale

A type of psychometric response scale in which respondents specify their level of agreement to a statement typically in five points: Strongly disagree (1), Disagree (2), Slightly Agree (3), Agree (4) and Strongly Agree as shown in Table 4.17.

Table 4.17: Interpretation of mean score (Interpretation of Mean Scores, 2015).

Mean Score	Interpretation of Mean Score
1.00-2.00	Low
2.01-3.00	Moderately Low
3.01-4.00	Moderately High
4.01-5.00	High

4.11.2 Overall Mean and Standard Deviation Interpretation

There are four sections that were analyzed by using SPSS software which are Section B (Delay payment), Section C (Insufficiency to Track Delivery Order), Section D (WhatsApp Group Medium), and Section E (Lack of communication).

Table 4.18: The Usability Level of the Current Method.

Variables	Mean	Standard Deviation	Interpretation
Delay payment	1.50	0.825	Low
Insufficiency to Track Delivery Order	1.60	0.754	Low
WhatsApp Group Medium	1.39	0.686	Low
Lack of communication	1.40	0.571	Low
Average	1.47	0.709	-

Table 4.19: The Usability Level of Delivery Order Tracking Systems.

Variables	Mean	Standard Deviation	Interpretation
Delay payment	4.85	0.366	High
Insufficiency to Track Delivery Order	4.80	0.410	High
WhatsApp Group Medium	4.07	0.330	High
Lack of communication	4.90	0.308	High
Average	4.66	0.527	-

In Table 4.18, the data illustrates the respondents' level of usability when utilizing the current method. The analysis reveals that the mean score for all tested variables was 1.47, below 2.00, indicating a very low usability level for the existing method. On the other hand, Table 4.19 presents the respondents' level of usability when using Delivery Order Tracking Systems (DOTS). The analysis demonstrates that the mean score for all variables is 4.66, exceeding 4.00, indicating that the usage of Delivery Order Tracking Systems (DOTS) is considerably easier compared to the existing method.

i.   Cohen's Kappa

Cohen's Kappa always between 0 and 1 scale, with 0 indicating no agreement between the two ratters and 1 indicating perfect agreement between the two ratters (Zach, 2021). Because Cohen's Kappa considers the impact of chance, it is a more reliable method than the observed proportion of agreement (Delgado & Xavier-Andoni Tibau, 2019), as shown in Table 4.20.

Table 4.20: Cohen's Kappa Interpretation (Zach, 2021).

Cohen's Kappa	Interpretation
0	No agreement
0.10 - 0.20	Slight agreement
0.21 - 0.40	Fair agreement
0.41 - 0.60	Moderate agreement
0.61 - 0.80	Substantial agreement
0.81 - 0.99	Near perfect agreement
1	Perfect agreement

4.12 CONCLUSION

In conclusion, the survey forms were answered by 20 respondents from the construction industry, providing valuable insights into the effectiveness of the Delivery Order Tracking Systems. The analysis included demographic criteria such as gender, age group, work position, and experience. Based on the pre-project questionnaire, it was found that 90% of the respondents strongly agreed that the current method of tracking delivery orders was difficult, and 90% of them strongly agreed that there was a lack of collaboration between different disciplines.

After considering the issues and gathering design requirements from the users, the Delivery Order Tracking Systems were developed and tested in the construction industry. The data collected from 20 respondents were analyzed using the Statistical Package for the Social Sciences software, and a T-test was conducted to evaluate the system's effectiveness. The results showed that 90% of the respondents were highly satisfied with the Delivery Order Tracking Systems, as it provided improved tracking capabilities. Furthermore, 80% of the respondents strongly agreed that the system enhanced their understanding of the project's progress.

The analysis included two sections, namely pre-testing and post-testing, which were interpreted based on the mean scores. In the post-testing phase, the average mean score for the effectiveness of the Delivery Order Tracking Systems was 4.66, indicating a high level of effectiveness. The average standard deviation for post-testing was 0.527, which falls within the category of perfect agreement according to Cohen's Kappa interpretation table. Thus, based on the mean score and standard deviation

interpretations, it can be concluded that the Delivery Order Tracking Systems have been proven to be effective.

Overall, the findings demonstrate that the Delivery Order Tracking Systems have successfully addressed the challenges identified in the construction industry, providing a more efficient and collaborative approach to tracking delivery orders.

CHAPTER 5

CONCLUSION AND RECOMMENDATION

5.0 INTRODUCTION

The conclusion of a research study is a vital component that summarizes the key findings, implications, and overall significance of the research conducted. It provides a concise and comprehensive summary of the study's objectives, methodologies, and the outcomes derived from the analysis of data.

In this research, the conclusion serves as the culmination of the investigation into enhancing procurement department efficiency through the implementation of an IoT-based Delivery Order Tracking System (DOTS) in the context of construction projects. The objectives of the study, namely identifying the need for an efficient payment system, developing the system using the WIX.com website builder, and evaluating its effectiveness, have been successfully addressed.

The conclusion outlines the key findings derived from the research, highlighting the importance of efficient payment processes in construction projects and the role of the developed DOTS in streamlining these processes. It emphasizes the positive impact of the system on procurement department efficiency, achieved through improved transparency, coordination, and communication facilitated by IoT technologies.

Additionally, the conclusion reflects on the significance of the research findings and their contribution to the construction industry. It underscores the potential benefits

of adopting technological solutions, such as DOTS, to optimize procurement department operations and enhance project outcomes. The conclusion also acknowledges the limitations of the study and suggests avenues for further research and development in this domain.

In the subsequent sections, this paper will provide an in-depth exploration of the research methodology employed, including data collection methods, analysis techniques, and the interpretation of results. It will delve into the implications of the findings and discuss their relevance in the broader context of procurement department efficiency in construction projects. By presenting a comprehensive summary of the research and its conclusion, this paper aims to contribute to the existing body of knowledge and inspire further advancements in the field.

5.1 CONCLUSION

In conclusion, this study focused on enhancing procurement department efficiency through an IoT-based Delivery Order Tracking System (DOTS) with the following objectives: 1) to identify the need for a system for efficient and timely payment in construction projects, 2) to develop a system using the WIX.com website builder for efficient and timely payment in construction projects, and 3) to evaluate the effectiveness of the system used by construction site management personnel and purchasing department personnel.

The first objective aimed to understand the requirements and challenges faced by procurement departments in construction projects, particularly in terms of payment efficiency and timeliness. Through extensive research and analysis, it was established that there is a crucial need for a system to streamline payment processes and improve efficiency within the procurement department.

To address the second objective, a system was developed utilizing the WIX.com website builder. This system incorporated IoT technologies, enabling real-time tracking and monitoring of delivery orders. By leveraging the capabilities of IoT, the system aimed to enhance transparency, communication, and coordination between different

stakeholders involved in the procurement process.

The third objective focused on evaluating the effectiveness of the developed system. Feedback and data were collected from construction site management personnel and purchasing department personnel who interacted with the system. Their experiences and perceptions were analyzed to assess the system's effectiveness in improving procurement department efficiency. This evaluation process provided valuable insights into the system's usability, user satisfaction, and overall impact on streamlining payment processes.

The results of the evaluation demonstrated that the IoT-based Delivery Order Tracking System (DOTS) significantly enhanced procurement department efficiency. It successfully addressed the identified challenges, enabling efficient and timely payment in construction projects. The system's utilization of IoT technologies improved coordination, transparency, and communication among stakeholders, leading to smoother payment processes and enhanced overall efficiency.

In summary, this study successfully achieved its objectives by identifying the need for an efficient payment system in construction projects, developing an IoT-based Delivery Order Tracking System, and evaluating its effectiveness. The findings highlight the significance of adopting technological solutions, such as DOTS, to enhance procurement department efficiency and improve project outcomes in the construction industry.

5.2 RECOMMENDATION

Based on the research conducted on enhancing procurement department efficiency through an IoT-based Delivery Order Tracking System (DOTS), the following recommendations are provided:

5.2.1 Implementation of DOTS

Construction companies and procurement departments should consider implementing an IoT-based Delivery Order Tracking System (DOTS) to improve payment processes and enhance efficiency. The system should be tailored to the specific needs and requirements of the organization, considering factors such as project scale, complexity, and stakeholder collaboration.

5.2.2 Collaboration and Communication

To fully leverage the benefits of DOTS, it is crucial to foster collaboration and communication among different stakeholders involved in the procurement process. This includes establishing clear lines of communication, promoting information sharing, and encouraging cross-functional coordination between site management personnel and purchasing department personnel.

5.2.3 User Training and Support

All users of the DOTS system should be trained and supported to use it effectively. Training sessions, user manuals, and ongoing technical support should be provided for smooth adoption and optimal usage.

5.2.4 Continuous Improvement

Organizations should continuously improve the DOTS system by regularly reviewing its performance. They should gather feedback from users, track key performance indicators (KPIs), and analyze data to find areas that can be enhanced. This iterative approach ensures that the system stays aligned with changing business needs and industry requirements.

5.2.5 Integration with Existing Systems

Consideration should be given to integrating the DOTS system with existing software and technology platforms used within the organization. Seamless integration will enable data exchange, streamline workflows, and facilitate a more cohesive and efficient procurement process. Compatibility with other systems such as enterprise resource planning (ERP) software and accounting systems should be explored.

5.2.6 Scalability and Adaptability

Organizations should assess the scalability and adaptability of the DOTS system to accommodate future growth and changing industry dynamics. The system should be designed with flexibility in mind, allowing for customization, expansion, and integration of additional functionalities as needed. Regular updates and enhancements should be implemented to stay aligned with evolving technological advancements and industry best practices.

5.2.7 Industry Collaboration

Collaboration and knowledge-sharing within the construction industry can significantly contribute to improving procurement department efficiency. Construction companies, industry associations, and research institutions should collaborate to exchange best practices, lessons learned, and innovative solutions related to procurement processes. This can be facilitated through industry conferences,workshops, and forums.

5.3 CONCLUSION

By implementing these recommendations, construction companies can enhance their procurement department's efficiency, streamline payment processes, and improve overall project outcomes. The adoption of an IoT-based Delivery Order Tracking System (DOTS) coupled with effective communication, user training, continuous improvement, and industry collaboration can drive significant improvements in procurement operations, ultimately leading to greater project success and stakeholder satisfaction.

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APPENDIX

APPENDIX A   **QUESTIONNAIRE**

APPENDIX B   **GANTT CHART SEMESTER 7 & 8**

APPENDIX A

Delivery Order Tracking Systems
BACHELOR OF CIVIL ENGINEERING TECHNOLOGY

A part of my study Final Year Project for Bachelor of Civil Engineering Technology (BCT) at Politeknik Ungku Omar (PUO), Ipoh, Perak. I am Nur Farisa
Binti Munshi (01BCT20F3033), and I am conducting
a survey of pre-test questionnaire. In order to overcome the difficulty of
creating a systematic tracking systems (DO Tracking Syatems).

Section A (Demography)

* Indicates required question

1. Gender *

   Mark only one oval.

   ◯ Male

   ◯ Female

2. Age *

   Mark only one oval.

   ◯ Under 18 years old

   ◯ 18-24 years old

   ◯ 25-34 years old

   ◯ 35-44 years old

   ◯ 45-54 years old

   ◯ 55-64 years old

   ◯ 65 years or older

3. Position *

   Mark only one oval.

   ◯ Site Personnel's

   ◯ Purchasing Personnel's

   ◯ Site Clerk

   ◯ Admin Junior Executive

   ◯ Admin Executive

   ◯ Admin Assistant

   ◯ Engineer

   ◯ Quantity Surveyor

   ◯ Project Manager

   ◯ Other: _____

4. Work Experience *

   Mark only one oval.

   ◯ <2 years

   ◯ 2-5 years

   ◯ 6-10 years

   ◯ >10 years

5. Existing method is easy to use for tracking delivery order at site. *

Mark only one oval.

Strongly Disagree

1 ⬭

2 ⬭

3 ⬭

4 ⬭

5 ⬭

Strongly Agree

6. Existing method is not systematic to manage delivery order tracking system. *

Mark only one oval.

Strongly Disagree

1 ⬭

2 ⬭

3 ⬭

4 ⬭

5 ⬭

Strongly Agree

Section B

Pre-Test

Delay Payment
Pre-Test

7. Do the existing method will subject some payment to suppliers always late due to Invoice & Delivery Order (DO) arrives late at HQ ?

Mark only one oval.

Strongly Disagree

1 ◯

2 ◯

3 ◯

4 ◯

5 ◯

Strongly Agree

8. Do existing method will subject blocking materials order from suppliers due to delay payment?

Mark only one oval.

Strongly Disagree

1 ◯

2 ◯

3 ◯

4 ◯

5 ◯

Strongly Agree

Insufficiency to Track Order
Pre-Test

9. Do existing method is difficult to follow up status purchase materials order from suppliers?

Mark only one oval.

Strongly Disagree

1 ◯

2 ◯

3 ◯

4 ◯

5 ◯

Strongly Agree

7. Do the existing method will subject some payment to suppliers always late due to Invoice & Delivery Order (DO) arrives late at HQ ?

Mark only one oval.

Strongly Disagree

1 ◯

2 ◯

3 ◯

4 ◯

5 ◯

Strongly Agree

8. Do existing method will subject blocking materials order from suppliers due to delay payment?

Mark only one oval.

Strongly Disagree

1 ◯

2 ◯

3 ◯

4 ◯

5 ◯

Strongly Agree

Insufficiency to Track Order
Pre-Test

9. Do existing method is difficult to follow up status purchase materials order from suppliers?

Mark only one oval.

Strongly Disagree

1 ◯

2 ◯

3 ◯

4 ◯

5 ◯

Strongly Agree

WhatsApp Group Medium
Pre-Test

10. Do existing method is posing a challenge for Purchasing Personnel's and Site Personnel's to update materials on site using WhatsApp group?

Mark only one oval.

Strongly Disagree

1 ◯

2 ◯

3 ◯

4 ◯

5 ◯

Strongly Agree

11. Do existing method is inconvenient to update materials on site at Excel refer to WhatsApp medium?

Mark only one oval.

Strongly Disagree

1 ◯

2 ◯

3 ◯

4 ◯

5 ◯

Strongly Agree

12. Do existing method staff miss in WhatsApp group information might cause some work to be delayed?

Mark only one oval.

Strongly Disagree

1 ◯

2 ◯

3 ◯

4 ◯

5 ◯

Strongly Agree

13. Do existing method can result materials order to be delayed due to overlook information in WhatsApp group?

Mark only one oval

    Strongly Disagree

1 ◯

2 ◯

3 ◯

4 ◯

5 ◯

    Strongly Agree

14. Do existing method can result delivery order to be missed or not being recorded due to overlook information in WhatsApp group?

Mark only one oval

    Strongly Disagree

1 ◯

2 ◯

3 ◯

4 ◯

5 ◯

    Strongly Agree

15. Do existing method may cause delivery to be delayed as a result of missing information in WhatsApp groups?

Mark only one oval

    Strongly Disagree

1 ◯

2 ◯

3 ◯

4 ◯

5 ◯

    Strongly Agree

Lack of communication
Pre-Test

16. Do existing method may result in a lack of communication among staff due to duplicate ordering and missing orders?

Mark only one oval.

Strongly Disagree

1 ⬭

2 ⬭

3 ⬭

4 ⬭

5 ⬭

Strongly Agree

The Need of electronic systematic delivery order tracking systems for Site Personnel's and Procurement Personnel's Pre-Test

17. Do systematic tracking centre is needed to manage the materials order?

Mark only one oval.

Strongly Disagree

1 ⬭

2 ⬭

3 ⬭

4 ⬭

5 ⬭

Strongly Agree

18. Do systematic tracking centre is needed to develop to solve the current method constraints in materials order?

Mark only one oval.

Strongly Disagree

1 ⬭

2 ⬭

3 ⬭

4 ⬭

5 ⬭

Strongly Agree

19. Question 1: Delay Payment
Do systematic tracking centre can solve delay payment?

Mark only one oval.

Strongly Disagree

1 ◯

2 ◯

3 ◯

4 ◯

5 ◯

Strongly Agree

20. Question 2: Insufficiency to Track Order
Do systematic tracking centre can reduce the insufficiency to Track Order?

Mark only one oval.

Strongly Disagree

1 ◯

2 ◯

3 ◯

4 ◯

5 ◯

Strongly Agree

21. Question 3: WhatsApp Group Medium

Do systematic tracking centre can reduce the inconvenient delivery order update, damage or missing delivery order and overlook information on materials rather than using WhatApps medium?

Mark only one oval.

Strongly Disagree

1 ◯

2 ◯

3 ◯

4 ◯

5 ◯

Strongly Agree

22. Question 4: Lack of communication

Do systematic tracking centre help to prevent miscommunication among staff to reduce the duplicate ordering materials and missing orders?

Mark only one oval.

	Strongly Disagree
1	⬭
2	⬭
3	⬭
4	⬭
5	⬭
	Strongly Agree

Section C

Post Test

Delay payment
Post Test

23. New method will subject payment to be on time due to Invoice & Delivery Order (DO) arrives on time at HQ

Mark only one oval.

	Strongly Disagree
1	⬭
2	⬭
3	⬭
4	⬭
5	⬭
	Strongly Agree

Insufficiency to Track Delivery Order
Post Test

24. New method is easy to know status of purchase materials order from supplier

Mark only one oval.

Strongly Disagree

1 ⬭

2 ⬭

3 ⬭

4 ⬭

5 ⬭

Strongly Agree

WhatsApp Group Medium
Post Test

25. New method is easy for Site Personnel's to update materials on site using Delivery Order Tracking Systems

Mark only one oval.

Strongly Disagree

1 ⬭

2 ⬭

3 ⬭

4 ⬭

5 ⬭

Strongly Agree

26. New method is time-saver to update delivery order and materials on site at Excel refer to Delivery Order Tracking System

Mark only one oval.

Strongly Disagree

1 ⬭

2 ⬭

3 ⬭

4 ⬭

5 ⬭

Strongly Agree

27. New method can result in time of delivery and payment due to notice information in WhatsApp group

Mark only one oval.

Strongly Disagree

1   ◯

2   ◯

3   ◯

4   ◯

5   ◯

Strongly Agree

28. New method can result order be in time due to not over notice information in WhatsApp group

Mark only one oval.

Strongly Disagree

1   ◯

2   ◯

3   ◯

4   ◯

5   ◯

Strongly Agree

29. New method can result materials on site be recorded due to notice information in WhatsApp group

Mark only one oval.

Strongly Disagree

1   ◯

2   ◯

3   ◯

4   ◯

5   ◯

Strongly Agree

30. New method can result update materials on site be in time due to notice information in WhatsApp group

Mark only one oval.

Strongly Disagree

1 ◯

2 ◯

3 ◯

4 ◯

5 ◯

Strongly Agree

Lack of communication
Post Test

31. New method can result prevention of miscommunication among staff due to double order and miss order

Mark only one oval.

Strongly Disagree

1 ◯

2 ◯

3 ◯

4 ◯

5 ◯

Strongly Agree

The Effectiveness of Delivery Order Tracking Systems for Purchasing Personnel's and Site Personnel's
Post Test

32. Do you agree this Delivery Order Tracking Systems effectively?

Mark only one oval.

	Strongly Disagree
1	⬭
2	⬭
3	⬭
4	⬭
5	⬭
	Strongly Agree

33. Do you agree a Delivery Order Tracking Systems can solve delay payment?

Mark only one oval.

	Strongly Disagree
1	⬭
2	⬭
3	⬭
4	⬭
5	⬭
	Strongly Agree

34. Do you agree a Delivery Order Tracking Systems can prevent delay payment will help to prevent blocking from supplier?

Mark only one oval.

	Strongly Disagree
1	⬭
2	⬭
3	⬭
4	⬭
5	⬭
	Strongly Agree

35. Do you agree a Delivery Order Tracking Systems can update status materials on site order from supplier?

Mark only one oval.

Strongly Disagree

1 ⬭

2 ⬭

3 ⬭

4 ⬭

5 ⬭

Strongly Agree

36. Do you agree a systematic Delivery Order Tracking Systems can update and track DO on site?

Mark only one oval.

Strongly Disagree

1 ⬭

2 ⬭

3 ⬭

4 ⬭

5 ⬭

Strongly Agree

37. Do you agree a Delivery Order Tracking Systems can prevent overlook all important information?

Mark only one oval.

Strongly Disagree

1 ⬭

2 ⬭

3 ⬭

4 ⬭

5 ⬭

Strongly Agree

The efficiency of purchase document and payment to suppliers
Post-Test

38. Do you agree the Delivery Order Tracking Systems more efficient of purchase documents and payments to suppliers?

Mark only one oval.

Strongly Disagree

1 ⬭

2 ⬭

3 ⬭

4 ⬭

5 ⬭

Strongly Agree

39. Do you agree the Delivery Order Tracking Systems helps Site Personnel's to track DO on site after order had been made very efficient?

Mark only one oval.

Strongly Disagree

1 ⬭

2 ⬭

3 ⬭

4 ⬭

5 ⬭

Strongly Agree

40. Do you agree the Delivery Order Tracking Systems helps purchasing personnel's track all the delivery order very efficient?

Mark only one oval.

Strongly Disagree

1 ⬭

2 ⬭

3 ⬭

4 ⬭

5 ⬭

Strongly Agree

41. Do you agree the Delivery Order Tracking Systems very efficient to prevent lack of communication among staff due to double order and miss order?

Mark only one oval.

Strongly Disagree

1 ◯

2 ◯

3 ◯

4 ◯

5 ◯

Strongly Agree

42. Do you agree the Delivery Order Tracking Systems is efficient in the role of follow up status purchase materials order from suppliers?

Mark only one oval.

Strongly Disagree

1 ◯

2 ◯

3 ◯

4 ◯

5 ◯

Strongly Agree

43. Do you agree the Delivery Order Tracking Systems will subject some payment to supplier always in time?

Mark only one oval.

Strongly Disagree

1 ◯

2 ◯

3 ◯

4 ◯

5 ◯

Strongly Agree

44. Do you agree the Delivery Order Tracking Systems can prevent blocking materials order from suppliers?

Mark only one oval.

Strongly Disagree

1 ⬭

2 ⬭

3 ⬭

4 ⬭

5 ⬭

Strongly Agree

45. Please give us some feedback/improvement regarding Delivery Order Tracking Systems for tracking delivery order from site. Thank you in advance :)

_____

_____

_____

_____

_____

APPENDIX B
SEMESTER 7 & 8

Gantt Chart Semester 7 & 8

		SEMESTER 7																				SEMESTER 8																
		SEP			OCT				NOV				DEC				JAN				FEB				MAC				APR					MAY				JUN	
		W1	W2	W3	W4	W5	W6	W7	W8	W9	W10	W11	W12	W13	W14	W15	W16	W17	W18	W19	W20	W21	W22	W23	W24	W25	W26	W27	W28	W29	W30	W31	W32	W33	W34	W35	W36	W37	W38	W39
NO.	ITEM																																							
1	REVIEW OF LITERATURE REVIEW																																							
2	CHAPTER 1: INTRODUCTION																																							
	Problem Statement																																							
	Objectives																																							
	Scope of Study																																							
	Significance of Study																																							
	Expected Outcome																																							
3	CHAPTER 2: LITERATURE REVIEW																																							
	Knowledges/Information/Theory of the Study																																							
	Gap of Study																																							
	Method Used for the Study																																							
4	CHAPTER 3: METHODOLOGY																																							
	Flowchart																																							
	Data collection																																							
	Template Design																																							
	Website Systems Development																																							
	Validate of the website																																							
5	WRITING PROPOSAL																																							
	Submission Draf																																							
	Chapter 1																																							
	Chapter 2																																							
	Chapter 3																																							
	Chapter 4																																							
	Chapter 5																																							
6	PROPOSAL PRESENTATION																																							
7	SUBMISSION OF FINAL PROPOSAL																																							
14	FINAL EVALUATION & KEY-IN PROCESS OF MARKS																																							

Week date ranges:
W1: 12/09/22-17/9/22, W2: 19/9/22-24/9/22, W3: 26/9/22-1/10/22, W4: 3/10/22-8/10/22, W5: 10/10/22-15/10/22, W6: 17/10/22-22/10/22, W7: 24/10/22-29/10/22, W8: 31/10/22-5/11/22, W9: 7/11/22-12/11/22, W10: 14/11/22-19/11/22, W11: 21/11/22-26/11/22, W12: 28/11/22-3/12/22, W13: 5/12/22-10/12/22, W14: 12/12/22-17/12/22, W15: 19/12/22-24/12/22, W16: 26/12/22-31/12/22, W17: 2/1/23-7/1/23, W18: 9/1/23-14/1/23, W19: 16/1/23-21/1/23, W20: 23/1/23-28/1/23, W21: 30/01/23-04/02/23, W22: 6/2/23-11/2/23, W23: 13/2/23-18/2/23, W24: 20/2/23-25/2/23, W25: 27/2/23-4/3/23, W26: 6/3/23-11/3/23, W27: 13/3/23-18/3/23, W28: 20/3/23-25/3/23, W29: 27/3/23-1/4/23, W30: 3/4/23-8/4/23, W31: 10/4/23-15/4/23, W32: 17/4/23-22/4/23, W33: 24/4/23-29/4/23, W34: 1/5/23-6/5/23, W35: 8/5/23-13/5/23, W36: 15/5/23-20/5/23, W37: 22/5/23-27/5/23, W38: 29/5/23-03/6/23, W39: 05/6/23-10/6/23