**POLITEKNIK UNGKU OMAR**

# E-REQUEST FOR INSPECTION FOR APPLICATION(E-RIN) FOR REINFORCED CONCRETE OF STRUCTURES

**MUHAMMAD RAFEEQ IRFAN BIN RADUA'AL**

**(01BCT20F3005)**

**CIVIL ENGINEERING DEPARTMENT**

**SESSION 2 2022/2023**

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

## CIVIL ENGINEERING DEPARTMENT

## SESSION 2 2022/2023

# STATEMENT OF AUTHENTICITY AND PROPRIETARYRIGHTS

## E-REQUEST FOR INSPECTION FOR APPLICATION(E-RIN) FOR REINFORCED CONCRETE OF STRUCTURES

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2. I hereby declare that the work in this thesis is my own except for quotationsand summaries which have been duly acknowledged.

3. I hereby agree to let go the intellectual property ownership of this project toUngku Omar Polytechnic in partial of the requirement for the award of the **Bachelor of Civil Engineering Technology with Honours.**

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Witnessed by;

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As the project supervisor, dated: )

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# ABSTRACT

The construction industry has improved drastically in parallel with the development of technology that facilitates the construction work sequence. It makes work more efficient in terms of quality, productivity and cost. However, the documentation and paperwork side has changed very little even with the advancement of technology. The aim of this project is to reduce the use of paper for internal use in the 8MD3 Putrajaya project. The use of paper for hard copies of reports, contracts and so on has never decreased. Some of this excessive use of paper for interior foundations can be reduced with the help of modern technology. Mobile applications can be used to replace some paper-based forms for internal operations that are not absolutely essential for long-term storage. App development helps eliminate paper-based processes between contractors and developers. The E-RIN app converts paper-based forms to electronic forms thereby reducing the use of paper.

**KEYWORDS**: E-RIN, Paperless, User friendly, Application

# ABSTRAK

Industri pembinaan telah bertambah baik secara drastik selari dengan perkembangan teknologi yang memudahkan urutan kerja pembinaan. Ia menjadikan kerja lebih cekap dari segi kualiti, produktiviti dan kos. Walau bagaimanapun, bahagian dokumentasi dan kertas kerja telah berubah sangat sedikit walaupun dengan kemajuan teknologi. Matlamat projek ini adalah untuk mengurangkan penggunaan kertas untuk kegunaan dalaman dalam projek 8MD3 Putrajaya. Penggunaan kertas untuk salinan cetak laporan, kontrak dan sebagainya tidak pernah berkurangan. Sebahagian daripada penggunaan kertas yang berlebihan untuk asas dalaman ini boleh dikurangkan dengan bantuan teknologi moden. Aplikasi mudah alih boleh digunakan untuk menggantikan beberapa borang berasaskan kertas untuk operasi dalaman yang tidak benar-benar penting untuk penyimpanan jangka panjang. Pembangunan apl membantu menghapuskan proses berasaskan kertas antara kontraktor dan pembangun. Aplikasi E-RIN menukarkan borang berasaskan kertas kepada borang elektronik dengan itu mengurangkan penggunaan kertas.

**KATA KUNCI** : E-RIN, Tanpa kertas, Mesra pengguna,

## LIST OF CONTENT

## LIST OF TABLES

## LIST OF FIGURES

# CHAPTER 1

# INTRODUCTION

## 1.1 INTRODUCTION

One of the earliest economic sectors in Malaysia is the construction business. The annual GDP growth rate in Malaysia is between 3 and 6 percent as a result of increased economic development. The growth of the nation's economy is directly correlated with the building industry. This is a result of the project or activity's expensive construction. To have the necessary funds or cash flow to start all of these construction projects, there must be stable and excellent economic conditions (UKEssays, 2018).

Building, often known as building construction, refers to the techniques and business of assembling and erecting buildings, particularly those that serve as shelter. Humans have long used construction as a tool. It all began with the need to control the impacts of the climate in a controlled environment. One method for people to adapt to themselves is to build shelters (Swenson et al., 2020).

The Malaysian construction sector includes planning, design, conservation, documentation, demolition, and repair for a variety of building types. Independent of time, place, or person, consistent process performance is made possible by documentation management. (Senaratne, 2015). Keepingenough records that have an impact on the history of the construction process is a necessary part of properly documenting a construction project. By identifying the facts, purposes, and tasks of the project, appropriate documentation aids in decision-making, helps save time and money, and increases the overall effectiveness of construction work.

Every construction site must use an RFI, which is a request for inspection, to carry out concrete work for a structure. The RFI that is carried out in the construction industry that is available starts by asking for the signature of the supervisor in charge of the building and the signature of the construction manager to confirm the RFI. After that, send the RFI to the Resident Engineer to get approval for the RFI to be carried out. After that, ask for confirmation of the signature on the RFI from the main contractor and consultant for each department such as architect, structure, mechanical, electrical and interior design if each department has already done an inspection of the structure to be concreted. Finally, if each department has signed the RFI, the RFI will be submitted to the Resident Engineer to request permission to allow the structure to be concreted.

## 1.2 PROBLEM STATEMENT

According to SafetyCalcure (2020), the development of a construction project is documented in a daily report on construction. It aids in keeping track of the job at a construction site and ensuring that the project is on schedule and within budget for site managers and contractors. Daily reports for construction projects frequently include details about the workers, the weather, the number of hours worked, the stage of the project, and any accidents or disruptions that can cause a delay. These daily updates give stakeholders and subcontractors access to information about the state of projects. The specific challenges that are frequently encountered, such record management, are not the problem. Popular concerns include delays, one of which is lost information. Problems may arise if a document is submitted late (Navigant, 2013).

Record management has emerged as a crucial concern for contemporary construction organisations. Site diaries and other paper records have all been converted to hard copies and stored in the archives without being updated. The records had no procedure in place for recording them. There is no softcopy for the site diary and no trace system that can monitor the complete content if something happens to the hard copy files. For the time being, an effective technique is required for the administration and control of documents that contain records of any usage or modification of the document. (SafetyCalcure, 2020).

For now, all document records, such as site diaries are in hard copy and entered into files without updates. There is no system to record documents. There is no soft copy for site diaries and also no tracking system that will keep track of all documents if something happens to the hard copy files. For now, an effective way is needed for document management and tracking to keep a record of any use or alteration of the document. Figure 1.1 shows the existing Request for Inspection (RFI) (Darin, 2021).

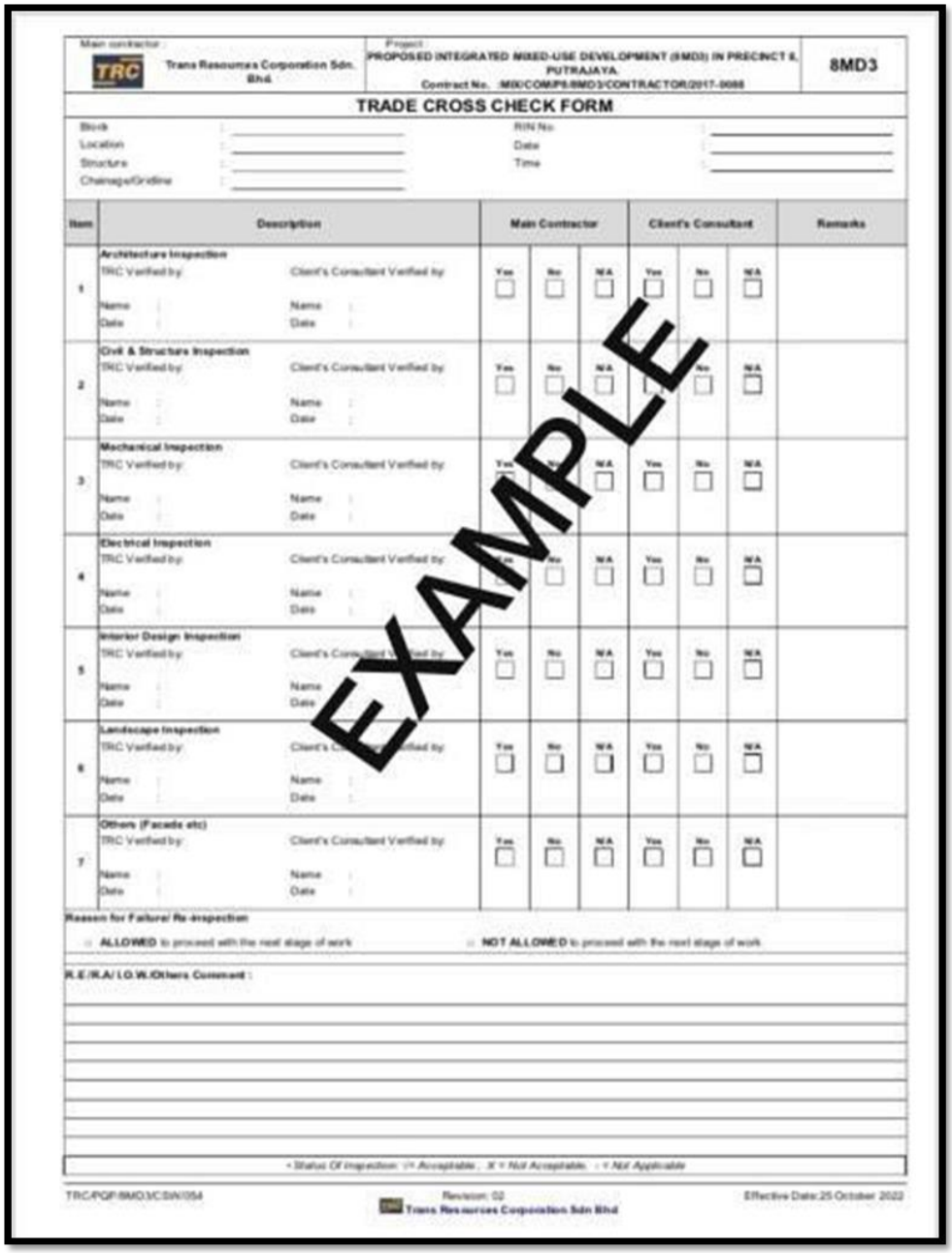


Figure 1.1: The current Request for Inspections (RFI), (TRC Sdn Bhd, 2022

The figure 1.1 refers to a document to ensure that the area to be concreted has been approved by the various parties concerned. Among the parties involved are architects, structural, mechanical, electrical and interior design. When the parties have made an inspection of a building structure, they will sign the document indicating that they have inspected.

Request For Inspection (RFI) is form that very syonym in site construction. It is used in every single step of construction such as to construct basement of the building. This form will be used in 3 phases of the construction, that is before the do construct, while constructing, and after constructed. As an example to concrete a beam of the building, the sub-contractor must put the signature on the form as an evidence of the inspection after check the works are followed by checklist. Then the form must be approved by the main contractor. The main contractor must make sure every checklist statement in the form has been followed by the sub-contractor, so the main contractor will re-check it on the site. The last part of this form is it will submit to consultant. The consultant will be certified this form after all the things are followed by checklist. The RFI is very useful to guide the construction by follow the specification needed but the way is used or by following how it is used the matter that be issued.

The problem involved in the 8MD3 Putrajaya project is that when a place wants tobe concreted, the request for inspection (RFI) document must be verified by the contractor and the consultant such as civil and structural (CNS), architect, M&E and interior design after they have carried out an inspection at area to be concreted. But when wanting to get confirmation, some of them are no longer on the site. This is due to the possibility that they have other things or unavoidable emergencies. Therefore, the resident engineer (RE) could not approve the RFI document to continue. So, it has delayed the process for concrete in that area.

In addition, this application faces difficulties in performing double verification of claim activity because it still uses a conversion system. The problem occurs when the site cannot commit to duplicate validation claims because the previous project document is missing. For example, meeting minutes. Complete construction project meeting minutes recording all topics discussed in the meeting should be submitted to the RFI. It is accurate, reliable, and then the meeting minutes become a very valuable contemporary text. As emphasis is placed on meeting minutes, they must be full, inclusive, correct and reliable. Therefore, RFI ensures that meeting minutes are accurate and factual (Lowe, 2021).

Apart from this, when using the conversion system there are a lot of papers used. The focus on waste minimization and recycling is intended to exemplify the types of projects that are possible to advance sustainability, which are cost-effective and necessary for a healthy future. Minimizing waste saves money throughout the process, from purchase to handling, to disposal. Reducing paper is the most cost-effective and environmentally and socially responsible approach to reducing waste-related costs. Therefore, by implementing an RFI for a site, it can reduce costs and at the same time reduce the use of paper (Saul, 2021). Figure 1.2 shows the papers that are wasted.

Figure 1.2: The Wastes of Paper (TRC Sdn Bhd, 2022)

## 1.3 OBJECTIVE OF THE STUDY

The aim of this study is to develop a more sustainable document management system for the construction site office at the 8MD3 Putrajaya project. The objectives of this study are:

i. To identify the issues of Request for Inspection at TRC 8md3 Project for current site documentation.

ii. To develop the e-Rin applications by using mobile application.

iii. To test the effectiveness of the e-RIN application for systematic site diary documentation.

## 1.4 SCOPE OF STUDY

This study focuses on the construction of mixed development in Precinct 8 Putrajaya. This study is about site planning for this project. The scope of this study is a project that only focuses on the problems that occur on the construction site and the pattern of document transmission between the construction site and the office. Figure 1.3 shows the location of the mixed development site plot in Precinct 8 Putrajaya.

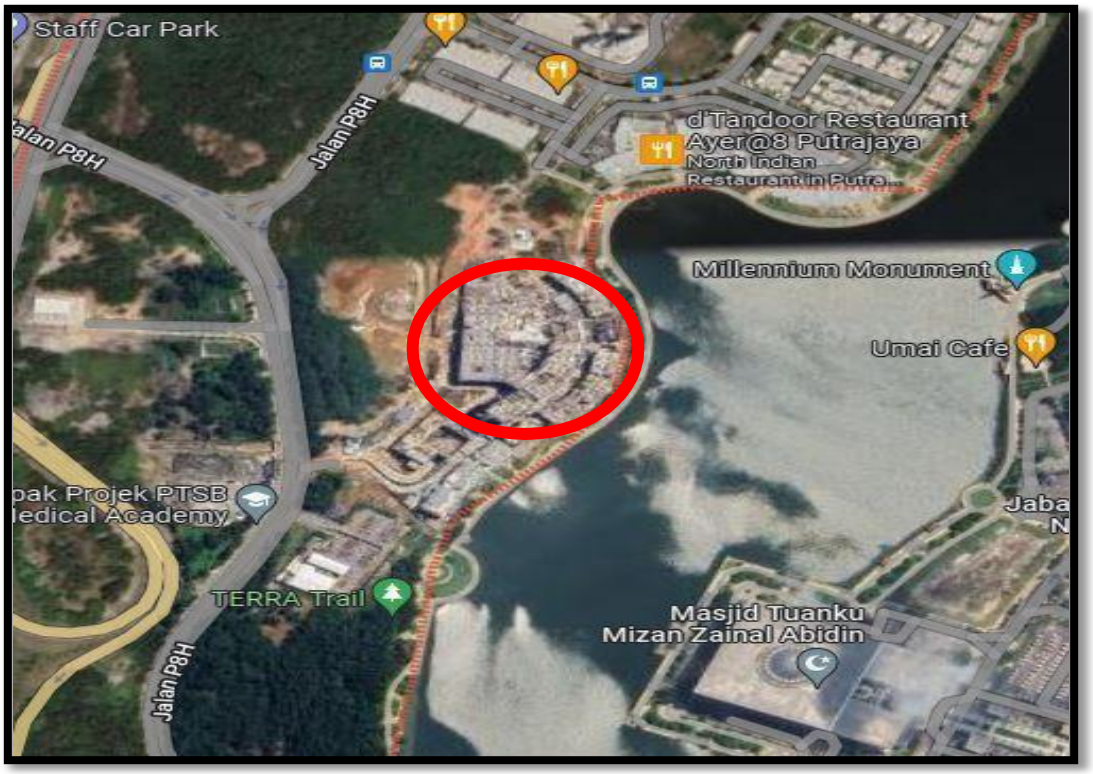


Figure 1.3 : Location of site 8MD3 Precint 8, Putrajaya

A project located in Precinct 8, Putrajaya which is a 9.3acre complex consisting of the following which is 1 block of 44-storey luxury apartments (187 units), 2 blocks of 30-storey apartments (280 units), 1 block of 16-storey serviced apartment towers (121 units), 3 blocks of 6-storey retail and serviced apartments by the sea (360 units), 1 block of 3-storey shopping center including offices, 1 block of 2-storey Event Hall, 4-storey multi-storey car park, 3-storey underground car park.

Furthermore, the product has used the RFI application to build the RFI system. This RFI template has made it easy to get information from contractors, architects or subcontractors along with consultants. For record keeping purposes, the template includes a section at the top for the project name and ID number, RFI number, RFI date and any drawings attached to it. When there are areas that need to be concreted, those areas will be updated in the RFI application. indirectly, architects, contractors, interior designers and consultants will know and continue to confirm if the area has been inspected by them.

In addition, this project will convert from conventional methods to technological systems for RFI. A Construction RFI is a formal written process where parties, such as contractors and designers, clarify information gaps in construction documents. RFI application is a new technology system. RFIs have been used to guide construction by following the required specifications, but how they are used or how they are used is an issue that will be released. This has helped improve construction efficiency. Finally, it will be tested by the main contractor's engineer and Inspection of Work (IOW) from the developer.

# CHAPTER 2

# LITERATURE REVIEW

## 2.1 INTRODUCTION

Over the past two decades, general practise in the construction sector has seen a significant change from manual methods to computer-supported ways of knowledge processing. In this chapter, the idea and philosophy of ongoing study will be highlighted. In this chapter also, background information on project monitoring technology will also be covered. The collection of pertinent information is crucial for producing high-quality writing. Print and electronic mediums are available for the dissemination of the information. Print media includes books, journals, articles, reports, and news about current events, whilst electronic media can be found online through websites.

In addition, technological growth has a huge effect on a country's capacity to lead the developed world. Refer to Malaysia's growth and promote all work carried out in this development. Even with this technology sector, it is possible to minimise traditional construction use (Chudley, 2011).

As a result, the use of technology in this industry of building would increase production and reduce waiting times. It may also be accessed from anywhere through technology, such as systems or programmes, and makes daily tasks easier with only the touch of a finger (Ater, 2017).

## 2.2 OVERVIEW ON DOCUMENT

A document is typically thought of as a piece of paper with written or drawn information for a specific purpose. It has been decided to utilise an enhanced definition of a document for the standardisation of information systems, which is "a defined quantity of information for human interpretation that may be transferred as a unit between users and systems". To put it another way, the record may be kept on paper or any other kind of storage, such as digital data files, audio, or video recordings. A document's ability to transfer knowledge from one person to another is crucial (Joann, 2017).

In the digital environment, the paper is replaced by computer files stored on some digital medium. However, there is not a one-to-one relationship between a text and a file. A document can consist of sections or views of many files, and a file may contain several documents as well. Technologies for electronic record management are essentially well suited to managing such vast quantities of documents present in the construction process, along with the related reference information (represented by metadata). Immediate benefits are cost savings and quality enhancements (Joann, 2017). The prospective advantages include:

a) Fast and direct propagation of alterations.
b) More well-founded decisions due to automated processes for workflow.
c) Reduced costs for physical document printing, copying and delivery.

### 2.2.1 Request of Inspection

Plans, drawings, specifications, and agreements are clarified in the Request for Inspection (RFI) for Building. The construction RFI is a formalised written process via which parties, including the contractor and designer, can clarify knowledge gaps in the building documentation. Although this strategy seems simple, RFIs can also cause delays, costs, controversy, and even legal disputes. Therefore, it is important for both parties involved in construction projects to comprehend how RFIs function and how to use them efficiently. Construction RFIs are used at various stages of the building process. A contractor can use an RFI throughout the bidding process to better comprehend the project's specifics and adjust a proposal (Ramos, 2020).

However, it happens more frequently after work is already underway that a contractor or subcontractor would send an RFI to the designer or engineer to request an explanation of a drawing or specification. The contractor or supplier may also utilise an RFI to register a complaint regarding the specified materials, request further information regarding the owner's intended use, or suggest a part modification or replacement. By providing prompt and thorough responses to RFI, it enables construction projects to stay on schedule and under their set budget. Giving prompt responses also ensures that the building is being constructed in accordance with the specifications (Ramos, 2020).

### 2.2.2 Construction Drawing

Drawings that are included in the production data that is included in the tender papers and afterwards in the construction work contract documents are collectively referred to as "construction drawings" in general. This suggests that they are governed by law and are a component of the employment relationship. Construction drawings' main objective is to give a visual depiction of what will be built. Construction drawings should be clear and ordered to reduce confusion and misunderstanding whenever possible (Designing Buildings Ltd. 2020).

## 2.3 APPS APPLICATION TO CONSTRUCTION INDUSTRY

In a technology-driven ecosystem, business firms from all verticals hope to optimize their productivity. To that end, mobile applications have penetrated deep into most industries, including real estate and construction. A survey involving over 600 workers from the construction industry revealed that 80% of respondents consider mobile technology to be a high priority. In addition, well-known app developers work closely with real estate companies to build customized solutions for businesses. So, it is clear that everything boils down to mobile applications and their implementation across industries (Gaith, 2012).

### 2.3.1 Benefits Using Application In Construction Industry

Mobile apps can significantly reduce the high hazards associated with operations in the construction industry. Compared to other industries, the injury rate in the construction sector is higher. Construction managers, using a mobile platform, can track training sessions. To ensure compliance with regulations, they can increase the level of employee safety. Another benefit of using a mobile app in the construction sector is that it enables immediate reporting of injuries and safety concerns. Authorities can manage these issues more carefully, strengthening regulatory compliance where necessary (Zawawi, 2019).

In the construction industry, one of the biggest challenges lies in completing projects on time. These delays are often due to rework. For example, after project construction begins, certain parts may need to be redesigned. This increases the overall cost and the project takes more time to complete. Most construction firms use this tool to create virtual tours and renderings, which help in spotting construction issues before the actual process begins. Using custom applications for construction, managers can synchronize and organize operational activities. They schedule tasks and ensure construction work is done on schedule. This also helps in optimizing resources. Sometimes, the construction manager may need to oversee the process at two different sites. Using this app simplifies the process to a great extent. Various cloud-based project management tools are available, which allow managers to view projects and review completed tasks. They can also get real-time data, reducing delays in the construction process (Klaus, 2020).

It is important for construction managers to improve the transparency and efficiency of operational processes. With a powerful mobile app, they can perform process monitoring, scheduling and authorization. Using a custom application in this mechanism calms down the entire process as it delivers a faster channel of communication. In supplier management and scheduling, mobile applications can prove to be very useful. Nowadays, ready-mixed concrete suppliers use custom applications, through which the map interface can be shared by the supplier with the customer. This ensures active agreement management at the service level. Replacing paper with a mobile app is a step forward towards digitization. A clutter-free workplace ensures optimized productivity levels (Rikke, 2020).

The lack of robust communication mechanisms in the construction industry can complicate the situation. At times, communication gaps between project managers, supervisors and owners lead to misunderstandings. A smooth communication process is necessary to ensure that all heads involved in the process remain in sync together. Through the construction management application, these three groups can get a complete view of the project and the overall communication process is improved. It is important to maintain transparency and leverage the communication process in the construction industry. The reason is that project stakeholders get increased visibility and they feel that they are actually involved in the process. This fosters better relationships between stakeholders and other parties involved in the construction process. Proper app integration can reduce misinterpretation of information and keep all departments in sync (Ismail, 2019).

In recent years, business intelligence and big data have grown rapidly. The task of integrating this technology in the construction industry requires robust application. Previously, reports had to be made at the end of each day. However, application developers have come up with tools, through which managers can get real-time data on their smartphones. In the process, they can stay updated on issues arising in the field and project costs, while monitoring the team's performance. Real-time analytics also allow project managers to predict improvements in operational processes, which may be necessary and take the desired actions. All team members will have access to these analytics, whether they are in the office or in the field (Ema, 2019).

## 2.4. INCORPORATING SUSTAINABILITY IN SYSTEM AND APPS

Sustainability is concerned with considering that nature and the environment are not inexhaustible resources and therefore, it is necessary to protect them and use them rationally. Sustainability promotes social development, seeking unity between society and culture to achieve a satisfactory level in quality of life, health and education. Third, sustainability focuses on equitable economic growth that generates wealth for all without damaging the environment. Nowadays, many challenges facing humanity such as climate change or water scarcity can only be addressed from a global perspective and by promoting sustainable development. Sustainability encourages people, politicians and businesses to make decisions that bet on the long term and take future generations into account. In this way, acting sustainably encompasses a temporal framework of decades (rather than months or years) and considers more than the gains or losses involved in the short term (Acciona, 2021).

Several examples of different sustainability depending on the industry can be found ahead. The use of electronic devices is increasing every day. However, these devices are made from Earth minerals extracted by the mining industry. Mining can be a very polluting industry and the development of new sites certainly has an impact on deforestation (Brian, 2017). Therefore, being sustainable in technology has a lot to do with using your device for a long time – so if you want to be sustainable, you must refuse to change your smartphone every year! It's also about making sure you dispose of it in a responsible way as it can be very polluting if not handled properly. Soon, sustainability in technology will also be about how (most) lithium-ion batteries of electric cars and solar panels will be disposed of. Companies that focus on recycling these batteries and building products whose core cars are maintained and swapped out for new batteries will also be at the forefront (Acciona, 2021).. Given the increasing global problems such as climate change, population growth, environmental pollution, and inefficient use and depletion of natural resources, countries need to use technologies and approaches towards economic activities that are less harmful to the environment and conserve resources. Sustainable development is associated with less environmental damage and is driven by comprehensive and inclusive, international and single national policies that take into account the needs of future generations. Among these policies, some suggest using green technology (Avda, 2019)

In construction, not only the building wants to achieve green elements. It must be all the project needs to achieve green requirements. It is because when the project has followed the whole green element, it will help limit pollution and affect the earth as well as human health. Green implementation is important to ensure it is safe as well as good for the user (Acciona, 2021).

In applying this aspect of sustainability it is very important in any field or project to launch the process and improve the quality of production and not have a negative impact in the future, therefore, the use of the application that will be applied on this website (Rosha Dynamic Project) is about the use of the System Defect Inspector that will have a positive impact on the quality of work as well as improve the quality of work in the implementation of document construction forms.

## 2.5. IMPLEMENTATION OF GREEN ELEMENTS

Green technology has become part of sustainable construction projects when looking at the large impact made on the built environment. Its value is influential and all-encompassing, contributing significant gains when used in innovative facilities as well as current structures. The purpose of this paper is to show the value of the transition from conventional technology to green technology towards achieving sustainable modern construction projects, identifying the value and challenges of using green technology in construction. Benefits are often assessed in purely qualitative terms, or measured only in terms of the level of green infrastructure protected or maintained. There is much less quantitative evidence on the ecosystem services delivered by green infrastructure, and the value of these services (Naumann, 2011). While this lack of evidence makes it difficult to speculate on the value of the services that most projects may have delivered, even a partial assessment of the value of green infrastructure benefits suggests that they can significantly exceed costs. Therefore, improving the understanding of ecosystem services and their value through further work and improved guidance and/or tools for assessment at the project level is necessary (McKenna, 2011)

The technology life cycle is relatively different from the product life cycle. The first discusses the performance of products in the market sphere while the emphasis of the technology life cycle is focused on the various phases of technological growth in the production and operation of technology towards industrial progress (Hitesh, 2019). Developing a mobile system and application as a solution to the problem, users will benefit a lot and it can also implement sustainability in the solution. Some of the benefits of this system and application are saving the use of paper, it can manage and reduce the time to complete documents and finally the work will be managed and easy to find information (Mason, 2017).

### 2.5.1. Minimize Paper Use

It can help manage the reduction in paper consumption by using this application or system. Paper usage will be reduced because the computer has sorted the actual document when the user finds the attachment, so the user will find and print the correct document. It will help to minimize the use of paper. When the use of paper is reduced, it will help the growth of trees. It can also limit the occurrence of air pollution. This is because, the world's forests absorb a third of global emissions every year. Particles, odors and pollutant gases such as nitrogen oxides, ammonia and sulfur dioxide settle on the leaves of a tree. Trees absorb these toxic chemicals through their stomata, or 'pores', effectively filtering these chemicals from the air. Trees also mitigate the greenhouse gas effect by trapping heat, reduce ground-level ozone levels and release life-giving oxygen. If we continue with our current rate of deforestation, it will have severe consequences on the quality of our air (Yale, 2020).

### 2.5.2. Time management

Also, another benefit of using this system and application is that it will take care of time management for searching and creating document forms. By doing this system and application, it will help users to find documents in less time than before. It can also maximize work productivity. Finally, it will help to complete document forms such as defect report and defect list on time without waiting (Benarroche, 2021).

### 2.5.3. Work Management

The final benefit of using this application and system is that functional management can manage well. Work such as creating document forms can run on time and also documents can be sent to customers on time. When work management is good, work will be well organized. Staff or users will find it easier to do work and work productivity will also increase over time.

## 2.6. INCORPORATING SUSTAINABILITY IN SYSTEM AND APPS

Sustainability is concerned with considering that nature and the environment are not inexhaustible resources and therefore, it is necessary to protect them and use them rationally. Sustainability promotes social development, seeking unity between society and culture to achieve a satisfactory level in quality of life, health and education. Third, sustainability focuses on equitable economic growth that generates wealth for all without damaging the environment. Nowadays, many challenges facing humanity such as climate change or water scarcity can only be addressed from a global perspective and by promoting sustainable development. Sustainability encourages people, politicians and businesses to make decisions that bet on the long term and take future generations into account. In this way, acting sustainably encompasses a temporal framework of decades (rather than months or years) and considers more than the gains or losses involved in the short term (Acciona, 2021).

Several examples of different sustainability depending on the industry can be found ahead. The use of electronic devices is increasing every day. However, these devices are made from Earth minerals extracted by the mining industry. Mining can be a very polluting industry and the development of new sites certainly has an impact on deforestation (Brian, 2017). Therefore, being sustainable in technology has a lot to do with using your device for a long time – so if you want to be sustainable, you must refuse to change your smartphone every year! It's also about making sure you dispose of it in a responsible way as it can be very polluting if not handled properly. Soon, sustainability in technology will also be about how (most) lithium-ion batteries of electric cars and solar panels will be disposed of. Companies that focus on recycling these batteries and building products whose core cars are maintained and swapped out for new batteries will also be at the forefront (Acciona, 2021).. Given the increasing global problems such as climate change, population growth, environmental pollution, and inefficient use and depletion of natural resources, countries need to use technologies and approaches towards economic activities that are less harmful to the environment and conserve resources. Sustainable development is associated with less environmental damage and is driven by comprehensive and inclusive, international and single national policies that take into account the needs of future generations. Among these policies, some suggest using green technology (Avda, 2019)

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Several examples of different sustainability depending on the industry can be found ahead. The use of electronic devices is increasing every day. However, these devices are made from Earth minerals extracted by the mining industry. Mining can be a very polluting industry and the development of new sites certainly has an impact on deforestation (Brian, 2017). Therefore, being sustainable in technology has a lot to do with using your device for a long time – so if you want to be sustainable, you must refuse to change your smartphone every year! It's also about making sure you dispose of it in a responsible way as it can be very polluting if not handled properly. Soon, sustainability in technology will also be about how (most) lithium-ion batteries of electric cars and solar panels will be disposed of. Companies that focus on recycling these batteries and building products whose core cars are maintained and swapped out for new batteries will also be at the forefront (Acciona, 2021).. Given the increasing global problems such as climate change, population growth, environmental pollution, and inefficient use and depletion of natural resources, countries need to use technologies and approaches towards economic activities that are less harmful to the environment and conserve resources. Sustainable development is associated with less environmental damage and is driven by comprehensive and inclusive, international and single national policies that take into account the needs of future generations. Among these policies, some suggest using green technology (Avda, 2019)

In construction, not only the building wants to achieve green elements. It must be all the project needs to achieve green requirements. It is because when the project has followed the whole green element, it will help limit pollution and affect the earth as well as human health. Green implementation is important to ensure it is safe as well as good for the user (Acciona, 2021).

In applying this aspect of sustainability it is very important in any field or project to launch the process and improve the quality of production and not have a negative impact in the future, therefore, the use of the application that will be applied on this website (Rosha Dynamic Project) is about the use of the System Defect Inspector that will have a positive impact on the quality of work as well as improve the quality of work in the implementation of document construction forms.

## 2.8. IMPLEMENTATION OF GREEN ELEMENTS

Green technology has become part of sustainable construction projects when looking at the large impact made on the built environment. Its value is influential and all-encompassing, contributing significant gains when used in innovative facilities as well as current structures. The purpose of this paper is to show the value of the transition from conventional technology to green technology towards achieving sustainable modern construction projects, identifying the value and challenges of using green technology in construction. Benefits are often assessed in purely qualitative terms, or measured only in terms of the level of green infrastructure protected or maintained. There is much less quantitative evidence on the ecosystem services delivered by green infrastructure, and the value of these services (Naumann, 2011). While this lack of evidence makes it difficult to speculate on the value of the services that most projects may have delivered, even a partial assessment of the value of green infrastructure benefits suggests that they can significantly exceed costs. Therefore, improving the understanding of ecosystem services and their value through further work and improved guidance and/or tools for assessment at the project level is necessary (McKenna, 2011)

The technology life cycle is relatively different from the product life cycle. The first discusses the performance of products in the market sphere while the emphasis of the technology life cycle is focused on the various phases of technological growth in the production and operation of technology towards industrial progress (Hitesh, 2019). Developing a mobile system and application as a solution to the problem, users will benefit a lot and it can also implement sustainability in the solution. Some of the benefits of this system and application are saving the use of paper, it can manage and reduce the time to complete documents and finally the work will be managed and easy to find information (Mason, 2017).

### 2.8.1. Minimize Paper Use

It can help manage the reduction in paper consumption by using this application or system. Paper usage will be reduced because the computer has sorted the actual document when the user finds the attachment, so the user will find and print the correct document. It will help to minimize the use of paper. When the use of paper is reduced, it will help the growth of trees. It can also limit the occurrence of air pollution. This is because, the world's forests absorb a third of global emissions every year. Particles, odors and pollutant gases such as nitrogen oxides, ammonia and sulfur dioxide settle on the leaves of a tree. Trees absorb these toxic chemicals through their stomata, or 'pores', effectively filtering these chemicals from the air. Trees also mitigate the greenhouse gas effect by trapping heat, reduce ground-level ozone levels and release life-giving oxygen. If we continue with our current rate of deforestation, it will have severe consequences on the quality of our air (Yale, 2020).

### 2.8.2. Time management

Also, another benefit of using this system and application is that it will take care of time management for searching and creating document forms. By doing this system and application, it will help users to find documents in less time than before. It can also maximize work productivity. Finally, it will help to complete document forms such as defect report and defect list on time without waiting (Benarroche, 2021).

### 2.8.3. Work Management

The final benefit of using this application and system is that functional management can manage well. Work such as creating document forms can run on time and also documents can be sent to customers on time. When work management is good, work will be well organized. Staff or users will find it easier to do work and work productivity will also increase over time.

## 2.9. THE IMPACT OF INSECURITY SUSTAINABLE CONSTRUCTION

The problems that occur as a result of this huge concrete jungle are even worse. The strong impact of the construction industry on sustainable development has inspired authorities to create sustainable development goals. Knowing the top sustainability issues that the construction industry is responsible for helps to understand the severity of the problem (Ezema, 2009).

## 2.10. CONCLUSION

The construction industry is repeatedly criticized for being inefficient and slow to innovate. Basic construction methods, techniques and technology have changed little since Roman times. But the application of innovation in the construction industry is not straight forward. Each construction project is different, each site is a single prototype, construction work is located in different places, and involves constant movement of personnel and machinery. In addition, weather and other factors can prevent effective use of previous experiences. The term 'advanced construction technology' encompasses a wide range of modern techniques and practices including the latest developments in materials technology, design procedures, quantity surveying, facilities management, services, structural and design analysis, and management studies. Incorporating advanced construction technology into practice can increase levels of quality, efficiency, safety, sustainability and value for money. However, there is often a conflict between traditional industry methods and innovative new practices, and this is often blamed for the relatively slow rate of technology transfer in the industry. The use of advanced construction technology requires appropriate design, commitment from the entire project team, appropriate procurement strategies, good quality control, appropriate training and careful commissioning.

# CHAPTER 3

# METHODOLOGY

## 3.1. INTRODUCTION

It is important to provide a concise and consistent overview of our project, where describing, explaining and predicting phenomena is called methodology, to provide a clearer view of the proposal. This chapter will cover the specifics of the approach used to complete and execute this project well. Many methodologies or results from this field are mainly produced in journals for others to benefit from and improve their future studies. This technique is used to fulfill strategic goals that will produce perfect results. Methodology, to analyze this project. To create an RFI application, all these processes are necessary. To make an application, it is important to follow the procedural steps to ensure that everything goes smoothly.

A detailed needs assessment was carried out during the planning process by providing a questionnaire to the target population. Application specifications will be configured to meet the needs and specifications of the respondents. This process is necessary because this project cannot run smoothly without good planning, and our product will not be developed. It will estimate a date line to fully complete the submission. Then, the programmer or device development process will be completed. Some templates and images are also included in the application to make it brief for users.

Following that, data will be obtained from testing methods for data collection. The application's strengths and limitations will be revealed during this process. If it is not suitable for the user, the application will be reissued to meet the needs and requests of the planning department. Finally, after collecting data from the testing process, data analysis will be conducted.

### 3.2. RESEARCH DESIGN

The test design aims to include the correct study method. The decision to look at the approach is a very important decision in the research design process because it determines how relevant data will be collected for the investigation. However, many interrelated decisions are included in the research design process

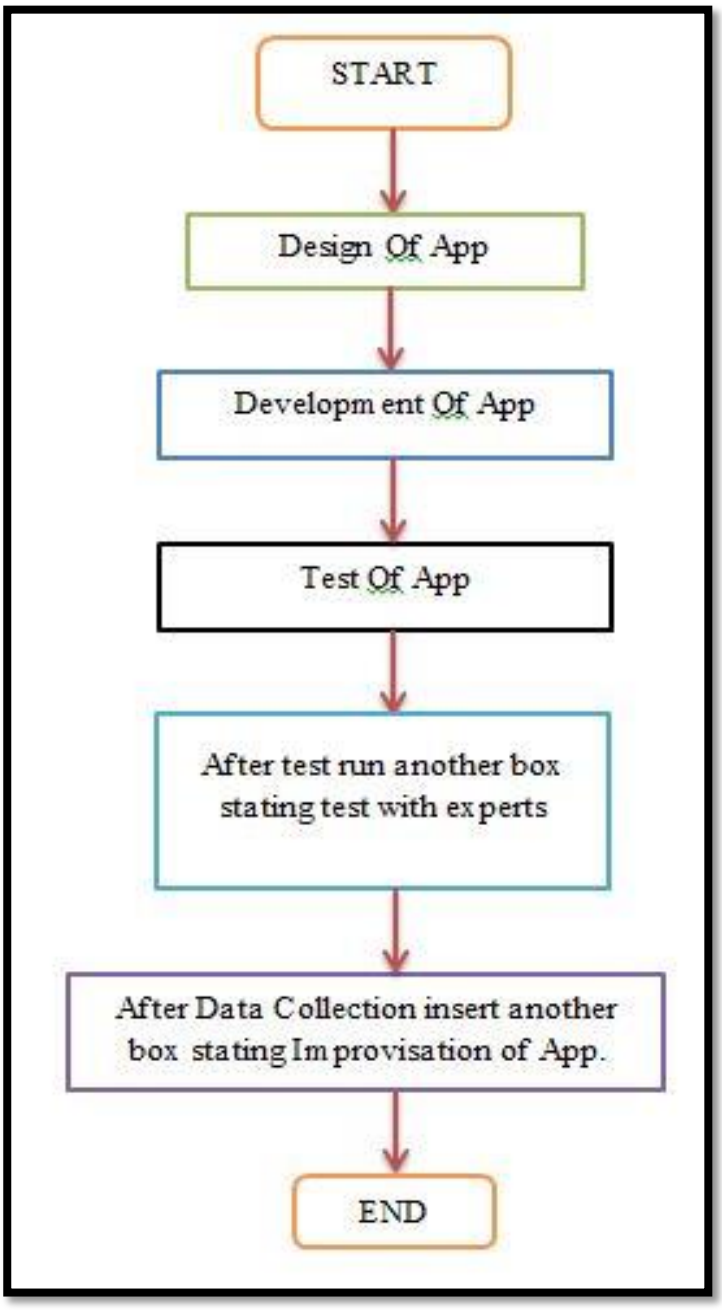



Figure 3.1 : Flowchart for Design Research

In this study, design thinking was used as a research framework. Figure 3.1 shows a flow chart for design research where the study flow that was considered in this project.

The methodology in this analysis is categorized into several levels and will be discussed in detail. In addition, other techniques were used for interviews, reading the results of literature review studies, making questionnaires and previewing the progress achieved during this project. There are three methodological phases that will be involved throughout the process of completing this project, namely:

i. Phase 1: Problem Statement and Literature Reviews
ii. Phase 2: Primary and Secondary data
iii. Phase 3: Conclusion

### 3.2.1. Phase 1 (Problem Statement and Literature Reviews)

The important thing at this stage is to plan the design and review of the project that will be produced. This stage is about gathering information needed for project implementation, as well as communicating with supervisors and mentors. It takes a long time to complete this level.

### 3.2.2. Stage 2 (Primary and Secondary data)

The main goal of this step is to check and compare the previously used and recent applications. The report includes fact-finding procedures, questionnaires and interview methods. The collected data is to build models, prototypes and to proceed to the next stage as well.

i. <u>Preliminary source</u>

Interviews, observation and questionnaire survey was used to collect challenging information.. This interview process is important to obtain certainty and accurate information about the variables measured based on the input collected from the survey. Through direct contact with those involved in construction projects involving contractors and consultants, this information is gathered.

ii. Secondary source

Secondary sources are information from various sources. These data reinforce the need for this research. These details are also required to obtain additional information on this report. Additional details are collected by project as information.

References used in this research are papers, Internet and company data collection. At this point, interface sketches are needed and additional functionality needs to be developed in the mobile application. First, detail the performance and feedback of the mobile application as a guide to the creation of a prototype to be introduced to mentors and supervisors at this stage. After that the system is developed as a program that can execute all the programs in the execution stage, using the applications that have been identified as RFI applications.

### 3.2.3. Phase 3 (Conclusion)

Some tasks was run immediately after the completion of the entire mobile application where the device was checked to ensure that the application execution does not have any compile or run time errors or problems.

## 3.3 PROCESS OF DEVELOPMENT

The majority of system development approaches are widely employed. Many techniques are influenced by the use of application development tools, the software architecture in which the application is housed, and the choice between building and purchasing. Regardless of the environment or available resources, all system development activities should be carried out using the usual steps and procedures.

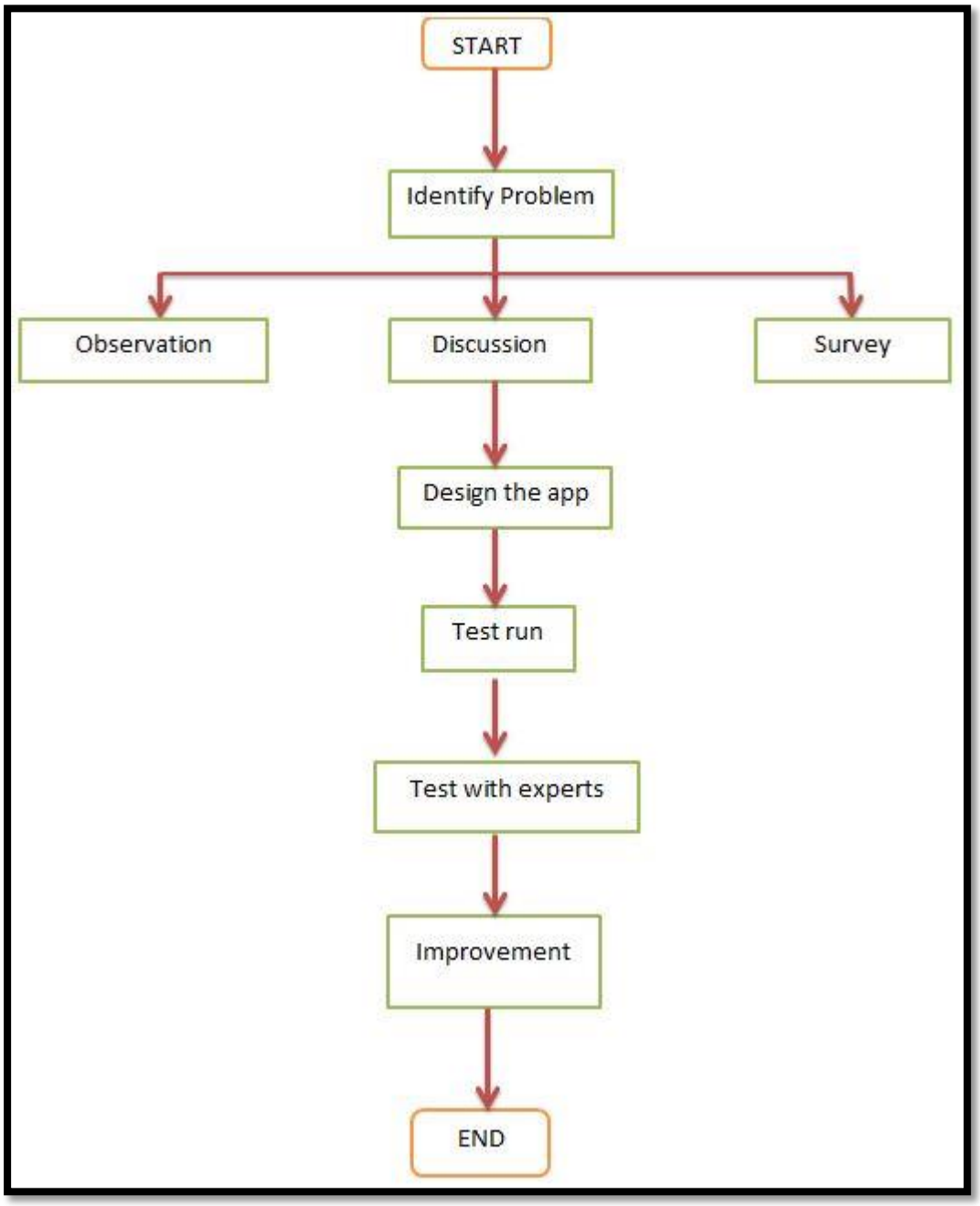



Figure 3.3: Flowchart Process of Develop FRI App

### 3.3.1. PLANNING

This is the initial phase of the system development process. This establishes whether or not a new system needs to be developed in order to achieve a company's strategic goals. It is a backup plan for a company's business endeavour to get the funding needed to create the infrastructure to change or grow a service. The company might endeavour to live up to the expectations of its stakeholders, customers, and employees. This action tries to evaluate the severity of the issue and suggest solutions. Considerations at this level include money, costs, time, advantages, and other factors.

### 3.3.2. SYSTEM DESIGN

The second stage outlines the parameters, characteristics and operations required to satisfy the system`s functional requirements. This is the step by which end users will address their business information requirement for a proposed system and evaluate them, during that step, the main components (application), (network capabilities), processing and methods for the system to fulfill its object will be considered.

### 3.3.3. DEVELOP

The third step is when the actual project work begins, especially when the main project work is done by programmers, network engineers or database developers. Such work involves the use of flux diagrams to ensure the correct operational structure of the system. The development phase marks the end of the first part of the process. This process also marks the beginning of development. Entry and transition are also characteristic of developmental phases. Training can be a major advantage during this period.

### 3.3.4. COMPILE THE FORM

The fourth step consists of writing the bulk of the program code. In addition, the current implementation of the newly developed system is involved in this point. In this phase, the project enters into production through a direct cut-out, transferring the data and components from the old system to the new one. Although this can be risky and complex step, the cut-off usually takes place during peak hours and minimizes the risk. The success of the project that has introduced improvements should now be seen by both observers and end users

### 3.3.5. TEST RUN/USING ON REAL SITUATION

In the fifth stage, system development and system testing—typically performed by Quality Assurance (QA) practitioners—are involved to assess whether the proposed concept meets the initial set of progress objectives. Testing, especially to verify errors, bugs and operability, may be repeated. Such checks are carried out to the satisfaction of the end user. Verification and validation is another aspect of this process, both of which help ensure that program milestones are achieved.

## 3.4 IDENTIFY THE PROBLEM

Problems arise when a place cannot be concreted due to an incomplete request for inspection (RFI) document verified by several consultants. This is because some consultants will perform on-site inspections at different times than other consultants. therefore, when wanting to get a signature from the consultant, the consultant has an outside business that results in the RFI document not being able to get a signature from the consultant and resulting in areas that are to be concretized.

## 3.5 OBSERVATION

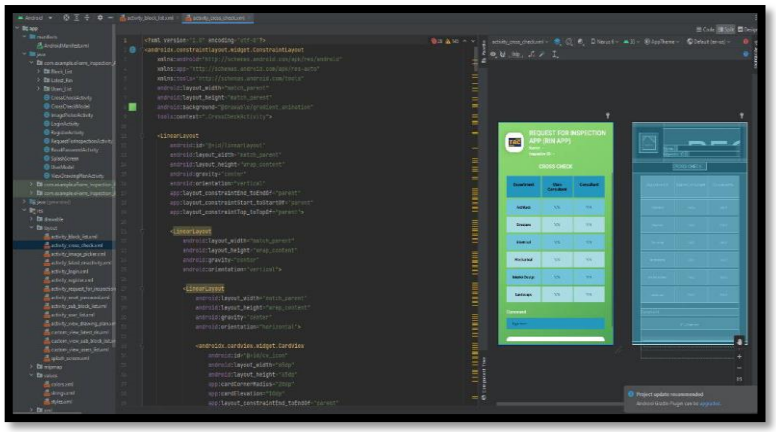
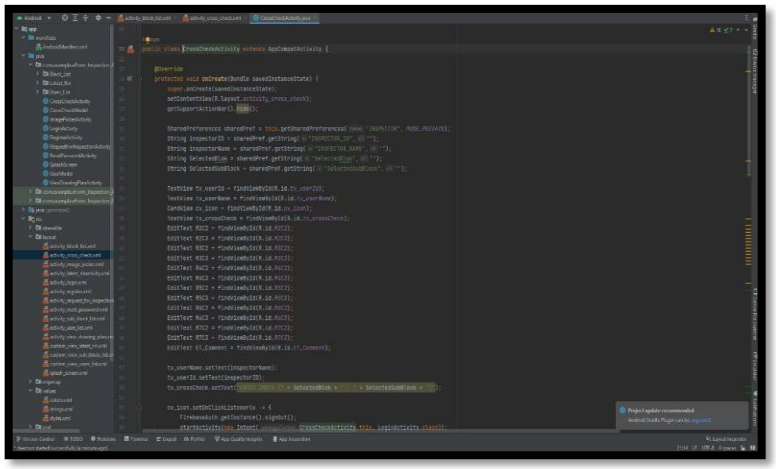
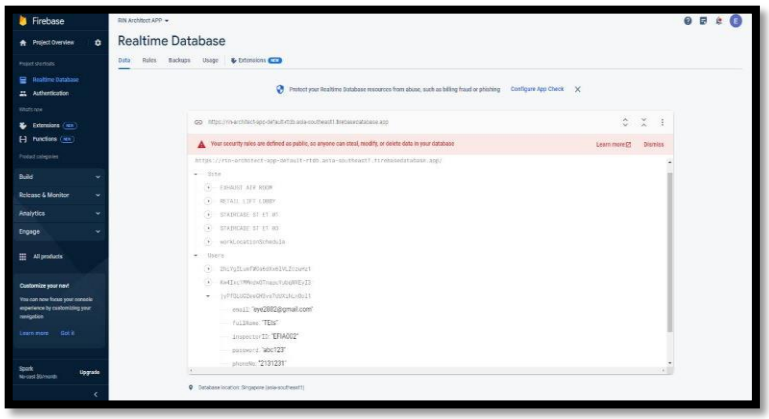
The observation on the issue was made and discussed with various staffs such as main contractors, sub-contractors and consultants. All parties agree that the problem is one of the problems faced at this construction site.

## 3.6 SURVEY

Surveys have been conducted with various parties such as main contractors and consultants. A survey has been conducted to find out if the problem has a negative impact on the construction site. The survey was given to individuals closely related to structural concrete works.

## 3.7 APP DESIGN

Table 3.4 : App Design

| | |
|---|---|
|  | Design user interface |
|  | Design nagivation |
|  | Design background process such as database connection and user information. |

### 3.8 TEST RUN

Once the RIN App is ready, the app was tested first before it can be fully used. the results after being tested, the app can be used in good condition and meet the requested requirements.

### 3.9 TEST WITH EXPERTS

The RIN App was also tested with experts from the construction field such as main contractors, sub contractors and consultants. some of them are satisfied with the functionality of the app. while some were also satisfied with the functionality of the app but still requires some improvisations.

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### 3.10 IMPROVEMENT

After getting opinions from experts in the construction site, the majority said there should be some improvements to the app. Among them is the cross trade in the app that can be downloaded to a pdf file if needed. In addition, show the word "complete" for each RFI that has been approved for concrete.

### 3.11 FLOW CHART OF APP USE

Figure 3.13 shows the manual user for RFI App

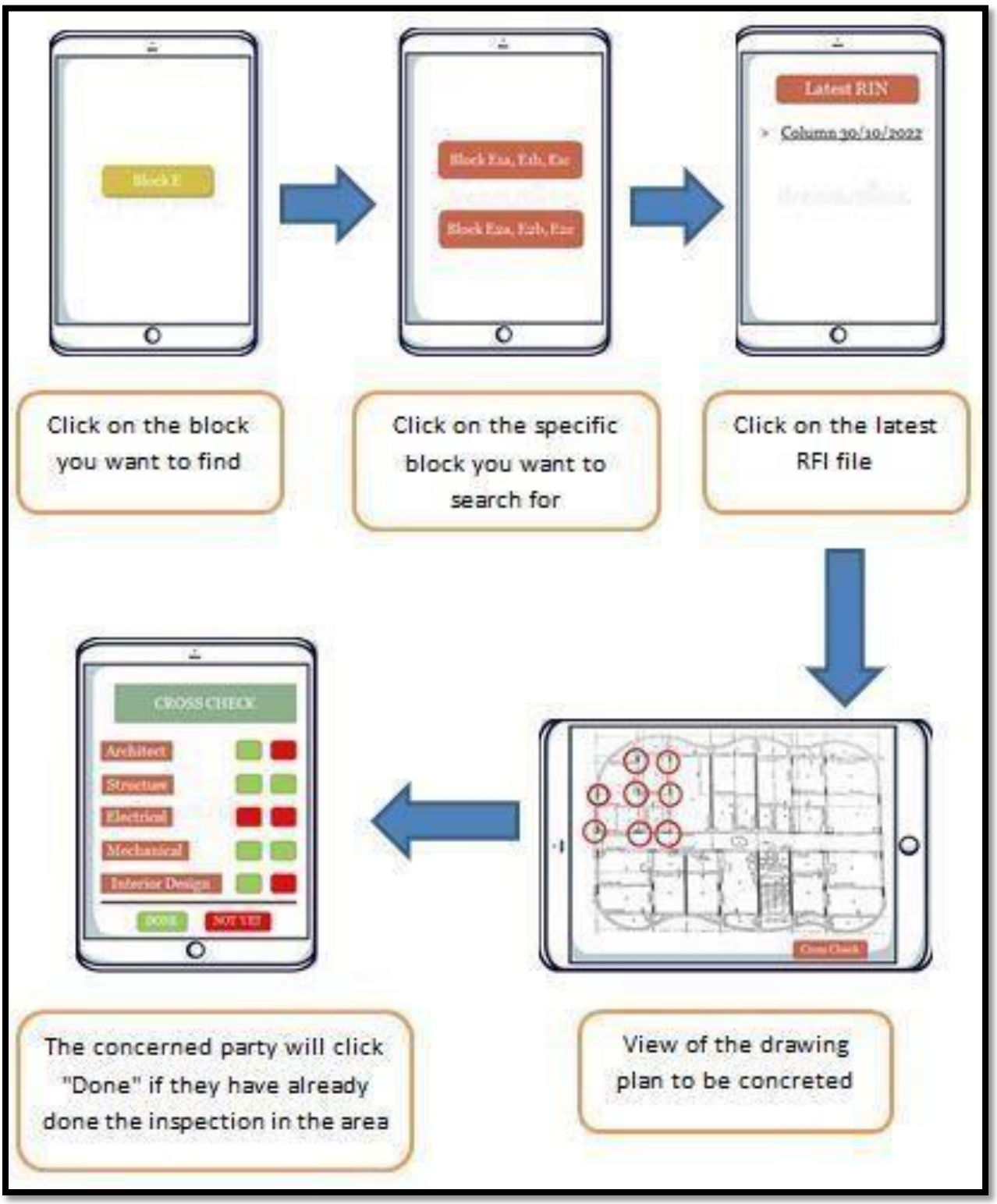


Figure 3.13: Manual user for RFI App

## 3.12 CONCLUSION

The conclusion that can be given in this chapter is how it discusses the method of data collection and research information. To determine the results, the collected data will be analyzed. In addition, this chapter also focuses on the location, respondents, research methods, data interpretation, and work steps performed during the review process.

In addition, the methods that will be used will also be fully explained based on the existing problems as well as the selection of the appropriate system when used and suitable for application in the site. Based on all work that can be achieved, this is based on existing references such as articles, interviews, experiences and other factors. Next in this chapter will be attached the process path that will be implemented for this project and will be used in the work environment when on site.

# CHAPTER 4

# FINDING AND ANALYSIS

## 4.1 INTRODUCTION

From the study, it shows the results and data in the research obtained from questionnaires and through interviews from the site. This chapter also discusses the objective results of this project. It will describe the results obtained for the objective and will identify whether the objective was achieved or not.

## 4.2 DATA COLLECTION AND FINDING

This chapter is based on a questionnaire provided to project managers, engineer, site supervisor and sub. contractor so they can find out what is needed to enhance the record management system in the field. This section is open to respondents. The surveys were carried out by only a few people were involved t. The analyses will be completed and the studies will be presented in table form, diagram and figure in order to illustrate the main facts.

## 4.3 DATA COLLECTION OF QUESTIONNAIRE

According QuestionnairePro (2021), questionnaire is a research tool that consists of a set of questions or other forms of prompts designed to gather data from a respondent. A typical research questionnaire has a combination of closed-ended and open-ended questions. Long-form, open-ended inquiries allow the reply to elaborate on their opinions. The information gathered from a data gathering questionnaire can be qualitative or quantitative. A questionnaire might be provided in the form of a survey or not, but a survey must always include a questionnaire.

## 4.4 OUTCOME FROM PRE-SURVEY

Pre-survey has been done to the parties dealing through interviews in structural concrete works regarding the problems that occur on the construction site. The pre-survey was given to 20 respondents to find out if the problem really happened at the construction site. Based on the pre-survey that has been made, one of the majority answers from the respondents is that the existing method is indeed slowing down the business for concrete at the construction site. In addition, existing methods use a lot of paper for the use of RFI documents.

## 4.5. OUTCOME FROM EXPERT TESTING

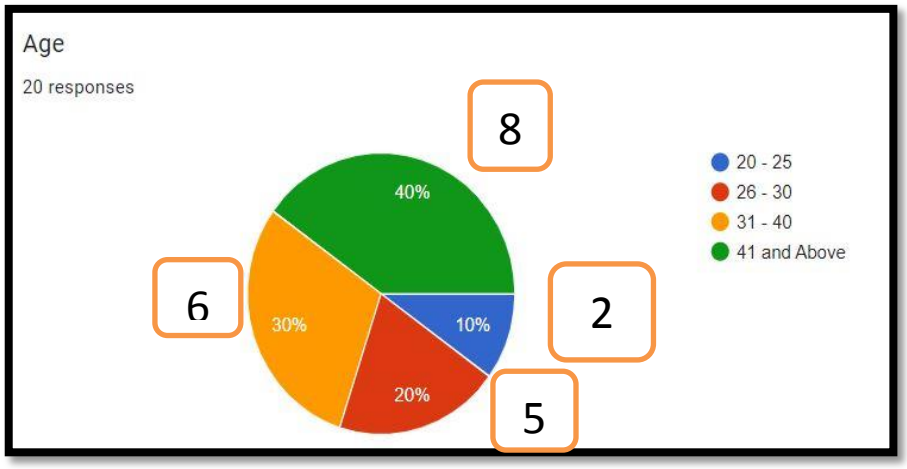


Figure 4.1: Age Of The Respondents

Diagram 4.1 shows that the age of the highest respondent is above the age of 41 years as many as 8 people. Besides that, the second highest is 31-40 years old with 6 people. The third is the age of 26-30 years as many as 5 people and the last is the age of 20-25 years as many as 2 people.

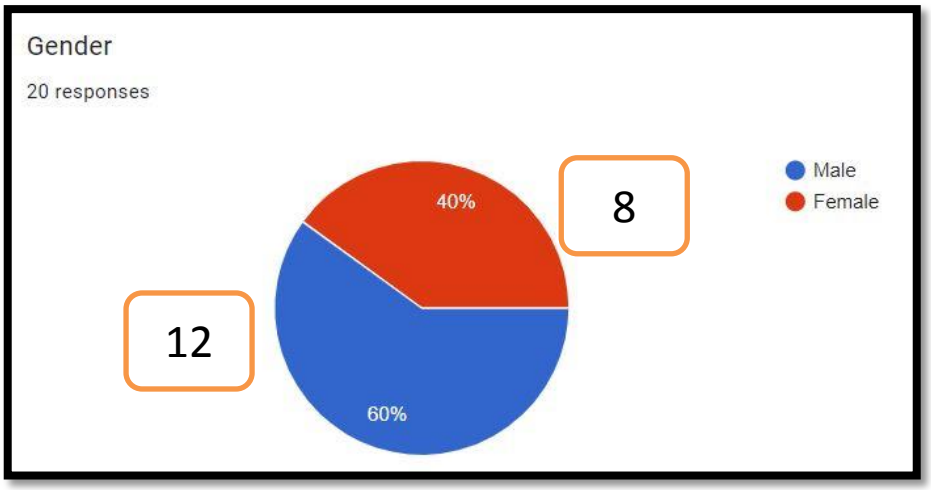


Figure 4.2: Gender Of The Respondents

Diagram 4.2 shows that the largest number of respondents are among men as many as 12 people. Where female respondents are as many as 8 people.

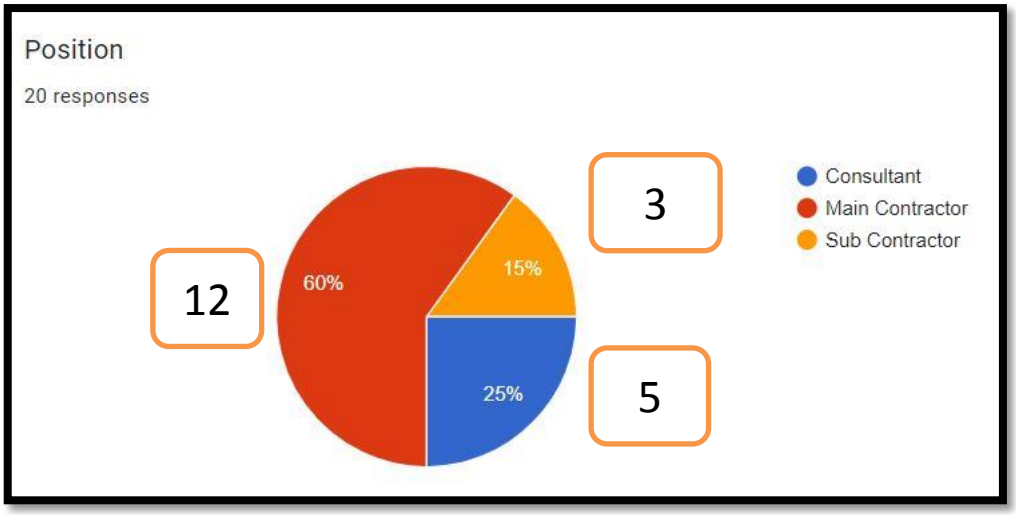


Figure 4.3: Position Of The Respondents

Diagram 4.3 shows that the largest number of respondents are among the main contractors which are 12 people. Besides that, the second highest is the group of consultants which is 5 people and the lowest is the group of sub-contractors which is 3 people.

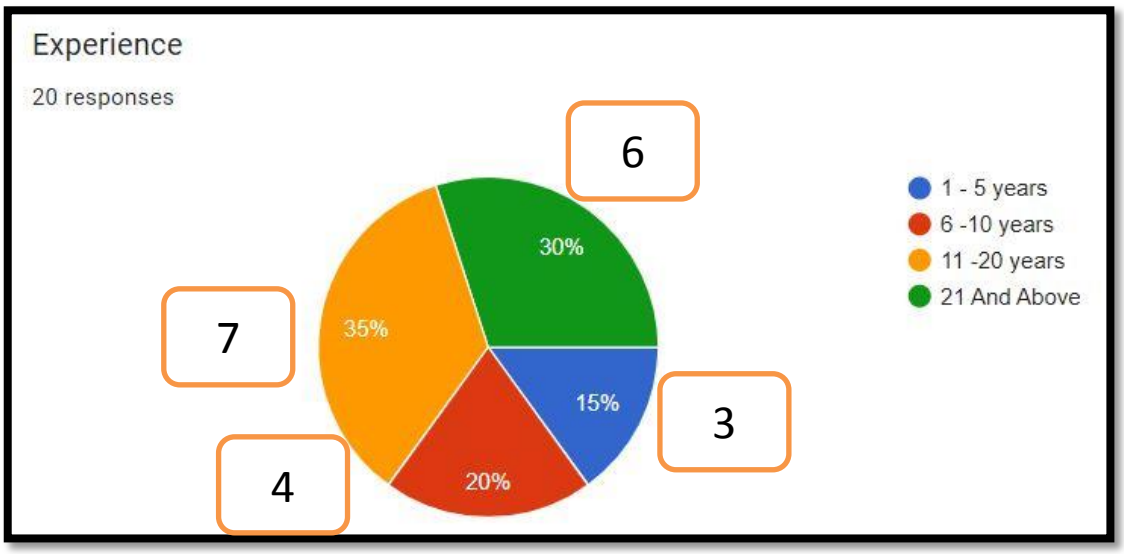


Figure 4.4: Experience Work  Of The Respondents

Diagram 4.4 shows that the longest work experience by respondents is 7 people which is for 11-20 years. The second highest is 6 people who are 21 years old and above. The third is 4 people for 6-10 years. The last one is 3 people for 1-5 years.

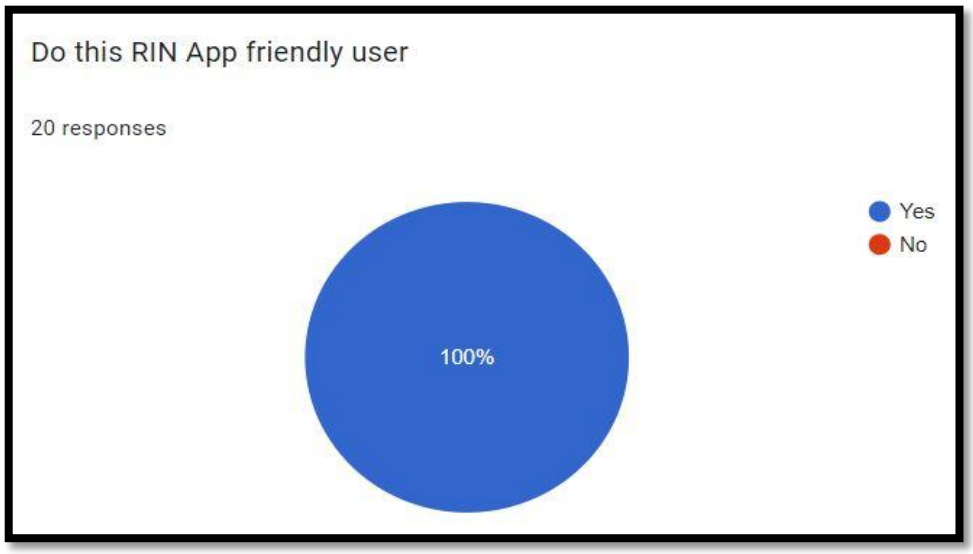


Figure 4.5: Do this RIN App user friendly

Diagram 4.5 shows that 20 respondents agree that RIN App is user friendly

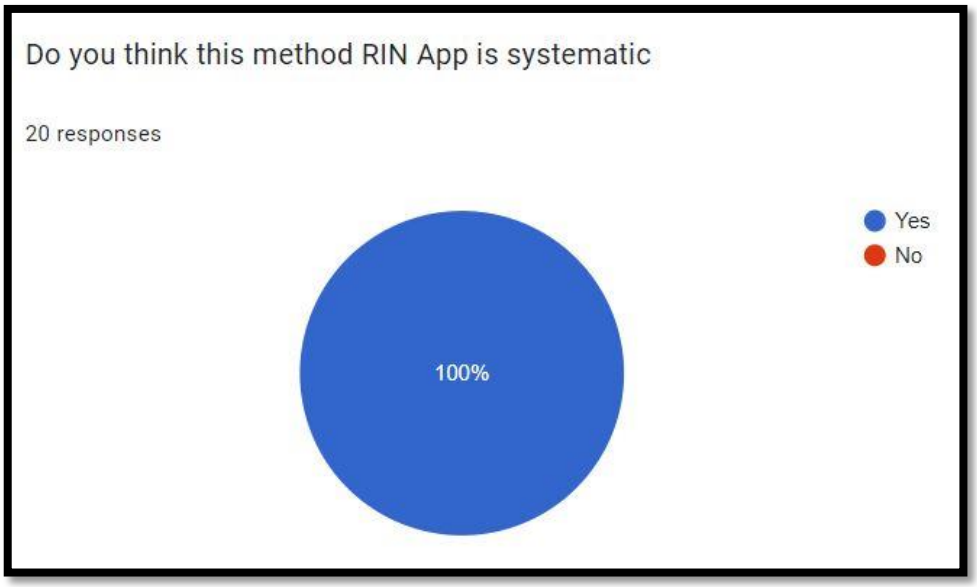


Figure 4.6: Do you think this RIN App is systematic

Figure 4.6 shows that 20 respondents agree that RIN App is systematic

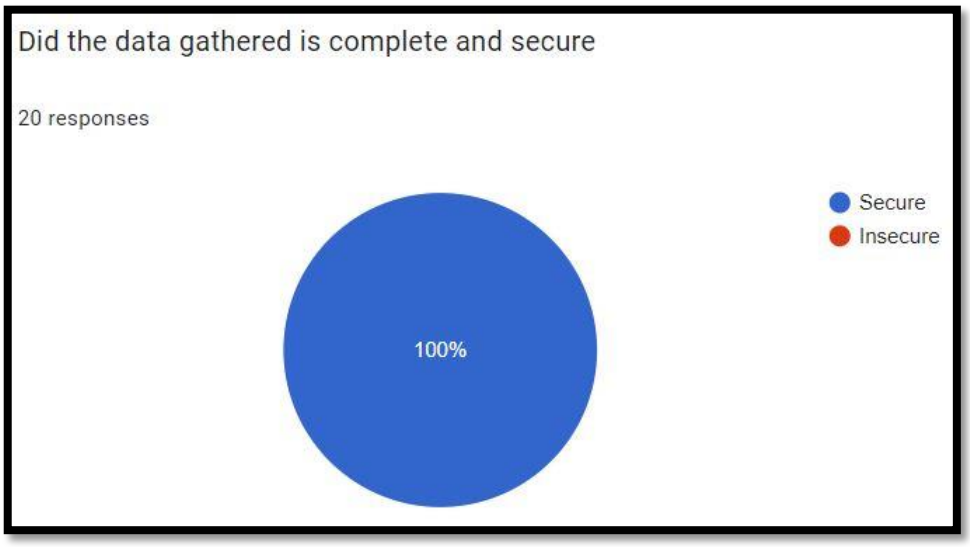


Figure 47: Did the data gathered is complete and secure

Figure 4.7 shows that 20 respondents agree that the data in the RIN App is complete and secure

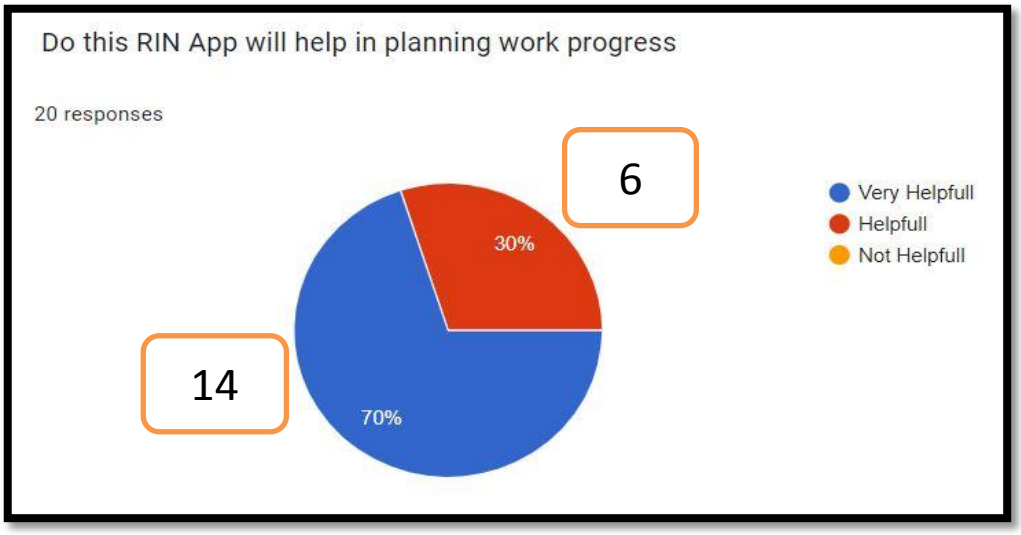


Figure 4.8: Do this RIN App will help in planning work progress

Figure 4.8 shows that 14 respondents said that the RIN App is very helpful in planning work progress. On the other hand, 6 respondents said that the RIN App helped a little in planning work progress.

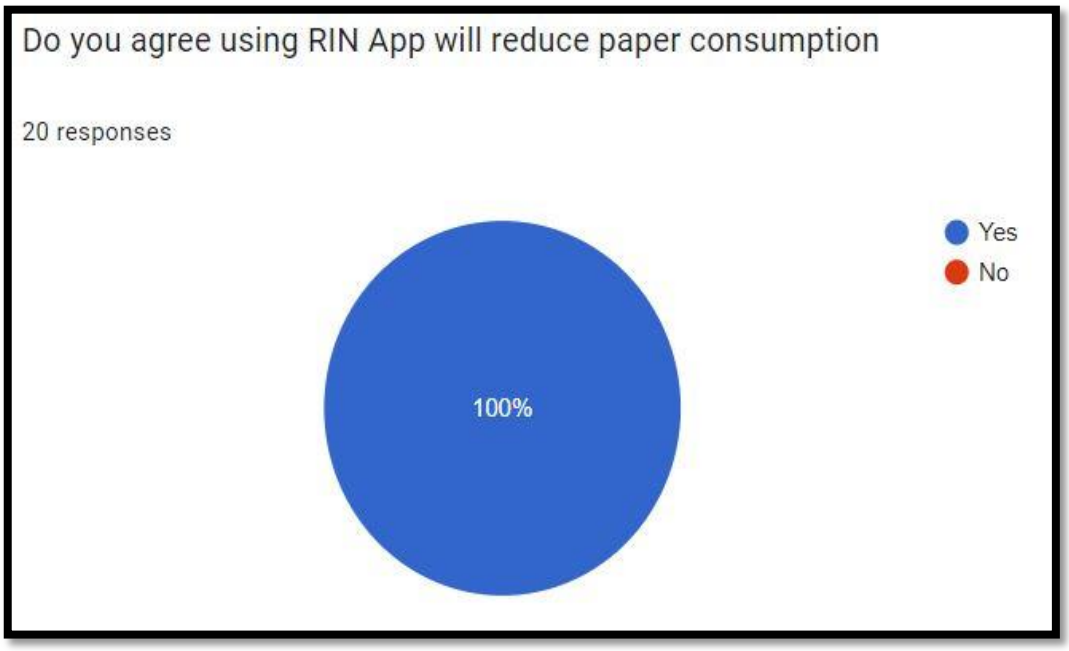


Figure 4.9: Do you agree using RIN App will reduce paper consumption

Figure 4.9 shows that 20 respondents agree that this RIN App can reduce the use of paper.

## 4.5 CONCLUSION

The data from the questionnaire for the first and third objectives have been analyzed, which is to evaluate the effectiveness of the RIN App and identify whether the development of this application is able to reduce the use of paper for internal use.

The results of the first objective questionnaire showed that the majority of respondents said they still use paper forms for daily progress. As a result, there is a lot of waste of paper. So, with the RIN App, it can solve the problems that occur.

To achieve the 3rd objective, respondents were shown the functions of the RIN App and its advantages. Through the questionnaire responses, the majority of them agreed with the effectiveness of the RIN App that helps make work more efficient, easily accessible and can reduce the use of paper.

# CHAPTER 5

# CONCLUSION AND RECOMMENDATION

## 5.1 INTRODUCTION

This chapter presents a summary of the findings, conclusions and recommendations based on the data analyzed in the previous chapter. The findings of the research have been prepared according to the objectives of the project has been determined. To evaluate effectiveness of E-RIN App preparation, compilation and submission for 8MD3 Project at Precint 8, Putrajaya evaluated by respondents from among construction workers.

## 5.2 CONCLUSION

The research framework in this study is design thinking. Design Thinking is a design methodology technique that provides a solution-based approach to problem solving. It is particularly beneficial in addressing complex challenges that are unclear or unknown by understanding the human needs involved by reframing the problem in a human-centered, brainstorming manner. various ideas, and use a hands-on approach in prototyping and testing.

The main objective of the study is to identify the issue of requests for inspections at the TRC 8md3 project for current site documentation. From the findings of the analytical questionnaire, it shows that the majority of respondents face problems when managing verification matters from various parties, especially when using conventional methods to meet face-to-face based on paper and also employees cannot make forms on site and must do it at the site office.

After the problem is stated well, the results come out with the second objective of the study which is to develop an E-Rin application using a mobile application. Chapter 3 has examined the methodology during the study mainly to create a construction document development system. The majority of documents used for this system are in the form of defect list reports for construction work.

As with the previous purpose, expect validation surveys to be distributed to evaluate comments on the effectiveness of the system during document management. According to the findings, the respondents strongly believe that the E-RIN App is very helpful for handling paper at the construction site.

Overall from the results of interviews, observations and questionnaires, it can be concluded that they have more or less problems that occur when managing documents. The respondents agreed that all the difficulties that occurred in the site office affected their work. The E-RIN App has been tested on the job site and proved beneficial for document management. E-RIN App helps in the creation of forms such as site defect reports and concrete area reports, as well as being effective in document management and easy to use. E-RIN App is recommended for use on construction sites as users are satisfied with this user-friendly application in document management.

## 5.3 RECOMMENDATION

As a result of the aforementioned findings, there are some recommendations that can be utilized as a guide or as a follow-up action to improve the use of the E-Defects Inspector System (RIN App). The recommendations are as follows :

1) Convert from soft copy to hard copy if needed..

2) Publish in google play application to make it easier for other users to get the latest version of software.

3) Able to be use without using internet (offline).

4) Further research into this study can be carried out in order to improve the RIN App from time to time in order to refresh the information and improve the function.

## 5.4 ADVANTAGE OF E-RIN APP

There are some advantages of using the E-RIN App. The advantages are as follows :

i. Manageable Reporting Preparation

The function of the E-RIN App is to report the preparation process starting from the compilation, completion, verification and submission process. E-RIN App is very convenient on the construction site because all relevant parties on the site have access to the application by using a phone with internet coverage. All data information can be updated using the mobile application and reports can be generated automatically.

ii. Increased Productivity

E-RIN App helps to improve the report preparation process for better quality of observation reports. This application can be opened using a phone or laptop, can also be used anytime and anywhere on the construction site.

iii. Paper Reduction and Sustainability

E-RIN App is an effective application for quality report observation submission process as reports can be shared through online platforms such as email or WhatsApp. It can be accessed to review via mobile before printing the final report. This application is very sustainable for use on construction sites as it helps to reduce the excessive use of paper.

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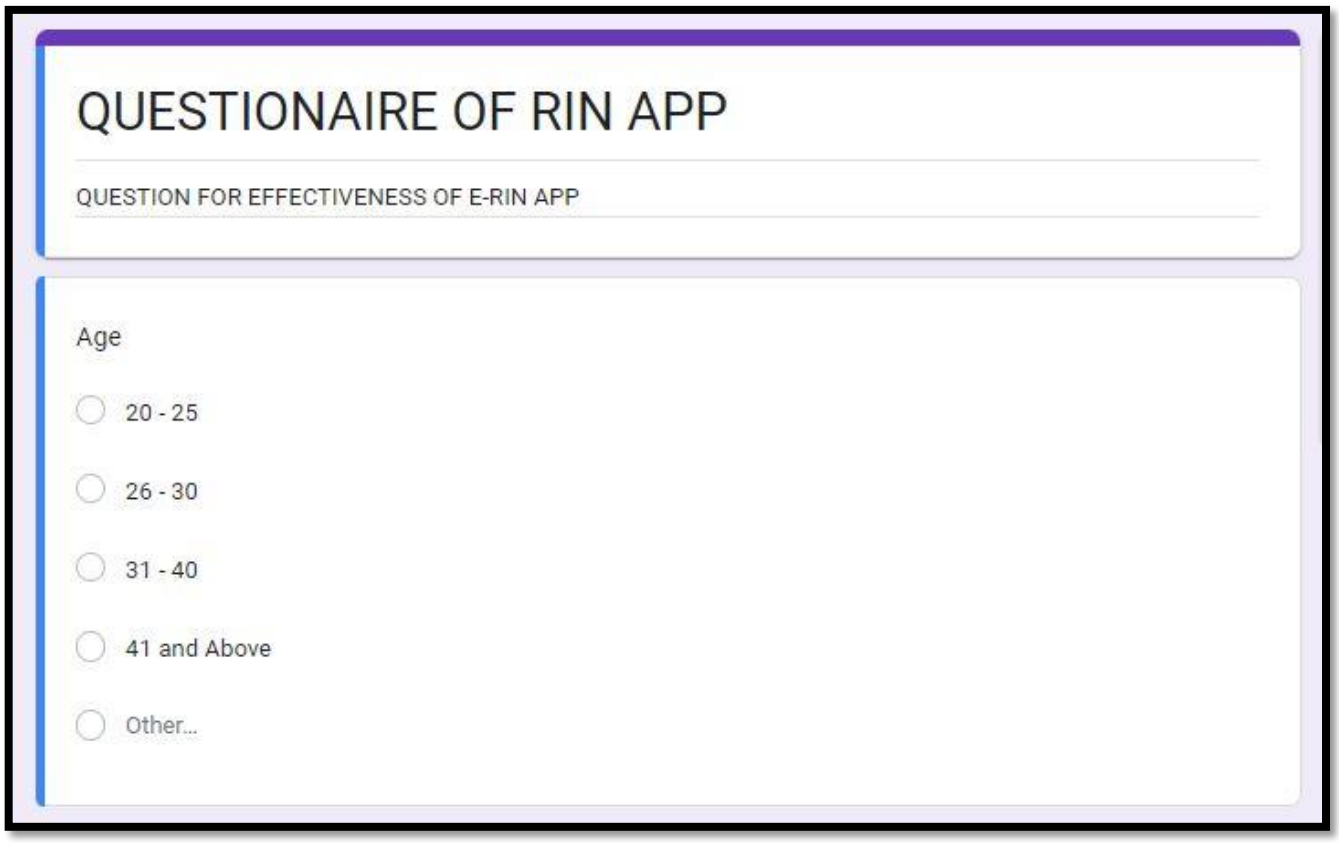
# APPENDIX

**APPENDIX A**



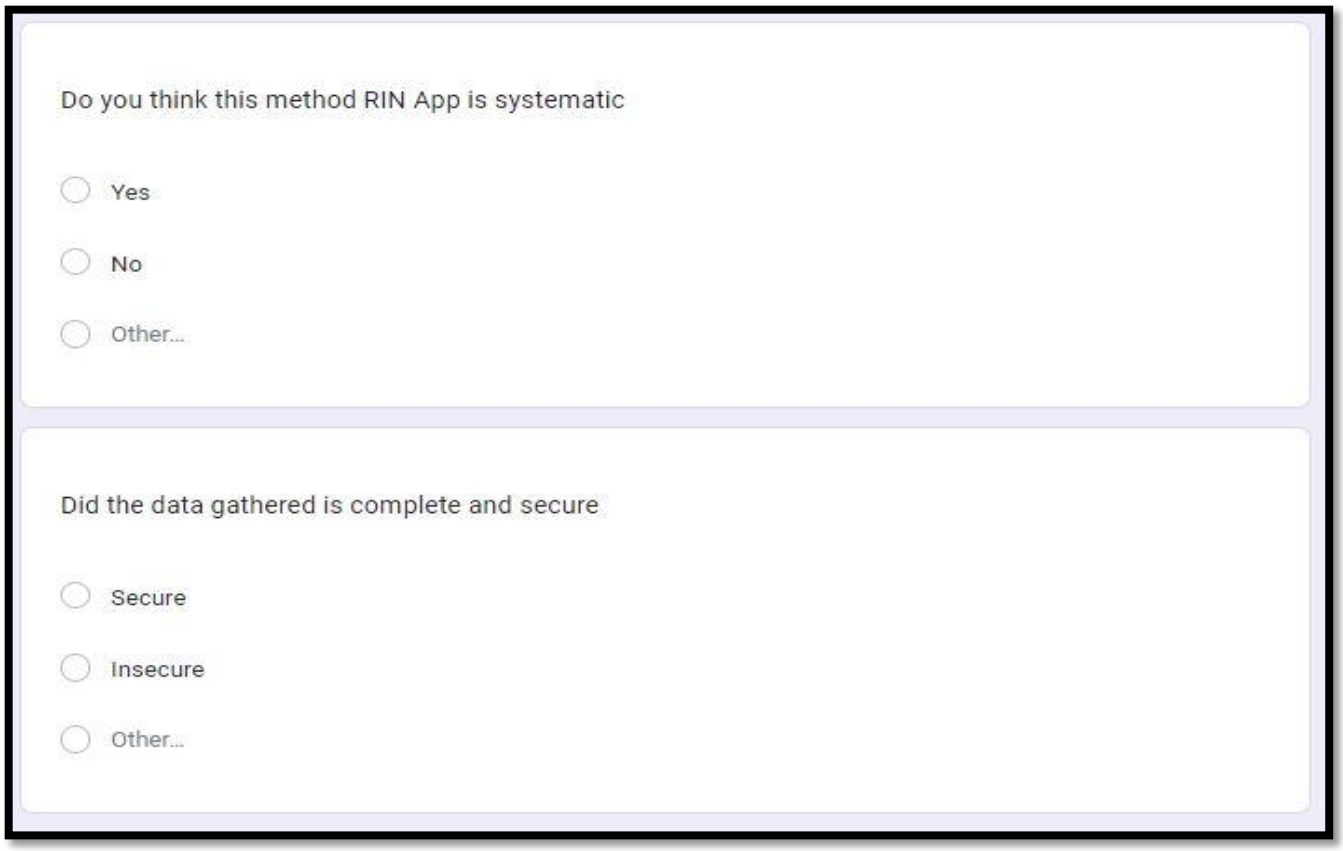
QUESTIONAIRE OF RIN APP

QUESTION FOR EFFECTIVENESS OF E-RIN APP

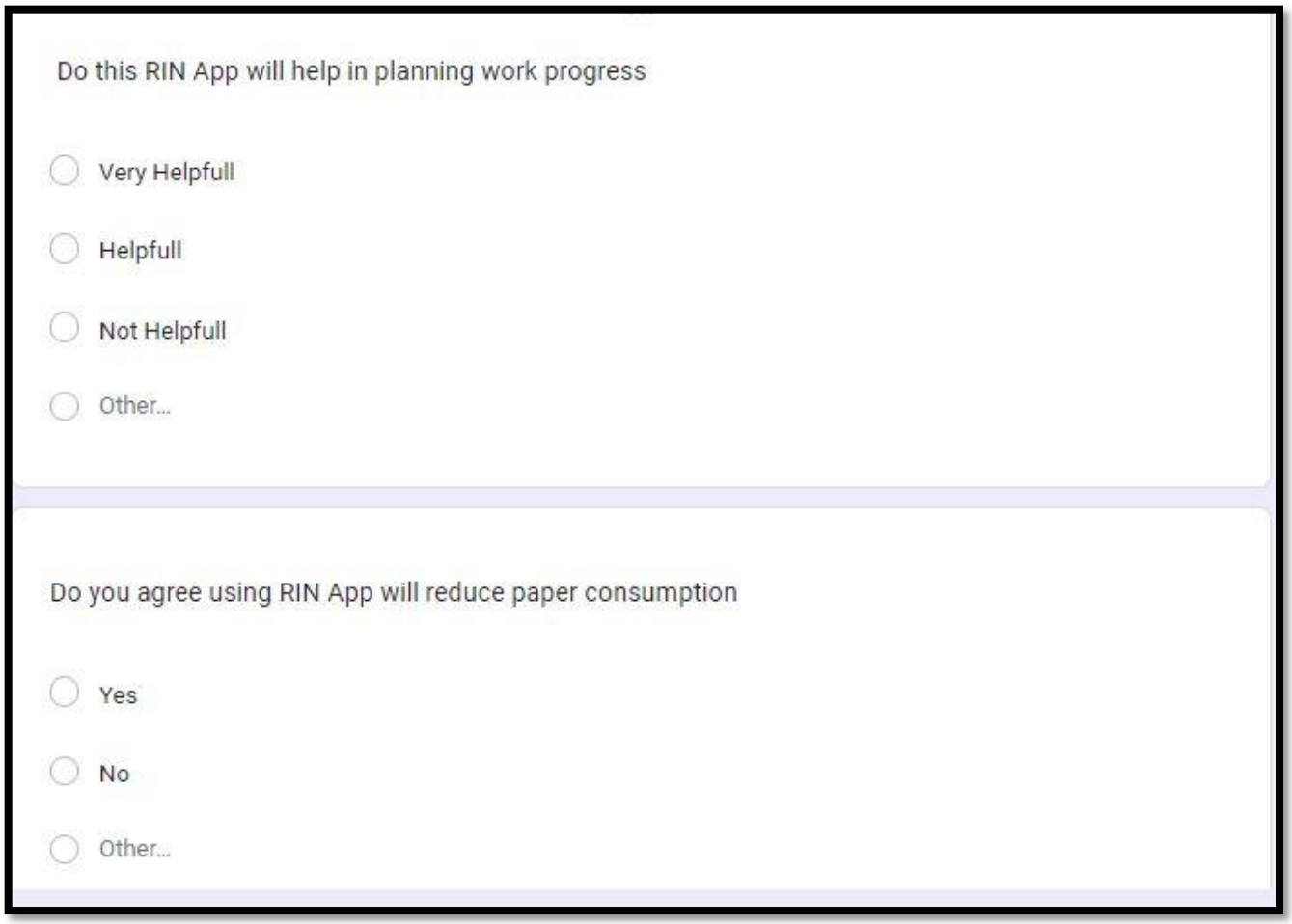
Age

- 20 - 25
- 26 - 30
- 31 - 40
- 41 and Above
- Other...

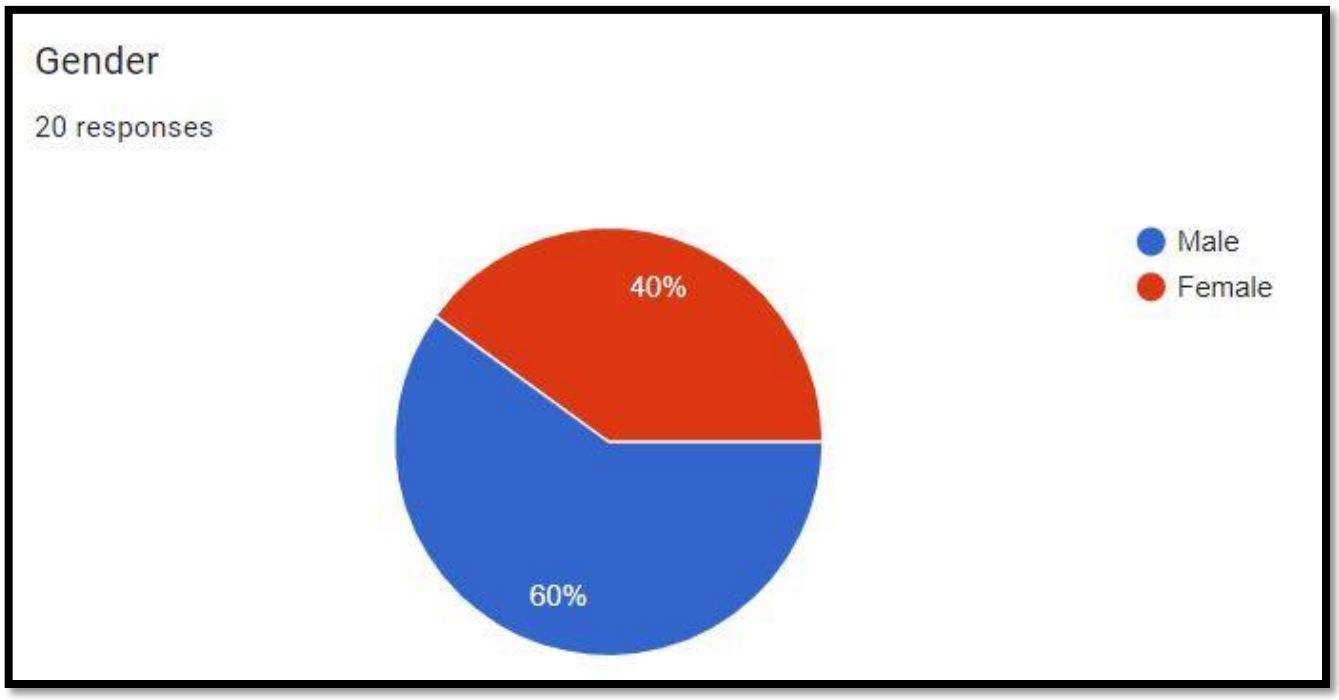

Experience
1 - 5 years
6 -10 years
11 -20 years
21 And Above
Other...
Do this RIN App friendly user
Yes
No

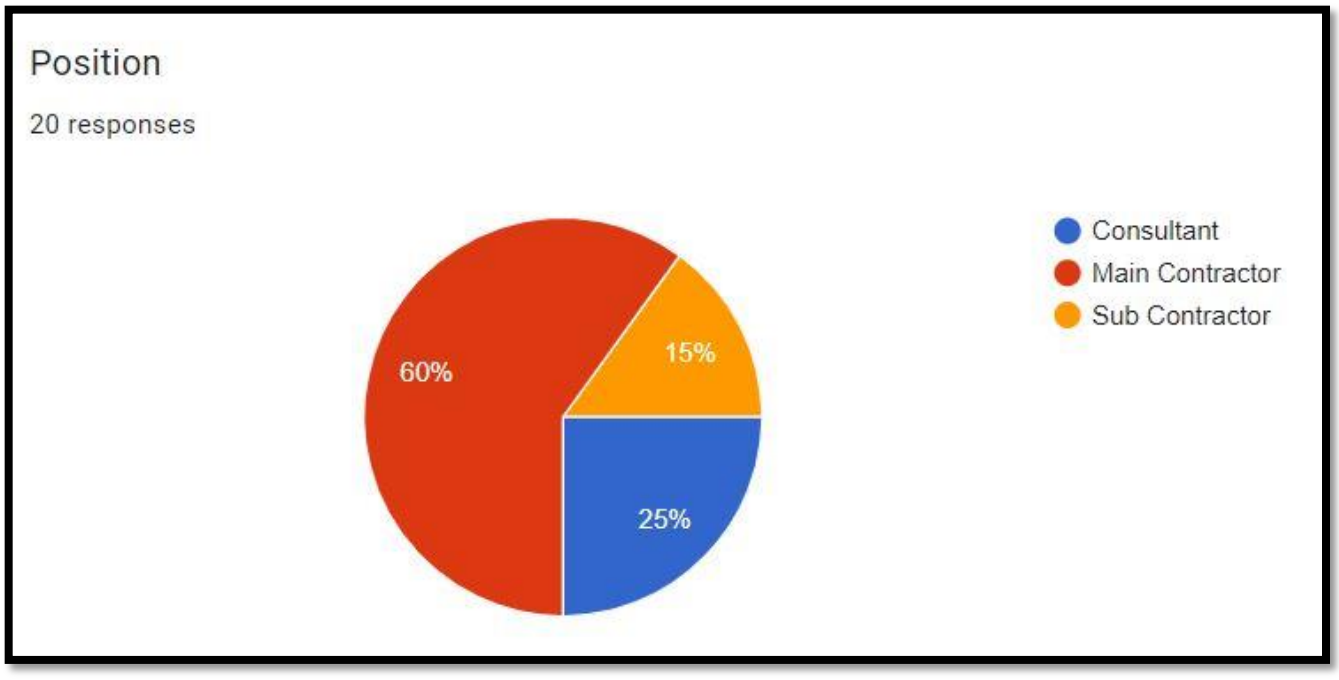

Do you think this method RIN App is systematic
Yes
No
Other...
Did the data gathered is complete and secure
Secure
Insecure
Other...

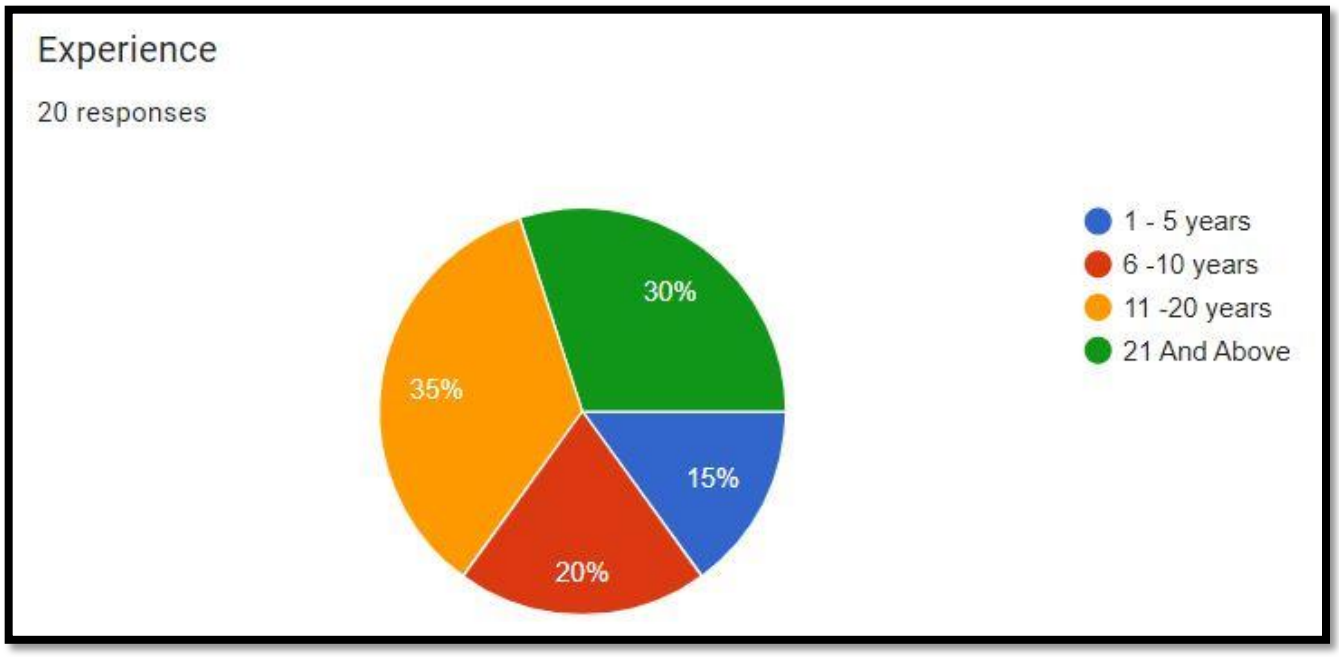

Gender
Male
Female
Other...
Position
Consultant
Main Contractor
Sub Contractor
Other...

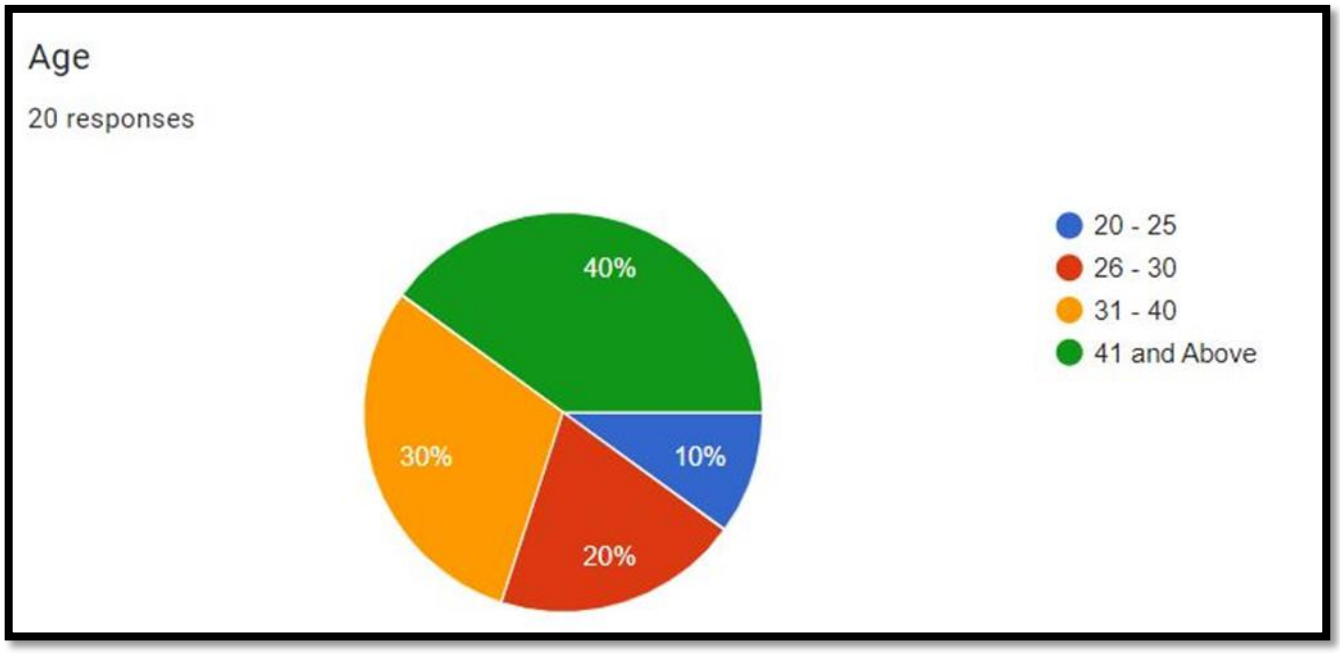

Do this RIN App will help in planning work progress
Very Helpfull
Helpfull
Not Helpfull
Other...
Do you agree using RIN App will reduce paper consumption
Yes
No
Other...

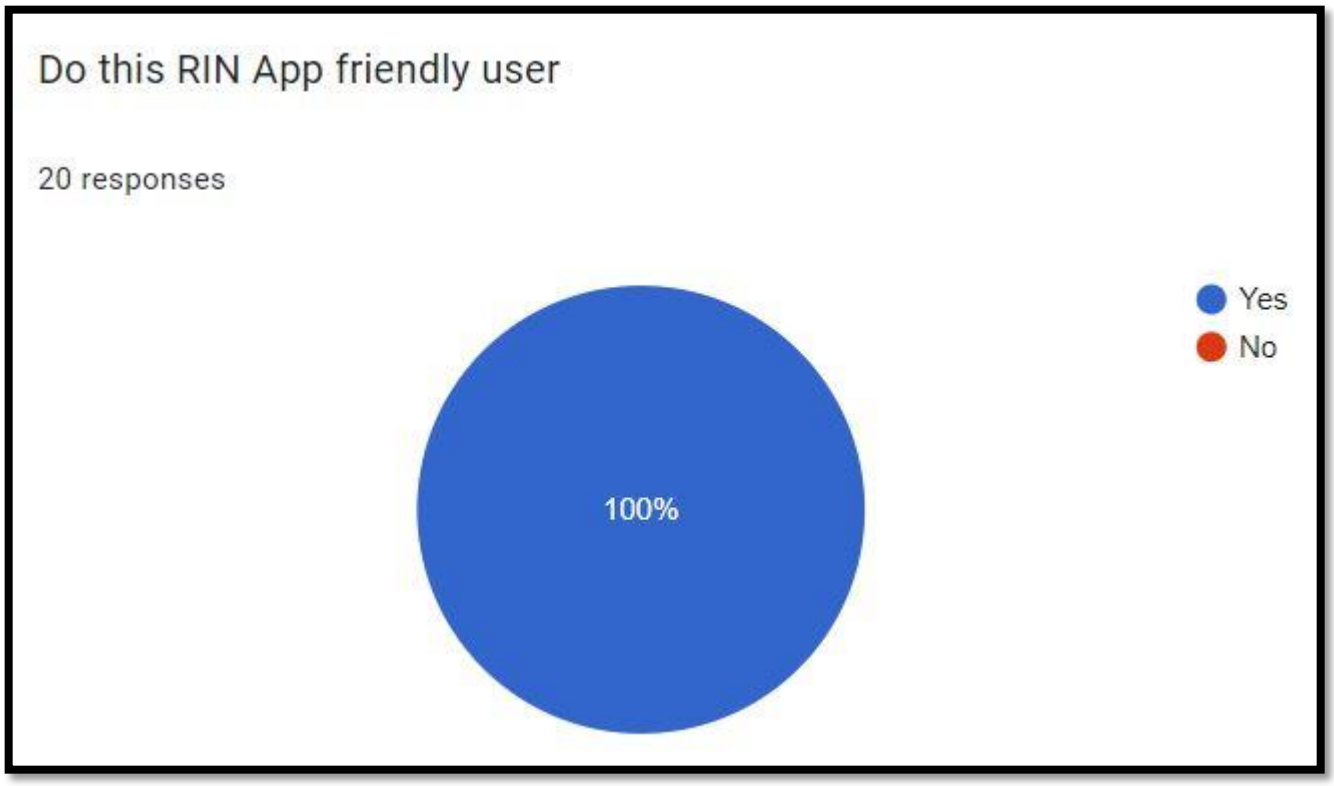
**APPENDIX B**

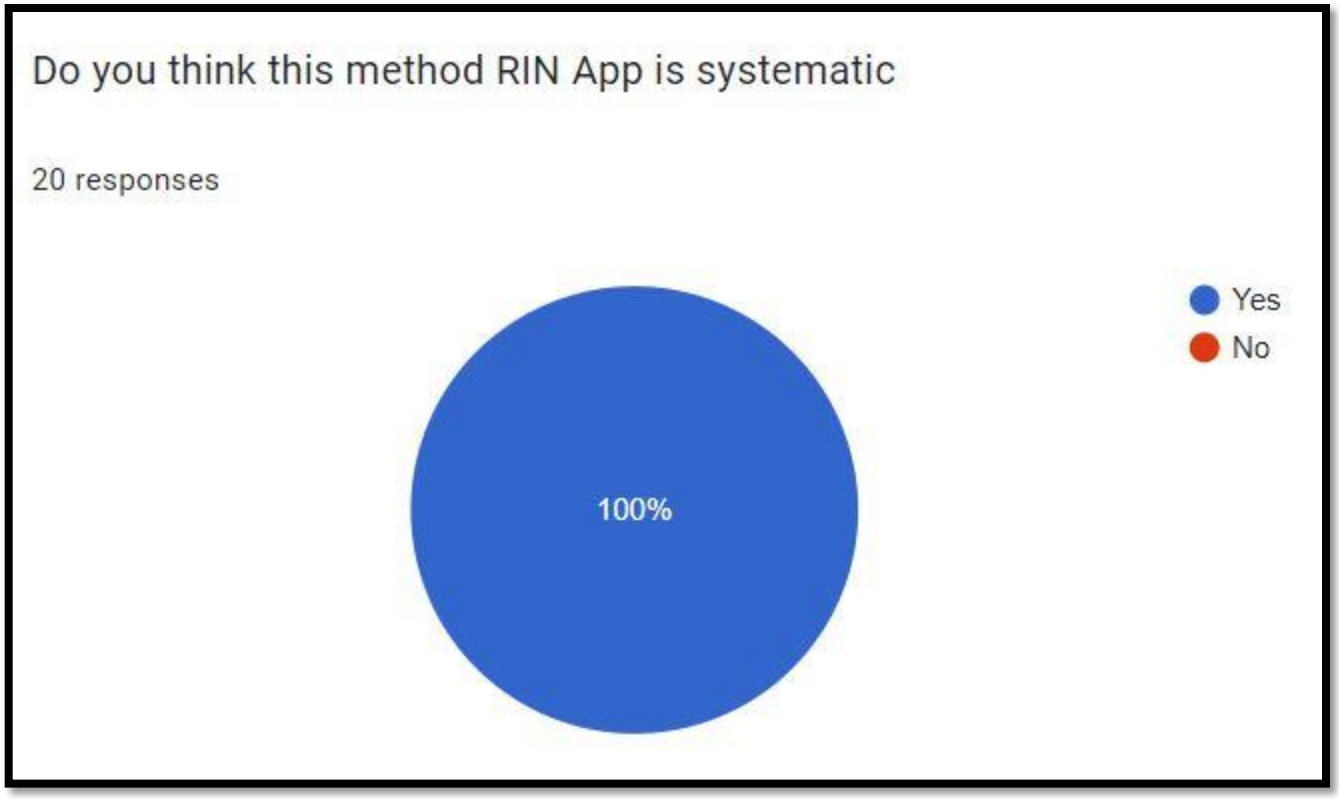

Gender
20 responses
40%
60%
Male
Female

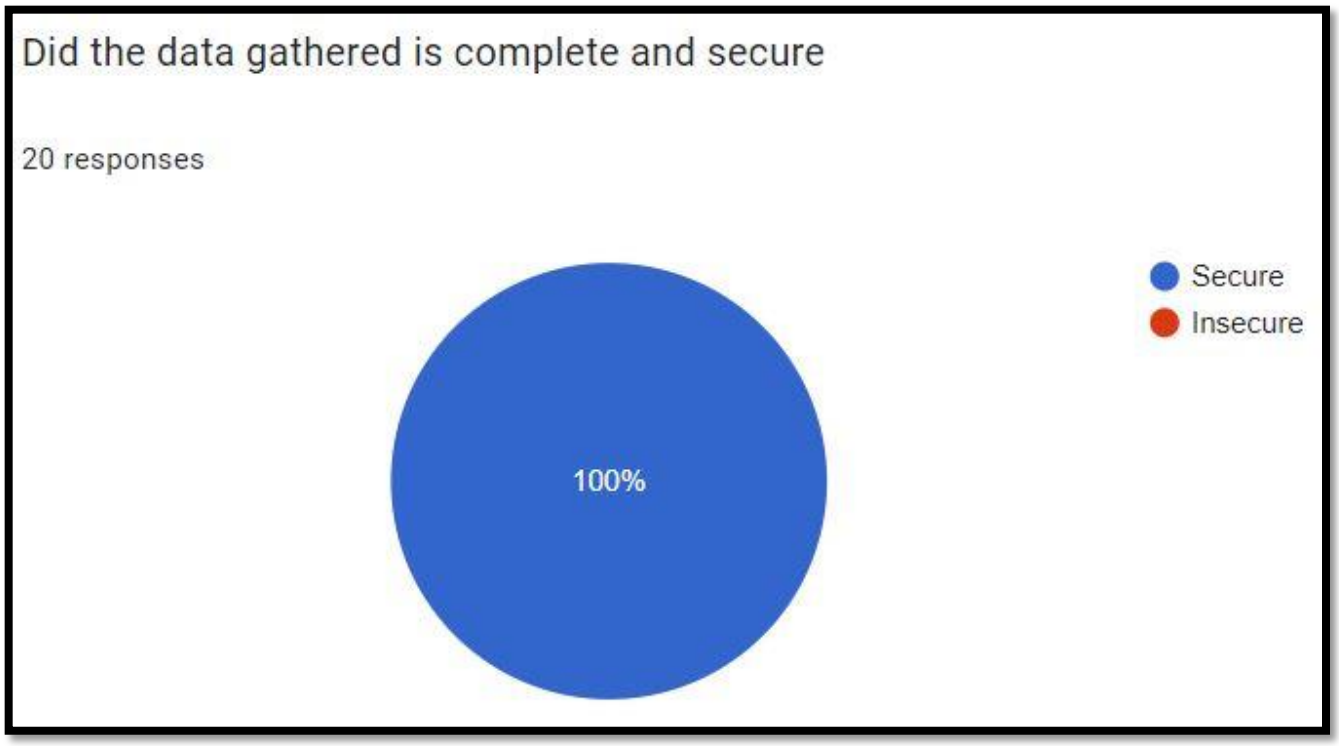

Position
20 responses
60%
15%
25%
Consultant
Main Contractor
Sub Contractor

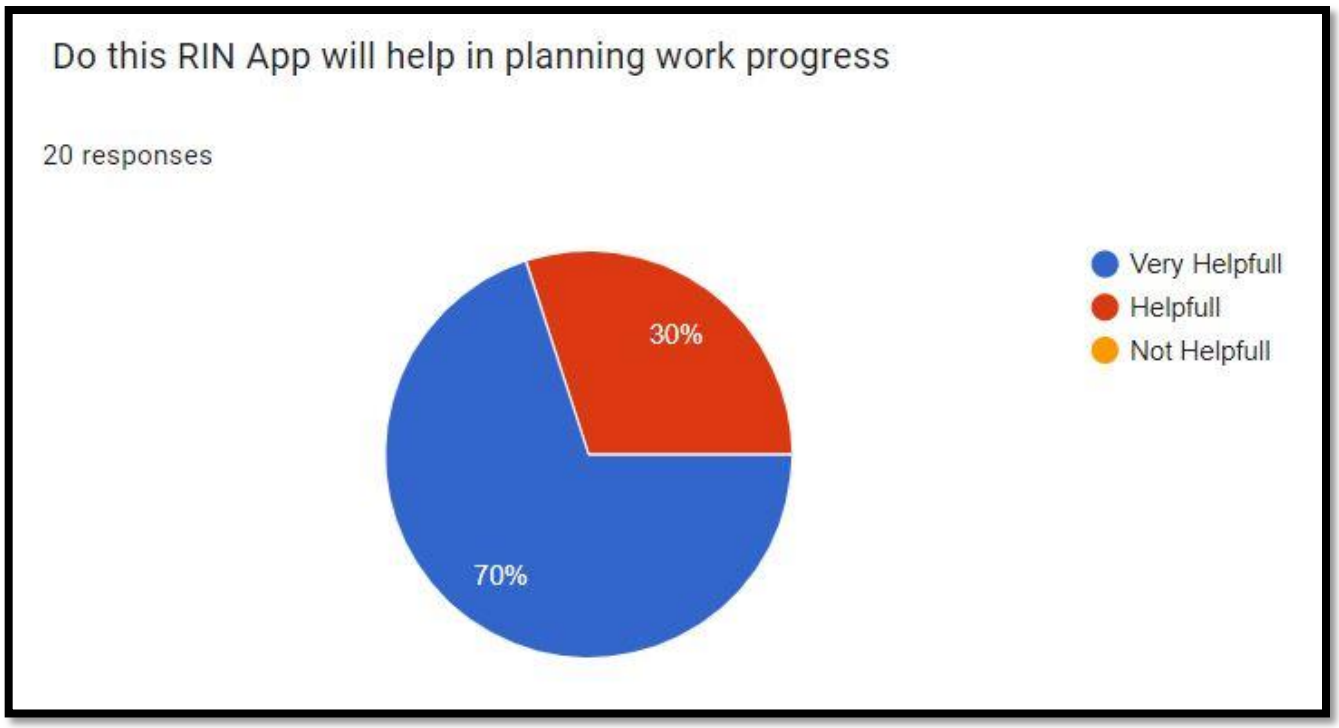

Experience
20 responses
30%
35%
15%
20%
1 - 5 years
6 -10 years
11 -20 years
21 And Above

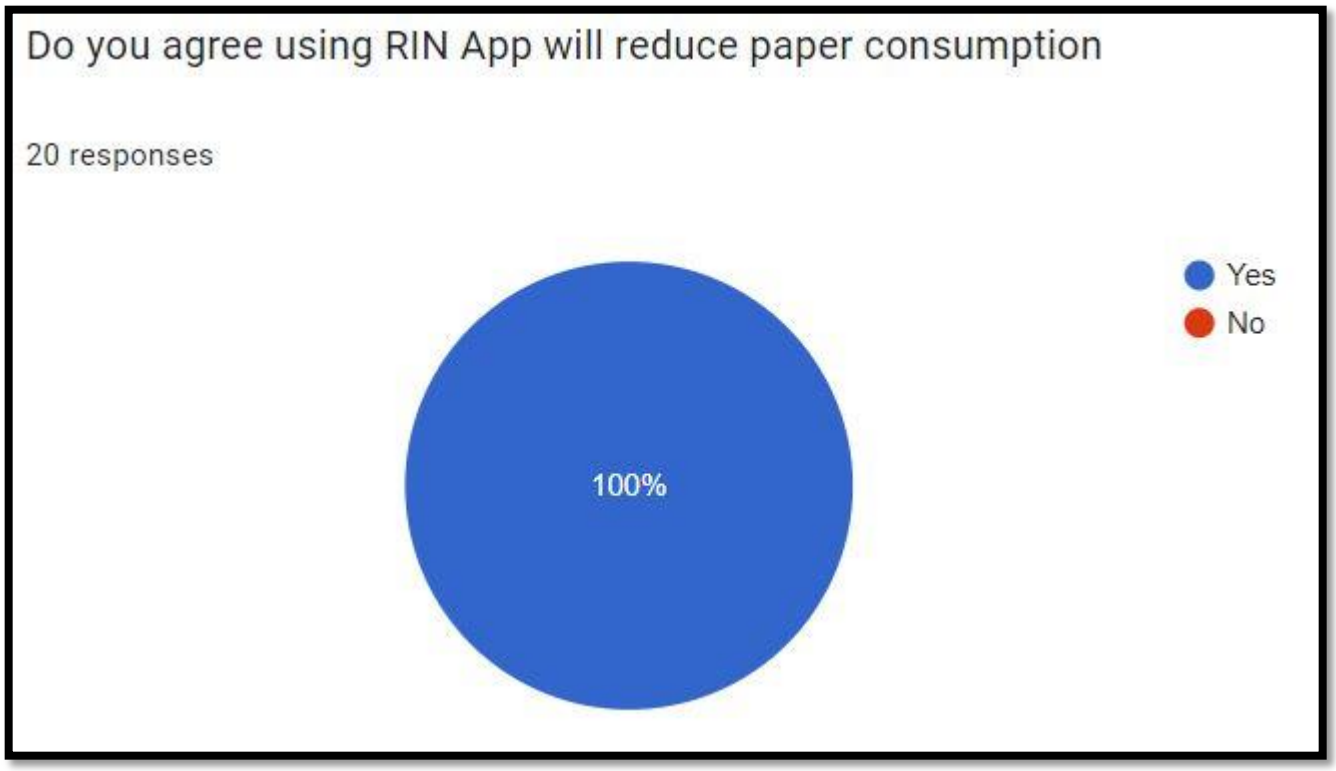

Age
20 responses
40%
30%
10%
20%
20 - 25
26 - 30
31 - 40
41 and Above


Do this RIN App friendly user
20 responses
Yes
No
100%


Do you think this method RIN App is systematic
20 responses
Yes
No
100%


Did the data gathered is complete and secure
20 responses
Secure
Insecure
100%


Do this RIN App will help in planning work progress
20 responses
Very Helpfull
Helpfull
Not Helpfull
30%
70%


Do you agree using RIN App will reduce paper consumption
20 responses
Yes
No
100%