POLITEKNIK UNGKU OMAR

e-BUDGET APPROVAL SYSTEM FOR SUBMISSION OF CONTRACT AND COMMERCIAL FORMS (e-BASCCF)

NUR'AFIFAH BINTI FADLULLAH

(01BCT20F3012)

CIVIL ENGINEERING DEPARTMENT

SESSION 2 2022/2023

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A project report/thesis submitted in partial fulfilment of the requirement for the award of the Bachelor's Degree of Civil Engineering Technology

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STATEMENT OF AUTHENTICITY AND PROPRIETARY RIGHTS

e-BUDGET APPROVAL SYSTEM FOR SUBMISSION OF CONTRACT AND COMMERCIAL FORMS (e-BASCCF)

1. I, **NUR'AFIFAH BINTI FADLULLAH (NO KP: 990522-05-5558)**, am a student of **Bachelor's Degree of Civil Engineering Technology,** in **Politeknik Ungku Omar,** at the address **Jalan Raja Musa Mahadi, 31400 Ipoh, Perak.**

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APPRECIATION

In the name of Allah SWT, most gracious, most merciful, peace and blessing be upon prophet Muhammad SAW, his family and his friend selected. Firstly, I want to offer my deepest gratitude must be towards Allah because of His grace and His guidance; I can enable complete this report "e-Budget Approval System for Submission of Contract and Commercial Forms (e-BASCCF)"

I convey my sincere gratitude to my academic supervisor **Pn. Noraziah Binti Hamid**, without her kind direction and proper guidance this study would have been a little success. In every phase of the project her supervision and guidance shaped this report to be complete perfectly.

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Thank you.

ABSTRACT

Gamuda Berhad's Contracts and Commercial (C&C) Department is responsible for developing and submitting budget and variation order papers for seven projects, including the Penang South Reclamation Island A (PSRA). Concerns with the current approach included inefficient processes, poor systematic management, insufficient time for budget approval, tracking information, and a risk of error due to a lack of double-checking procedures. Therefore, the aim of this study is to develop the e-Budget Approval System for submission of Contract and Commercial Forms (e-BASCCF) using Power App and Power Automate for systematic and efficient budget approval. Objectives 1 and 3 use Quantitative method and objective 2 use PowerApp and Power Automate to develop the e-BASCCF. The results for objective 1 showed that the current method; average mean is very low in every constraint element; <1.5 average mean. Result for objective 2 show that e-BASCCF for submission of C&C Forms using Power App and Power Automate successful to developed. Meanwhile, result for objective 3 show that > 90% respondents agree the e-BASCCF for submission of C&C Forms is a systematic and efficient in budget approval system. Paired T Test showed that the effectiveness of budget approval system for submission of C&C Forms is highest in element of using the electronic medium (e-BASCCF) by resulted as 3.37 in differences mean; High in agree interpretation. Conclusion for the study is the e-BASCCF is a systematic and efficient medium and needs to be implementing by C&C Department in budget approval system.

ABSTRAK

Jabatan Kontrak dan Komersial (C&C) Gamuda Berhad bertanggungjawab membangunkan dan menyerahkan kertas pesanan belanjawan dan variasi untuk tujuh projek, termasuk Pulau Penambakan Selatan Pulau Pinang A (PSRA). Kebimbangan dengan pendekatan semasa termasuk proses yang tidak cekap, pengurusan sistematik yang lemah, masa yang tidak mencukupi untuk kelulusan belanjawan, maklumat penjejakan dan risiko ralat kerana kekurangan prosedur semakan dua kali. Oleh itu, matlamat kajian ini adalah untuk membangunkan Sistem Kelulusan e-Belanjawan bagi penyerahan Borang Kontrak dan Komersial (e-BASCCF) menggunakan Power App dan Power Automate untuk kelulusan belanjawan yang sistematik dan cekap. Objektif 1 dan 3 menggunakan kaedah Kuantitatif dan objektif 2 menggunakan PowerApp dan Power Automate untuk membangunkan e-BASCCF. Keputusan untuk objektif 1 menunjukkan bahawa kaedah semasa; purata purata adalah sangat rendah dalam setiap elemen kekangan; <1.5 purata min. Keputusan untuk objektif 2 menunjukkan bahawa e-BASCCF untuk penyerahan Borang C&C menggunakan Power App dan Power Automate berjaya dibangunkan. Sementara itu, keputusan untuk objektif 3 menunjukkan bahawa > 90% responden bersetuju bahawa e-BASCCF untuk penyerahan Borang C&C adalah sistematik dan cekap dalam sistem kelulusan belanjawan. Ujian T Berpasangan menunjukkan keberkesanan sistem kelulusan belanjawan bagi penyerahan medium Borang C&C adalah tinggi dalam elemen menggunakan medium elektronik (e-BASCCF) dengan menghasilkan purata perbezaan 3.37; Sangat Tinggi dalam tafsiran setuju. Kesimpulan kajian ialah e-BASCCF adalah medium yang sistematik dan cekap dan perlu dilaksanakan oleh Jabatan C&C dalam sistem kelulusan belanjawan.

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LIST OF ABBREVIATION

PTMP	Penang Transport Master Plan
ESG	Environmental, Social and Governance
e-BASCCF	e-Budget Approval System for submission of Contract and Commercial Forms

CHAPTER 1

INTRODUCTION

1.1 Introduction

The construction industry globally is one of the industries that play an important role in the development and improvement of the economy in many countries. The activity of the construction industry is a contributor to environmental problems because many difficulties may arise if the progress and development of the sector is not carefully planned. The construction industry is a large sector that includes three types of construction, namely civil engineering, heavy civil engineering and building construction. The civil engineering construction involved in such as dams, bridges, aqueducts, canals, highways, power plants, sewerage systems, and other infrastructure. Heavy civil engineering revolves around big government and community projects. Heavy civil projects can include constructing water structures, waterways, and heavy industries such as a shipyard. Building construction is the process of adding structure to real property. Most building construction projects are small renovations, such as the addition of a room, or renovation of a bathroom. Often, the owner of the property acts as a labour, paymaster, and design team for the entire project. It is responsible for the infrastructure of cities, towns, and countries, this industry is one of the largest in the world.

Nowadays, island reclamation is an activity that involves filling part of the sea area with fill material such as rock, sand, and soil with the aim of obtaining a new land area. Examples of countries involved in reclamation are Hong Kong International Airport, Dalian's Xinghai Square, Flevopolder in the Netherlands, and Beirut's Central District. In Malaysia, there are several places involved in reclamation, including Melaka, Johor, Langkawi, and Penang. Most of the places in Malaysia that are involved in reclamation are due to the development of the manufacturing industry. Malaysia is now rapidly developing its manufacturing industries to become the main exporter abroad. Manufacturing industries such as electronics, food, textiles, oil, and others.

Penang attracts multinational companies such as Intel Corporation, Keysight Technologies and Agilent Technologies (Hewlett Packard), Robert Bosch, AMD, Osram Opto Semiconductor, Renesas (formerly Hitachi), Clarion and National Semiconductor. According to the Department of Statistics and UN Comtrade, Penang accounted for about 5% of global semiconductor exports in 2019. Penang still faces problems such as insufficient land for new development, traffic congestion and reduced livability, causing the state to lose its appeal to investors, leading to the loss of investment dollars and high-paying jobs in other countries in the region. Penang introduced the reclamation of South Island, which will play a major role in the future expansion of the state's electrical and electronics (E&E) sector and economic growth for decades to come.

Moreover, Gamuda Berhad is a Malaysian engineering, real estate, and infrastructure firm. It is one of the biggest infrastructure companies in Malaysia and has worked on numerous local and international projects, including the construction of the Klang Valley MRT lines, highways, airport runways, railways, tunnels, water treatment plants, dams, infrastructure concessions, and the creation of new townships. The company's goal is to constantly provide to its clients through its primary world-class infrastructure and top lifestyle property operations in infrastructure development and construction, infrastructure facility operation, and property development. The organization wants to lead the way in the region for innovative new solutions for massive public infrastructure and real estate development. Beside that in Penang, Gamuda Berhad has joint venture with Loh Phoy Yen Holding Sdn Bhd and Ideal Property Development Sdn Bhd to founded SRS Consortium Sdn Bhd company. This company is the project delivery partner of the Penang Transport Master Plan (PTMP).

Gamuda Berhad uses a Code of Business Ethics that has been developed to guide and support the business operations and governance policies of the Gamuda Group ("Gamuda" or the "Group") which includes the General Administrative Policy and Procedures, the Group Human Resources Policy and Procedures, and the Anti-Bribery Policy & Corruption and Whistleblowing Policies and Procedures. The Code is built on the Group's five core values of Take Personal Ownership, Walk the Talk, Practice Open and Honest Communication, Demonstrate True Teamwork and Develop Our Employees to ensure all our operations and affairs are conducted ethically. This Code applies to all Employees of Gamuda. The objective of this code is to ensure, in all areas

of Gamuda's business operations, correct and ethical business practices, a safe and conducive work environment, fair treatment of the interests of all relevant stakeholders and compliance with all applicable laws and regulations.

The Penang Transport Master Plan (PTMP) is a comprehensive, effective, and interconnected transport strategy that will provide the framework for a modern and integrated transport network on land and sea for the benefit of the people of Penang. It is based on an engineering design feasibility study that establishes constructability, a cost-benefit analysis that establishes economic viability, and a financing model that combines economic and social benefit analysis. This transportation plan includes several different transportation modes, including elevated light rail transit, bus rapid transit, streetcars, taxis, e-hailing services, ferries, and water taxis. By 2030, the master plan wants a 40:60 modal split between public and private transport.

Gamuda Berhad, they are using the Environmental, Social, and Governance (ESG) Criteria as a set of standards for a company's behaviour used by socially conscious investors to screen potential investments. Environmental criteria consider how a company safeguards the environment, including corporate policies addressing climate change, for example. Social criteria examine how it manages relationships with employees, suppliers, customers, and the communities where it operates. Governance deals with a company's leadership, executive pay, audits, internal controls, and shareholder rights, according to Thomas Brock, 2022.

The Contracts and Commercial Department is a department that is working on preparing documentation such as quotations, offers, orders, acknowledgements of orders, acceptances, and specifications of the purchaser or seller, and any documents referred to in any of them. The term Quantity Surveyor (QS) refers to the person who manages the contracts and costs of a construction project from start to finish. They are expected to have an aptitude for mathematics, estimation, and problem-solving. They are responsible for the preparation and submission of documents such as budget and variation orders for seven projects which is Bayan Lepas Light Rail System (BL LRT), Shared Services (SS), Common Infrastructures (CI), PAN Island Link 1 (PIL1A), PAN Island Link 2A (PIL2A), Penang South Reclamation Island A (PSRA) and Master planning, Investor Marketing and Land Tenders (MPIL).

Procurement tender type this project is the restrictive tender process, it is the process is more limited in terms of a select number of suppliers being invited to tender, rather than being completely open to all. This is typically presented in the form of a two-stage submission, comprising a selection questionnaire (SQ) and invitation to tender (ITT). The aim of the selection questionnaire stage is to reduce the number of bidders that progress to the ITT stage based on mandatory requirements, experience, and financial thresholds. The selection questionnaire will essentially focus on what you have done, which list those who are invited to ITT stages must then explain what they will do to deliver the contract. In every project, there must be stakeholders involved as show in Table 1.1 below:

Table 1.1 Stakeholders involve in Project.

Stakeholder	**Role**
Gamuda Berhad	Act as a developer
SRS Consortium Sdn Bhd	This company is the project delivery partner of the Penang Transport Master Plan (PTMP)
Bahagian Perancang Ekonomi Negeri (BPEN)	Act as one of the organizations that make sure the country economy in a good condition
Pejabat Daerah dan Tanah Daerah Barat Daya	A responsibility to ensure that the land being used for the construction
Penang Infrastructure Corporation (PIC)	The organisation that will finance the project
Environmental Impact Assessment (EIA)	To assess the EIA reports for quarrying activities which have been submitted to the Department of Environment

From that, the problem is QS still uses the current method in the documentation form submission, and it does not follow the company goal which is using ESG. And the problem can cause by time, cost and waste to the environment and society. And some processes would involve filling up Excel forms, which may come in multiple versions and therefore cause confusion, manually scanning the documents and then circulating them between multiple approvers one at a time. Besides that, based on the company goal of using ESG the Low-code tools for automated digital e-form were the solution to the problem. The digital e-form is going to generate using Microsoft's PowerApps and Power Automate.

Using Power Apps can quickly build custom business apps that connect to the data stored either in the underlying data platform (Microsoft Dataverse) or various online and on-premises data sources. Power Automate is a service that helps create automated workflows between favourite apps and services to synchronize files, get notifications, collect data, and more. This digital e-form can relate to the fourth industrial revolution (IR 4.0) and the Internet of Things (IoT). IR 4.0 take emphasised digital technology in recent decades to a whole new level with the help of interconnectivity through the IoT, access to real-time data, and the introduction of cyber-physical systems. As shown in Figure 1.1 and 1.2 below the overview of Microsoft Power App and Microsoft Automate

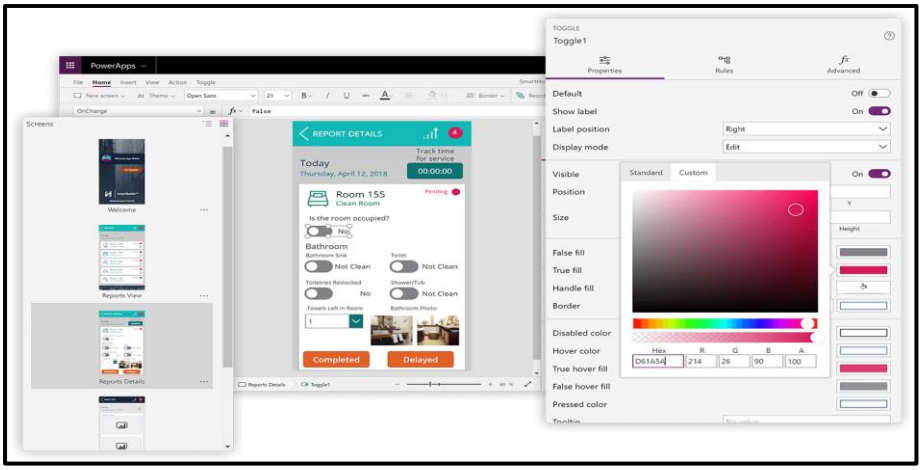


Figure 1.1 Overview Microsoft Power App (source from Microsoft)

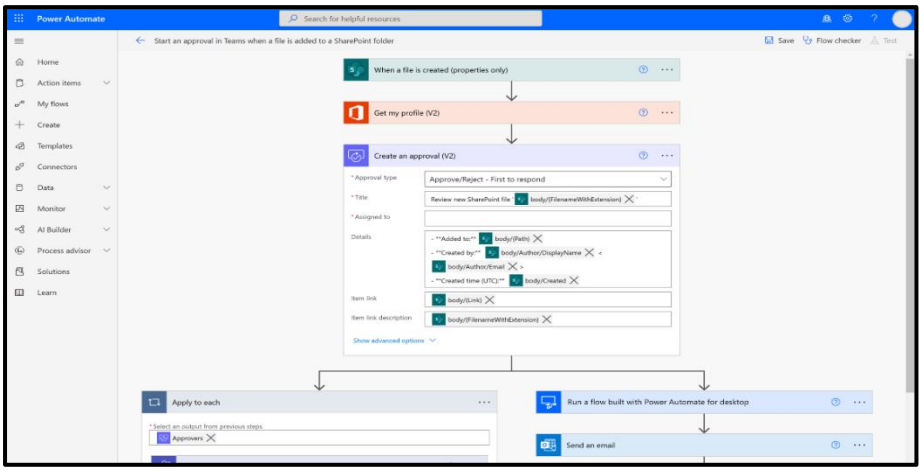


Figure 1.2 Overview Microsoft Power Automate (source from Microsoft)

1.2 Problem Statement

The contract and Commercial department (C&C Team) work in Gamuda Berhad issuing the problem that they must faces when another department was requested for some budget, they must fill out the Miscellaneous Services/Goods Procurement Authorisation form and must prepare the following document by the checklist that has given. The problem is that they must do the data entry which is to fill the forms by handwriting, supporting documents printed out and stapled together and form entry was recorded manually by C&C Team into an excel spreadsheet. In C&C Team has 3 people handling form entries recorded into an excel spreadsheet. Another problem is transparency or traceability, which is all forms are tracked individually and manually by the C&C Team and changes or amendments to the form may not be reflected in duplicate copies. Editing problems can be a big problem for them, need to write or fill out the form again. This will need to be repeated every time they make an error and must make corrections.

Cost is another problem for the company because the company needed to buy physical paper forms. The use of paper documents may use a lot of space, and the amount of paper produced daily will rise. Additionally, it is usually necessary to have documents close at hand so that they may be accessible as quickly as possible. Not just that, Time is one of the problems that the C&C Team issuing because as this process relies on a middle person to do the legwork of generating the document, printing, scanning and physically handing over the document, a substantial delay may happen between the point of form generation to arriving at the approver's desk. Approvals may also be held up by a backlog of documents queue that the approver must manually filter and respond to individually.

The current method is bad for the environment and won't help much to boost the company's green credentials as mentioned using ESG. Many of today's employees want to work for a company that prioritizes sustainability, and many consumers also prefer environmentally friendly alternatives. This digital e-form will help to reduce the number of paper people waste around the office and will increase the effectiveness of the operation and productivity. It also offers a way for a company or department to change its whole approach to data storage and management. Gamuda Berhad not only focuses on ESG but also on Sustainable Development Goals (SDGs). Among the goals that are

focused on are goal 9 – Industry, Innovation and Infrastructure, goal 11 – Sustainable Cities and Communities and goal 13 – Climate Action. This study will focus on SDG, goal 9 alongside with the company has focused on.

In Gamuda Berhad, the Contract and Commercial Department most of the forms that they always use for a request for the budget Miscellaneous Services or Goods Procurement Authorisation and Payment Requisition Form. So, from observation two most important forms will be transformed into digital e-form which is as E-Budget Approval System For Submission of Contract and Commercial Forms (e-BASCCF), the two forms will call as Miscellaneous Services or Goods Procurement Authorisation (E-MSGPA) and Payment Requisition Form (E-PRF).

1.3 Objectives

The aim of the objective is to develop the e-Budget Approval System for Submission of Contract and Commercial Forms (e-BASCCF) using Power App and Power Automate for systematic and efficient budget approval. Hence to achieve the aim, the objectives listed are: -

i. To identify the constraints of current method for the budget approval forms submission system.

ii. To develop the e-BASCCF for submission of Contract and Commercial Forms using Power App and Power Automate.

iii. To test the effectiveness of e-BASCCF as a systematic and efficient budget approval forms submission medium.

1.4 Scope of Study

The scope of study of this project at Gamuda Office (SRS Consortium Sdn Bhd). The office is show in Figure 1.3 below. The project involved in this company which is Bayan Lepas Light Rail System (BL LRT), Shared Services (SS), Common Infrastructures (CI), PAN Island Link 1(PIL1A), PAN Island Link 2A(PIL2A), Penang South Reclamation Island A(PSRA) and Master planning, Investor Marketing and Land Tenders (MPIL). The focused scope of the study is mostly on the contract and commercial department (C&C Team) and they will allow accessing all form that has been submitted and get approved by the originating department. The user can access the system using any electronic device. This system will have a lot of potential to be used in every form submitted to help user to save time and reduces waste.

Figure 1.3 SRS Consortium Sdn Bhd Office (source from Google Maps)

1.5 Significant of the Study

Based on research, among the problems that are often contract and commercial departments is the current method submission form system. To solve this problem, digital e-BASCCF can help the department manage their form submitted everywhere and anytime. This system can help users track the data or information in the submitted form they need. This system saves time for the related department or person to approve the document or form that has been submitted to the digital system with the digital e-BASCCF, the goal of the company has been achieved. The novelty as show as Figure 1.4 below is Develop e-BASCCF Form, fill, and update digital form and submit by SharePoint list.

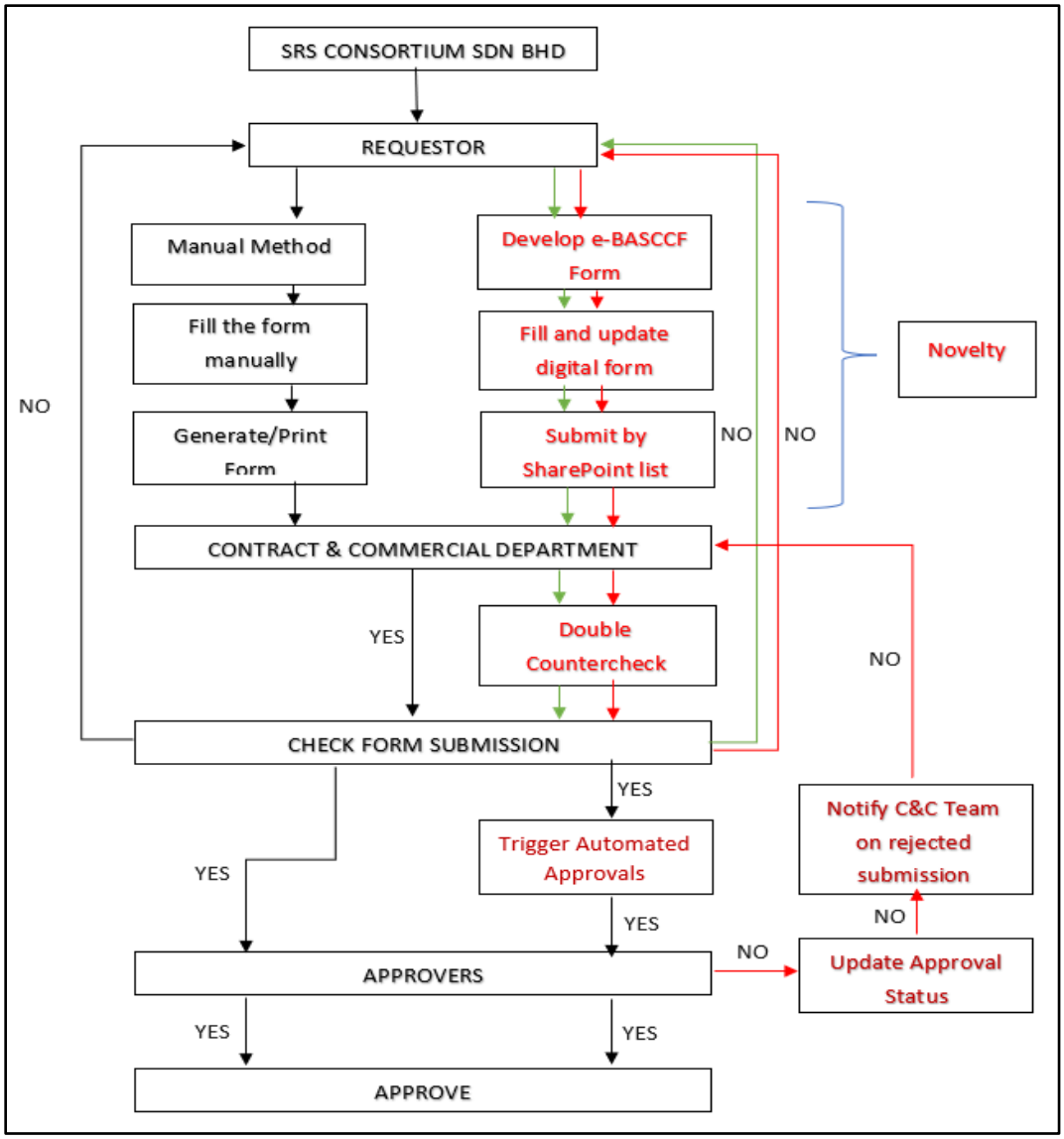


Figure 1.4 Significant of Study

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

We live in a digital world. From toothbrushes, thermostats, and telephones to cars, buildings and aeroplanes, the objects we use at work and in everyday life are augmented with digital capabilities that infuse their substance and meaning (Baskerville et al., 2020). As Floridi (2012) put it, our physical world, and the objects in it are being "enveloped" by a digital layer building on the pervasive and accessible digital infrastructure of computers, broadband networks and mobile devices (Brynjolfsson & McAfee, 2014; Fichman et al., 2014). Digital platform businesses dominate our economy (Tiwana, 2015). Innovative digital devices feature in the experiences of more and more people (Yoo, 2010) through the proliferation of smart, connected products, online social networks, and wearable devices (e.g., Benbunan-Fich, 2019; Beverungen et al., 2019; Gerlach & Centefelli, 2020; Marchant & O'Donohoe, 2019). Digital devices now outnumber humans as information processors. At present, over 20 billion devices are connected feeding off more than 50 billion sensors that track, monitor, or feed data to those objects (Zhang, 2016). Digital devices are everywhere, and they seem to be changing everything.

What is often overlooked in this story is that digital innovation is not only about the objects (a.k.a., infrastructure, platforms, devices, or other artefacts) – it is also about the processes they facilitate. Digital innovation may take the form of new technology but the key to its impact is that it unleashes generative capacity (Tilson et al., 2010): digital innovation yields the ability to rejuvenate, reconfigure, reframe, and challenge the way we see and understand the world and act within it (Avital & Te'Eni, 2009). In other words, digital innovation is the story of how we change what we do because of the digital technologies emerging around us.

Construction 4.0 represents the exploration of new technologies in the architecture, engineering, and construction (AEC) industry. The development of digital

technologies is rapid and the adoption of them significantly impacts construction projects, for example, leading to a reduction in change orders, better decision-making, and improvements in the quality of work. However, stakeholders may find it challenging to determine the promising technologies within the context of the AEC industry. It presents an exploratory study to investigate the potentially applicable technologies and their research and practice trends in the AEC industry. A scoping review was the method utilized to perform a quantitative analysis of over five thousand journal papers published from 2010 onward based on two academic databases (Scopus and CNKI).

The results present the top 10 construction 4.0 technologies, including building information modelling (BIM), artificial intelligence (AI), 3D printing, machine learning, internet of things (IoT), geographic information systems (GIS), virtual reality (VR), big data, robotics, and augmented reality (AR). Subsequently, 145 industry professionals were invited to select the most used construction 4.0 technologies in their projects via a questionnaire survey. Mobile devices, BIM, and Digital signatures are mostly adopted on-site. The findings of this study can enhance the awareness of stakeholders toward construction 4.0 technologies and may help them make better decisions in selecting and implementing promising technologies.

2.2 Project Management Life Cycle

The relationship between project management and procurement as an organisational function is often a clash of wills (Rinkavage, Bennis & Gault,2006: l). Successful projects are defined as those projects completed on time, within budget and in ways that meet quality and business objectives (Schermerhorn, 2005:197). The classic definition of procurement as an organisational function entails all the activities that must be performed to ensure that products of the right quality, at the right price, in the right quantities, at the right time, and from the right supplier are procured (Cronje, Du Toit, Mol & Van Reenen, 1 997:377; Hugo, Badenhorst & Van Rooyen, 2002:4).

The procurement office should not wait to be invited by the project manager to become a stakeholder within the project management life cycle but should take the initiative to market the services of the procurement management function to the project manager (White, 2002: l). The role of the procurement management function within the

organisation is determined by the focus of the function and the procurement management function itself determines its status within the organisation (Syson, 1992:254).

2.3 Procurement

The level of domestic and international rivalry facing manufacturing companies in the 1990s is higher than ever. Companies that succeed must put plans into place to cut costs, continuously improve quality, improve customer service, enhance delivery, and shorten the time it takes for a product to reach the market. One of the most important tactics for reaching this objective is considered to be global sourcing (Frear et al., 1992; Min and Galle, 1991). Because of this, a lot of multinational corporations and other big companies have embraced this strategy to strengthen their position in the market.

Procurement from suppliers located outside the company's place of manufacturing is known as international sourcing. The entire world must be considered as a possible source for raw materials, components, services, and finished items, according to procurement experts. International sourcing slowly gained relevance as a procurement and commercial strategy during the 1980s and the early 1990s (Monczka and Trent, 1991). According to research, a company will source from outside of its national boundaries if it anticipates achieving substantial and quick improvement in four critical areas:

i. cost reduction
ii. quality improvement
iii. increased exposure to technology
iv. delivery and reliability improvements

Other factors which influence the international sourcing decision include:

i. the introduction of competition to the domestic supply base
ii. establishing a presence in a foreign market
iii. satisfying offset requirements
iv. increasing the number of available sources
v. reacting to the offshore sourcing practices of competitors

2.3.1 Construction Procurement

This analysis looks at the many technological innovation trends in web-based procurement for construction. To focus on certain parts of building procurement operations, it was necessary to identify them. The bulk of published works on construction procurement, according to the literature review, focus on the various procurement routes and systems, their selection criteria, operational procedures, and strengths and limitations (see for example Cheung et al., 2001; El Wardani et al., 2006; Laedre et al., 2006; Oyegoke et al., 2009). Other studies (such as Love et al., 1998; Brown et al., 2001; Watermeyer, 2004; Vitkauskaite and Gatautis, 2008) provide information on the types of activities and duties that contractors participate in during the procurement processes for goods and services. The combined results of this research assist to demonstrate that the procurement of construction products, services, and works is a process that involves various processes and actions people, or organisations engage in.

According to ISO 10845 (2010), there are three main activities involved in construction procurement: establishing, administering, and carrying out contracts for the provision of products, services, engineering and construction works, disposal, or any combination of these. In a conceptual paper on a BIM-based perspective of electronic procurement in the architectural engineering and construction sector, Grilo and JardimGoncalves (2011) explain that these three basic activities involve specific tasks related to the procurement of construction materials, equipment, and professional and non-professional services. In this essay, we define construction procurement as including all tactical and strategic actions taken by buyers during the planning, execution, and management of building or engineering projects.

It was able to link the numerous road maps for construction procurement offered by the various authors mentioned in the previous paragraphs to the six basic construction procurement activities specified by Watermeyer (2004) and ISO 10845. (2010). These actions consist of:

i. Establishment of what is to be procured
ii. Establishment of procurement strategies
iii. Soliciting for tender offers
iv. Evaluating tender offers

v. Awarding of contract
vi. Administrating contracts to ensure that they comply with requirements.

These six basic activities serve as a general road map for the construction procurement process, even if the extent to which each of these activities is carried out in a specific construction procurement effort depends on the procurement method or system used. As a result, these six basic construction procurement activities serve as the basis for the identification and analysis of the patterns of technical innovation in e-procurement use in construction as provided in this study.

2.3.2 E-Procurement

It was important to first identify the various e-procurement technologies and applications available to support the execution of the six basic construction procurement activities taken into consideration in this study to analyse the patterns of technological innovations in the use of e-procurement in construction. E-procurement or e-commerce technologies, according to Min and Galle (1999) and Gunasekaran and Ngai (2008), are the various packages, tools, and/or applications that support electronic communication, information exchange, and transactions related to the purchase of goods and services over the Internet.

Web software packages for the performance of specific procurement tasks (such as BIM used in the production of construction documents); network technologies for the exchange of data and information among project participants (such as EDI, e-mail, and wireless technologies); and web-supported transactional and collaborative tools are just a few examples of the e-procurement technologies and applications available to support execution of the six basic construction procurement activities (e.g. Web 2.0, BIM, ERP, Cloud computing, web-based project management and customised e-procurement software applications). The common aspect of these technologies, according to studies (see, for instance, Gunasekaran and Ngai, 2008; Underwood and Isikdag, 2011; Grilo and Jardim-Goncalves, 2011; Ren et al., 2013), is that they tend to encourage real-time interactions and data exchange throughout the entire construction procurement lifecycle.

2.3.3 Procurement Management

Due to separated procurement management and unpredictable supply chains, the construction sector in many countries is still unable to fully benefit from innovation (Holt and Goulding 2016). As a result, in most construction projects, the connection between a company and its suppliers does not demonstrate an alignment of strategy. Blayse and Manley (2004) thus classified the factors that influence construction innovation into the following categories: clients and manufacturers; production structure; relationships between people and companies within the industry; relationships between the industry and outside parties; procurement systems; regulations/standards; and the nature and quality of organisational resources. These categories make it abundantly evident that the external sources and their interaction with the organisation have a significant impact on the innovation process.

All project stakeholders must be involved and cooperative for the innovation process to be effective. Systems for outsourcing and purchasing are regarded as a determinant of effective innovation processes (Ling et al. 2003). Additionally, the organization's culture and policies should be firmly rooted in the value of procurement management.

According to Filipescu and Cazares (2012) and Sears (2015), the procurement management process can be defined as the activities related to involving and introducing service providers or materials to a project or organization's activities. This includes managing contracts and coordinating the subcontractor's strategy and goals with the organization. Additionally, organizations use a third party to complete some tasks for a variety of reasons, including sharing the risk, the high cost of new technology, a lack of expertise in a particular area, a reduction in the cost or time to implement a project, or to introduce a fresh perspective by hiring a specialized company (Streule et al. 2016).

On the other hand, an organization could avoid outsourcing due to concerns about information confidentiality, knowledge sharing, project control or conflict of interests (Tidd and Bessant 2018).

2.4 Internet of Things (IoT)

The Internet of Things (IoT) is an innovative concept of the internet, initially introduced by Kelvin Ashton in 1999 (Ashton, 2009). It is defined as the possibility of connecting things using the internet to form a platform used to execute certain activities (Al-Qaseemi et al., 2016). It uses internet connectivity and all the things around it to have the capability to connect and communicate with each other to perform any specific function through the network (Gershenfeld et al., 2004). It is an approach of giving the possibility to things around to communicate using internet connectivity (Gubbi et al., 2013). The method is carried out by always connecting all things with everyone and locations using the built-in wireless connection. Moreover, this facility enables easy linkage with all the surroundings, which eases the monitoring and control process via the internet (Ashton, 2009).

Theoretically, IOT comprises four different layers, which are the application layer, perception layer, network layer and physical layer. The application layer refers to common practices such as smart cities, smart transport, and intelligent homes; however, the perception layer refers to technologies such as sensors and devices, which communicate with other objects. The network layer refers to network communication and the component of network coverage. The physical layer refers to the hardware including smart appliances and other devices (Kumar et al., 2016)

There are many advantages to using IoT in the construction sector. These consist of better execution monitoring, effective controlling, better quality, cost, and timesaving. It has also been expanded to be used in making fast decision making because of the availability of real-time data analytics (Ning and Xu, 2010; Gubbi et al., 2013; Dave et al., 2016). In addition, it improves crisis management and emergency responses by introducing efficient monitoring of the structure (Zhao et al., 2013). The IoT technology can be used in environmental-related aspects such as waste management, pond pollution and flood concentration analysis (Wei and Li, 2011).

The introduction of the new technology is associated with multiple challenges, which are categorized into three main parts such as the method of introduction, lack of acceptance and lack of knowledge and expertise (Bari et al., 2013; Matharu et al., 2014). This study aims to investigate the awareness of construction parties towards IOT application and significance; moreover, it then identifies the challenges of adopting IoT

in construction projects and finally determines the dominant challenges of adopting IoT in the construction industry.

2.4.1 Email

The important source of information is email. It offers a simple-to-mine repository of communication between users of the social network and includes knowledge about expertise as well as actual displays of competence (such as responding to a query on a particular topic) (e.g., decision of who should be asked the question). Email messages and communication patterns both reveal who is aware of what within a company. In this essay, we consider email communication patterns carefully. In addition to describing a system that extracts expertise from email, we also assess how well two distinct algorithms for mining expertise stack up against human judgements. ("Expertise Identification Using Email Communications | Proceedings of the Twelfth International Conference on Information and Knowledge Management," 2022)

2.4.2 Outlook.com

The default email client for sending and receiving emails from Microsoft Exchange Server is Microsoft Outlook. Accessibility to contact, email, calendar, and task management tools is also provided by Outlook. Although it may be used alone, Microsoft Outlook is also a component of Office 365 and the Microsoft Office suite, which also includes Microsoft Excel and PowerPoint. The outlook may be used as a stand-alone personal email programme and as multiuser software by business clients. It can be integrated with Microsoft SharePoint so users can exchange documents and project notes, work together with coworkers, remind people of appointments, and more. Outlook has a free browser-based version with fewer capabilities. Users who don't want the full functionality of the app can choose that version over a Microsoft 365 subscription. (Gillis & Gervais, 2017)

2.4.3 Microsoft Teams

The Microsoft 365 and Office 365 software suites include Microsoft Teams, a cloud-based team communication tool. Business calls, video meetings, file sharing, and business messaging are some of Microsoft Teams' primary features. Teams may be used by companies of any size. Teams, the main unified communications (UC) service provided by Microsoft, competes with services like Slack, Cisco Webex, and Google

Workspace. As a tool for corporate communications, Teams enables both local and distant workers to work together on the material in real-time and almost real-time on a variety of gadgets, including laptops and smartphones. Exchange, PowerPoint, and SharePoint are just a few of the Microsoft business apps that Microsoft Teams connects with. (O'Neill, 2021)

Because it keeps scattered teams of employees linked and talking, Microsoft Teams is especially helpful for remote collaboration. Organizations all around the world were driven by the COVID-19 epidemic to heavily utilise Microsoft Teams as well as other collaboration software as a communications platform for remote work. Microsoft Teams is often used throughout the entirety of an enterprise, not simply inside certain business units. In some circumstances, Teams might take the role of email for employee communication within the firm. (O'Neill, 2021)

2.4.4 Sharepoint

SharePoint is a highly adaptable cloud-based content management and collaboration software that may make it easier for your team to collaborate remotely and more effectively. SharePoint is a document management system that promotes team communication no matter where teams are located and are used by over 200,000 businesses worldwide. Simply put, SharePoint enables you to manage all of your corporate content (including RFIs, marketing materials, financials, and more), build websites and intranets to inform your users of what's going on, develop business processes to automate some of your more routine tasks (like workflows), and develop customised apps to boost team productivity. (ProServeIT, 2021)

2.4.5 Power Apps

Power Apps is a package of apps, services, connectors, and a data platform that offers a quick development environment for creating unique apps for your company's requirements. You can easily create unique business apps with Power Apps that link to your data stored in the Microsoft Dataverse underpinning data platform or in a variety of online and on-premises data sources (such as SharePoint, Microsoft 365, Dynamics 365, SQL Server, and so on). (KumarVivek, 2022)

Power Apps-created applications offer robust business logic and workflow features to convert your manual business processes into digital, automated ones.

Additionally, Power Apps-created apps have a responsive design and can function flawlessly on mobile devices and in browsers (phone or tablet). Power Apps "democratises" the process of constructing unique, feature-rich business apps by allowing consumers to do it without writing any code. The versatile platform offered by Power Apps enables expert developers to programmatically interact with data and metadata, apply business logic, build unique connections, and link with external data. (KumarVivek, 2022)

2.4.6 Power Automate

Users may build automated workflows across different apps and services using Microsoft Power Automate, formerly known as Microsoft Flow. To increase productivity, Microsoft created the programme to assist users in automating repetitive, manual tasks in both Microsoft Office 365 and Microsoft Azure. All Office 365 programmes come with Power Automate activated by default, which has roughly 150 standard connections. To expand automation possibilities, the tool offers an equivalent number of premium connections that may be purchased.

A scripting/development language where network users may create their own instructions to automate the process. It is essentially a variation of PowerShell. Power Automate is highly attractive to hackers since if you have access to the environment, you probably also have access to it. Users with admin-level access tend to produce similar scripts, making it challenging to identify suspicious script production. For instance, once inside the network, a hacker may write a script to route all emails from the CFO to a certain email account. Without security personnel going through and reading every script, it is difficult to determine whether a given script is harmful. (“Power Automate: What Is It and Who Is It For? | Vectra AI,” 2022)

2.4.7 Excel

For the Microsoft Windows and Mac OS operating systems, Microsoft creates and distributes the commercial spreadsheet program known as MS Excel. A few of its important capabilities include the capacity to carry out simple calculations and the ability to employ graphing tools, pivot tables, and macros. Organizing and modifying data is done using rows and columns of cells in spreadsheet programs like MS Excel. Charts, histograms, and line graphs can all be used to display data.

Users of MS Excel can organize data to see various elements from multiple angles. Microsoft Visual Basic is a programming language that Excel users may use to build several sophisticated numerical techniques. Programmers have the option of writing code directly using the Visual Basic Editor, which includes Windows for coding, debugging, and organizing code modules. (Techopedia, 2011)

2.5 The Fourth Industrial Revolution (IR 4.0)

Ever since the industrialization era began in the 1700s, each industrial revolution carried a significant role in the advancement of today's development. In the 1700s, mechanical looms were first introduced which were driven by the power of water and steam on mechanical equipment and replaced the agricultural sectors, further enhancing the economic structure. The Second Industrial Revolution occurred in the 1870s when electrical energy was introduced which formed a major system known as mass production. These revolutions relied on the number of human capabilities to achieve more.

During the 1970s, the Third Industrial Revolution occurred with the rise of electronics. The innovation of technology from analogue electronic and mechanical devices to today's digital technology available is referred to as Digital Revolution. Today, the Fourth Industrial Revolution (IR 4.0) is built upon the Digital Revolution, where technology and people are connected. The technological breakthrough has found new ways of demonstrating its abilities by blurring the lines between physical, digital, and biological entities. The revolution not only presents modern techniques supporting every component within the industry but also sustainability, where renewable energy and energy efficiency are two central components.

Renewable energy still contributes 19.2% to consumption, where energy efficiency is influenced by technological innovations in the industry, though the implementation is difficult. IR 4.0 aims for a viable and sustainable manufacturing system and has a higher level of complexity for integrating the production and product processes, where it becomes part of the sustainable system [10]. All three dimensions of sustainability; social, economic, and environmental value the creation of a sustainable industry by using Industry 4.0 and utilizing it for long-term competitiveness. It is important to have consideration for tactical, operational, and strategic dimensions as well as short and long-term impacts on sustainability.

By focusing on the areas of specialization, the progression has altered manufacturing processes, thus forging constructive economic prospects. Originating in Germany, the government supports this futuristic idea by endorsing the automation of industrial processes [14]. IR 4.0 has been established as a term for the industrial developmental process made up of automation and data exchange and was first introduced to the public as "Industries 4.0" to drive the implementation of IR 4.0 within the German manufacturing industries. This working group was formed by multiple representatives from different backgrounds. The IR 4.0 workgroup developed a strategic application work plan to increase German industrial competition globally, which led to the adoption of the German federal government's 2020 High-Tech Strategy.

The trend of digitization, automation, and the wide use of Information and Communications Technology (ICT) in the industry contain technologies of cyber-physical systems, the Internet of Things (IoT), cloud computing, and cognitive computing, described as IR 4.0. The concept of IR 4.0 is to digitize industrial processes to accomplish an adaptive yet extensive production and service network. Like the manufacturing industry, the construction industry's performance can be enhanced through IR 4.0 [20]. The implementation of IR 4.0 renders an area where every mechanized automation will be interconnected through technological advancements to operate and share information without the need for humans, which will improve efficiency. The industry develops a concept called "a smart factory," where cloud computing and cognitive computing store data and make decisions. The IoT however, comes functional with cyber-physical systems, allows humans to monitor the processes

in real-time without physical presence and has proven the capabilities of the vision of IR 4.0 manifest.

2.6 Environmental, Social and Governance (ESG)

ESG stands for Environmental, Social and Governance which refers to standards that define a company's behaviour and are utilised by socially responsible investors to evaluate possible investments (FLY: Malaysia, 2022). Socially responsible investing, impact investing, sustainable investing, and other terms are all used to describe ESG investments. The term "ESG" refers to a methodology for evaluating how much an organisation contributes to societal goals in addition to maximising profits for its shareholders. ESG investors work to make sure the companies they support are good corporate citizens, responsible environmental stewards, and run by management who are held accountable. The environmental criteria, to put it simply, consider a company's environmental activities, such as corporate climate change strategies. The management of relationships with clients, partners, staff, and the communities in which the business works are all subject to the social standards. Finally, governance includes issues like management, executive pay, audits, internal controls, and shareholder rights.

ESG refers to the use of environmental, social, and governance aspects to assess how far along companies and nations are with sustainability. When choosing which stocks or bonds to buy, these three criteria can be included in the investment decision-making process if sufficient data has been gathered on them ("Robeco.com," 2023). ESG has concentrated on three factors:

i. Environmental - A company's or government's impact on climate change through greenhouse gas emissions, waste management, and energy efficiency are all environmental considerations. Redoubling our efforts to counteract global warming has made reducing emissions and decarbonizing increasingly crucial. ("Robeco.com," 2023).

ii. Social - Human rights, labour standards in the supply chain, any exposure to child labour that is prohibited, and more everyday concerns like the observance of workplace health and safety are all considered social. If a company is effectively integrated into its neighborhood and hence has a "social license" to operate with approval, its social score will also increase. ("Robeco.com," 2023).

iii. Governance - In the context of corporate governance, a system of rules or principles that specify the obligations, rights, and expectations of various parties is referred to as governance. A well-defined corporate governance structure may be used as a tool to support a company's long-term strategy and to balance or align the interests of stakeholders. (“Robeco.com,” 2023).

2.7 Sustainable Development Goals (SDGs)

In 2015, the General Assembly of the United Nations (UN) adopted 17 sustainable development goals (SDGs). These goals aim to set attainable targets that can be achieved as a 2030 agenda for sustainable development, e.g., "the goals and targets will stimulate action over the next 15 years in areas of critical importance for humanity and the planet" (UN 2015, p. 5). The SDGs are further decomposed into 169 targets, and there are currently about 230 indicators that have been proposed for realizing these targets.

The SDG approach adopted by the UN fits well within the systems approach to sustainable development discussed previously. First, the 2030 agenda emphasizes that the SDGs are interlinked and that ensuring integration across all 17 goals is critical to achieving sustainable development. Second, each of the SDGs can be characterized as a goal primarily attributed to the economic, environmental, or social system.

2.8 Stakeholders

A stakeholder is a party with an interest in a business who has the potential to influence or be impacted by it. A typical corporation's investors, workers, clients, and suppliers make up its main stakeholders. However, the idea has been broadened to encompass communities, governments, and trade groups as a result of the growing focus on corporate social responsibility. Stakeholders are important for several reasons. They are significant to internal stakeholders since the operations of the company depend on their capacity to cooperate in achieving the company's objectives. On the other hand, external stakeholders may have an indirect impact on the company. Customers can alter their purchasing patterns, suppliers can alter how they manufacture and distribute their products, and governments can alter the laws and regulations. The secret to a company's

long-term success is ultimately managing relationships with internal and external stakeholders.

2.8.1 Gamuda Berhad

Gamuda Berhad is a Malaysian engineering, real estate, and infrastructure firm. It is one of the biggest infrastructure companies in Malaysia and has worked on numerous local and international projects, including the construction of the Klang Valley MRT lines, highways, airport runways, railways, tunnels, water treatment plants, dams, infrastructure concessions, and the creation of new townships. The company's goal is to constantly provide to its clients through its primary world-class infrastructure and top lifestyle property operations in infrastructure development and construction, infrastructure facility operation, and property development. The organization wants to lead the way in the region for innovative new solutions for massive public infrastructure and real estate development.

2.8.2 SRS Consortium Sdn Bhd

Under the Penang Transportation Master Plan, Gamuda Bhd's 60 percent-owned single-purpose vehicle SRS Consortium Sdn Bhd would build Island A. (LIM, 2021). SRS Consortium Sdn Bhd is made up of Gamuda (60% stake), Ideal Property Development Sdn Bhd (20%), and Loh Phoy Yen Sdn Bhd (20%).

2.8.3 Bahagian Perancang Ekonomi Negeri (BPEN)

Functions such as studying, researching, analyzing, and drafting state development policies, programs, and activities in sectors such as infrastructure and utilities, social education, health, housing, sports, youth and women's development, agriculture, animal husbandry & fishing, industry & trade, services, tourism, culture, arts, and heritage. BPEN also serves as a center that provides program and project planning for the Five Year Malaysia Plan (RML), RML Half-Term Review, Five-Year State Plan, State Half-Term Review, and State Annual Development Plan. BPEN also studies, examines, analyzes, and formulates state development policies, programs/activities in macro-socio-economic aspects and, as an information and reference centre for the collection of state socio-economic information and data, completes information and data in the database (EIS), Conducting socio-economic

studies, analyzing socio-economic information/data and preparing socio-economic reports.

2.8.4 Penang Infrastructure Corporation (PIC)

Penang Infrastructure Corporation Sdn Bhd (PIC) is the special-purpose vehicle set up by the Penang Government to spearhead the implementation of the Penang Transport Master Plan (PTMP). PIC's vision is to build resilient developments and transport infrastructure, namely components of the PTMP such as the Bayan Lepas Light Rail Transit (LRT), Pan Island Link highways, major roads, the Third Link, and the Penang South Islands, to develop Penang as a leading state. PIC's board members are the Rt. Hon. Penang Chief Minister Chow Kon Yeow, State Secretary Dato' Dr. Ahmad Jailani Bin Mohamed Yunus, State Infrastructure and Transport Committee chairman YB Zairil Khir Johari, and PIC Chief Executive Officer Dato' Seri Farizan Bin Darus.

2.8.6 Environmental Impact Assessment (EIA)

Environmental Impact Assessment (EIA) is a tool used to assess the significant effects of a project or development proposal on the environment. EIAs make sure that project decision makers think about the likely effects on the environment at the earliest possible time and aim to avoid, reduce or offset those effects. This ensures that proposals are understood properly before decisions are made. There as five stages of EIA process which is Screening, Scoping, Preparing the EIA Report, making an application and consultation, Decision making and Post decision.

2.9 Summary

Finally, the construction industry is utilising technology. Construction companies that invest in and use technology benefit from improved production, better teamwork, and project completion on time and under budget, all of which lead to larger profit margins. Even though it may be a bitter pill to chew, companies that do not invest in cutting-edge technologies and solutions are falling behind those that do. Construction companies that don't use new technologies will collapse.

Finally, but not least the technological revolution of the construction sector brought about by technology brings up a wide range of exciting options, from gaining a competitive edge to improving working conditions for employees and lowering the carbon imprint of our planet. The study predicts that the construction sector will eventually reach a stage when adopting digitalization technologies will no longer be a choice but rather a need across all corporate industries.

CHAPTER 3

METHODOLOGY

3.1 Introduction

The process of developing an imprecise requirement into a finished product or design solution is known as the design process. High levels of creativity are required during the design process, but these levels are managed and directed by the process to provide a viable, proper solution to the design problem that meets or exceeds the brief's stated objectives. Design is an activity that serves both economic and creative purposes, even if creativity is vital in design. Making sure a design satisfies each of these requirements is made easier by the design process. The process is critical for generating many potential solutions and employs a variety of techniques or mechanisms that encourage participants to think outside the box in the pursuit of a creative or innovative solution (G. Ambrose, P. Harris., 2010).

In recent years, a lot of people and organizations have come to understand the value of design thinking in the development of innovations. Through the integration of user viewpoints, technological viability, and commercial perspectives, new solutions that go above and beyond the norm may be produced. By transforming the way, we approach challenges, think, and create products and services, design thinking has the potential to transform the way we create (H. Plattner, Ch. Meinel, and L. Leifer, 2015).

A set of questionnaires will be distributed to all contract and commercial department team members at Gamuda Berhad (SRS Consortium Sdn Bhd). As a result, they may provide feedback on the effectiveness of the database to solve the problem at procurement submission. Before the questionnaire is distributed to all the related staff offices, the employee should access the system for submission of the related e-form. To meet the study aims and objectives, the research process is divided into four primary activities such as research literature review, study system and identify related documents, design thinking process and data analysis.

3.2 Design Thinking

Design Thinking is a process that takes a deep understanding of various issues that focused on the users and applied creativity and perspective from various people to generate ideas solution—bringing various guidelines to test and develop to get a solution or innovation that meets the needs of users and that situation (Binn Poothanapibul, 2016).

Leading companies throughout the world, like Google, Apple, Phillips, P&G, and Airbnb, among others, use design principles as a tool to develop breakthroughs in everything from goods and services to operational procedures to business strategies, including integrated business models. Design thinking has no formal definition. It is a concept, a technique, or a tactic. It is broadened beyond the purview of any individual or group. and as its effects grow. Design thinking is a method for finding creative solutions to challenges, according to IDEO (2018). It's not the sole tactic, nor is it a means of protection. However, the importance of design thinking has never been higher given the effect it has had on business. Figure 3.1 below shows the design thinking process.

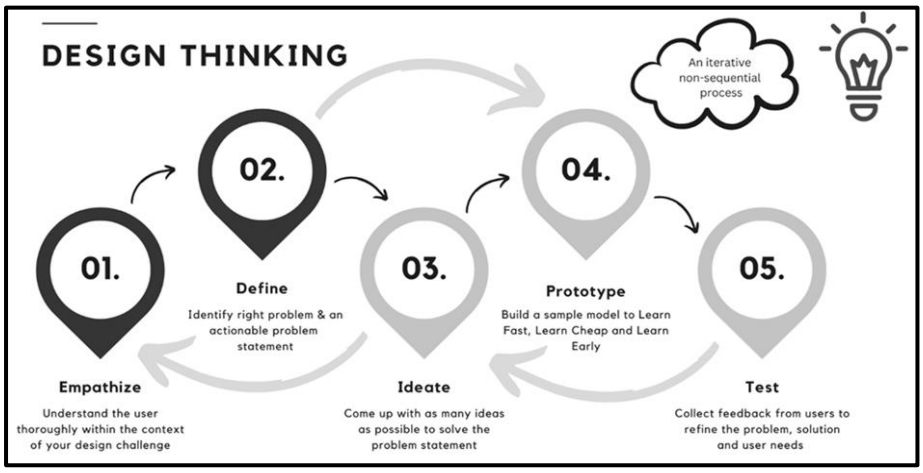


Figure 3.1 Design Thinking Process

3.3 Research Design

The framework for the methodologies and procedures a researcher will employ to conduct research is the research design. The design makes it possible for researchers to concentrate on research techniques that are relevant to the topic at hand and to put up successful research studies. For any observational planning, this technique is essential. Monitoring the implementation process can help you spot any possible issues. Changes must be made if a critical problem is a significant factor in the work's implementation failure. Control measures must then be put in place to keep the flow consistent.

A research topic's design describes the type of research, such as experimental, survey research, correlational, semi-experimental, and review and its sub-type are experimental design, research problem, and descriptive case study. So, there are three main sorts of designs for research which are data collection, measurement, and analysis. The type of research problem an organization is facing will determine the research design and not vice-versa. The design phase of a study determines which tools to use and how they are used.

Impactful research usually creates a minimum bias in data and increases trust in the accuracy of collected data. A design that produces the least margin of error in experimental research is generally considered the desired outcome. The essential elements are:

i. Accurate purpose statement
ii. Techniques to be implemented for collecting and analyzing research
iii. The method applied for analyzing collected details
iv. Type of research methodology
v. Probable objections for research
vi. Settings for the research study

Therefore, the purpose of design research is to discuss and explains the method used by the researcher in providing a plan of study that permits accurate assessment in conducting the usability using the digital e-form for the digital system is calling as e-BASCCF using Power App and Power Automate. The method of illustrating to create of an e-Budget Approval System for Submission of Contract and Commercial Forms

(e-BASCCF) as show in Figure 3.2 and Table 3.1 show research design to create e-BASCCF below.

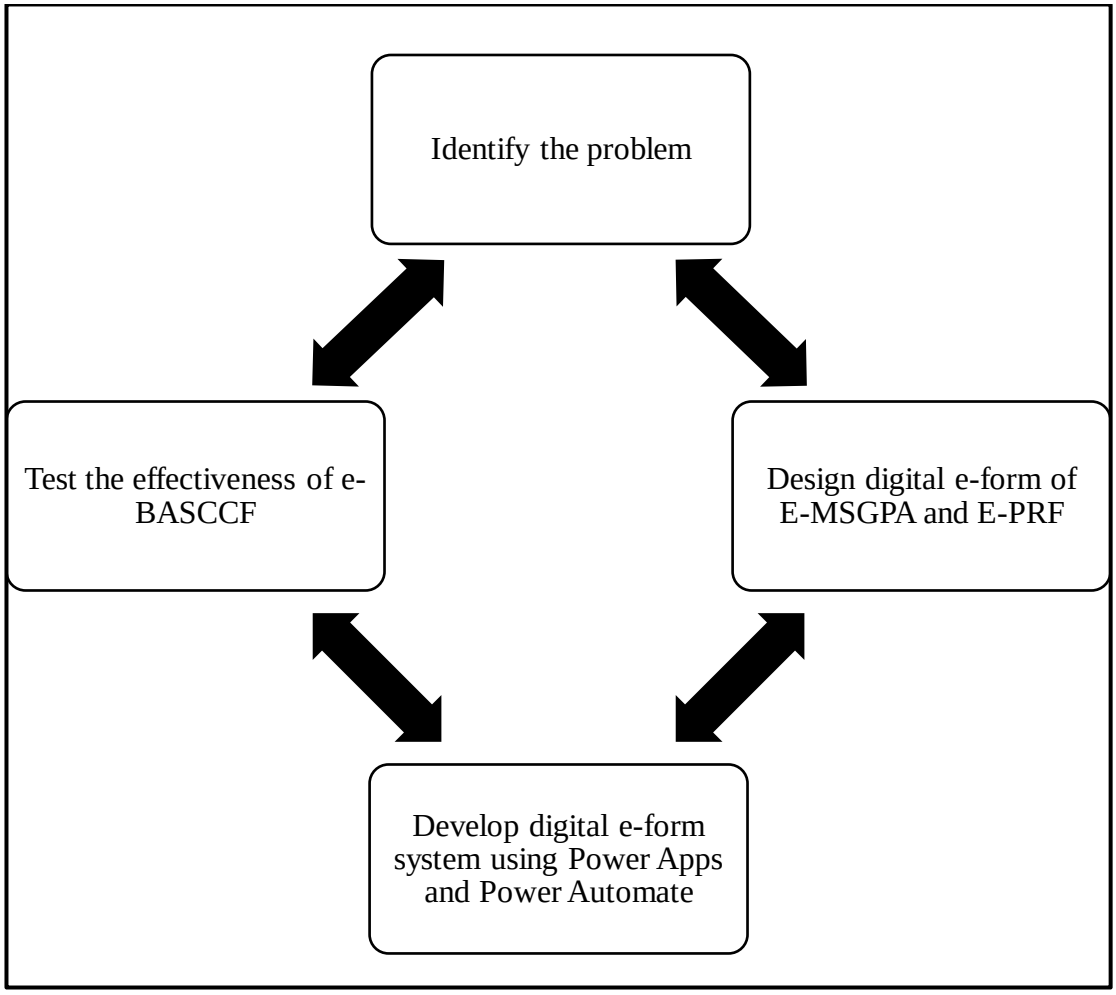


Figure 3.2 The method of illustrated to create e-Budget Approval System for Submission of Contract and Commercial Forms (e-BASCCF)

Table 3.1 Research Design

Objective	Method	Instrument	Analysis	Expected Outcome
To identify the constraints of current method for the budget approval forms submission system.	Survey	i. Quantitative ii. Respondents iii. Questionnaire iv. Google Form	SPSS Software i. Reliability test ii. Frequency Analysis iii. Descriptive Analysis • Excel-Average mean	Identify the constraints of current method for the budget approval forms submission system for ideate the innovation system.
To develop the e-BASCCF for submission of Contract and Commercial Forms using Power App and Power Automate.	Develop	i. Microsoft Power App ii. Microsoft Automate	i. Systematic submission of Miscellaneous Services/Goods Procurement Authorisation (MSGPA) and Payment Requisition Form (PRF) ii. Efficient Budget Approval.	Develop the e-BASCCF for submission of Contract and Commercial Forms using Power App and Power Automate for systematic submission of MSGPA and PRF to become efficient budget approval.

Test the effectiveness of e-BASCCF as a systematic and efficient budget approval forms submission medium.	Survey	i. Quantitative ii. Questionnaire iii. Respondents iv. Google Form	SPSS Software iv. Reliability test v. Frequency Analysis vi. Descriptive Analysis • Excel-Average mean • Paired T- Test (Compare)	Test the effectiveness of e-BASCCF as a systematic and efficient budget approval form submission medium by using digital medium.

3.4 Development of Research

Research development is a set of proactive, strategic, catalytic, and capacity-building activities that support central research administrations, teams of researchers, and individual faculty members in establishing connections, gaining extramural research funding, and creating and implementing plans to increase institutional competitiveness. The researcher went into detail in this area to describe how the application operated from start to finish. It was important to construct a flowchart before starting the application to aid in understanding. The Flow of Research Framework is show as Figure 3.3 below.

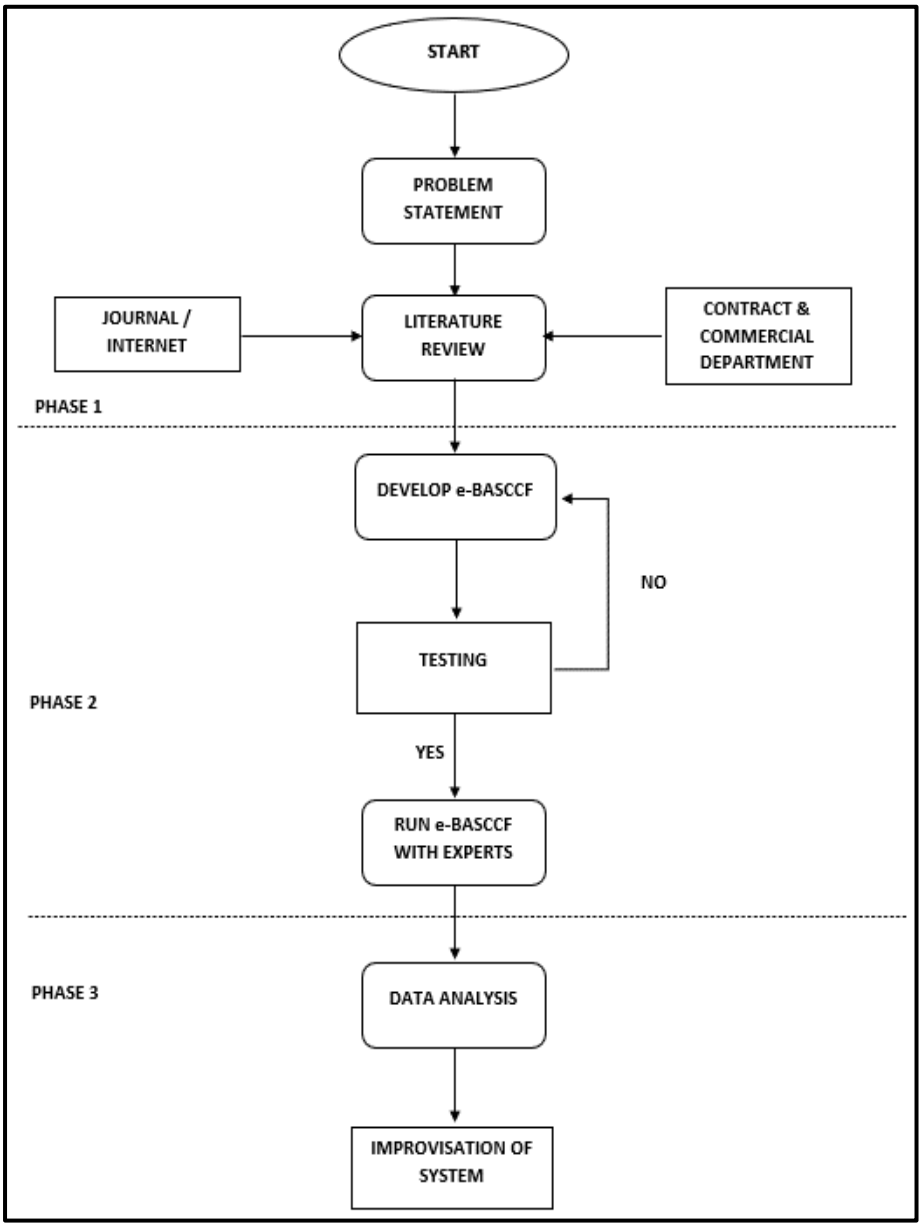


Figure 3.3 Flow of Research Framework

This framework served as a guideline for carrying out the project. As illustrated in the figure, the process in this study is separated into many parts. This development research is a process approach from the beginning to the end of the e-BASCCF. During this process, create a flow chart for this system to ensure that the project runs smoothly and as intended. The detail of research development as Figure 3.4 and Figure 3.5 show the three phase of research flow of methodology below.

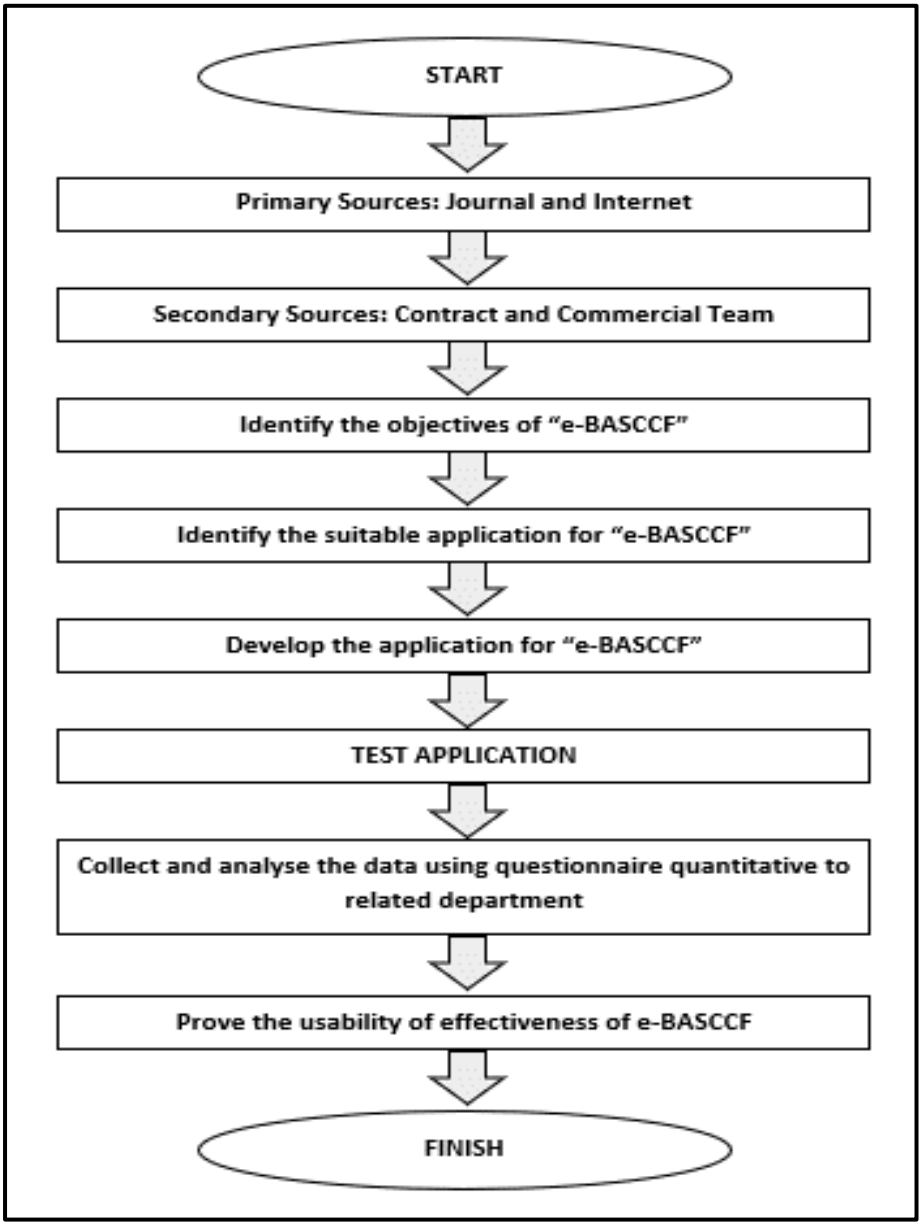
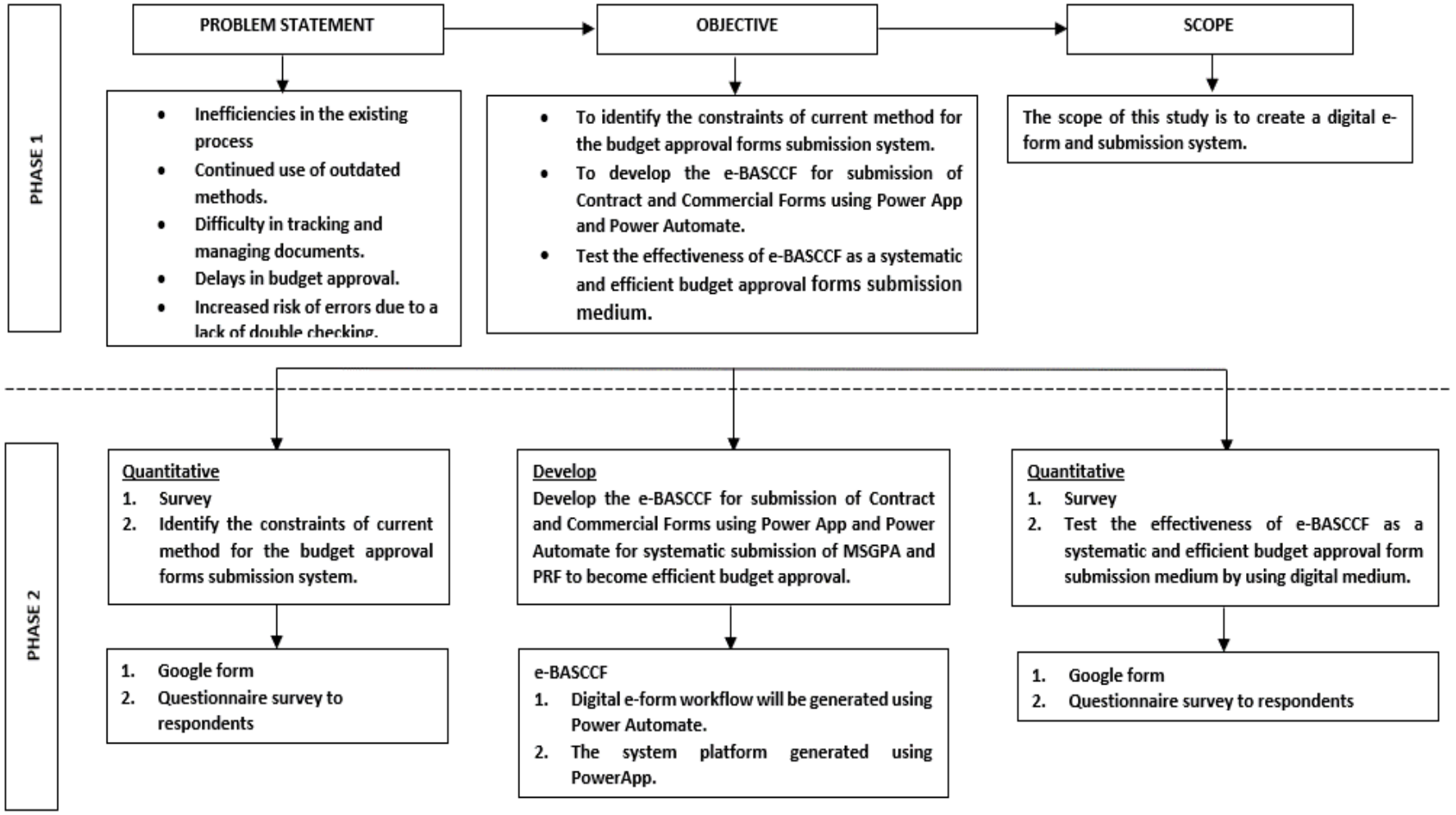


Figure 3.4 The detail of research development


PHASE 1
PROBLEM STATEMENT
OBJECTIVE
SCOPE
• Inefficiencies in the existing process
• Continued use of outdated methods.
• Difficulty in tracking and managing documents.
• Delays in budget approval.
• Increased risk of errors due to a lack of double checking.
• To identify the constraints of current method for the budget approval forms submission system.
• To develop the e-BASCCF for submission of Contract and Commercial Forms using Power App and Power Automate.
• Test the effectiveness of e-BASCCF as a systematic and efficient budget approval forms submission medium.
The scope of this study is to create a digital e-form and submission system.
PHASE 2
Quantitative
1. Survey
2. Identify the constraints of current method for the budget approval forms submission system.
Develop
Develop the e-BASCCF for submission of Contract and Commercial Forms using Power App and Power Automate for systematic submission of MSGPA and PRF to become efficient budget approval.
Quantitative
1. Survey
2. Test the effectiveness of e-BASCCF as a systematic and efficient budget approval form submission medium by using digital medium.
1. Google form
2. Questionnaire survey to respondents
e-BASCCF
1. Digital e-form workflow will be generated using Power Automate.
2. The system platform generated using PowerApp.
1. Google form
2. Questionnaire survey to respondents

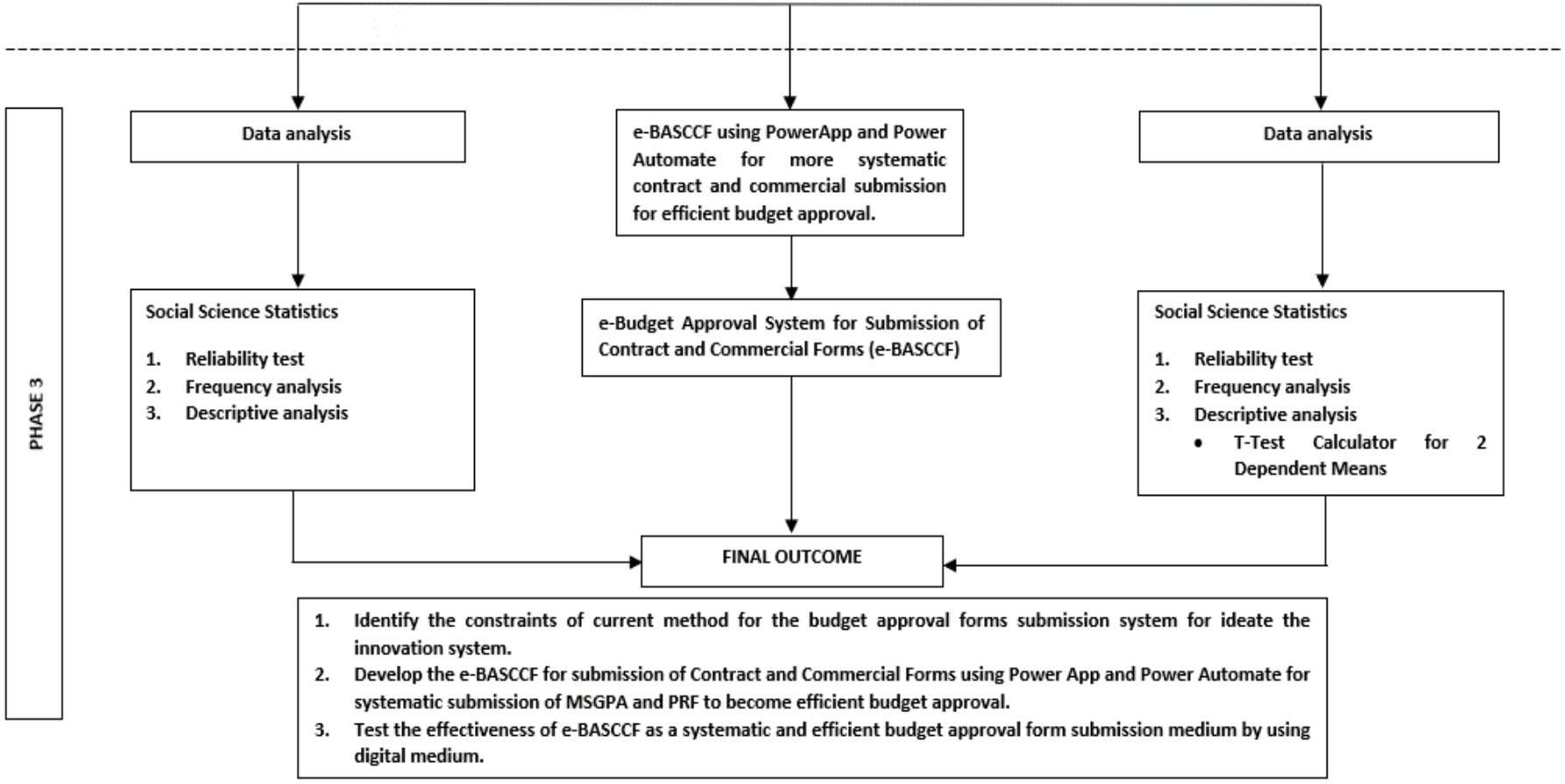


Figure 3.5 Research flow of Methodology

3.5 System Process and Development of e-Budget Approval System for Submission of Contract and Commercial Forms (e-BASCCF)

System processes are the result of collecting and quantifying a product's inputs and outputs throughout its life cycle (ISO 14040:2006). System development refers to the process of creating or altering systems, as well as the procedures, techniques, models, and methodologies necessary to do so. As a result, the system process and development of the electronic budget approval system medium are crucial to ensuring that the process is appropriately developed and run. A systematic method is essential to lead all labor activities while designing an e-budget approval system for submission of contract and commercial forms (e-BASCCF).

In some cases, to manage a successful product, evaluate procedures to ensure product efficiency. SWOT analysis is used to create products. A SWOT (strengths, weaknesses, opportunities, and threats) analysis is a design method that can help overcome obstacles and determine prospects that lead to pursuit. In this project, the strength of the product provides an advantage to the user. Second, weakness. This is where the product must be improved to continue to be used in the future. Third, opportunity. An opportunity is an external element that may give a company a competitive advantage. Finally, the threat. A threat is an event that has the potential to harm an organization.

3.5.1 The Purpose of e-BASCCF Process

The purpose of the e-BASCCF process is to improve the current legal system architecture by providing a useful and important medium and progress for system component implementation. It is the process of creating, expressing, documenting, and sharing the architecture of a real-world system using a comprehensive set of design features expressed in an implementation-ready service.

Nowadays, technology is important because it can help everyone connect with each other. Technology has contributed to solving various human issues, especially given the rapid rate of change associated with the quantity of information available today. It has also helped in the provision of various modes of transport and the introduction of new agricultural technologies, all of which have contributed to increased food production. It should be emphasized that the applications produced in the field of health care and subsequent well-being, as well as many other technological means, have

improved people's lives and helped them save time and effort. Among the examples of technology that is used nowadays are laptops, smartphones, the internet, and so on.

Power Apps is a collection of applications, services, and connectors, as well as a data platform, that enables the quick development of bespoke apps for your company's needs. You may easily create unique business apps using Power Apps that link to data stored in the underlying data platform (Microsoft Dataverse) or other online and on-premises data sources (such as SharePoint, Microsoft 365, Dynamics 365, SQL Server, and so on).

Power Apps built apps offer depths of business logic and workflow features, allowing you to turn your manual business procedures into digital, automated processes. Moreover, Power Apps-created apps have a responsive design and may function perfectly in browsers and on mobile devices (phone or tablet). Power Apps "democratizes" the process of creating business applications by allowing anyone to develop feature-rich, personalized business apps without writing code. Power Apps also has an expandable platform that allows professional developers to interact with data and metadata programmatically, apply business logic, build custom connections, and link with other data.

Microsoft Power Automate (formerly known as "Flow") is a cloud-based tool that allows customers to design their processes. Routine actions and procedures in many applications and services can therefore be automated. This simplifies and improves productivity. Mapping and automating business processes were previously only feasible through programming. There were no industry-standard IT connections. Workflows could previously only be created within the Office environment using the SharePoint Designer. This is changing thanks to the cloud-based Microsoft Power Automate service, which allows people to create workflow solutions between different services both inside and outside the Microsoft Cloud. This enhances the degree of automation and, as a result, the efficiency of the company's procedures.

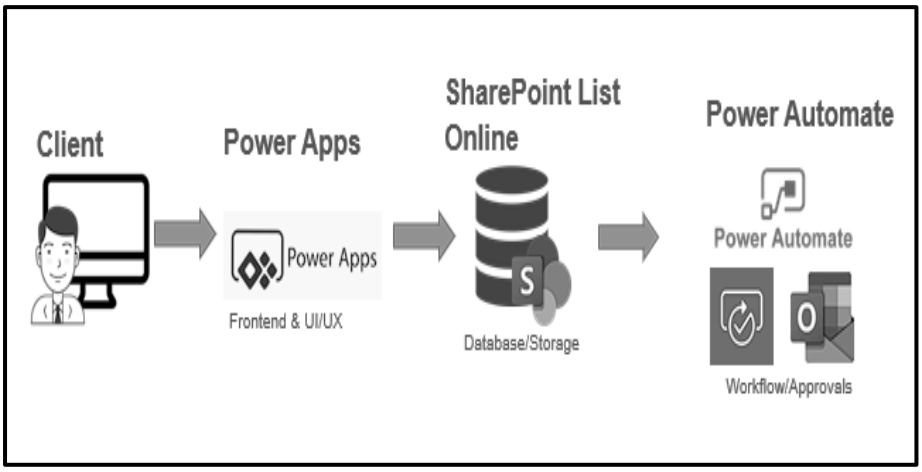


Figure 3.6 System architecture

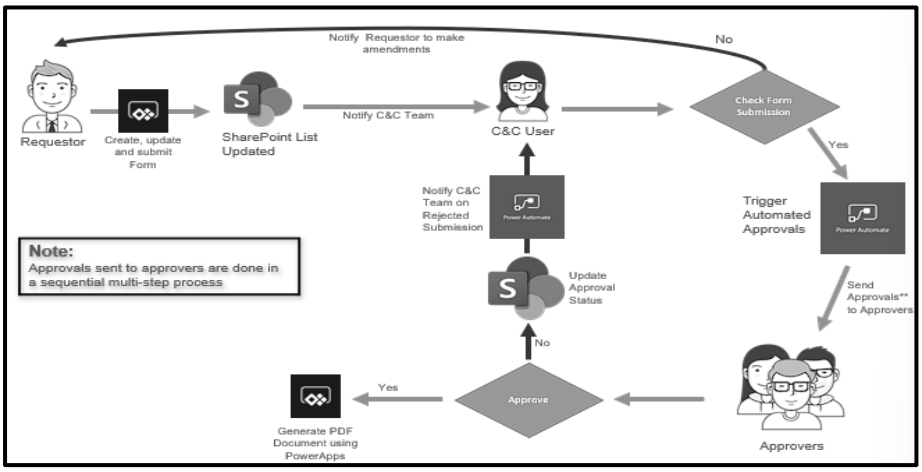


Figure 3.7 Overall Workflow

3.5.2 System Development

The process of defining, designing, testing, and implementing a new software application or program is known as systems development. It might involve the internal development of bespoke systems, database system development, or the procurement of third party-produced software. Every information system processing function must be guided by written standards and procedures. The management of the organization must design and apply standards, as well as adopt an acceptable system development life cycle methodology, to control the process of creating, acquiring, implementing, and managing computerized information systems and related technologies.

Figure 3.6 below shows the system development of e-BASCCF. There are five processes including requirement gathering or planning, design, implementation and integration, testing and deployment, and maintenance for improving the system.

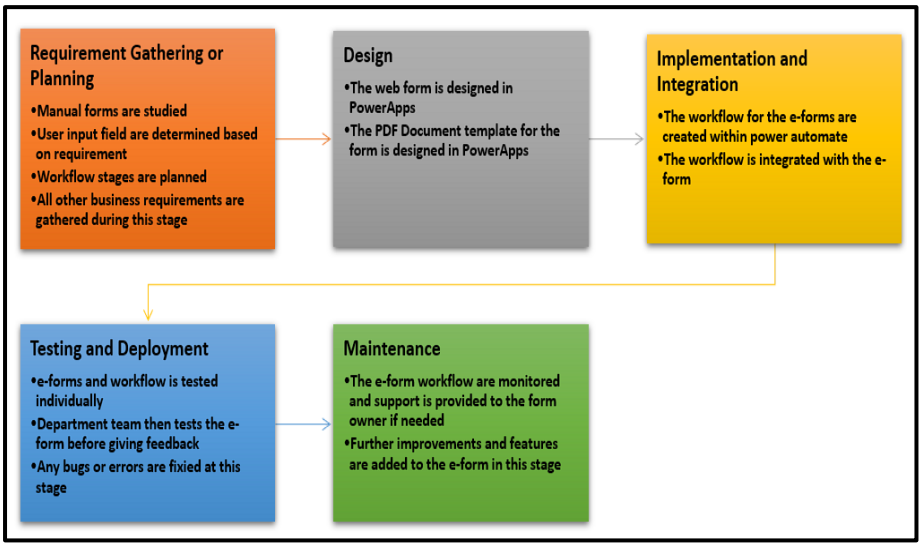
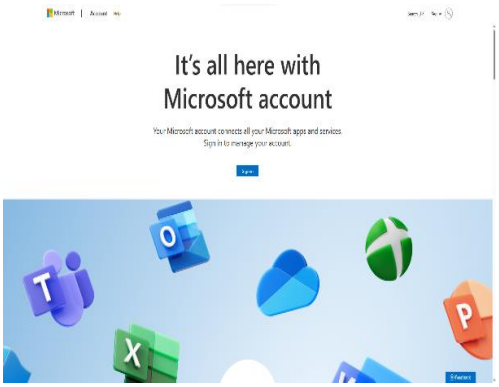


Figure 3.8 System development of e-BASCCF

3.5.3 Material Used

Table 3.2 Material used.

Materials	Function
Computers/Laptops 	• To create a system and store data. • To test functionality of the e-BASCCF medium.
Internet/Wifi 	• To link the computer and internet connect to upload the data.

Microsoft PowerApps 	• To provide a web form for system development.
Microsoft Power Automate 	• To provide workflow for the e-form in system development.
Microsoft Account/Email 	• To register for the form submission medium system.
SharePoint 	• To upload the document in the medium.

3.6 Testing of Product

At this stage, the product is tested with users or customers to see if they are satisfied with this product to solve the problems. To upgrade the product or any available improvement can be made. The questionnaire will be distributed to respondents such as project managers, engineers, site supervisors, quantity surveyors, and others.

The implementation would take place during the observation while working on the job to assess the application's efficacy. Feasibility studies were undertaken, utilizing primary and secondary sources to add value to the project. For the primary source, questionnaires and observation were used. The main source is derived from the data and analysis obtained, whereas the secondary source is generated from the data and analysis collected.

The purpose of the distributed questionnaire is to find out about the public about their perception and knowledge regarding to this project. Apart from that, to collect the possible feedback used to improve this system. Following that, the aim of this questionnaire is to collect feedback from targeted users whether they agree or not with the concept of this system.

3.7 Data Collection

The techniques of collecting include comprehensive instructions on how to use Google Forms to gather data from a questionnaire. In this investigation, a quantitative methodology was used. This technique allows for rapid data collection, accurate data capture, and a larger range of data analysis. All features of the site, responders, and study methodology will be covered. These facts guarantee that the project's goals can all be met.

3.7.1 Location

This study will be conducted at Gamuda Berhad (SRS Consortium Sdn Bhd) under contract and commercial (C&C) department because they have problems with submitting the related form using a current method process. Respondents are the related person who is responsible for submitting the documents.

3.7.2 Respondents

Respondents are people who participate in a survey, interview, or contribute information that is used to evaluate data for a research project. Respondents must give their informed consent to participate, and their ages might vary depending on the study's parameters. Foreman and staff from the procurement department were among the respondents who received surveys to complete.

The number of respondents is a total of 44 respondents from five departments in the Gamuda Berhad office located in Penang. The departments involved in this survey are Contract and Commercial (C&C), Approval Management (AM), Strategic Communication and Stakeholder Management (SCSM), Project Information Management System (PIMS) and Project Management (PMD). Generally, sample sizes of around 30-50 are deemed sufficient for the CLT to hold, meaning that the distribution of the sample means is normally distributed. A sample size of 30 is common across statistics. A sample size of 44 often increases the confidence interval of your population data set enough to warrant assertions against your findings. (Central Limit Theorem (CLT): Definition and Key Characteristics, 2023) and sample size was determined using Krejcie and Morgan Table (1970) in Figure 3.9 show whereby for population of 50 respondents, 44 sample were adequate.

N	*S*	*N*	*S*	*N*	*S*
10	10	220	140	1200	291
15	14	230	144	1300	297
20	19	240	148	1400	302
25	24	250	152	1500	306
30	28	260	155	1600	310
35	32	270	159	1700	313
40	36	280	162	1800	317
45	40	290	165	1900	320
50	44	300	169	2000	322
55	48	320	175	2200	327
60	52	340	181	2400	331
65	56	360	186	2600	335
70	59	380	191	2800	338
75	63	400	196	3000	341
80	66	420	201	3500	346
85	70	440	205	4000	351
90	73	460	210	4500	354
95	76	480	214	5000	357
100	80	500	217	6000	361
110	86	550	226	7000	364
120	92	600	234	8000	367
130	97	650	242	9000	368
140	103	700	248	10000	370
150	108	750	254	15000	375
160	113	800	260	20000	377
170	118	850	265	30000	379
180	123	900	269	40000	380
190	127	950	274	50000	381
200	132	1000	278	75000	382
210	136	1100	285	1000000	384

Note.—*N* is population size. *S* is sample size.

Source: Krejcie & Morgan, 1970

Figure 3.9 Krejcie and Morgan Table

3.7.3 Questionnaire Survey

The questionnaire was used by researchers to gather data for this investigation. A google form might be used to collect data. When researchers are aware of the needs of the study, the questionnaire is a useful tool for data collection. By emailing the URLs to google forms, the questionnaire will be delivered to the responders.

In this study, the questionnaire is divided into two main sections, Section A and Section B. Section A will focus on the demographic information of the respondent, and Section B will focus on the criteria of e-BASCCF. In addition, all sections of the questionnaire will test respondents on their perception of the use of e-BASCCF in construction site practice, such as implementation, employee knowledge and employee participation. A summary of information about the questions in this questionnaire is listed in Table 3.2 and Table 3.3.

Table 3.2 Distribution of the questioner items

Section	**Aspects of evaluation**
A	Demography
B	Criteria of e-BASCCF

Table 3.3 Likert scale items

Scale	**Description**
1	Strongly Disagree
2	Disagree
3	Satisfactory: Slightly Agree
4	Agree
5	Strongly Agree

3.8 Data Analysis

Data analysis is the methodical application of statistical and/or logical tools to explain and illustrate, condense, summarize, and evaluate data. Depending on the industry and the objective of the research, there are several approaches and strategies

for doing analysis. Both quantitative and qualitative techniques of research serve as the foundation for all these many approaches to data processing.

The Statistical Package for the Social Sciences (SPSS) software will be used to calculate the data when it has been gathered. A pie chart displaying the percentages of respondents and tables will be used to represent the data. Besides, that has a few statistical methods that may be used, including:

i. Descriptive statistics, including methodologies such as frequencies, cross-tabulation, and descriptive ratio statistics.

ii. Numeral outcome prediction such as linear regression.

iii. Prediction for identifying groups, including methodologies such as cluster analysis and factor analysis.

For the E-Budget Approval System for Submission of Contract and Commercial Forms (e-BASCCF), paired T-test will be used.

3.9 Technology Acceptance Model (TAM)

Based on Fred Davis's study from 1989, the Technology Acceptance Model (TAM model) was developed. According to the TAM model, a product's adoption rate is more influenced by the user's experience than by the features it offers. There was widespread agreement that the purpose to utilise the product is what determines how widely a system would be deployed before Fred Davis began his research. Not shocking. Surprisingly, although this was understood at the time, the decision to utilise a product is heavily influenced by the way that potential customers feel about it. The technological acceptance model, for instance, claims that the perceived utility and the perceived ease of use have the greatest impact on the rate at which a new product is adopted, with the perceived usefulness weighing approximately 1.5 times more than the perceived ease of use. The degree to which a user perceives the increased value or utility of the product is known as perceived usefulness, while the perceived ease of use is known as perceived usability. According to the concept, societal norms, friend recommendations, and prior knowledge are examples of outside influences that can have an impact on both elements.

3.10 Summary

This chapter discusses the methods for data collection and information in the study, which leads to the conclusion that it discusses the methods for data collection and information in the study. The collected data will be analysed to determine the outcomes. Furthermore, this chapter focuses on the location, the respondents, the research method, data interpretation, and work completed during the review process.

According to the results of the analysis, the use of this digital is better than before. Digital is being used more effectively. The current system may make it difficult for employees to complete their daily tasks. In terms of flexibility, this website can be used to deploy any project at any time because it is simple to understand and apply for users. This eventually became an advantage for all departments to quickly refer to the materials used without having to ask the other department to find the catalogue of the product used.

Furthermore, the methods to be used will be explained based entirely on the available problems, as well as the selection of appropriate systems when employed and applicable to the site. This is based on existing references such as articles, interviews, experiences, and other factors, and is based on all reachable work. Following this chapter, the process path that will be implemented for this project and applied to the work environment when on-site will be attached.

CHAPTER 4

DATA AND ANALYSIS

4.1 Introduction

In this chapter, the researcher should have an idea of what the project's predicted outcome will be. It is also one of the pre-project planning tasks, and researchers carefully analyzed what data will be created over the course of the project's execution. The researchers want to know that the information they collect will help them achieve their objectives. Also, demographic information for survey respondents has been described further in this chapter. Using quantitative method by distributing the questionnaire to more than 44 respondents had given the feedback and process by Excel. Result had been analysis by T-Test calculator for two (2) dependent means and Statistical Package for the Social Sciences (SPSS) version 26. The E-Budget Approval System for Submission of Contract and Commercial Forms (e-BASCCF) is anticipated to help achieve the following aim and objectives to develop e-BASCCF using PowerApps and Power Automate for systematic and efficient budget approval. First objective is to identify the constraints of current method for the budget approval forms submission system. Second, to develop the e-BASCCF for submission of Contract and Commercial Forms using Power App and Power Automate. Lastly, to test the effectiveness of e-BASCCF as a systematic and efficient budget approval forms submission medium.

4.2 To Identify the Constraints of Current Method for The Budget Approval Forms Submission System.

4.2.1 Data Collection

This study presents the findings of a quantitative method pre-test questionnaire using google form to respondents, who included project managers, engineers, site supervisors, assistant managers, quantity surveyors, and others, to determine the necessity for an E-Budget Approval System for Submission of Contract and Commercial Forms (e-BASCCF). This questionnaire is divided into two sections: Section A and Section B. Section A contains demographic information. In Section B, constraint element that related to current method. This questionnaire has been distributed to 44 respondents by Contract & Commercial Team, Approval Management, Strategic Communication & Stakeholder Management, Project Information Management System, and Project Management by G-Form through links.

4.2.2 Demographic Data

Section A is a demographic data section that includes four questions on the respondent's backgrounds. The respondents of pre and post questionnaire were same. The items are as follows:

a) Gender
b) Age
c) Position
d) Work Experience

4.2.2.1 Gender

This research included 25 (56.8%) male respondents and 19 (43.2%) female respondents. Male respondents exceed female respondents by a wide margin, as seen by the proportion. This is because a male, rather than a woman, dominated the responses at the SRS Consortium Sdn Bhd main office. The number of respondents by gender is shown in Table 4.1 below.

Table 4.1 The number of respondents by gender

No.	Gender	No. of Respondent	Percentage (%)
1	Male	25	56.8
2	Female	19	43.2
	Total	44	100

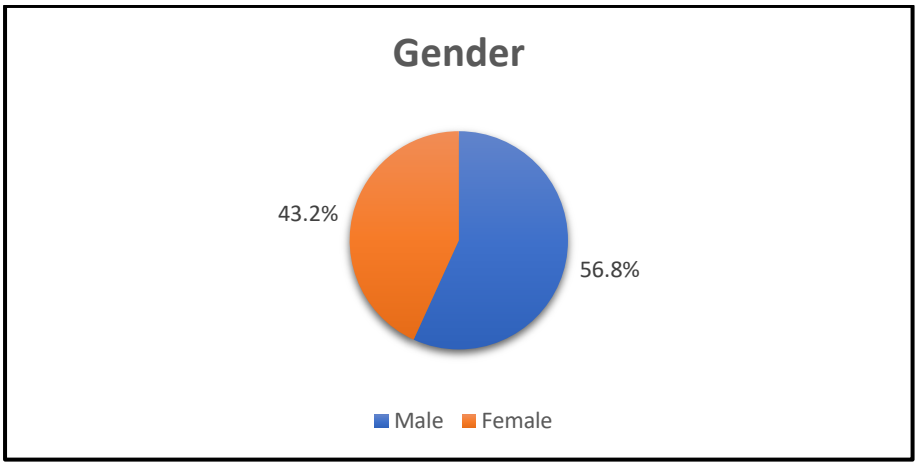


Figure 4.1 The percentages of respondents by gender.

4.2.2.2 Age

Table 4.2 below shows the number and percentage of respondents in the age category divided into seven categories. This section was formed to assist with data processing and identifying respondents at office by several department. In the survey, showing the age group of 35 - 44 years old is the largest number of respondents with 14 people (31.8%), the age group of 45 - 54 years old is the second largest number of respondents which is a total of 11 respondents (25%), the third largest number of respondents is the age group of 25 - 34 years old which is as many as 10 respondents (22.7%). For the age group of 18 - 24 years old there are 6 respondents with 13.6% and for the age group of 65 years old above there are two respondents with 4.5% and 55 – 64 years old there one person with 2.3%. Meanwhile for the under-18 age group, there were no respondents.

Table 4.2 The percentage of respondents by age

No.	Age	No. of Respondent	Percentage (%)
1	Under 18 years old	0	0.0
2	18 - 24 years old	6	13.6
3	25 - 34 years old	10	22.7
4	35 - 44 years old	14	31.8
5	45 - 54 years old	11	25.0
6	55 - 64 years old	1	2.3
7	65 years or older	2	4.5
	Total	44	100

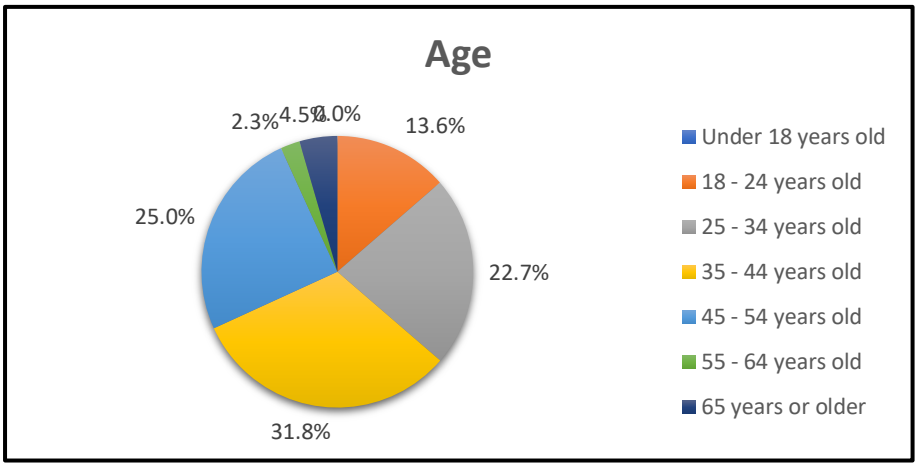


Figure 4.2 The percentage of respondents by age

4.2.2.3 Position

Positions in the SRS Consortium office, which comprises Head of Department, Project Manager, Manager, Assistant Manager, Quantity Surveyor, Executive, Engineer, Supervisor, Operation, Officer, and Others. Table 4.3 shows that Executive have the most respondents which are 9 respondents (20.5%). The second largest respondent is the Engineer with a total of 8 respondents (18.2%). The third largest respondent is the Manager and Quantity Surveyor with a total of five respondents (11.4%). For Assistant Manager and Officer with four respondents (9.1%). In addition, Head of Department and Operation have a total of three respondents (6.8%), Supervisor have a total two respondent (4.5%) and Project Manager has one respondent (2.3%).

Table 4.3 The number of respondents by position

No.	Position	No. of Respondent	Percentage (%)
1	Head of Department	3	6.8
2	Project Manager	1	2.3
3	Manager	5	11.4
4	Assistant Manager	4	9.1
5	Quantity Surveyor	5	11.4
6	Executive	9	20.5
7	Engineer	8	18.2
8	Supervisor	2	4.5
9	Operation	3	6.8
10	Officer	4	9.1
11	Others	0	0.0
	Total	44	100

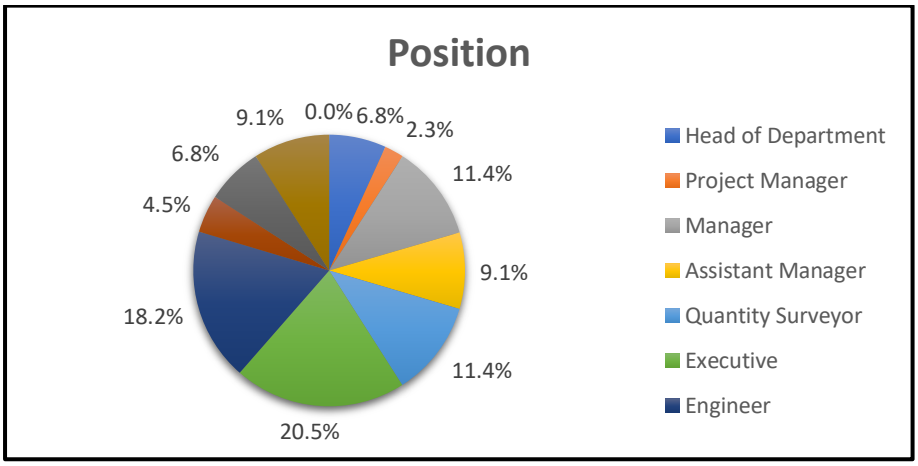


Figure 4.3 The percentage of respondents by position

4.2.2.4 Work Experience

Table 4.4 below shows the work experience of the respondents. A total of seventeen respondents (38.6%) has work experience of more than 10 years. A total of thirteen respondents (29.5%) has two to five years of work experience. A total of twelve respondents (27.3%) has 6 to 10 years of work experience. Meanwhile a total of 2 respondents (4.5%) have less than two years of work experience.

Table 4.4 The percentage of respondents by work experience

No.	Work Experience	No. of Respondent	Percentage (%)
1	< 2 years	2	4.5
2	2 - 5 years	13	29.5
3	6 - 10 years	12	27.3
4	> 10 years	17	38.6
	Total	44	100

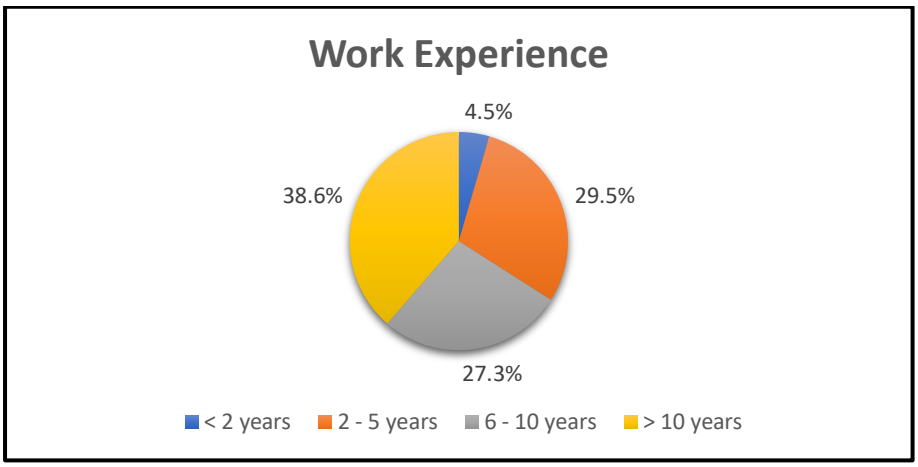


Figure 4.4 The percentage of respondents by work experience

4.2.3 Respondent Perspective

Section B presents respondents' perspectives on the constraint elements of the current method for the budget approval form submission system. Respondents were asked to select their level of agreement on the following issues according to scale 1 to 5. As Table 4.5 this survey displays the results of a questionnaire distributed to respondents, which includes Department Heads, Project Managers, Managers, Assistant Managers, Quantity Surveyors, Executives, Engineers, Supervisors, Operations,

Officers, and Others, to determine what needs to be resolved regarding the current method issue in the Contract & Commercial (C&C) form submission system for budget approval. The table 4.6 below shows the collection of issue 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

Table 4.6 Issue related to the current method in the Contract & Commercial (C&C) form submission system for budget approval.

No	**Constraint elements of the current method for the budget approval forms submission system.**	**Issues Related to the current method in the Contract & Commercial (C&C) form submission system for budget approval**	**Level of Agreement**				
			Strongly Disagree	**Disagree**	**Slightly Agree**	**Agree**	**Strongly Agree**
			1	**2**	**3**	**4**	**5**
1	Efficient process	Current method able to increase efficiency in the form submission process.	35	9	0	0	0
2	Systematic management	Current method is systematic to manage form submission system.	34	10	0	0	0
3	Enough time in budget approval	a) Current method always saves time in preparing and managing complete documents for budget approval.	35	9	0	0	0
		b) Current method allows enough time for approvers by manual review	31	13	0	0	0

		the budget approval form.					
4	Easy tracking information	Current method uses manual procedure to track the information from the submitted form can be trusted and easy to track.	29	15	0	0	0
5	Error risk due to lack of double checking procedure.	a) Current method is still filling out the form with handwriting but not cause errors.	32	12	0	0	0
		b) Current method is still attached the hard copy document for budget approval which does not cause errors without double checking.	33	11	0	0	0
		c) Current method is still manually enters the data recorded by the C&C team into an excel spreadsheet which not cause errors.	26	18	0	0	0
		d) Current method does not have an effect in the risk of errors despite not having a double check due to the lack of time to submit the document to the approving party.	33	11	0	0	0

		e)	Current method has high trusted in the accuracy of the initial information although no double-check information before submission.	29	15	0	0	0
6	Electronic medium for efficients Budget Approval System.	a)	Current method is systematic and efficient budget approval medium which does not require an electronic medium?	35	10	0	0	0
		b)	Current method is easy system and not need an electronic medium?	28	16	0	0	0
		c)	Will you regularly use the current method as a platform for submitting the form if a new platform is developed?	35	9	0	0	0
		d)	Do you always use the current method if the new platform is developed?	30	14	0	0	0

4.2.4 Data Analysis

SPSS is an acronym that stands for Statistical Package for the Social Sciences, and it is used by a wide range of academics to analyse complex statistical data. In this study, SPSS will be used to analyse the data. The methodical application of statistical and logical approaches to explain, demonstrate, and condense. Data should be summarized and evaluated. Researchers use data analysis to reduce data to a story and

evaluate it to get different perspectives. Data analysis assists in reducing massive volumes of data into smaller, more consumable portions (parts).

4.2.5 Reliability Test

Reliability analysis may be used to investigate the properties of measuring scales and the items that form the scales. The reliability analysis procedure computes several commonly used scale reliability metrics as well as information on the correlations between scale items. Intraclass correlation coefficients can be used to calculate inter-rater reliability estimates. Table 4.7 show the range of reliability and its coefficient of Cronbach's Alpha. and table 4.8 show the result of questionnaire.

Table 4.7 Range of reliability and its coefficient of Cronbach's Alpha

No	Coefficient of Cronbach's Alpha	Reliability Level
1	> 0.90	Excellent
2	0.80 - 0.89	Good
3	0.70 - 0.79	Acceptable
4	0.60 - 0.69	Questionable
5	0.50 - 0.59	Poor
6	< 0.50	Unacceptable

Table 4.8 displays the reliability test results of the pre-test questionnaire, revealing a Cronbach's Alpha coefficient of 0.886. This coefficient surpasses the threshold of 0.80, indicating a good level of reliability. Consequently, based on these findings, the questionnaire demonstrates strong validity, affirming its suitability as a robust assessment tool.

Table 4.8 Reliability Test

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
0.886	0.884	14

4.2.6 Frequency Analysis

Frequency analysis is a generic approach to analysis that is used in many scientific disciplines, not just social measurement research. Moreover, it is a statistical branch that investigates the number of occurrences (frequency) and assesses metrics such as central tendency, dispersion, percentiles, and so on. Using Excel Solution to obtain the analysis frequency date. Table 4.9 show the result of Frequency Analysis of Current Method below.

Table 4.9 Frequency Analysis of current method

No	Constraint elements of the current method for the budget approval forms submission system.	Issues Related to the current method in the Contract & Commercial (C&C) form submission system for budget approval	Level of Agreement				
			Strongly Disagree	Disagree	Slightly Agree	Agree	Strongly Agree
			1	2	3	4	5
1	Efficient process	Current method able to increase efficiency in the form submission process.	35 (79.5%)	9 (20.5%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
2	Systematic management	Current method is systematic to manage form submission system.	34 (77.3%)	10 (22.7%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
3	Enough time in budget approval	a) Current method always saves time in preparing and managing complete documents for budget approval.	35 (79.5%)	9 (20.5%)	0 (0.0%)	0 (0.0%)	0 (0.0%)

		b)	Current method allows enough time for approvers by manual review the budget approval form.	31 (70.5%)	13 (29.5%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
4	Easy tracking information	Current method uses manual procedure to track the information from the submitted form can be trusted and easy to track.		29 (65.9%)	15 (34.1%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
5	Error risk due to lack of double checking procedure.	a)	Current method is still filling out the form with handwriting but not cause errors.	32 (72.7%)	12 (27.3%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
		b)	Current method is still attached the hard copy document for budget approval which does not cause errors without double checking.	33 (75.0%)	11 (25.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
		c)	Current method is still	26 (59.1%)	18 (40.9%)	0 (0.0%)	0 (0.0%)	0 (0.0%)

			manually enters the data recorded by the C&C team into an excel spreadsheet which not cause errors.					
		d)	Current method does not have an effect in the risk of errors despite not having a double check due to the lack of time to submit the document to the approving party.	33 (75.0%)	11 (25.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
		e)	Current method has high trusted in the accuracy of the initial information although no double-check information before submission.	29 (65.9%)	15 (34.1%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
6	Electronic medium for efficients Budget	a)	Current method is systematic and efficient	35 (77.3%)	10 (22.7%)	0 (0.0%)	0 (0.0%)	0 (0.0%)

Approval System.		budget approval medium which not require an electronic medium?				
	b)	Current method is easy system and not need an electronic medium?	28 (63.6%)	16 (36.4%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
	c)	Will you regularly use the current method as a platform for submitting the form if a new platform is developed?	35 (79.5%)	9 (20.5%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
	d)	Do you always use the current method if the new platform is developed?	30 (68.2%)	14 (31.8%)	0 (0.0%)	0 (0.0%)	0 (0.0%)

The percentage Level of agreement by respondents as show in Table 4.10 below.

Table 4.10 Percentage of the respondents agree and disagree with the current method.

Current Method	**Level of agreement**				
Constraint elements of the current method for the budget approval forms	Strongly Disagree	Disagree	Slightly Agree	Agree	Strongly Agree
Efficient Process	79.50%	20.50%	0%	0%	0%
Systematic Management	77.30%	22.70%	0%	0%	0%
Enough Time in Budget Approval	75.00%	25.00%	0%	0%	0%
Easy Tracking Information	65.90%	34.10%	0%	0%	0%
Error Risk Due to Lack of Double-Checking Procedure	69.50%	30.50%	0%	0%	0%
Electronic medium for efficients Budget Approval System.	72.20%	27.90%	0%	0%	0%

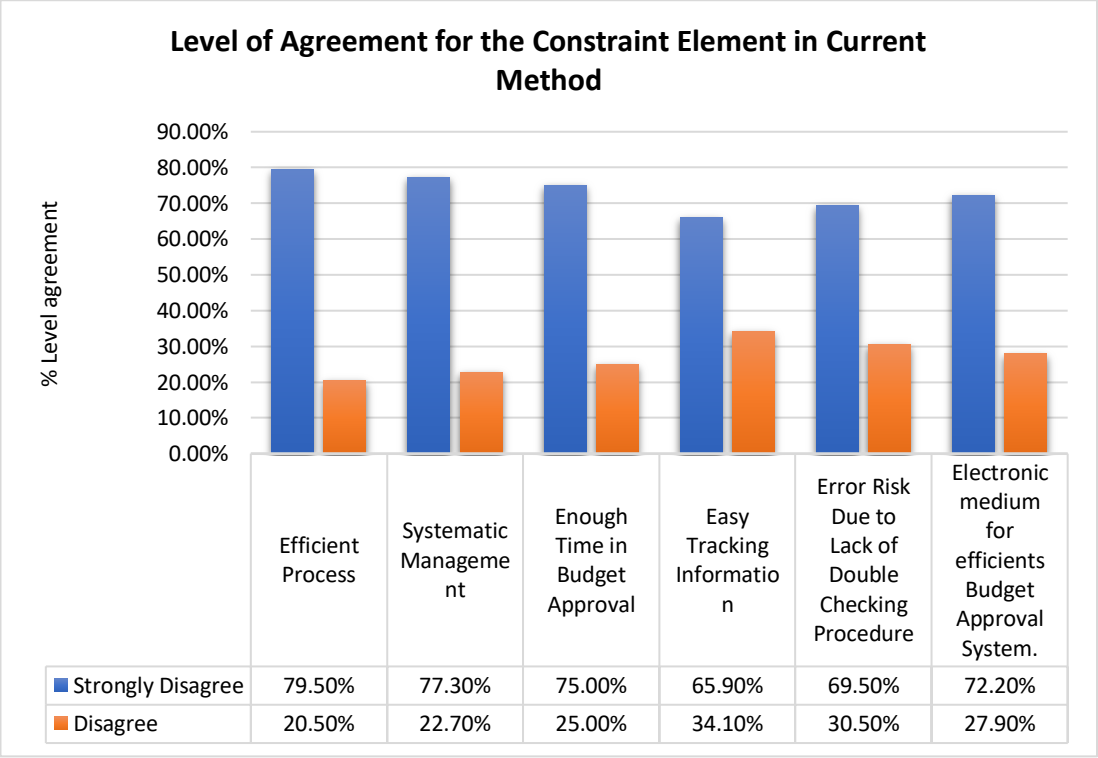


Figure 4.5 Percentage of level agreement of current method at Contract and Commercial Department.

Figure 4.5 shows the percentage of respondents who disagree with the use of current methods for the budget approval submission form. From the percentage that

shows that resulted is 100% in all constraint elements. Element No.6 in the Table 4.9 show the need for electronic medium for efficient budget approval system.

4.2.7 Descriptive Test

Descriptive statistics are those that describe or characterize the characteristics of a data set. It also categorizes measurements 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 data within a collection is described by variability or spread measurements. This test using SPSS version 26.

4.2.7.1 Mean

The mean, also referred to as the arithmetic mean or average, serves as a key measure of central tendency in descriptive statistics. It represents the typical value of a variable in a dataset and is computed by summing all values and dividing by the total number of observations. In the context of this study, the mean offers a concise summary statistic that provides insights into the central position or average level of the [variable name] among the [sample size] participants. By analysing the mean, we gain a better understanding of the overall magnitude or central value of the variable within our data.

Table 4.11 Mean in constraint elements for current method

	N	**Mean**		**Std.**	**Variance**
	Statistic	Statistic	Std. Error	**Deviation**	**Statistic**
Efficient Process	44	1.20	0.062	0.408	0.166
Systematic Management	44	1.25	0.066	0.438	0.192
Enough Time in Budget	44	1.27	0.068	0.451	0.203
Approval	44	1.30	0.070	0.462	0.213
Easy Tracking Information	44	1.27	0.068	0.451	0.203
Error Risk Due to Lack of Double-Checking Procedure	44	1.30	0.070	0.462	0.213
	44	1.27	0.068	0.451	0.203
	44	1.39	0.074	0.493	0.243
	44	1.23	0.064	0.424	0.180

	44	1.41	0.075	0.497	0.247
Electronic medium for efficients Budget Approval System.	44	1.25	0.066	0.438	0.192
	44	1.30	0.070	0.462	0.213
	44	1.18	0.059	0.390	0.152
	44	1.30	0.070	0.462	0.213

Table 4.11 show the results of respondent about the mean score for constraint elements to the current method in the Contract & Commercial (C&C) form submission system for budget approval. There are 6 constraint elements of the current method for the budget approval forms submission system. The data was generated by using SPSS Software, version 26.

4.2.7.2 Average Mean

The average mean, or arithmetic mean, represents the typical value of a variable in the dataset, calculated by summing the values and dividing by the sample size. It provides insight into the central tendency and level of the variable among the participants. The average mean of constraint element as show Table 4.12 below.

Table 4.12 Mean and average mean of the constraint element for current method

No	Constraint elements of the current method for the budget approval forms	Mean	Average Mean	Average Mean (%)
1	Efficient Process	1.20	1.20	15.83
2	Systematic Management	1.25	1.25	16.49
3	Enough Time in Budget Approval	1.27	1.29	16.95
		1.30		
4	Easy Tracking Information	1.27	1.27	16.75
5	Error Risk Due to Lack of Double-Checking Procedure	1.30	1.32	17.41
		1.27		
		1.39		
		1.23		
		1.41		
6	Electronic medium for efficients Budget Approval System.	1.25	1.26	16.58
		1.30		
		1.18		
		1.30		
	Total Average	**1.28**	**7.58**	**100**

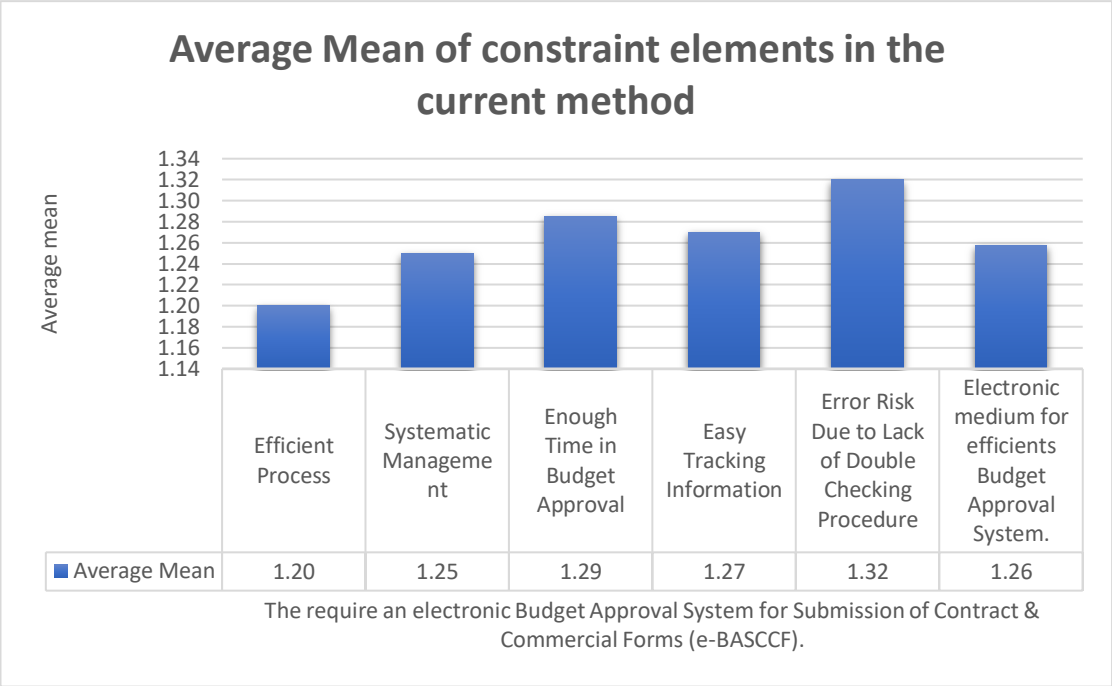


Figure 4.6 Average mean in constraints element.

Based on the bar chart in Figure 4.6, the average means for all constraints elements are below 1.5, indicating a significantly low level as interpreted from Table 4.13. Notably, particular attention should be directed towards addressing constraint element of six (6) numbers, necessitating the development of an effective system to resolve the limitations associated with the current method.

According to the statistics in Table 4.12 and Figure 4.6 above, the greater percentage rate of average mean, the require an electronic Budget Approval System for Submission of Contract & Commercial Forms (e-BASCCF) medium is error risk due to lack of double-checking procedure with 1.32. Second, enough time in budget approval with 1.29. Third, easy tracking information with 1.27. Fourth, electronic medium for efficients budget approval system with 1.26. Continue with systematic management with 1.25. Lastly, efficient process with 1.20 in average mean.

Table 4.13 Mean range and interpretation of usability.

No	Mean Range	Interpretation
1	4.51 - 5.00	Very High
2	3.51 - 4.50	High
3	2.51 - 3.50	Medium
4	1.51 - 2.50	Low
5	1.00 - 1.50	Very Low

Table 4.14 Constraints element of current method

Variables	Mean	Interpretation
Efficient Process	1.20	Very Low
Systematic Management	1.25	Very Low
Enough Time in Budget Approval	1.29	Very Low
Easy Tracking Information	1.27	Very Low
Error Risk Due to Lack of Double-Checking Procedure	1.32	Very Low
Electronic medium for efficient Budget Approval System.	1.26	Very Low

Table 4.14 above shows, respondent level of usability toward current method whereby analysis shows for all variables tested the mean score less than 1.50 average mean meaning that the constraints element of current method was very low based on Table 4.13, interpretation. Therefore, needs to develop the systematic and efficient budget approval medium. However, an electronic system is important to use in construction industry which need to achieve IR 4.0 which includes the six (6) constraint element such as efficient process, systematic management, enough time in budget approval, easy tracking information, error risk due to lack of double-checking procedure, and electronic medium for efficient budget approval system. Hence, the e-Budget Approval System for Submission of Contract and Commercial Forms (e-BASCCF) medium is need to developed to solve the constraint element of current method in Contract & Commercial (C&C) form submission system for budget approval.

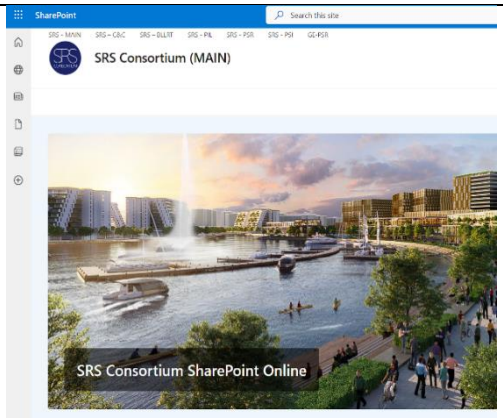
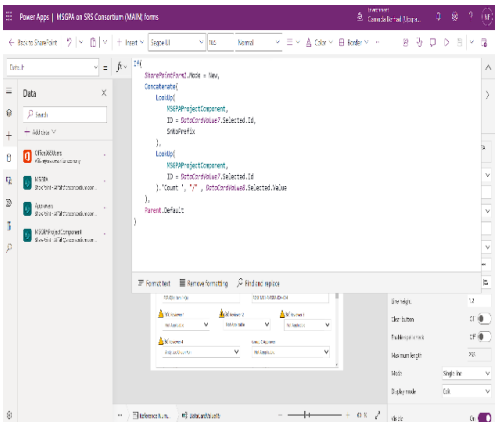
4.3 To Develop the e-BASCCF for Submission of Contract and Commercial Forms Using Power App and Power Automate.

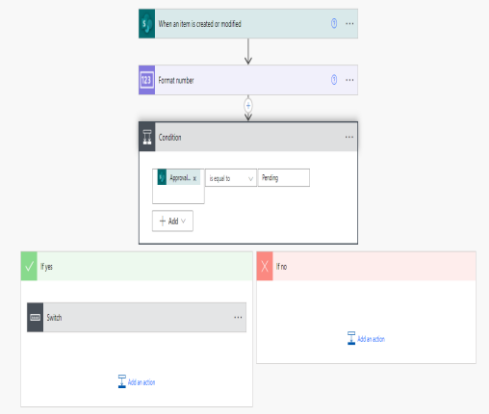
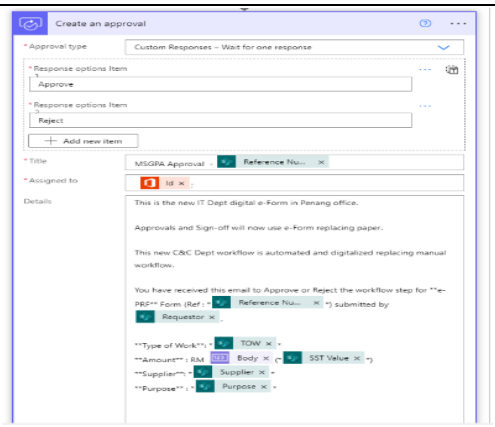
The Internet of Things (IoT) describes the network of physical object “things” that are embedded with sensors, software, and other technologies for the purpose of connecting and exchanging data with other devices and systems over the internet. In developing the submission of Contract and Commercial Forms system, Microsoft PowerApps and Power Automate were selected as the applications that will be used to

develop this e-BASCCF. Microsoft PowerApps and power automate are very easy to use and most companies use these two applications to develop their own systems or applications. Why is this system linked to IoT because this system requires internet access which can be used via computer, laptop, and tablet to get budget approval from the approver.

4.3.1 To develop e-BASCCF.

Table 4.15 The process to develop e-BASCCF as budget approval submission system.

Develop	Work Description
	**Step 1:** SharePoint Online Lists SharePoint Online is used as the Data Storage. Data from form entries are stored in SharePoint Lists. Reference Data Components (List of Approvers) are also stored in SharePoint Lists.
	**Step 2:** PowerApps PowerApps is used as the development platform for the frontend/UI of the forms. PowerApps is used to implement form controls for data entry. PowerApps is used to develop Custom Canvas App print app to save e-form in PDF format.

	**Step 3:** Power Automate Power Automate is used to handle and automate e-form workflows. It is used to update e-form approval status and data based on e-approvals.
	**Step 4:** Approvals (Power Automate) Approvals is a connector/tool within Power Automate which is used to handle e-approvals which are done via email. Sends out actionable email notifications for approvers to respond to.

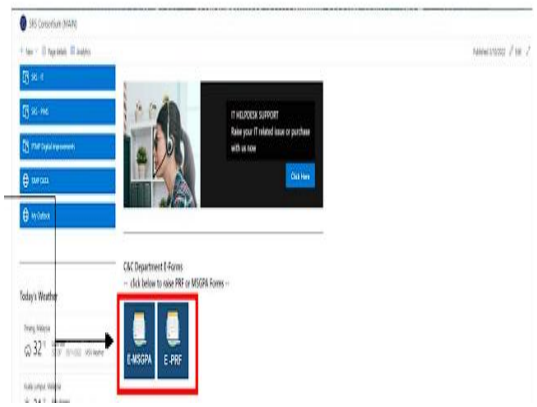
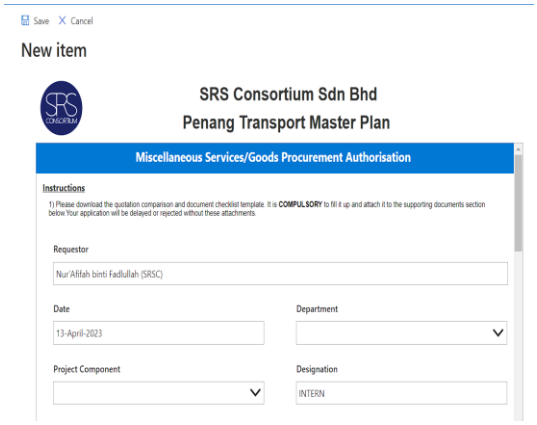
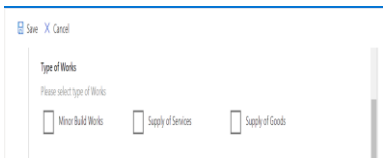
4.3.2 End product of e-BASCCF

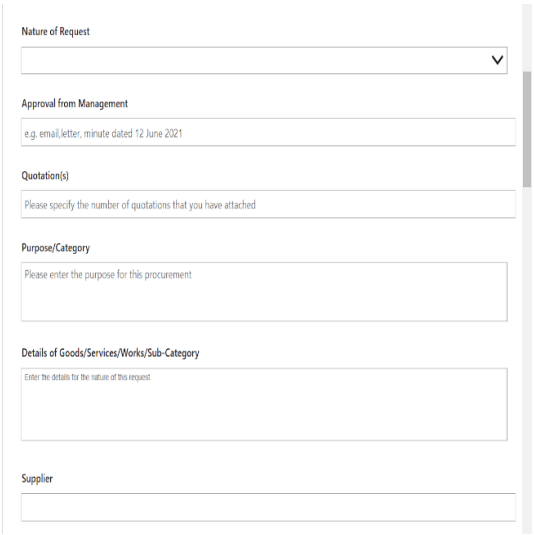
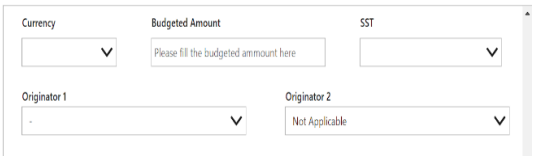
This product was successfully developed using PowerApps and Power Automate. Based on the goal of the project, is to develop an e-Budget Approval System for the Submission of Contract and Commercial Forms (e-BASCCF) using Power App and Power Automate for systematic and efficient budget approval. The product must achieve the efficiency objective of the electronic Budget Approval System for the submission of Contracts and Commercial Forms medium (e-BASCCF). In this system, there are two types of forms that have been designed namely Miscellaneous Services or Goods Procurement Authorisation (e-MSGPA) and Payment Requisition Form (e-PRF) as shown in Table 4.14 and Table 4.15 below.

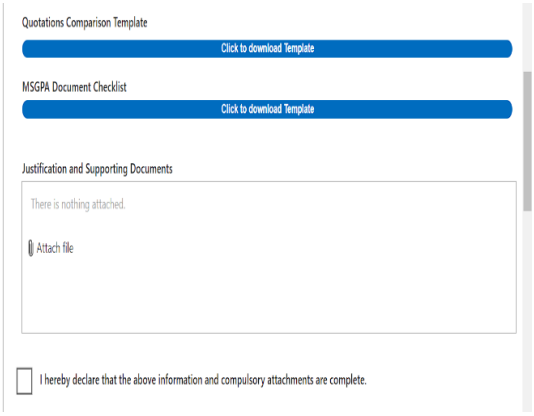
4.3.2.1 e-MSGPA

The e-MSGPA is a request budget form used to authorize the procurement of miscellaneous services or goods. It streamlines the process, enhances transparency, and ensures proper control of expenditures in this context.

Table 4.16 e-MSGPA in as submission form e-BASCCF as Budget Approval Submission System

Design	Description
	**Step 1.** Need to access to the SRS Consortium (MAIN) SharePoint page and the links are on the navigation panel. Click on link and will be redirected to a new form
	**Step 2.** • Requestor – Auto-populated from the credential signed in on SharePoint. • Date – Auto-populated as current date. • Project component – Choose from the list. • Department – Choose from the list. • Designation – Auto-populated from the credential signed in on SharePoint.
	**Step 3.** • Type of work – Choose the correct type of work. Can choose more than one.

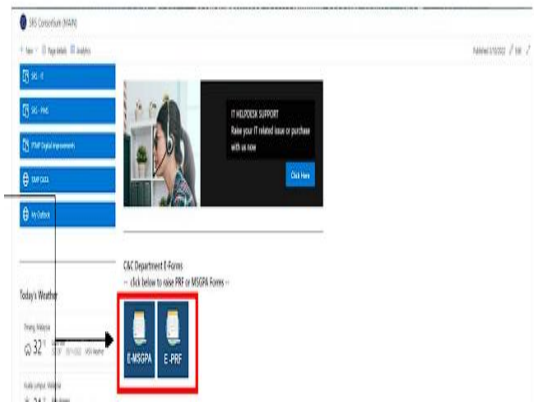
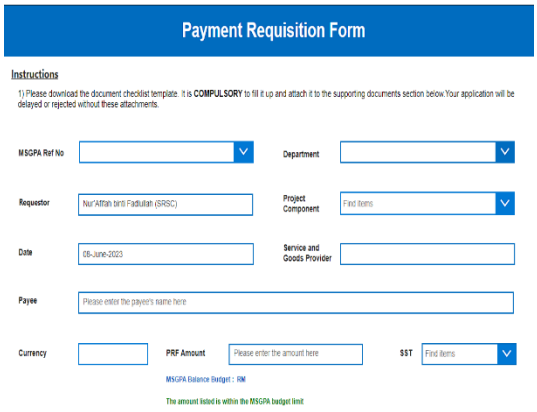
	**Step 4.** • Nature of request – Choose only one nature of request which is applicable. • Approval from management – State the email letter with date. • Quotation(s) – State the number of quotations attached. • Purpose – Enter short and precise purpose of this procurement. • Details – Elaborate the service or goods to be procured in detail. • Supplier – State the name of the selected supplier as per the quotation.
	**Step 5.** • Currency – State the currency for this budget application. • Budgeted amount – State the budgeted amount for this procurement. The amount has to tally with the quotation from selected supplier or vendor. • SST – Specify if SST is applicable. • Originator 1 – The first reviewer for the budget requested. Normally is the direct superior of the requestor. Auto populated from the credential signed in on SharePoint. • Originator 2 – The second reviewer for the budget requested. Normally is the HOD or Managing personnel of the department. Auto populated from the credential signed in on SharePoint.

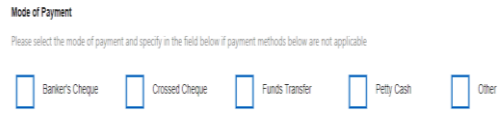
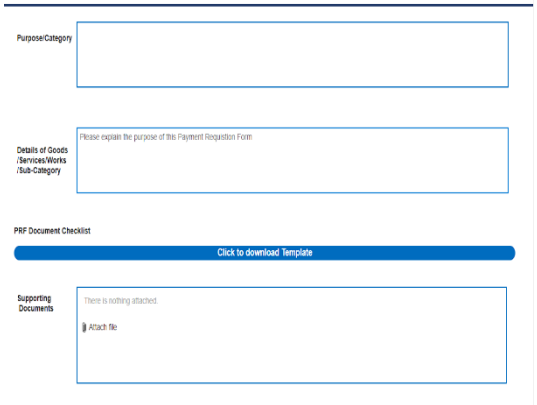
	**Step 6.** • Quotations comparison template – Download the template by clicking the link. Fill in the template. Save as PDF and acquire relevant signatures. Upload it as one of the attachments. • MSGPA document checklist – Same way with Quotations comparison template. • Justification and supporting documents – PDF format for uploading. Size shall not exceed 20MB.
	**Step 7.** • Form can download for reference purpose.

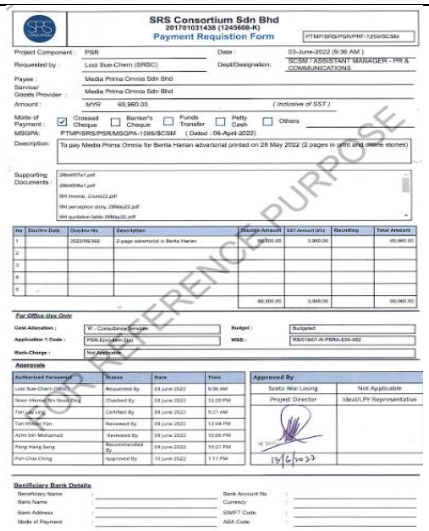
4.3.2.2 e-PRF

The e-PRF, or payment request form, serves as a concise request budget form for initiating and documenting fund requests for specific payments or expenses. It streamlines the process, enhances transparency, and facilitates proper financial management.

Table 4.17 e-PRF in product of e-BASCCF medium

Design	Description
	**Step 1.** Need to access to the SRS Consortium (MAIN) SharePoint page and the links are on the navigation panel. Click on link and will be redirected to a new form
	**Step 2.** • MSGPA ref. no – Choose the approved MSGPA prepared by your own department only. • Requestor – Auto-populated from credential. • Date – Dated current. • Payee – Should be same as Service and Goods Provider by default. The payee can be the name of the employee if the payment is made on behalf. • Currency – Data will sync with the selected MSGPA. • Department – Data will sync with the selected MSGPA.

	• Project Component – Data will be pulled from MSGPA. • Service & Goods provider – Key in the service or goods provider's name as per invoice. • PRF amount – The accumulated amount should not exceed the budget approved. The PRF will not be submitted otherwise. • SST – Indicate if SST is applicable as per the invoice.
	**Step 3.** • Mode of payment – "Crossed-cheque" by default. Check with Finance if other mode of payment is to be used.
	**Step 4.** • Invoice info. Template – Download the template and fill in the necessary information. The template will need to be PDF and uploaded again as an attachment. • Purpose – Key in a short and precise prescription to explain the purpose of this payment. • PRF document checklist - Same way with Invoice info. Template • Supporting document - PDF format for uploading. Size shall not exceed 20MB.

	**Step 7.** • Form can download for reference purpose.

4.3.2.3 Budget Approval Submission System

Figure 4.7 displays the main page in SRS Consortium SharePoint.

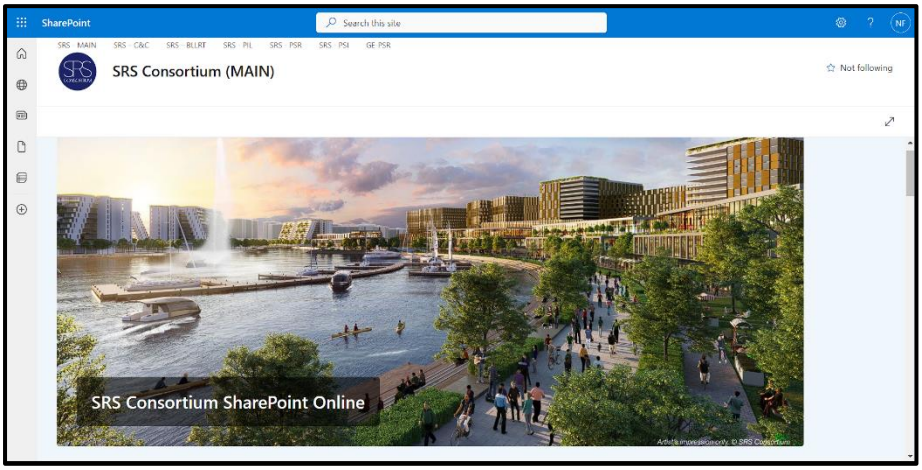


Figure 4.7 Main Page of e-BASCCF for budget approval submission system

Scroll down to C&C Department e-form, user can select the e-form there want to use like e-MSGPA, and e-PRF. Figure 4.8 shows the e-form button.

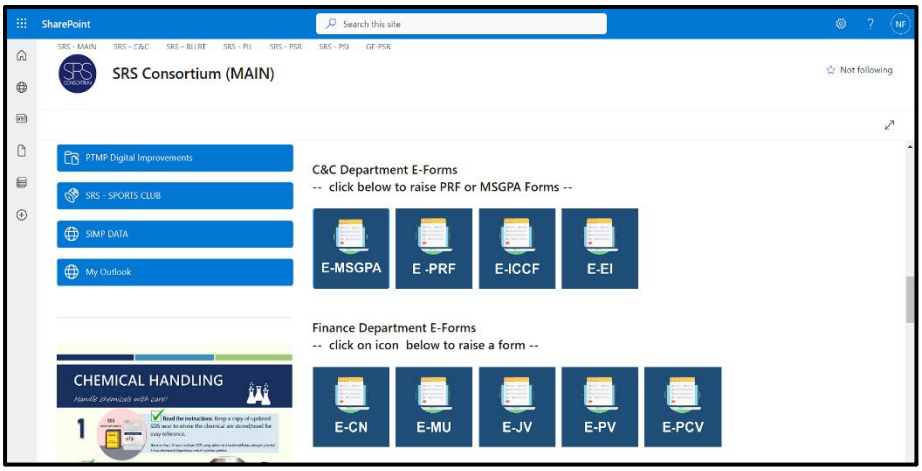


Figure 4.8 C&C Department e-form

Figure 4.9 shows the button for user to select their department.

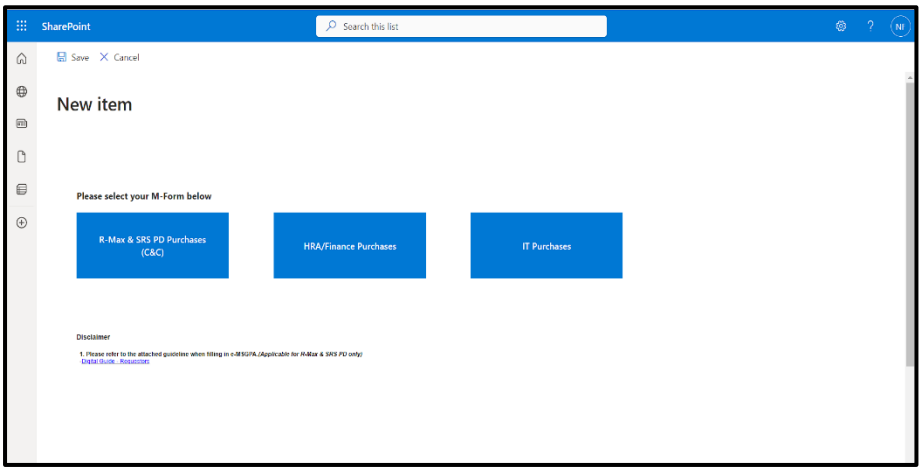


Figure 4.9 Section for department

Figure 4.10 shows the item in form that user must fill in and submit.

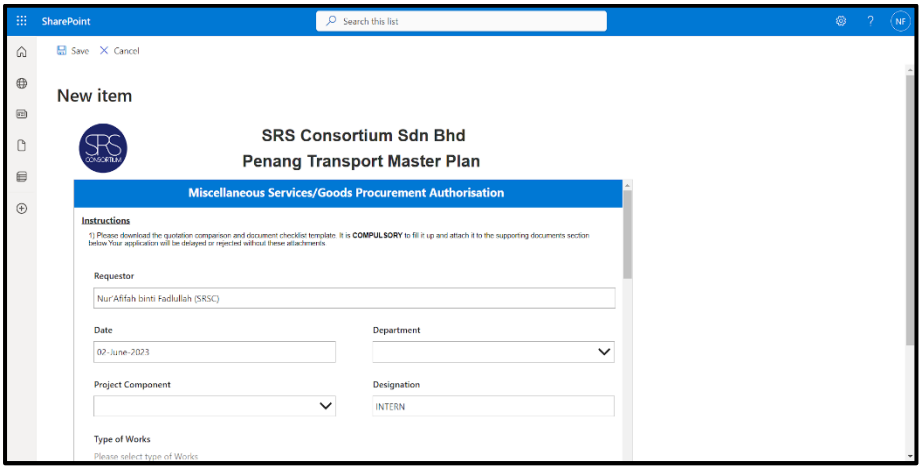


Figure 4.10 e-MSGPA form

Figure 4.11 shows the approval part which is the user can see the status of approver.

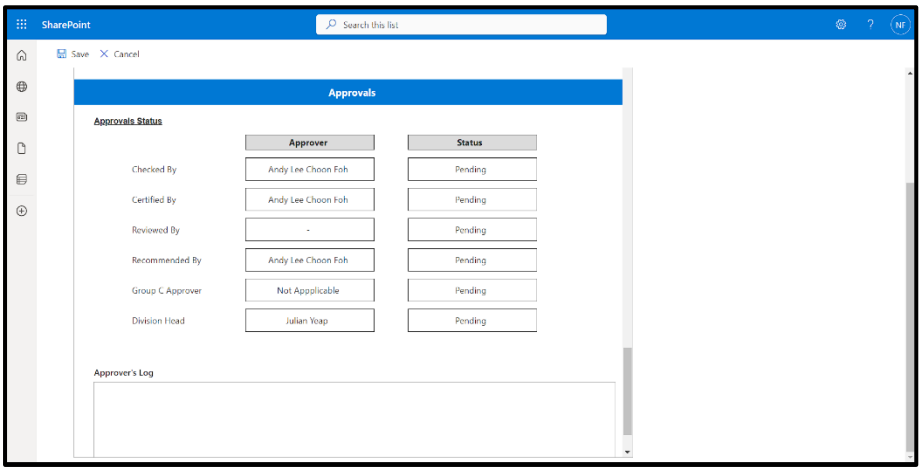


Figure 4.11 Approval section

4.3.4 Analysis the development of e-BASCCF

Regarding the need for an electronic medium for an efficient budget approval system, more than 90% of respondents agreed based on six categories to develop e-BASCCF medium for efficient process, systematic management, enough time in budget approval, easy tracking information, error risk due to lack of double-checking procedure and require an electronic medium. The main objective of efficiency analysis is to understand how inputs are converted into valuable output.

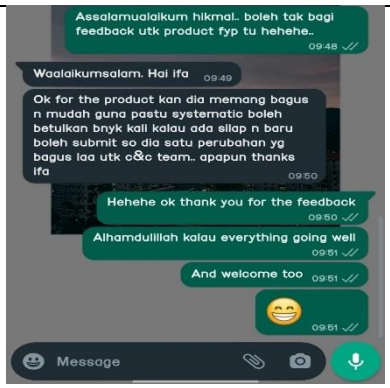
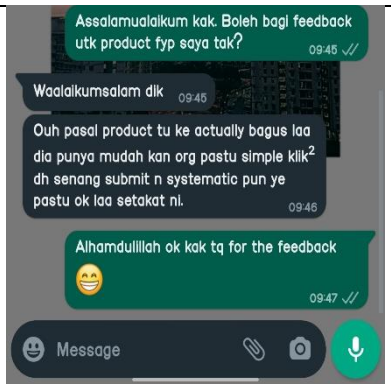
4.3.5 Test the product.

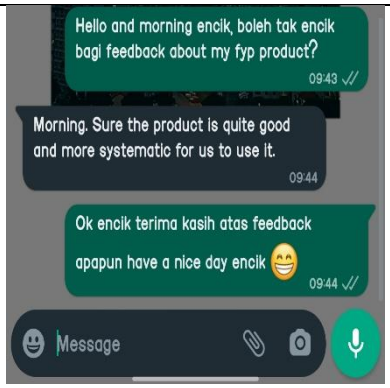
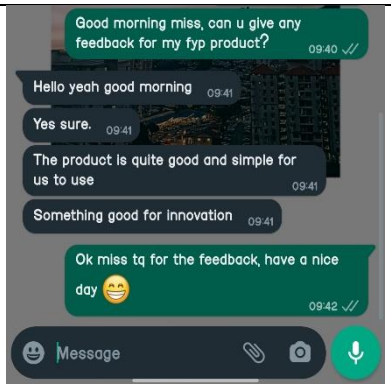
Product testing is the process of effectiveness a product's attributes or performance. Customer testing and comparative testing are other terms for it. The completed product was tested with a questionnaire distributed via Google Form links. This product was tested on 44 respondents from five departments in the Gamuda Berhad office located in Penang. The departments involved in this survey are Contract and Commercial (C&C), Approval Management (AM), Strategic Communication and Stakeholder Management (SCSM), Project Information Management System (PIMS) and Project Management (PMD). The questionnaire was created using the Technology Acceptance Model (TAM model) and is one of the most prominent theories of technology adoption.

Fred Davis research revealed that the decision to use a product is heavily influenced by the way potential customers feel about it. The technological acceptance model claims that perceived utility and perceived ease of use have the greatest impact on the rate at which a new product is adopted, with perceived usefulness weighing 1.5 times more than perceived ease of use. Outside influences such as societal norms, friend recommendations, and prior knowledge can also have an impact on both elements.

Table 4.18 below show the feedback from the tester. Every five (5) departments have one (1) person to test the product. Before releasing the product to the public. Based on their expertise with e-BASCCF, to take the user experience to the next level. Finally, the product is more systematic and efficient for budget approval submission.

Table 4.18 Feedback from Tester

Feedback	
	

<table>
<tr>
<td> 
</td>
<td> 
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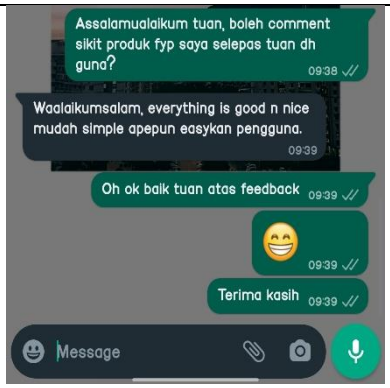
<td> 
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<td></td>
</tr>
</table>

4.4 To Test the Effectiveness of E-BASCCF as A Systematic and Efficient Budget Approval Forms Submission Medium.

This study shows the research results and data, which are collected from the questionnaire and an interview done in the office. This chapter also discussed the outcomes of the project's aims. It will detail the outcomes obtained for the objectives and indicate whether the objectives were met. The concerns concerning e-BASCCF are listed in the table below to e-BASCCF.

4.4.1 Data Collection

For e-BASCCF post-questionnaire method, respondents are 44 respondents same with pre-questionnaire. Therefore, the data collection for demographic will be same as pre-questionnaire.

4.4.2 Data collection of level agreement

Table 4.19 The effectiveness of using e-BASCCF medium.

No	Elements for electronic Budget Approval System for submission of Contract & Commercial Forms (e-BASCCF) medium	The effectiveness of using electronic Budget Approval System for submission of Contract & Commercial Forms (e-BASCCF) medium	Level of Agreement				
			Strongly Disagree	Disagree	Slightly Agree	Agree	Strongly Agree
			1	2	3	4	5
1	Efficient process	e-BASCCF can enhance the productivity in process form submission system	0	0	2	18	24
2	Systematic management	e-BASCCF is systematic to manage form submission system.	0	0	4	16	24
3	Enough time in budget approval	a) e-BASCCF saves time preparing and managing complete documents in approving the budget	0	0	2	16	26
		b) e-BASCCF allows enough time for approvers to review the budget approval form in the system.	0	0	3	15	26
4	Easy tracking information	e-BASCCF uses system to track the information from the submitted form can be trusted and easy to track.	0	0	3	13	28

5	Error risk due to lack of double-checking procedure.	a)	e-BASCCF is filling out forms using system which cannot cause errors	0	0	2	13	29
		b)	e-BASCCF is not attached to the hard copy document for budget approval which does not cause errors and require double checking	0	0	6	13	25
		c)	e-BASCCF is auto recorded data in the system without manually enters by C&C team which does not cause errors.	0	0	2	14	28
		d)	e-BASCCF does not have an effect in the risk of errors and have double check, still saving time to submit documents to the approving party.	0	0	3	16	25
		e)	e-BASCCF has high confidence in the accuracy of the initial information and has the double check before submission.	0	0	3	12	29

6	Electronic medium for efficients Budget Approval System.	a)	e-BASCCF is systematic and efficient budget approval medium?	0	0	2	14	28
		b)	e-BASCCF solve the current method constraints?	0	0	2	14	28
		c)	Will you regularly use the e-BASCCF as a platform for submitting this form if the platform is developed?	0	0	1	14	29
		d)	Do yo always use the e-BASCCF if the platform is developed?	0	0	0	13	31

4.4.3 Data analysis

SPSS is an acronym that stands for Statistical Package for the Social Sciences, and it is used by a wide range of academics to analyse complex statistical data. In this study, SPSS will be used to analyse the data. The methodical application of statistical and logical approaches to explain, demonstrate, and condense. Data should be summarized and evaluated. Researchers use data analysis to reduce data to a story and evaluate it to get different perspectives. Data analysis assists in reducing massive volumes of data into smaller, more consumable portions (parts).

4.4.4 Reliability Test

A researcher developed six categories in the questionnaire, to test the effectiveness of using e-BASCCF medium. In addition, the questions were on the 5-point Likert Scale with responses ranging from “Strongly disagree” to “Strongly agree”. To determine if the questionnaire could “reliably” measure the latent variable like the effectiveness of e-BASCCF, Cronbach alpha test was conducted. The acceptable

reliability value is 0.940. Therefore, if the questionnaire's reliability result is more than 0.9 then the questionnaire is considered Excellent.

Table 4.20 Range of reliability and its coefficient of Cronbach's Alpha

No	Coefficient of Cronbach's Alpha	Reliability Level
1	> 0.90	Excellent
2	0.80 - 0.89	Good
3	0.70 - 0.79	Acceptable
4	0.60 - 0.69	Questionable
5	0.50 - 0.59	Poor
6	< 0.50	Unacceptable

Table 4.21 Reliability test for e-BASCCF

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
0.940	0.940	14

4.4.5 Frequency Analysis

Frequency analysis is a generic approach to analysis that is used in many scientific disciplines, not just social measurement research. Moreover, it is a statistical branch that investigates the number of occurrences (frequency) and assesses metrics such as central tendency, dispersion, percentiles, and so on. Using Excel Solution to obtain the analysis frequency date. The result as show in Table 4.22 below

Table 4.22 Frequency analysis element for e-BASCCF medium.

No	Elements for electronic Budget Approval System for submission of Contract & Commercial Forms (e-	The effectiveness of using electronic Budget Approval System for submission of Contract & Commercial Forms (e-BASCCF) medium	Level of Agreement				
			Strongly Disagree	Disagree	Slightly Agree	Agree	Strongly Agree
			1	2	3	4	5

	BASCCF) medium						
1	Efficient process	e-BASCCF can enhance the productivity in process form submission system	0 (0.0%)	0 (0.0%)	2 (4.5%)	18 (40.9%)	22 (54.5%)
2	Systematic management	e-BASCCF is systematic to manage form submission system.	0 (0.0%)	0 (0.0%)	4 (9.1%)	16 (36.4%)	22 (54.5%)
3	Enough time in budget approval	a) e-BASCCF saves time preparing and managing complete documents in approving the budget	0 (0.0%)	0 (0.0%)	2 (4.5%)	16 (36.4%)	24 (59.1%)
		b) e-BASCCF allows enough time for approvers to review the budget approval form in the system.	0 (0.0%)	0 (0.0%)	3 (6.8%)	15 (34.1%)	24 (59.1%)
4	Easy tracking information	e-BASCCF uses system to track the information from the submitted form can be trusted and easy to track.	0 (0.0%)	0 (0.0%)	3 (6.8%)	13 (29.5%)	26 (63.6%)
5	Error risk due to lack of double-checking procedure.	a) e-BASCCF is filling out forms using system which cannot cause errors	0 (0.0%)	0 (0.0%)	2 (4.5%)	13 (29.5%)	27 (65.9%)
		b) e-BASCCF is not attached to the hard copy document for budget approval which does not cause errors and require	0 (0.0%)	0 (0.0%)	6 (13.6%)	13 (29.5%)	23 (56.8%)

			double checking					
		c)	e-BASCCF is auto recorded data in the system without manually enters by C&C team which does not cause errors.	0 (0.0%)	0 (0.0%)	2 (4.5%)	14 (31.8%)	26 (63.6%)
		d)	e-BASCCF does not have an effect in the risk of errors and have double check, still saving time to submit documents to the approving party.	0 (0.0%)	0 (0.0%)	3 (6.8%)	16 (36.4%)	23 (56.8%)
		e)	e-BASCCF has high confidence in the accuracy of the initial information and has the double check before submission.	0 (0.0%)	0 (0.0%)	3 (6.8%)	12 (27.3%)	27 (65.9%)
6	Electronic medium for efficients Budget Approval System.	a)	e-BASCCF is systematic and efficient budget approval medium?	0 (0.0%)	0 (0.0%)	2 (4.5%)	14 (31.8%)	26 (63.6%)
		b)	e-BASCCF solve the current method constraints?	0 (0.0%)	0 (0.0%)	2 (4.5%)	14 (31.8%)	26 (63.6%)

	c)	Will you regularly use the e-BASCCF as a platform for submitting this form if the platform is developed?	0 (0.0%)	0 (0.0%)	1 (2.3%)	14 (31.8%)	27 (65.9%)
	d)	Do you always use the e-BASCCF if the platform is developed?	0 (0.0%)	0 (0.0%)	0 (0.0%)	13 (29.5%)	29 (70.5%)

The percentage of the frequency analysis of e-BASCCF medium as show in Table 4.23 below.

Table 4.23 Percentage of the respondents for the requirement of e-BASCCF.

e-BASCCF Medium	**Level of agreement**				
Elements for electronic Budget Approval System for submission of Contract & Commercial Forms (e-BASCCF) medium	Strongly Disagree	Disagree	Slightly Agree	Agree	Strongly Agree
Efficient Process	0%	0%	4.50%	40.90%	54.50%
Systematic Management	0%	0%	9.10%	36.40%	54.50%
Enough Time in Budget Approval	0%	0%	5.70%	35.30%	59.10%
Easy Tracking Information	0%	0%	6.80%	29.50%	63.60%
Error Risk Due to Lack of Double-Checking Procedure	0%	0%	7.20%	30.90%	61.80%
Electronic medium for efficients Budget Approval System.	0%	0%	2.80%	31.20%	65.90%

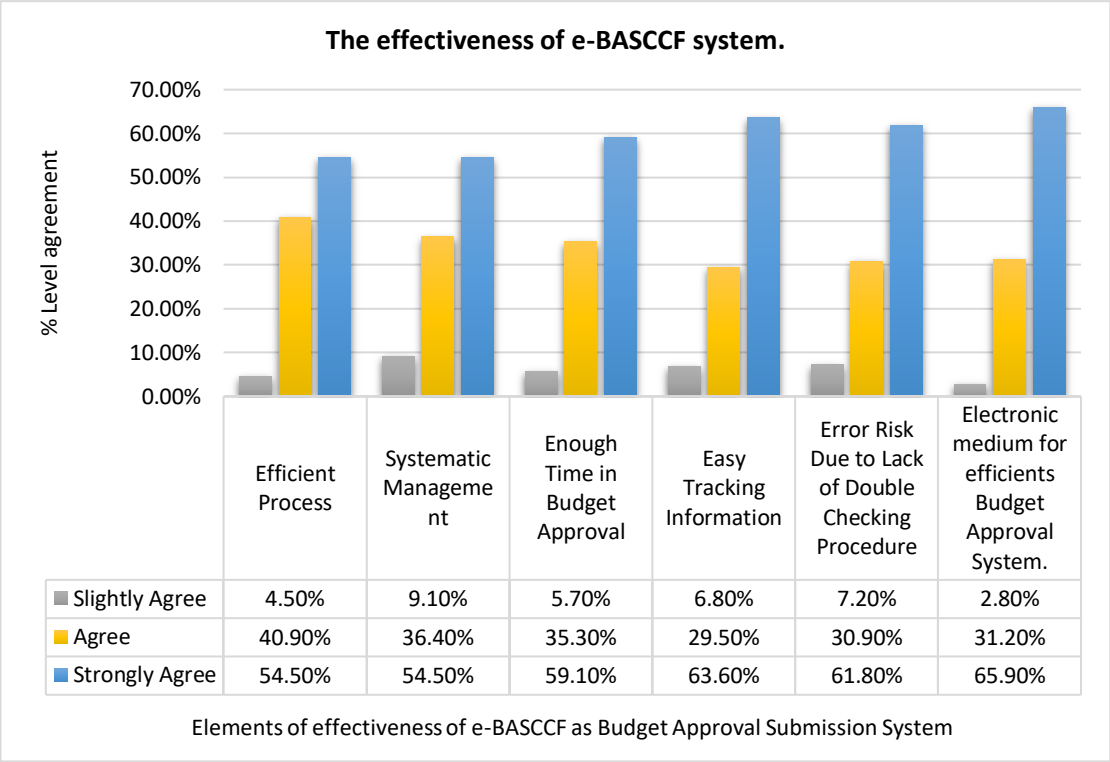

Figure 4.12 The effectiveness of e-BASCCF system

4.4.6 Descriptive Analysis

Table 4.24 show the results of respondent about the mean for elements of e-BASCCF medium. There are 6 constraint elements of the e-BASCCF for the budget approval forms submission system. The data was generated by using SPSS Software, version 26.

Table 4.24 Mean for elements of e-BASCCF medium.

	N	Mean		Std.	Variance
	Statistic	Statistic	Std. Error	Deviation	Statistic
Efficient Process	44	4.50	0.089	0.591	0.349
Systematic Management	44	4.45	0.100	0.663	0.440
Enough Time in	44	4.55	0.089	0.589	0.347
Budget Approval	44	4.50	0.095	0.629	0.395
Easy Tracking Information	44	4.57	0.094	0.625	0.391
	44	4.61	0.087	0.579	0.336

Error Risk Due to	44	4.45	0.110	0.730	0.533
Lack of Double-	44	4.59	0.088	0.583	0.340
Checking	44	4.50	0.905	0.629	0.395
Procedure	44	4.57	0.094	0.625	0.391
Electronic	44	4.59	0.088	0.583	0.340
medium for	44	4.59	0.088	0.583	0.340
efficients Budget	44	4.64	0.080	0.532	0.283
Approval System.	44	4.70	0.070	0.462	0.213

The average mean as show in Table 4.25 below, average mean resulted >4.45 in every six (6) elements of e-BASCCF system, interpretation as High and Very High in effectiveness of e-BASCCF system as a electronic medium.

Table 4.25 Average mean of elements for e-BASCCF medium.

No	Elements for electronic Budget Approval System for submission of Contract & Commercial Forms (e-BASCCF) medium	Mean	Average Mean	Average Mean (%)
1	Efficient Process	4.50	4.50	16.53
2	Systematic Management	4.45	4.45	16.35
3	Enough Time in Budget Approval	4.55	4.53	16.62
		4.50		
4	Easy Tracking Information	4.57	4.57	16.79
5	Error Risk Due to Lack of Double-Checking Procedure	4.61	4.54	16.69
		4.45		
		4.59		
		4.50		
		4.57		
6	Electronic medium for efficients Budget Approval System.	4.59	4.63	17.01
		4.59		
		4.64		
		4.70		
	Total Average	**4.56**	**27.22**	**100**

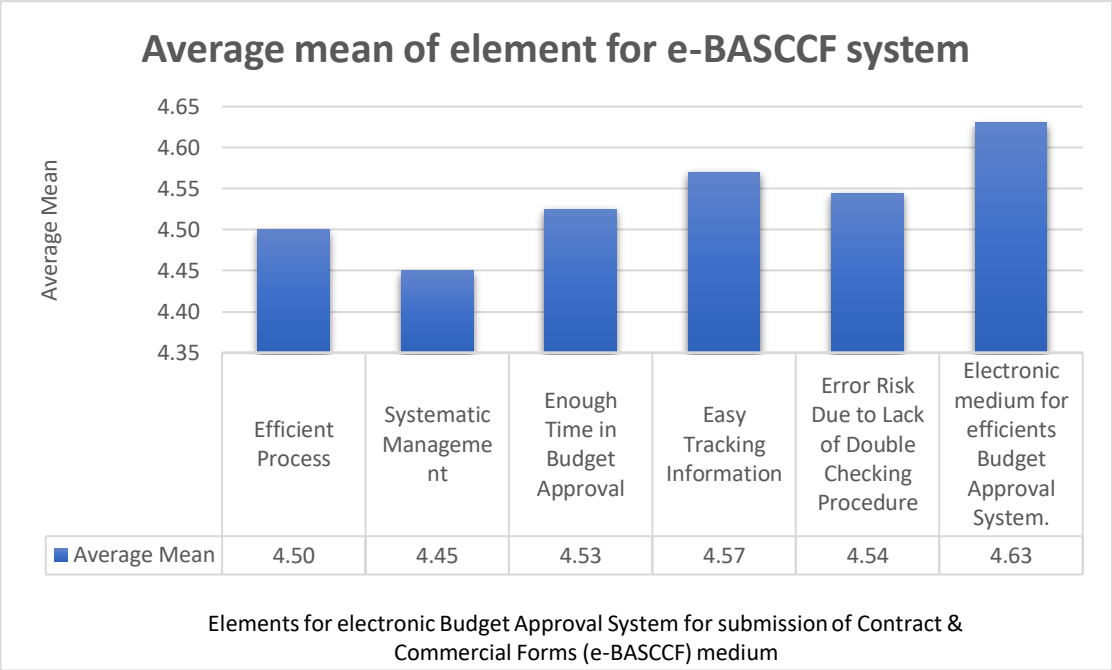

Figure 4.13 Average mean of elements for e-BASCCF system

According to the statistics in Table 4.25 and Figure 4.13 above, the greater rate of average mean, the require an electronic Budget Approval System for Submission of Contract & Commercial Forms (e-BASCCF) medium in electronic medium for efficients Budget Approval System element with 4.63 average mean. Second, easy tracking information element with 4.57 average mean. Third, error risk due to lack of double-checking procedure element with 4.54 average mean. Fourth, enough time in budget approval element with 4.53 average mean. Efficient process element with 4.50 average mean. Lastly, systematic management element with 4.45 average mean. The interpretation based on the Table 4.26 below and the results summaries as Table 4.27 below.

Table 4.26 Mean range and interpretation of usability.

No	Mean Range	Interpretation
1	4.51 - 5.00	Very High
2	3.51 - 4.50	High
3	2.51 - 3.50	Medium
4	1.51 - 2.50	Low
5	1.00 - 1.50	Very Low

Table 4.27 Average mean of element for system interpretation e-BASCCF

Variables	Mean	Interpretation
Efficient Process	4.50	Very High
Systematic Management	4.45	High
Enough Time in Budget Approval	4.53	Very High
Easy Tracking Information	4.57	Very High
Error Risk Due to Lack of Double-Checking Procedure	4.54	Very High
Electronic medium for efficients Budget Approval System.	4.63	Very High

4.5 Paired sample statistics

Paired sample statistics is to test the effectiveness of e-BASCCF and compare to the current method. The electronic method in the electronic Budget Approval System for submission of Contract & Commercial Forms (e-BASCCF) medium resulted as Table 4.28 and Figure 4.14 below.

Table 4.28 Paired sample statistics.

	Paired sample statistics	
	Average Mean	
Effectiveness Category	**Current Method**	**e-BASCCF**
Efficient Process	1.20	4.50
Systematic Management	1.25	4.45
Enough Time in Budget Approval	1.28	4.52
Easy Tracking Information	1.27	4.57
Error Risk Due to Lack of Double-Checking Procedure	1.32	4.55
Electronic medium for efficients Budget Approval System.	1.26	4.63

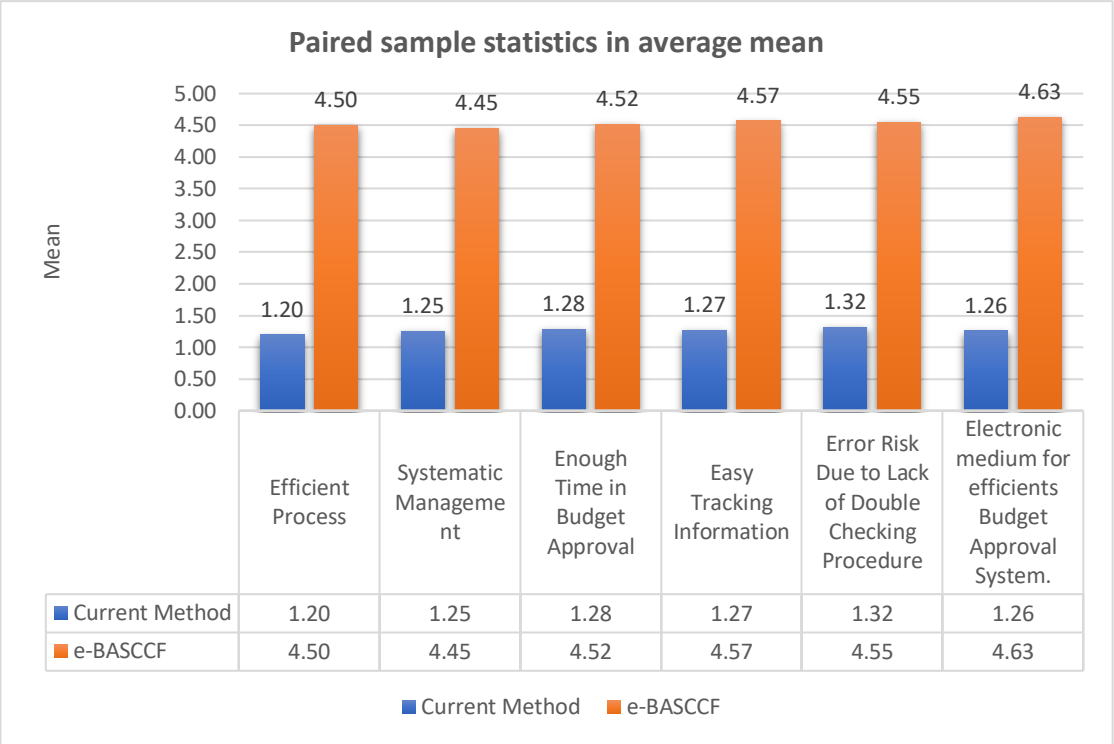

Figure 4.14 The average mean value of current method and e-BASCCF

4.5.1 Paired Sample T-Test

In order to test the effectiveness of e-BASCCF in the project, a paired sample t test was performed. Results as shown in Table 4.28, respondent preferred using e-BASCCF whereby all variable measured, efficient process (Mean = 4.50), systematic management (Mean = 4.45), enough time in budget approval (Mean = 4.52), easy tracking information (Mean = 4.57), error risk due to lack of double checking procedure (Mean = 4.55) and efficiency of e-BASCCF medium (Mean = 4.63) were more higher compared with current method, efficient process (Mean = 1.20), systematic management (Mean = 1.25), enough time in budget approval (Mean = 1.28), easy tracking information (Mean = 1.27), error risk due to lack of double checking procedure (Mean = 1.32) and efficiency of e-BASCCF medium (Mean = 1.26).

A paired sample t-test found this difference to be significant for all variables being measured, the value of t of Efficient Process is 29.79 and the value of p is < .00001. The result is significant at $p < .05$. The value of t of Systematic Management is 24.97 and value of p is < .00001. The result is significant at $p < .05$. The value of t of Enough Time in Budget Approval is 31.31 and the value of p is < .00001. The result is significant at $p < .05$. The value of t of Easy Tracking Information is 29.79 and the value of p is

< .00001. The result is significant at p < .05. The value of t of Error Risk Due to Lack of Double-Checking Procedure is 36.14 and the value of p is < .00001. The result is significant at p < .05. The value of t of the efficiency of electronic Budget Approval System for submission of Contract & Commercial Forms (e-BASCCF) medium is 40.14 and the value of p is < .00001. The result is significant at p < .05. This suggests that using e-BASCCF was much easier and resourceful compared with current method. This mean that e-BASCCF was more effective compare with the current method.

Table 4.29 Paired Sample T-Test

Pair	Paired Different Average Mean	t	Significant (two tailed)
Efficient Process	3.30	29.79	.000
Systematic Management	3.20	24.97	.000
Enough Time in Budget Approval	3.24	31.31	.000
Easy Tracking Information	3.30	29.79	.000
Error Risk Due to Lack of Double-Checking Procedure	3.23	36.14	.000
Electronic medium for efficients Budget Approval System.	3.37	40.14	.000

4.6 Summary

In today's constructing sector, having a methodical and efficient application is advantageous. Using technology in the construction industry to create this system can assist to tackle the problem. As a result, the purpose of developing this application is to aid in the process of identifying problem-related issues such as efficient process, systematic management, needed time in budget approval, easy tracking information, and error risk due to a lack of double-checking procedure. Develop the system for testing the effectiveness of using an electronic Budget Approval System for Contract and Commercial Forms submission (e-BASCCF) medium.

In this study, a lot of analysis related to develop and effectiveness had been done. With appropriate steps and methodology, any process of complete the project can be managed wisely and will produce a good result. From the data analysis that had been done, majority of the respondent are agreed for every question. This result obtained that the e-BASCCF medium are very effective to be used on submission form system at site office and construction site, easy to use and understand and really helping in tracking actual activity. The result of the study has found the third objective can be achieved through the effectiveness the respondent is more preferred to using e-BASCCF medium (Mean=4.56) as a budget approval system of submission contract & commercial form compared to current method (Mean=1.28) for contract & commercial submission form.

Finally, from the data analysis result that the aim of the develop the e-Budget Approval System for Submission of Contract and Commercial Forms (e-BASCCF) using Power App and Power Automate for systematic and efficient budget approval is effective. The paired T-Test shows that 3.37 is the highest differences mean among the six categories of the usage of e-BASCCF medium. The element is in element of electronic medium for efficient Budget approval System current method is 1.26 average mean meanwhile e-BASCCF medium is 4.63 in average mean.

CHAPTER 5

CONCLUSION AND RECOMMENDATION

5.1 Introduction

The main aim of this study is to develop the e-Budget Approval System for Submission of Contract and Commercial Form (e-BASCCF) using Power App and Power Automate for systematic and efficient budget approval. The effectiveness of e-BASCCF as a systematic and efficient budget approval forms submission medium in contract and commercial department was tested by respondents, as well as their ease of use and functionality, user satisfaction and experience, and user effectiveness in solving problem in submission system. This section provides a summary of the findings, conclusions, and recommendations based on the data examined in the previous chapter. The effectiveness of e-BASCCF as a systematic and efficient budget approval forms submission medium was assessed by determining the extent to which some of the study's objective were met.

This study's research framework is design thinking. Design Thinking is a design methodology technique that gives a problem-solving strategy centred on solutions. It is particularly beneficial in solving ill-defined or unknown difficult challenges by recognising the human needs involved, re-framing the problem in human-centric ways, and brainstorming various solutions. Library and field research are employed to obtain data. The qualitative technique is used for field research, and a group of interviewees is participating in the study procedure. The data obtained from the questionnaire will be sent to SPSS, where it will be analysed, debated, and the results shown.

5.2 Conclusion

The first objective of this study was to identify the constraints of current method for the budget approval forms submission system. From the findings of the analytical questionnaire, it shows that most of the respondents had the problems regarding the inefficiency process, still using current method, hard to tracking documents, delay budget approval and error risk due to lack of double checking.

The second objective of this study are to develop the e-BASCCF for submission of Contract and Commercial Forms using Power App and Power Automate. Chapter 3 has reviewed the methodology used during the study, specially to design of a medium for the submission form system development. Most of the document's submission used for this system are fill in, upload, and keep, easy to tracking and easy for approver to approve the budget approval.

The last objective, a survey is distributed to the target respondent to test the feedback on the effectiveness of e-BASCCF as a systematic and efficient budget approval forms submission medium. According to the results of data, respondents strongly agree that e-BASCCF is extremely effective systematic and efficient budget approval form submission medium.

Based on the findings of the survey through distributed questionnaire, it is feasible to assume that they have roughly problems that occur during budget approval submission. All responders is 100% agree that difficulties at the contract and commercial department (C&C Team) have an influence on their job. The e-BASCCF medium was tested at SRS Consortium's main office and found to be useful in the budget approval submission system. According to the respondent, e-BASCCF helps to enhance the efficient process, systematic management, enough time in budget approval, easy tracking information, error risk due to a lack of double-checking procedure, and electronic medium for efficient budget approval system.

5.3 Recommendations

Future research on this issue should provide suggestions for enhancing and acquiring more accurate results. The researchers would like to give some recommendations based on the findings that may be used as a guide or as a follow-up activity to enhance the usage of an e-BASCCF. Firstly, ensure data security and compliance. Prioritise data security and compliance with appropriate requirements, such as data protection laws or industry-specific standards, while adopting an e-form system. Select a platform with strong security features like encryption, access limits, and frequent backups. Establish suitable data governance rules and processes to protect sensitive data and guarantee compliance with applicable requirements. Second, monitor and assess the system's performance and continually monitor and evaluate the performance of the e-form system after implementation. Collect user feedback on their

experience, efficiency benefits, and any issues encountered. Review system logs and analytics regularly to discover bottlenecks and opportunities for improvement. This feedback and data will help make required modifications, optimise operations, and ensure the e-form system's long-term success. Finally, add extra capabilities that can be accessed without utilising the internet or create a more accessible application for users anytime and anywhere.

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