Pearson
Higher Nationals in
Computing

Unit: 6 Planning a Computing Project

Higher Nationals – Summative Assignment Feedback Form

Student Name/ID	M.M.M AASHIK/E230667
Unit Title	Unit: 6 Planning a Computing Project

Assignment Number	1	**Assessor**	Ms Sumudu Samarakoon
Submission Date		**Date Received 1st submission**	
Re-submission Date		**Date Received 2nd submission**	

Assessor Feedback:

LO1. Conduct small-scale research, information gathering and data collection to generate knowledge on an identified subject

Pass, Merit & Distinction Descripts	P1 ☐	P2 ☐	M1 ☐	D1 ☐

LO2. Explore the features and business requirements of organisations in an identified sector

Pass, Merit & Distinction Descripts	P3 ☐	P4 ☐	M2 ☐

LO3. Produce project plans based on research of the chosen theme for an identified organisation

Pass, Merit & Distinction Descripts	P5 ☐	M3 ☐

LO4. Present your project recommendations and justifications of decisions made, based on research of the identified theme and sector

Pass, Merit & Distinction Descripts	P6 ☐	P7 ☐	P8 ☐	M4 ☐	D2 ☐

* Please note that grade decisions are provisional. They are only confirmed once internal and external moderation has taken place and grades decisions have been agreed at the assessment board.

Assessor Feedback:		
Grade:	**Assessor Signature:**	**Date:**

Resubmission Feedback:

- Please note resubmission feedback is focussed only on the resubmitted work

Grade:	**Assessor Signature:**	**Date:**

Internal Verifier's Comments:

Signature & Date:

- Please note that grade decisions are provisional. They are only confirmed once internal and external moderation has taken place and grades decisions have been agreed at the assessment board.

Important Points:

1. It is strictly prohibited to use textboxes to add texts in the assignments, except for the compulsory information. eg: Figures, tables of comparison etc. Adding text boxes in the body except for the before mentioned compulsory information will result in rejection of your work.
2. Avoid using page borders in your assignment body.
3. Carefully check the hand in date and the instructions given in the assignment. Late submissions will not be accepted.
4. Ensure that you give yourself enough time to complete the assignment by the due date.
5. Excuses of any nature will not be accepted for failure to hand in the work on time.
6. You must take responsibility for managing your own time effectively.
7. If you are unable to hand in your assignment on time and have valid reasons such as illness, you may apply (in writing) for an extension.
8. Failure to achieve at least PASS criteria will result in a REFERRAL grade.
9. Non-submission of work without valid reasons will lead to an automatic RE FERRAL. You will then be asked to complete an alternative assignment.
10. If you use other people's work or ideas in your assignment, reference them properly using HARVARD referencing system to avoid plagiarism. You have to provide both in-text citation and a reference list.
11. If you are proven to be guilty of plagiarism or any academic misconduct, your grade could be reduced to A REFERRAL or at worst you could be expelled from the course
12. Use word processing application spell check and grammar check function to help editing your assignment.
13. Use **footer function in the word processor to insert Your Name, Subject, Assignment No, and Page Number on each pag**e. This is useful if individual sheets become detached for any reason.

STUDENT ASSESSMENT SUBMISSION AND DECLARATION

When submitting evidence for assessment, each student must sign a declaration confirming that the work is their own.

Student name: MOHAMMED MAHROOF MOHAMMED AASHIK	Assessor name: Ms Sumudu Samarakoon

Issue date:	Submission date: **16.12.2024**	Submitted on:

Programme: BTEC HND in Computing
Unit: 6 Planning a Computing Project
Assignment number and title: 1 | Managing a research project on practical applications and limitations of the use of AI

Plagiarism

Plagiarism is a particular form of cheating. Plagiarism must be avoided at all costs and students who break the rules, however innocently, may be penalized. It is your responsibility to ensure that you understand correct referencing practices. As a university level student, you are expected to use appropriate references throughout and keep carefully detailed notes of all your sources of materials for material you have used in your work, including any material downloaded from the Internet. Please consult the relevant unit lecturer or your course tutor if you need any further advice.

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Student Declaration

Student declaration

I certify that the assignment submission is entirely my own work and I fully understand the consequences of plagiarism. I understand that making a false declaration is a form of malpractice.

Student signature: Date:20.11.2024

Assignment Brief

Student Name/ID Number	MOHAMMED AASHIK /E230667
Unit Number and Title	**Unit: 6 Planning a Computing Project**
Academic Year	2024/2025
Unit Tutor	
Assignment Title	**Managing a research project on practical applications and limitations of the use of AI**
Issue Date	
Submission Date	16.12.2024

Submission Format

This assignment should be submitted to the ELMS as a single document on or before the given submission date and time.

The document should comprise of

- **A comprehensive project plan** - including a work, time and resource allocation/ breakdown using appropriate tools. A business area analysis Including the features and operational areas of the business and the role of stakeholders and their impact on the success of the business.

- **A research paper** - including application and evaluation of quantitative and qualitative research methods to generate relevant primary data and examination of secondary sources to collect relevant secondary data and information.

- **An Action plan** – including recommendations and evaluation of project outcomes comparing the decisions given in the project plan.

The assignment should be word-processed, and figures can be either hand drawn or generated from a tool.
There is no specific word limit for this assignment.

Unit Learning Outcomes
LO1 Conduct small-scale research, information gathering and data collection to generate knowledge on an identified subject **LO2** Explore the features and business requirements of organisations in an identified sector. **LO3** Produce project plans based on research of the chosen theme for an identified organisation **LO4** Present your project recommendations and justifications of decisions made, based on research of the identified theme and sector
Transferable skills and competencies developed
This unit offer students an opportunity to demonstrate the skills required for managing and Implementing a project. The students will undertake independent research and investigation for carrying out and Executing a computing project which meets appropriate business aims and objectives. Students will develop competencies of: • project management skills • research skills • Writing, investigative, field study, performance skills, as appropriate presentation skills.

Learning Outcomes and Assessment Criteria

Pass	Merit	Distinction

| Assignment activity and guidance : | 8 | P a g e |

Research Theme: Artificial Intelligence

Research Topic: Practical applications and limitations of the use of AI in an identified sector (e.g. e-commerce, healthcare, biomedical science, education, lifestyle, automotive engineering, agriculture, gaming, finance)

"Artificial intelligence is at the forefront of innovation within Computer Science that uses a combination of logic, algorithms and large data sets to produce an AI model. The AI model is created to perform specific tasks or make predictions on supplied sets of input data, for example identifying patterns in weather data, internet search data or analysis of medical data. Artificial intelligence is predicted to generate a potential impact to the global economy of $13 – $15 Trillion by 2030, with sales of AI related hardware, software and services predicted to see a global revenue of $900 billion. It is predicted that AI will boost the GDP of China by a little over 26% by 2039, and of North America by 14.5%. AI requires the input of structured and labelled data, where the outputs are already known. The input data sets to the AI model are intrinsically linked to study field to which the AI engine is to be applied. The AI model can then be used to identify and recognize patterns and relationships within the input data. This identification step is referred to as 'training' the AI model. Once this training is completed, the model can then be used to make predictions and identify patterns within brand new data sets. This new data set can then be added to the existing data set, so that the AI model keeps 'growing'. As the model data set keeps expanding, and the AI algorithms are modified and refined, this gives the impression that the AI is 'learning' and demonstrating 'intelligence'. AI has been used extensively to analyses and process large and complex datasets produced by big data systems, often in real time and using Computer Vision to extract data from image sources. Developing Artificial Intelligence required a range of knowledge and skills across a broad range of computer science disciplines. AI developers need to be familiar with the algorithms and techniques in fields such as machine learning, natural language processing, and computer vision and data science. Knowing the required computing skills will help organization's recruit the correct resources to help develop and extend AI systems. Artificial Intelligence has a range of benefits across many industry sectors. In the finance industry, AI is rapidly becoming a game changer, using advanced algorithms, models and machine learning to carry out predictive analytics on large, rapidly changing financial datasets to provide more accurate financial predictions. In the field of business operations, AI automation is helping to support and enhance labour productivity, leading to

greater cost savings and increased efficiency. AI is also revolutionising the way businesses interact with their customers, by providing AI driven expert systems to help customers resolve queries as well as providing personalized recommendations based on customer choices and preferences. In the field of biomedical science, AI models help in the development of new drug treatments for a range of diseases by searching and processing large scale medical and DNA datasets. While Artificial Intelligence has numerous benefits in the analysis and processing of large data sets to solve problems, there are some clear risks to the application technology. AI systems respond to the data fed into the model, and so if this data is not representative of the problem area under study, there is a likelihood that the output of the AI model will be biased. In addition, there are security and privacy concerns on the source and storage of the large datasets used for AI. The rise of the Deep fake image and the manipulation of the human voice is also a concern because of the spread of misinformation. The wide-ranging effects of these risks mean that they can only be dealt with by a diverse range of stakeholders, including computer scientists, law makers, governments, and industry leaders. There are also incidental risks of AI in business, for example the increasing adoption of AI based systems may increase unemployment across a range of sectors and workforce demographics. Learners will have the opportunity to investigate the applications, benefits and limitations of Artificial Intelligence while exploring the responsibilities and solutions to the problems it is being used to solve." (Pearson, 2024)

You are expected to carry out small-scale research in order to explore the practical applications and limitations of the use of AI in an identified sector (e.g. e-commerce, healthcare, biomedical science, education, lifestyle, automotive engineering, agriculture, gaming, finance). The research that you carry out can be based on an organization that you have access to gather sufficient information to investigate the practical applications and limitations of the use of AI.

The findings of the research should be presented in a professionally compiled report and the report should cover the given tasks including,

- A comprehensive project plan - including a work, time and resource allocation/ breakdown using appropriate tools. A business area analysis Including the features and operational areas of the business and the role of stakeholders and their impact on the success of the business.
- A research paper - including application and evaluation of quantitative and qualitative research methods to generate relevant primary data and examination of secondary sources to collect relevant secondary data and information.
- An Action plan – including recommendations and evaluation of project outcomes comparing the decisions given in the project plan.

Activity   1 - A comprehensive project plan

Activity 1

1.1. Select an organization of your choice that allows you to explore and study the relevant data.

Provide an introduction and background to your project and the chosen organization. Define the scope and devise aims /objectives of the project that you are going to carry out. You also should include risks and benefits of exploring the practical applications and limitations of the use of AI of the chosen organization/s or the field.

2.1. Plan a small-scale research project to explore practical applications and limitations of the use of AI.

Produce a comprehensive project plan including the following.

- Cost, scope, time, quality, communication, risk, and resources management plan.
- Comprehensive Work Breakdown Structure (WBS) with clearly defined activities and milestones.
- Gantt chart to illustrate project schedule with realistic time allocated for each activity and clearly defined deadlines for milestones.

Activity 02 – Research Report

2.1. Discuss the features and operational areas of the chosen organization/s, the role and the impact of stakeholders for the success of the business. You also need analyses the challenges the organization/s may face in achieving the success and meeting business objectives by applying AI technologies to achieve operational efficiency.

2.2. Carry out the research to investigate the "**Practical applications and limitations of the use of AI in an identified sector "and** generate relevant primary data by applying appropriate qualitative and quantitative research methods. You need to examine secondary sources to collect relevant secondary data and information to support the research. You then need to analyses the data and information and interpret the findings to generate knowledge on how the application of AI supports business requirements in the identified organization/s.

Activity 03: Action Plan

4.1 Communicate appropriate project recommendations derived from the research data analyzed for technical and non-technical audiences and assess the extent to which the project recommendations meet the needs of the chosen organization/s.

4.2 Discuss the reliability, accuracy, and the appropriateness of the research methods applied while arguing and evaluating the planning recommendations made in the project plan comparing them to the actual outcomes and the need of the chosen organization/s.

Recommended Resources

Please note that the resources listed are examples for you to use as a starting point in your research – the list is not definitive.

- Costley, C., Elliot, G. and Gibbs, P. (2010) Doing Work Based Research: Approaches to Enquiry for Insider-researchers. London: SAGE.
- Dawson, C. (2016) Projects in Computing and Information Systems: A Student's Guide. UK: Pearson Education.
- Gray, D. (2009) Doing Research in the Real World. 2nd Ed. London: SAGE.
- Guay, M., Schreiber, D. and Briones, S. (2016) The Ultimate Guide to Project Management: Learn everything you need to successfully manage projects and get them done. Free Kindle Edition. US: Zapier Inc.
- Lock, D. (2013) Project Management 8th Edition. UK: Routledge.
- Pinto, J.K. (2015) Project Management: Achieving Competitive Advantage 4th Ed. Pearson.

LO1 Conduct small-scale research, information gathering and data collection to generate knowledge on an identified subject

P1 Demonstrate qualitative and quantitative research methods to generate relevant primary data for an identified theme.	**M1** Analyse data and information from primary and secondary sources to generate knowledge on an identified theme.	**D1** Interpret findings to generate knowledge on how the research theme supports business requirements in the identified sector.
P2 Examine secondary sources to collect relevant secondary data and information for an identified theme.		

LO2 Explore the features and business requirements of organisations in an identified sector

P3 Discuss the features and operational areas of a businesses in an identified sector. **P4** Discuss the role of stakeholders and their impact on the success of a business.	**M2** Analyse the challenges to the success of a business in an identified sector.	

Pass	Merit	Distinction
LO3 Produce project plans based on research of the chosen theme for an identified organisation		
P5 Devise comprehensive project plans for a chosen scenario, including a work and resource allocation breakdown using appropriate tools.	**M3** Produce comprehensive project plans that effectively consider aims, objectives and risks/benefits for an identified organization.	**D2** Evaluate the project planning recommendations made in relation to the needs of the identified organisation and the accuracy and reliability of the research carried out.
LO4 Present your project recommendations and justifications of decisions made, based on research of the identified theme and sector		
P6 Communicate appropriate project recommendations for technical and nontechnical audiences. **P7** Present arguments for the planning decisions made when developing the project plans. **P8** Discuss accuracy and reliability of the different research methods applied.	**M4** Assess the extent to which the project recommendations meet the needs of the identified organisation, including fullysupported rationales for planning decisions made.	

*********************** *END* ***********************

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Acknowledgment

I would like to take this opportunity to thank you for being an excellent lecturer Mrs.Nuwangi alwis for your guidance and support. I am grateful for the knowledge and experience you have imparted to me during my studies at Esoft Metro Campus Kandy. You have helped me to understand the various concepts in the course and have encouraged me to think critically and creatively.

Once again, I want to thank you for being a lecturer and for your support.

Thank You,

M.M.M AASHIK
E230667

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Here are some simple and practical future suggestions for AI in waste management at Asiri Hospital

References

Introduction

Artificial Intelligence (AI) is a transformative force in computer science, combining logic, advanced algorithms, and vast data sets to perform tasks, make predictions, and identify patterns. With the potential to contribute up to $15 trillion to the global economy by 2030, AI is revolutionizing industries such as healthcare, finance, and business. In healthcare, AI is being used to analyze complex medical and DNA datasets, aiding in the development of treatments and improving patient outcomes. However, the increasing reliance on electronic devices for AI systems also raises concerns about electronic waste, contributing to environmental pollution. Additionally, improper waste management of medical and technological devices exacerbates global pollution challenges. AI can play a critical role in addressing these issues by optimizing waste management, improving recycling processes, and promoting sustainable practices. By leveraging AI responsibly, industries can protect the environment while driving innovation, especially in critical sectors like healthcare.

Activity 01

Introduction to the Organization

Hospital healthcare plays a vital role in ensuring the well-being of individuals and communities by providing essential medical services, advanced treatments and preventive care. In recent years, technological advances have transformed the healthcare industry, allowing hospitals to offer cutting-edge solutions to diagnose and treat complex medical conditions. Among these advances, artificial intelligence (AI) has emerged as a revolutionary element, revolutionizing the way health works. Combining logic, sophisticated algorithms and vast data sets, AI enables hospitals like Asiri Hospital Private Limited to analyze medical data, interpret diagnostic images and predict patient outcomes with incredible accuracy. Artificial intelligence has proven invaluable in areas such as drug discovery, where it processes massive sets of DNA and medical data to identify potential treatments for various diseases. AI also improves hospital efficiency by automating routine tasks, streamlining administrative processes and supporting clinical decision-making. The financial impact of AI is immense: it is expected to contribute up to $15 trillion to the global economy by 2030, underscoring its transformative potential in health and beyond.

However, along with these benefits, hospitals face challenges that require urgent attention, especially when it comes to managing the environmental impact of health technology. At Asiri Hospital Private Limited, the growing reliance on electronics for AI-powered systems and other hospital equipment contributes significantly to e-waste. The inappropriate disposal of these devices, combined with general medical waste, aggravates pollution, harming the environment and public health. AI itself can be part of the solution, optimizing waste management systems, improving recycling processes and promoting sustainability in healthcare environments.

By responsibly integrating AI, Asiri Hospital Private Limited can address environmental issues by using the latest technology to improve patient care. This balance between innovation and ecological protection allows the hospital to set a benchmark in modern medicine, ensuring a healthier society and a healthier planet.

Background

Hospitals generate a variety of waste types, including medical, electronic, and general waste. In many cases, the waste management process is complex and involves sorting different materials to ensure safe disposal. However, manual waste sorting is often slow, inconsistent, and prone to mistakes. Improper handling of waste, especially hazardous or medical waste, can lead to pollution, health risks, and unnecessary costs.

At Asiri Hospital, the challenge is made even more difficult due to the high volume of patients and the constant demand for medical services. The hospital must manage waste efficiently to avoid contributing to environmental pollution or violating health and safety regulations.

Using AI to assist with waste management can address these problems. AI can automate the sorting of waste, making it easier to separate recyclables from non-recyclables, and ensure that dangerous materials are disposed of safely. AI can also analyse waste data to predict trends, helping the hospital plan better and reduce overall waste production. This AI-driven approach would help Asiri Hospital not only improve its environmental footprint but also set an example for other healthcare facilities in promoting sustainability.

Project charter

Project name : AI in Waste Management at Asiri Hospital	
Project Manager	Ravi Kumar
Project Manager contact details	Email – ravikumar@gamil.com Contact Number - 0760647164
Project sponsor	Mahindha anandha
Project sponsor contact details	Email – mahindhaanandaha@gmail.com Contact Number - 0750647161
Project description	The purpose of this project is to implement an AI-powered waste management system at Asiri Hospital to improve the efficiency, accuracy, and sustainability of waste sorting and disposal. Given the high volume and complexity of waste produced in healthcare settings, the project aims to reduce waste sent to landfills, ensure safe disposal of hazardous materials, and contribute to the hospital's environmental sustainability goals.
Creation date	20/11/2024
Duration	2 mouths
Budget	331,500/=

Project Objectives

AI Sorting	Use AI to automatically sort waste into recyclables, non-recyclables, and hazardous materials with high accuracy.
Sustainability Goals	Reduce waste sent to landfills and promote recycling, contributing to Asiri Hospital's sustainability targets.
Efficiency	Optimize waste collection and disposal through AI-driven predictions of waste volume and collection schedules.
Staff Training	Ensure hospital staff are properly trained to work with AI systems for waste management.
Safe Disposal	Improve the handling and disposal of medical waste to reduce health and environmental risks.

Project key stakeholders	**Name**	**Role**
	Project Sponsor	Hospital management team. The sponsor champions the project, secures funding, and communicates its importance to the hospital. They may also assist in removing obstacles that the project team encounters.
	Project Manager	Assigned project manager for AI implementation in hospital waste system in order to check the working progress
	Project Team	IT team, waste management team, healthcare staff, and external AI technology partners
	External Partners	AI technology vendors, sustainability consultants
	End Users	Hospital staff (e.g., waste handlers, cleaners), hospital administration

Milestones	
Project Initiation	AI system design and vendor selection.
Planning Stage	Installation of AI waste sorting system.
Execution Stage	Staff training and system testing.

Monitoring and Control	Full system integration and monitoring.		
Project Closure	Final review, documentation.		
Potential risks	Budget Constraints	May impact the scope of infrastructure improvements.	
	Resistance to Change	Inadequate training and clear communication to ensure smooth adoption of the new system.	
	Technical Challenges	Technology issues in implementing digital tools.	
Approval Date	25/11/2024		
Project charter status	Approved		

The **Project Charter** provides a clear overview of the objectives, timeline, and risk for the successful implementation of an AI-based waste management system at Asiri Hospital.

Introduction about AI that used for the organization

(BLOG, 2023)

Asiri Hospital, a busy healthcare facility in a major urban area, faces a common challenge among hospitals managing the large amount of waste it generates daily. This includes medical waste, such as syringes and used bandages, as well as general waste like plastics, paper, and electronic waste from outdated equipment. If not properly managed, this waste can harm the environment and public health.

To address these issues, Asiri Hospital is exploring the use of Artificial Intelligence (AI) to improve its waste management system. AI has the potential to make waste sorting, recycling, and disposal more efficient and accurate. By using AI-powered systems like smart sensors, computer vision, and data analysis, the hospital can reduce the amount of waste sent to landfills, better handle hazardous materials, and promote recycling. This could help Asiri Hospital reduce its environmental impact while also saving money and improving overall waste management.

(Anon., 2024)

Purpose of the Project

✓ **Reduce Environmental Impact**

For hospitals like Asiri, which generate large volumes of waste daily, minimising the environmental impact is crucial. Through data pattern analysis, waste classification accuracy, and waste collection efficiency, artificial intelligence (AI) technology can help optimise waste management procedures. This lowers the hospital's carbon footprint while also guaranteeing adherence to environmental laws, encouraging sustainability, and enhancing the hospital's standing as an ethical organisation. AI-powered waste management supports long-term community and hospital benefits while also being in line with global sustainability goals.

✓ **Make Waste Sorting More Accurate**

Use AI to automatically sort different types of waste (medical, electronic, and general) to make sure everything is disposed of properly.

✓ **Increase Recycling**

By effectively identifying and sorting recyclable materials, lowering contamination in recycling streams, capturing recyclable items prior to disposal, increasing the scalability and cost-effectiveness of the recycling process, providing useful data for improving waste management practices, and attaining higher recycling rates to lessen environmental impact and support sustainability goals, artificial intelligence (AI) for recycling in hospitals can improve waste management.

✓ **Ensure Safe Disposal of Hazardous Waste**

Make sure dangerous waste, like medical and chemical waste, is identified and handled safely, following all regulations.

✓ **Save Time and Resources**

Hospitals like Asiri can save time and money by automating sorting, streamlining collection schedules, and controlling inventory by incorporating AI into waste management systems. AI speeds up processing times, decreases manual labour, and lowers operating expenses, all of which contribute to a more economical and effective waste management procedure that helps the hospital achieve its objectives of environmental sustainability and operational efficiency.

✓ **Track Waste More Effectively**

Use AI to monitor and track waste in real-time, so the hospital can make better decisions about waste management.

✓ **Predict Future Waste Trends**

AI helps predict trends in hospital waste by examining historical data to identify trends in waste composition and generation. To predict future waste volumes and types, AI models can find recurring patterns and connections to hospital operations. This promotes sustainability and operational efficiency by enabling waste management teams to effectively plan resources and comply with disposal regulations.

✓ **Support Sustainability Goals**

Help the hospital meet sustainability targets by using AI to manage waste in a more eco-friendly way.

✓ **Promote a Green Image**

Asiri Hospital has strengthened its reputation, attracted new talent, inspired other industries and adapted its operations to new market demands and regulatory frameworks, positioning itself as a leader in environmental sustainability through quality and environmentally friendly management. Collaborations with government and non-profit organizations further enhance the hospital's sustainability capabilities and visibility, positioning it as a responsible and progressive organization that prioritizes the health of its patients and its environment.

✓ **Encourage Staff Involvement**

Train staff to use AI systems and get them involved in improving the hospital's sustainability practices.

✓ **Improve Safety and Health**

Reduce the risk of pollution and health hazards by ensuring waste is properly handled and disposed.

✓ **Cut Operational Costs**

At Asiri Hospital, AI automation is efficiently managing waste to reduce costs for labor, treatment, and disposal operations. This technology streamlines activities like waste sorting and tracking to improve accuracy and avoid fines, while predicting waste generation patterns enhances procurement procedures. Identifying recyclable items helps reduce landfill waste and disposal costs, while optimizing the collection schedule reduces transportation costs and carbon emissions. This allows funds to be redirected towards staff training, infrastructure improvements, and patient care, promoting innovation and environmental stewardship while ensuring financial performance and operational excellence.

Scope of the Project

The project will focus on using Artificial Intelligence (AI) to improve waste management at Asiri Hospital.

➢ **AI for Sorting Waste**

By classifying waste categories and using AI, Asiri Hospital aims to improve waste classification for better waste management. AI systems can operate continuously, improve accuracy, reduce costs, improve safety, reduce pollution and provide real-time monitoring. This technology will help the hospital implement sustainable, effective and efficient waste management procedures.

➢ **Tracking Waste in Real-Time**

Setting up AI systems to monitor waste production in real-time, helping to understand how much waste is being generated and where it's coming from.

➢ **Training Hospital Staff**

Training staff to use AI systems effectively and work alongside the new technology to improve the hospital's waste management processes.

➢ **Improving Recycling**

Using machine learning models and sensors to accurately identify recyclable materials, the initiative uses AI to improve the hospital's recycling processes. This technology improves the quality of recyclable materials, promotes waste diversion from landfills, reduces misclassification, and offers the prospect of gradually increasing recycling rates. By reducing waste disposal costs and encouraging resource recovery, AI also reduces costs, transforming waste into useful resources, and helping Asiri Hospital become more environmentally sustainable.

➢ **Handling Hazardous Waste**

Ensuring that dangerous materials, like medical or chemical waste, are safely separated and disposed of using AI technology.

> ➤ **Predicting Waste Trends**

In order to forecast future trash generation in hospitals and help with efficient resource planning and budgeting for waste management costs, the project use artificial intelligence (AI) to evaluate historical waste data. Hospitals can take proactive steps to cut waste and boost operational effectiveness in line with environmental goals by using AI to identify patterns, seasonal fluctuations, and variables impacting waste output.

Key Deliverables of the Project.

•   Project management plan

•   Budget

•   Research report

•   Action plan

•   Training

Aims of the Project

> ➤ **Reduce Total Waste**

Through improved waste management techniques such as optimizing sorting, increasing recycling, and using AI to accurately detect and sort waste, the initiative aims to reduce waste at Asiri Hospital. By reducing contributions to landfills and encouraging smarter planning and operational procedures, it will help avoid unnecessary waste generation and improve sustainability.

> ➤ **Increase Recycling**

Ensure more recyclable materials are recovered from the waste and reused, rather than thrown away.

> ➤ **Handle Hazardous Waste Safely**

By employing AI to automatically recognise and classify hazardous materials according to their characteristics, the project seeks to handle hazardous waste in a safe manner. In order to safeguard hospital employees and the environment, this will help guarantee appropriate disposal in accordance with safety regulations.

> ➤ **Encourage a Sustainable Culture**

Create a hospital-wide mind-set that values sustainability by incorporating AI into everyday waste management practices.

> ➢ **Set an Example for Others**

The project intends to establish Asiri Hospital as a pioneer in sustainable healthcare by utilising AI for waste management to illustrate the advantages, enhance waste classification, lessen the impact on the environment, and increase operational efficiency. This can boost reputation, encourage sustainability, set a standard for responsible waste management, act as a model for other healthcare facilities, and motivate other organisations to follow suit.

Objectives

> ➢ **Assessing Current Digital Device Usage**

I begin the assignment by thoroughly examining the hospital present usage of wastage management. This examination will include a broad variety of devices, such as medical equipment. Understanding the amount to which they are utilized is critical for finding possible environmental improvements.

> ➢ **Make Waste Sorting Faster and More Accurate**

Automate the sorting of waste to make the process quicker and reduce human errors.

> ➢ **Examination of the Carbon Footprint and Waste**

After assessing use, I do a thorough study of the carbon footprint and amount of electronic trash created by these hospital equipment. This research will give crucial insights into the environmental effect, assisting us in identifying key areas that must be addressed.

> ➢ **Reduce Environmental Harm**

Cut down on the amount of waste that ends up in landfills, increase recycling, and ensure hazardous waste is disposed of safely.

> ➢ **Investigating Long-Term Alternatives and Practices**

The project will look into and examine sustainable options and techniques for successfully minimizing the environmental impact from the wastage of hospital. This inquiry will look at eco-friendly technology, energy-efficient practices, and waste-reduction techniques, with the objective of creating a more ecologically responsible.

> ➢ **Save Time and Resources**

Streamline the waste management process to save time and reduce costs, by relying more on AI instead of manual sorting.

> ➢ **Creating Practical Guidelines and Recommendations**

Based on my results and observations, I will provide a set of practical guidelines and suggestions to encourage long-term used equipment use in hospital. These guidelines will equip doctor, patient, and staff with concrete measures and best practices to follow, ensuring that the environmental values.

> ➢ **Support Sustainability**

Help Asiri Hospital lead the way in environmentally-friendly practices by using AI to manage waste in a smarter way.

> ➢ **Plan Waste Management Better**

Use AI to predict how much waste will be generated in the future, so the hospital can prepare better and waste less.

> ➢ **Raising awareness.**

We will begin a broad awareness campaign. This initiative aims to inform and educate doctors, patient, and staff on the environmental consequences of change. I wish to foster a collective commitment to sustainability by raising awareness and motivating people to adopt responsible actions.

> ➢ **Ensure Safety and Compliance**

By using AI to improve the accuracy and tracking of waste classification, the project aims to ensure safety and compliance in the management of hazardous waste in hospitals. In addition to reducing human error and improving overall environmental accountability, this will help reduce contamination and health risks for hospital workers, patients, and the environment.

The use of AI in waste management at Asiri Hospital

Efficient Sorting
By automating the classification of different types of waste, such as hazardous materials, recyclable materials, and medical waste, artificial intelligence (AI) technology can improve waste management at Asiri Hospital. It simplifies material storage and ensures efficient waste management by reducing human error, speeding up the process, and gradually increasing accuracy.

Environmental Impact
By optimizing waste management, AI can reduce the hospital's environmental footprint, making processes more sustainable.

Cost Savings
By decreasing manual labour, boosting productivity, and improving waste disposal, Asiri Hospital can save money by implementing AI to automate waste sorting and management. More sustainable waste management techniques and financial savings result from this.

Safety Improvements
AI systems can minimize human exposure to hazardous materials, enhancing the safety of hospital staff.

Resource Optimization
AI can predict the appropriate amount of resources required, optimise resource utilisation in waste management, increase cost-efficiency, guarantee timely waste processing, and uphold regulatory compliance.

Data-Driven Decisions

By gathering information on waste types and disposal techniques, identifying areas for waste reduction strategy improvement, monitoring regulatory compliance, and enabling proactive changes to waste management policies for more efficient and sustainable practices, artificial intelligence (AI) can assist Asiri Hospital in analysing waste patterns.

Project Issues in Waste Management at Asiri Hospital

Large Volume of Waste

The volume of waste produced by its large patient base, including general, medical and electronic waste, has become too much for Asiri Hospital. The volume and hazardous nature of medical waste makes its management and disposal difficult, requiring effective methods and resources. Hospital waste management is made more difficult by compliance with health and safety laws.

Manual Sorting Challenges

At Asiri Hospital, manually sorting waste takes a lot of time and effort, which can result in errors and inconsistencies. AI-powered process automation can increase waste management's accuracy and efficiency while assisting the hospital in achieving its sustainability objectives.

Improper Disposal of Hazardous Waste

Mishandling hazardous medical waste (e.g., syringes, bandages) can cause pollution and health risks.

Environmental Impact

Because of inadequate segregation and disposal, waste management at Asiri Hospital has a major negative influence on the environment, leading to pollution and environmental deterioration. Hazardous waste can contaminate water and land, increasing the ecosystem's long-term risks. Ineffective waste management techniques also increase carbon emissions through processing, disposal, and transportation. By enhancing the sorting, recycling, and disposal procedures, artificial intelligence (AI) in waste management can lessen the environmental impact of hospitals overall.

Regulatory Compliance

Failure to meet health and safety regulations related to waste management can lead to legal and financial penalties.

Lack of Data-Driven Planning

Without proper data analysis, the hospital struggles to predict waste trends and plan effective strategies.

Rising Costs

Inefficient waste management at Asiri Hospital is leading to increased costs in several areas. This includes increased labor costs for waste management, waste of valuable resources such as recyclable materials, and higher landfill fees for mixed waste. By streamlining the process, increasing sorting accuracy, and reducing unnecessary resource use, AI-based waste management systems can help hospitals save a lot of money.

Key Questions AI Can Address

♦ How can AI improve the accuracy of waste sorting?

By evaluating real-time images or video data to distinguish different types of waste based on their appearance, texture, and colour, AI-based tools such as computer vision can increase the accuracy of waste sorting. By automatically sorting waste without human intervention and being trained to identify patterns and characteristics of materials, these systems can reduce errors and increase sustainability in waste management. In addition, AI can continuously improve its sorting accuracy based on feedback and historical data.

♦ What systems can AI use to manage hazardous waste?

AI can use sophisticated algorithms and smart sensors to identify hazardous materials in hospital waste streams. To detect materials such as medical sharps and bio hazardous materials, these sensors can track temperature and chemical composition data at waste collection sites or sorting systems. AI can trigger alerts and direct waste to appropriate disposal techniques, ensuring safety standards are met and reducing the risk of exposure to employees and patients. Artificial intelligence (AI) systems can improve hazardous waste management and regulatory compliance by continuously adapting to new data.

♦ Can AI help reduce the total amount of waste produced?

Artificial intelligence (AI) can review historical data on hospital waste generation to identify trends and reduce waste, recommending better resource utilization, waste sorting, and purchasing procedures. AI can make real-time suggestions to help hospitals reduce waste and increase productivity.

♦ How can AI make the process cost-effective?

By automating processes, decreasing manual labour, and increasing efficiency, artificial intelligence (AI) can improve waste management procedures. It can minimise resource waste by identifying inefficiencies, optimise logistics to lower transportation costs, and optimise waste sorting. In the end, this results in hospitals adopting more sustainable practices and cutting costs.

♦ What role does AI play in promoting sustainability?

By increasing recycling efforts, monitoring waste generation patterns, optimising energy use, and predicting future waste trends for long-term sustainability and less environmental impact, artificial intelligence (AI) improves hospital waste management systems.

♦ How can AI help the hospital comply with regulations?

By tracking and documenting the disposal of different kinds of waste, automating compliance checks, producing reports, and sending out real-time alerts in the event of non-compliance, artificial intelligence (AI) can assist hospitals in adhering to waste disposal regulations. AI can guarantee that waste is managed in accordance with certain standards, lowering the possibility of legal infractions and assisting medical facilities in maintaining an all-encompassing and sustainable waste management system.

The integration of AI into Asiri Hospital's waste management aims to address these challenges by automating and optimizing processes. AI tools can sort waste accurately, ensure safe handling of hazardous materials, and provide actionable insights from waste data. This will help reduce pollution, save costs, and position Asiri Hospital as a leader in sustainable healthcare practices.

Organizational structure

The structure of Asiri Hospital Private Limited is designed to provide comprehensive healthcare services with a focus on efficiency, patient comfort, and advanced medical technology. This is a sample of asiri hospital structure

1. Ground Floor - Reception and Outpatient Services

Reception and Help Desk:-Centralized area for patient inquiries, appointments, and registrations.

Outpatient Department (OPD):-Consultation rooms for general practitioners and specialists.

Laboratory Services:-Facilities for diagnostic tests like blood work and pathology.

Pharmacy:-On-site access to prescribed medications.

Radiology and Imaging Services:-Advanced diagnostic imaging, including X-ray, ultrasound, and CT/MRI scanning.

Emergency Department:-24/7 emergency care with dedicated triage, resuscitation, and minor procedure areas.

2. First Floor - Inpatient Facilities

General Wards:-Affordable, shared patient rooms.

Private Rooms:-individual rooms offering more privacy and amenities.

Intensive Care Unit (ICU):-High-tech facilities for critical care and monitoring.

Neonatal Intensive Care Unit (NICU):-Specialized care for newborns requiring intensive medical attention.

3. Second Floor - Specialized Services

Operating Theatres:-State-of-the-art surgical suites equipped for general and specialized procedures.

Recovery Rooms:-Post-operative care for patients after surgery.

Maternity Ward:-Delivery suites, antenatal, and postnatal care facilities.

Pediatrics Ward:-Dedicated care for children and adolescents.

4. Third Floor - Administrative and Research

Hospital Administration Offices:-Central hub for hospital management and administrative functions.

Staff Rooms and Training Areas:-Spaces for staff meetings, training, and development programs.

Research and Development (R&D):-Facilities for medical research and clinical trials.

5. Additional Facilities

Cafeteria:-Dining area for patients, visitors, and staff.

Parking:-Ample space for vehicle parking, with valet services if required.

Waste Management:-On-site systems for the segregation and safe disposal of medical and electronic waste.

This structure allows Asiri Hospital Private Limited to deliver a wide range of medical services while ensuring a patient-centric approach, making it a leading healthcare provider in the region. (kumara, 2023)

Project organization structure (POS)
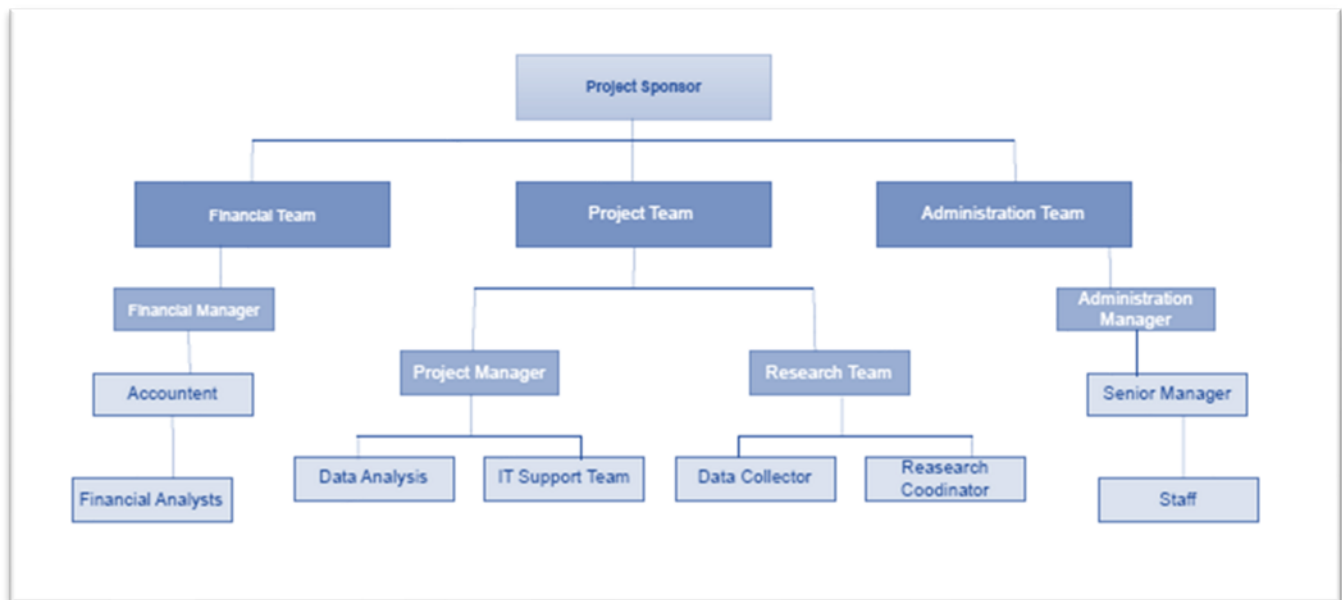
The project organisational structure is an important instrument for identifying the hierarchy of personnel, their functions, workflow, and reporting systems. It is a project management aspect that is critical to guiding and defining how the organisation operates. Different project organisational structures are developed based on the region in which the organisation operates: they are determined by the activities associated with the main business. If an organisation is dealing with temporary work, the structure will most likely better manage employee recruitment and firing as needed. On the other hand, if the organisation manages a production chain that demands continuous operation, the structure will be different. In this situation, the duties allocated will keep employees engaged for a longer period of time while achieving the organization's goals. When organisations expand or their demands change, the organisational structure must adapt to support the new aims.

Why is an organisational structure for a project required?

Any organisation that wants to operate effectively and accomplish its objectives with fewer risks needs to have a clearly defined organisational structure. To thrive in today's economy, businesses need to be fiercely competitive, effective, and flexible. In actuality, stakeholders are growing more conscious, demanding, and impatient. Therefore, any organisation must create an organisational structure that can best support its objectives in order to meet client wants and thrive in the market.
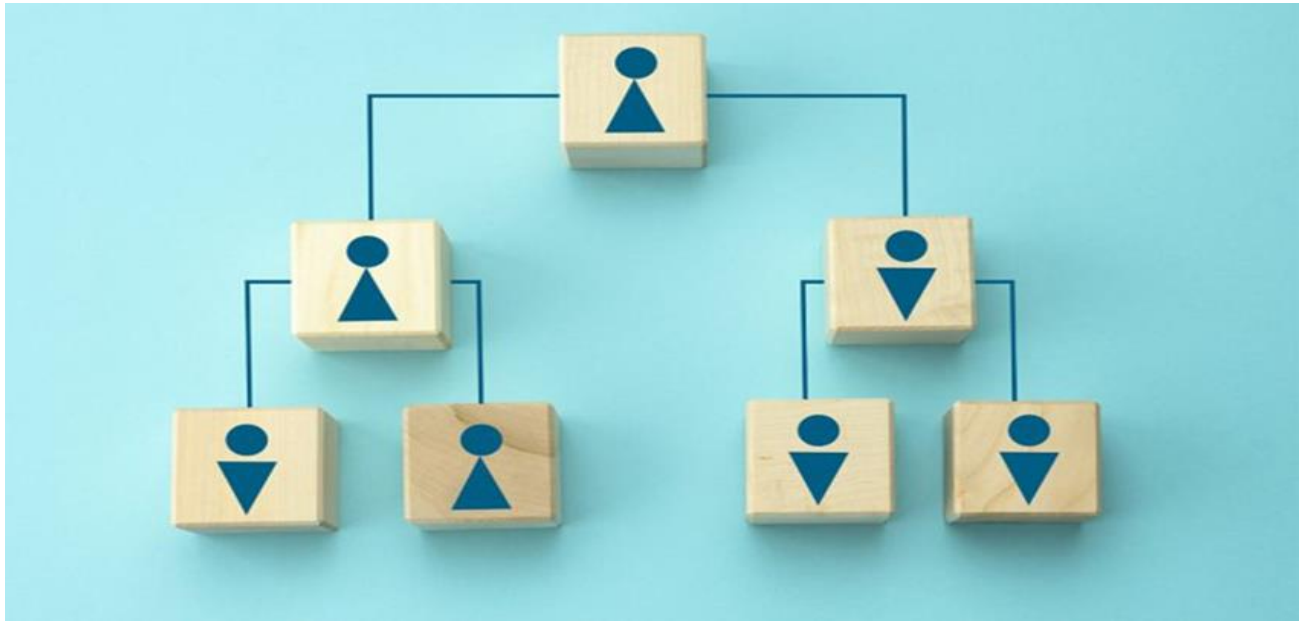
Types of project organizational structure

The organizational structure depends on many factors, such as the style of government, the style of leadership, the type of organization, the workflow, the hierarchy, etc.
    The PMBOK orders organizational structures into eight types
- Organic or Simple Organization
- Functional or Centralized Organization
- Multi-divisional Organization
- Matrix Organization – strong, weak or balanced
- Project Oriented (composite or hybrid) Organization
- Virtual Organization Hybrid
- PMO

The benefits of possessing an efficient organisational framework

A framework that enables an organisation to efficiently run its operations and accomplish its objectives with little effort is known as an organisational structure. The relationships between the many teams and departments within the organisation are outlined in this structure. Additionally, it aids organisations in assigning responsibility, authority, and power. However, the project organisational structure also establishes the relationship between the employees and the project manager or superiors; as a result, it becomes a strategic tool for group coordination and cooperation. Since roles, duties, and reporting lines are clearly defined, the primary benefit of having an efficient organisational structure is the decrease in conflict and discourse among staff members. Letting a company expand. Focussing on overall objectives rather than individual department's agenda. Joining a group and guiding them towards a shared objective. Letting workers enhance their abilities. Improving the speed, ease, and efficiency of the decision-making process. Promoting the specialisation of employees. Permitting improved resource management and use. Facilitating improved and easier communication, which lessens conflict. Enabling improved behaviour from employees. Assisting workers with job development, career advancement, and the integration of new co-workers. Assisting in the accurate and unambiguous identification of roles and duties. An organizational structure is essential for the good functioning of a company. Each company should choose its organizational structure according to its specific needs and requirements, since this also depends on the achievement of the prefixed results. (Anon., 2024)

Project Organizational Structure of Asiri Hospital

Asiri Hospital Holdings PLC is one of the leading private healthcare providers in Sri Lanka. Its organizational structure typically adheres to a hierarchical format to ensure efficient operations and delivery of quality healthcare services. Below is the key organizational structure,

Board of Directors

The Board of Directors oversees the governance of the hospital, formulates strategies, and ensures compliance with healthcare regulations. Includes a Chairperson and several executive and non-executive directors.

Executive Management
Led by the Chief Executive Officer (CEO), who is responsible for the hospitals overall administration and performance.
Key positions include:

Chief Operating Officer (COO): Manages daily operations.

Chief Financial Officer (CFO): Oversees financial planning and budgets.

Director of Medical Services: Ensures high standards in clinical care.

Clinical Departments

These departments focus on delivering specialized medical services:

Surgery Department, Cardiology Department, Orthopaedics Department, Gynaecology and Obstetrics Department, Oncology Department, Neurology Department, Radiology and Imaging Services

Each department is headed by a Department Head or Consultant, who oversees medical staff and operations.

Nursing Division

Managed by the Chief Nursing Officer (CNO):

Coordinates nursing staff across wards and ICUs.

Ensures adherence to patient care standards and protocols.

Administrative Support Services

Includes non-clinical departments that support hospital operations:

Human Resources: Staff recruitment, training, and welfare.

Facilities Management: Maintenance of hospital infrastructure.

Finance and Accounts: Billing and revenue management.

IT and Technology: Manages hospital information systems and ensures smooth operation of digital solutions.

Quality and Compliance Department

Oversees quality assurance, risk management, and compliance with healthcare regulations.

Ensures adherence to international healthcare standards such as ISO or JCI.

Customer Relations and Marketing

Manages patient feedback, public relations, and marketing initiatives.

Focuses on improving patient satisfaction and promoting the hospital's services.

Support Services

Pharmacy: Manages medication supply and distribution.

Laboratory Services: Conducts medical tests and diagnostics.

Housekeeping and Security: Ensures cleanliness and safety within the hospital premises.

This hierarchical structure ensures that Asiri Hospital operates smoothly by clearly delineating responsibilities, promoting specialization, and fostering accountability across all levels. (kumara, 2023)

Analyzing Data and Information on Practical Applications and Limitations of AI in Hospital Waste Management at Asiri Hospital

1. **Organizing the Data**

At Asiri Hospital, organising the data for analysis of the real-world uses and constraints of AI in hospital waste management requires an organised plan to managing primary and secondary data sources.

➢ **Primary Data Collection and Structuring**
  ✓ **Surveys and interviews**

Surveys and interviews with hospital employees are essential to identify waste management challenges and opportunities. Responses can be categorized into topics such as delays in waste collection, difficulties in sorting waste, and potential benefits of AI. Identifying common problems and opportunities for improvement, such as staff training or change management tactics, can help tailor the AI implementation plan for a successful transition.

  ✓ **Observational records**

Maintain detailed records of hospital waste generation and disposal procedures. Record information such as the type of waste generated (e.g., medical, hazardous, or general waste), frequency of waste collection, and disposal methods. Organize this data chronologically to determine long-term trends, or by waste category to identify specific problem areas.

  ✓ **Quantitative data**

Quantitative data is information that has been processed and organized using tools such as Excel and statistical software. It tracks the amount of waste generated, disposal costs, and recycling rates. This information helps with statistical studies, looking for trends, inefficiencies, and anomalies. It promotes data-driven decision-making and evaluates the effectiveness of waste management initiatives.

  ✓ **Qualitative data**

Group information from open-ended questions into topics, such as staff concerns (e.g., AI replacing manual tasks) or identified benefits (e.g., efficiency improvements).

➢ **Secondary Data Gathering and Organization**
  ✓ **Relevant Literature**

The literature on artificial intelligence (AI) in medical waste management is reviewed in depth and categorized based on topics such as AI effectiveness and implementation challenges. Case studies present real-world examples of the use of AI in waste management, with a focus on outcomes such as environmental benefits. In light of the needs of Asiri Hospital, this methodical approach allows for the examination of opportunities and constraints.

  ✓ **Regulatory Information**

Compile national or international guidelines on hospital waste management and AI applications to ensure the findings align with legal and ethical standards.

✓ **Comparable Case Studies**

To provide Asiri Hospital with insights and comparisons, case studies on the implementation of AI in waste management in various healthcare facilities were analysed. The grouped under the themes of waste management and AI technology. To help Asiri Hospital evaluate its operations and tailor AI solutions to its specific needs, the results, best practices, and challenges faced by these institutions are examined.

2. **Integration in a centralized database**

Combine primary and secondary data in a centralized system or software, separating them into folders or categories for easy access and comparison.

✓ **Primary data**

Surveys, interviews, observations.

✓ **Secondary data**

Academic studies, regulatory documents, industry reports.

3. **Visual presentation**

Create spreadsheets or tables to visualize quantitative data (e.g., waste volumes or staff responses). Use flowcharts or mind maps for qualitative topics to see relationships and recurring patterns.

4. **Ensure relevance and usability**

Filter out irrelevant data to ensure that all information contributes to the analysis of the role of AI in waste management at Asiri Hospital. Structure data in a format ready for analysis, such as tables, graphs or thematic summaries, ensuring clarity and accessibility for stakeholders.

5. **Contextualize the results**

✓ **The role of AI in improving operational efficiency**

The results show that AI can automate waste sorting, reducing reliance on manual processes and human intervention. This is in line with global trends where AI-based solutions have been successfully used to manage complex waste streams in the healthcare sector, ensuring efficiency and safety.

✓ **Alignment with sustainability goals**

Primary data from Asiri Hospital reveals a significant volume of recyclable and hazardous waste. Artificial intelligence can help identify recyclable materials more efficiently, minimize landfills, and promote environmentally friendly practices. These findings are consistent with secondary data that highlights the role of AI in achieving sustainability in similar institutions around the world.

✓ **Compliance and risk mitigation**

The results show that AI promotes compliance with strict waste management regulations by ensuring accurate segregation of hazardous waste. This directly addresses a critical need at Asiri Hospital, where improper disposal can pose legal and financial risks. The benefits of AI for compliance were also evident in the secondary data reviewed.

✓ **Cost-benefit analysis in a real-world context**

While primary data highlights concerns about initial setup costs, secondary data shows that long-term cost savings are achievable through AI. reducing fines for improper disposal and increasing recycling rates can offset the initial costs. The findings contextualize this challenge as a common barrier to AI adoption, but highlight its feasibility with strategic investments.

✓ **Integration challenges**

Comments from Asiri Hospital staff reflect concerns about adapting to AI systems due to skills gaps and resistance to change. This is in line with broader industry trends where similar challenges have been addressed through targeted training programs and phased implementations.

✓ **Global and local relevance**

Secondary data illustrate the potential of AI to transform waste management practices around the world, and the findings   from Asiri Hospital suggest that these innovations can be adapted to the local context. AI systems can address region-specific waste streams, improving their practical implementation.

6. Conclusion

✓ **Efficiency gains**

AI has the potential to improve the operational efficiency of waste management at Asiri Hospital by automating waste separation processes. This reduces the   misclassification   of hazardous waste, improves compliance with waste disposal rules and minimizes time spent on manual tasks.

✓ **Financial implications**

Although implementing AI involves high initial costs for system acquisition, onboarding and staff training, these investments can translate into long-term savings. By reducing penalties for improper waste disposal and optimizing recycling processes, AI can contribute to financial sustainability.

✓ **Impact on sustainability**

AI systems support the hospital's environmental goals by accurately separating recyclable materials, reducing the amount of waste sent to landfills, and ensuring safer disposal of hazardous materials. This complies with global sustainability standards and reinforces the hospital's ecological reputation.

✓ **Improved security and compatibility**

AI minimizes human contact with hazardous waste, reducing the risk of infection and accidents. It also ensures compliance with national and international waste management guidelines, protecting the hospital from legal and financial consequences.

✓ **Identified challenges**

The main limitations include the need for a large initial investment, the need for skilled personnel to operate and maintain AI systems, and the potential resistance of personnel to adapt to new technologies. Additionally, AI systems are only as effective as the data provided, making accurate data capture and continuous monitoring imperative.

✓ **Future Recommendations**

❖ Initiate a pilot program to assess the effectiveness of AI in specific waste management processes before expanding to the entire hospital.

❖ Invest in staff training to ease the transition and maximize the success of AI adoption.

❖ Regularly monitor the performance of the AI system and integrate feedback to improve operations.

7.   Knowledge Generation

➢   **Insights into the Impact of AI**

✓ **Improved Efficiency**

 AI has the potential to improve waste sorting processes, ensuring that hazardous and recyclable waste are sorted more accurately and quickly. This minimizes human error and improves the overall efficiency of waste management.

✓ **Cost Reduction**

AI systems can reduce operational costs by reducing manual sorting work and optimizing collection schedules, which can lead to long-term savings.

✓ **Regulatory Compliance**

 AI systems can help meet strict medical waste management guidelines by ensuring that recycling and reprocessing processes are followed.

➢ **Identifying challenges**

✓ **Initial investment**
 The cost of implementing AI solutions, such as hardware, software, and training, is a barrier to implementation.

✓ **Staff adaptation**
 Staff may require significant training to use AI systems effectively, which can lead to resistance or delays during the transition phase.

✓ **Data limitations**
 The effectiveness of AI depends on the quality of input data. Gaps in Asiri Hospital's historical waste management records may hinder AI training.

➢ **Opportunities for improvement**

✓ **Customized AI solutions**
Developing AI tools tailored to hospital waste types and operational processes can maximize their effectiveness.

✓ **Integration with existing systems**
Combining AI with existing hospital waste tracking systems can provide real-time insights, ensuring a smooth transition.

✓ **Collaboration and partnerships**
Partnering with AI developers or leveraging case studies from other hospitals can accelerate implementation success.

➢ **Recommendations**

✓ **Pilot program**
Launch a small-scale AI waste management pilot project to test its effectiveness before large-scale adoption.

✓ **Staff Training**
Provide seminars and training programs to familiarize staff with AI systems, troubleshoot issues, and build trust.

✓ **Focus on Data Accuracy**
Ensure high-quality structured data is used to train AI, improving its reliability and predictive accuracy.

✓ **Environmental Impact Measurement**
Use AI to track and report the hospital's environmental footprint, presenting sustainability improvements to stakeholders.

➢ **Broader Healthcare Sector Awareness**

✓ **Scalability**
The results from Asiri Hospital can serve as a model for implementing AI waste management in other healthcare facilities, locally and internationally.

✓ **Ethical considerations**
Address ethical issues, such as job displacement, by designing roles that complement AI systems.

✓ **Innovation in healthcare**
Successful adoption of AI in waste management can pave the way for AI applications in other operational areas, such as inventory or patient health systems.

Risk Analysis

Risk identification

Risk ID	Risk Name	Description	Probability	Impacts
R1	Data Availability	Difficulties in data collection, such as data gaps, late data submission, or incomplete records.	Medium	• Delayed project timeline as data collection may take longer than anticipated. • Compromised analysis due to missing or incomplete data.
R2	Stakeholder Resistance	Concerns about changes in device usage or skepticism about environmental impacts may prompt resistance from key stakeholders.	Low	• Potential implementation challenges and delays. • Difficulty in achieving buy-in for recommended changes.
R3	Budget Constraints	Budget constraints may limit the project's ability To get necessary resources, such as technology, expertise, and tools for data analysis and awareness campaigns.	High	• Reduction in the scope of the project, potentially leading to incomplete analysis. • Compromised project quality due to insufficient resources.
R4	Time Constraints	Tight project schedules and deadlines can cause time constraints, making thorough data collection, analysis, and awareness campaigns difficult.	High	• Incomplete data analysis due to rushed efforts. • Missed project deadlines and milestones.
R5	Technological Challenges	Hardware or software issues during data Collection, analysis, or awareness campaign implementation can create technological challenges, potentially leading to project delays.	Medium	• Delays in project execution and potential impact on project timelines. • Concerns about data accuracy and reliability.

Risk Management

Risk Name	Mitigation	Responsible Person	Response Time
Data Availability	Mitigate the risk by conducting a thorough assessment of data sources and availability before project initiation. Establish data-sharing agreements with relevant parties and set clear deadlines for data submission. Monitor data collection progress regularly.	Project Manager	Ongoing monitoring
Stakeholder Resistance	Implement a robust stakeholder engagement plan that includes clear communication about the project's goals and benefits. Involve stakeholders in the decision-making process and address concerns promptly.	Project Manager	Ongoing monitoring
Budget Constraints	Develop a detailed budget plan with cost estimates for all project activities. Prioritize project activities to ensure essential components are adequately funded. Explore potential cost-saving measures and seek additional funding sources if feasible.	Finance Manager	As needed
Time Constraints	Create a well-structured project schedule with built-in buffers to accommodate unexpected delays. Allocate additional resources or adjust project priorities as needed to meet deadlines. Closely monitor project progress and address time-related issues promptly.	Project Manager	Ongoing monitoring
Technological Challenges	Engage IT experts or technical specialists to provide support and expertise in handling technological challenges. Conduct thorough testing of technology solutions and have contingency plans in place to address technical issues promptly.	IT Specialist	As needed

Roles and Responsibilities

Roles	Description	Responsibilities
Project Sponsor	The hospital project sponsor, typically represented by the hospital manager, serves as the project sponsor. They provide overall objectives, goals, mission, vision, and strategic direction for the project.	• Approving project initiation and major milestones. • Allocating financial and human resources. • Resolving high-level project issues. • Ensuring the project aligns with the hospital's mission and objectives.
Project Manager	The Project Manager is responsible for the day-to-day management and execution of the project. They oversee the project team, manage timelines, and ensure project goals are met.	• Planning, executing, and closing the project. • Managing project risks and issues. • Communicating progress to stakeholders. • Allocating resources and setting priorities.
Research Coordinator	The Research Coordinator oversees the research aspects of the project, ensuring data collection and analysis align with project objectives.	• Designing research methodologies. • Coordinating data collection efforts. • Analyzing research findings. • Reporting research results.
Project Team	Responsible for the overall execution of the project.	• Collect and analyze data • Develop recommendations. • Implement changes and monitor project progress.
IT Support Team	Provide technical expertise for data collection, analysis, and technology related challenges.	• Ensure the smooth operation of data collection tools. • Assist with IT-related issues. • Support the project's technical aspects.

Finance Team	Manage project finances, budgeting, and resource allocation.	• Create and maintain the project budget. • Allocate funds to different project activities, and track expenditures.

The demarcation of roles and duties within the asiri hospital private limited project team is critical to guaranteeing the research project's success. Each job inside this organized framework is significant in its own right, contributing to the overall success of the project. asiri hospital private limited project dedication to improve health industry quality and peoples experience via research into the environmental effect of wastage .The project's relevance arises from its connection with the hospital goal and objectives, therefore defining roles and duties is critical.

These roles and duties create clarity, which is vital to the project's success. Each job has a specific purpose, resulting in more efficient decision-making, resource allocation, and dispute resolution. The organized approach to roles and duties encourages openness and responsibility while limiting the possibility of misunderstandings and disputes. It simplifies communication, ensuring that everyone understands their tasks and supports efficient progress monitoring. This well-organized structure allows the project team to work together toward the shared objective of increasing the quality of health industry and sustainability via effective research.

Project Team

01. Project Manager

   Oversees the entire project and ensures its successful execution.

02. Data Analysts

   Responsible for data collection, analysis, and reporting.

03. IT Specialists

   Provide technical support for data-related tasks and technological challenges.

04. Awareness Campaign Coordinator

   Manages the creation and implementation of awareness campaigns.

05. Administrative Support

   Assists in project documentation, scheduling, and logistics.

Initial Project planning

Work Breakdown Structure (WBS)

Project: AI in Waste Management at Asiri Hospital
Initiation
Environmental Impact assessment
Feasibility study
Obtain Stakeholders buy- in
Milestone - Obtain approval for project Initiation
Project Planning
Project Blueprint
**   - Evaluation**
Define project scope and objectives
Identify project stakeholders
Form project team and roles
Secure project sponsor and resources
Milestone – finalize project planning
Execration (design & develop)
Implement eco-friendly technologies
Staff training and awareness
Implement quality control measures
Milestone - Successful Execution of Environmental Initiatives
Risk Management Plan
Risk monitoring and control
Risk mitigation
**   -Risk identification address potential risks**
Risk analysis
Milestone – ongoing project oversight and control
Conduct Research
Conduct literature review
Develop data collection plan
Collect data on wastage in healthcare industry
Project Reporting and Documentation
Prepare project progress reports
Document research findings and analysis

Compile final project report

Project Closure
Final review and documentation   **- Evaluate project against initiation objectives** **- Document lesson learned** **Present findings and recommendations to hospital stakeholders** **- share project outcomes with stockholders** **Conduct project research** **Milestone - Finalize project Documents successfully closed**

Work Breakdown Dictionary (WBD)

Project: AI in Waste Management at Asiri Hospital	Duration	Start date	End date
Initiation			
Environmental Impact assessment	13 days	29.10.2024	11.11.2024
Feasibility study	12 days	11.11.2024	23.11.2024
Obtain Stakeholders buy- in	10 days	23.11.2024	03.12.2024
Milestone - Obtain approval for project Initiation			
Project Planning			
Project Blueprint **- Evaluation**	4 days	03.12.2024	07.12.2024
Define project scope and objectives	6 days	07.12.2024	13.12.2024
Identify project stakeholders	5 days	13.12.2024	17.12.2024
Form project team and roles	3 days	17.12.2024	20.12.2024

Secure project sponsor and resources	4 days	20.12.2024	24.12.2024
Milestone – finalize project planning			
Execration (design & develop)			
Implement eco-friendly technologies	10 days	24.12.2024	04.01.2025
Staff training and awareness	5 days	04.01.2025	07.01.2025
Implement quality control measures	6 days	13.01.2025	19.01.2025
Milestone - Successful Execution of Environmental Initiatives			
Risk Management Plan			
Risk monitoring and control	15 days	19.01.2025	02.02.2025
Risk mitigation **-Risk identification address**	6 days	02.02.2025	08.02.2025
potential risks	8 days	08.02.2025	16.02.2025
Risk analysis	7 days	16.02.2025	23.02.2025
Milestone – ongoing project oversight and control			
Conduct Research			
Conduct literature review	6 days	23.02.2025	29.02.2025
Develop data collection plan	5 days	29.02.2025	04.03.2025
Collect data on wastage in healthcare industry	5 days	04.03.2025	09.03.2025
Project Reporting and Documentation			
Prepare project progress reports	8 days	09.03.2025	17.04.2025
Document research findings and analysis	5 days	17.04.2025	23.04.2025
Compile final project report	10 days	23.04.2025	03.05.2025
Project Closure			
Final review and documentation - Evaluate project against	8 days	03.05.2025	11.05.2025

initiation objectives - Document lesson learned	6 days	11.05.2025	17.05.2025
Present findings and recommendations to hospital	12 days	17.05.2025	29.05.2025
stakeholders	6 days	29.05.2025	05.06.2025
- share project outcomes with			
Conduct project research	15 days	05.06.2025	20.06.2025
Milestone - Finalize project Documents successfully closed			

Milestone Chart

DATE	MILESTONE	ASSIGNED TO	POSITION
29-10-2024	PROJECT START	KUMAR JOHNSON	20
15-11-2024	PROJECT INITIALATION	RAVI KANTH	10
19-11-2024	REQUIREMENTS GATHERING	THUSARA	4
01-12-2024	DESIGN PHASE	ROEY	25
15-12-2024	DEVELOPMENT	MADUTH	15
15-01-2024	TESTING	KRISHNA	15
15-02-2024	FINALIZING FEATURES	AZAM	20
29-02-2024	PROJECT RISK MITIGATION	SIMON	20
05-03-2024	QUALITY ASSURANCE	HARINI	15
15-03-2024	PROJECT ASSESSMENT	ANURA KUMARA	10
30-03-2024	PROJECT END		5

Project Budget

Budget Category	Description	Estimated Cost
Research Expenses		
	Survey creation and distribution	20,000/=
	Data collection and analysis tools	30,000/=
	Research materials and publications	15,000/=
Technology		
	Software licenses (data analysis, simulation)	25,000/=
	Hardware upgrades	40,000/=
	Electronic devices for data collection	35,000/=
Travel		
	Site visits (transportation, accommodation)	5,000/=
	Data collection expenses (travel to various locations)	3,500/=
Awareness Campaigns		
	Marketing materials (brochures, posters)	5,000/=
	Awareness events (workshops, seminars)	8,000/=
Data Analysis Tools		
	Specialized software for data analysis	15,000/=
	Data analytics tools and subscriptions	20,000/=
Miscellaneous		
	Contingency fund	20,000/=
Training	Trainer cost	30,000/=
	Refreshment	20,000/=
	Study materials	35,000/=
Total Estimated Budget		**331,500/=**

The Proposed Project Budget summarizes the expected funding needs for asiri hospital private limited for the research project on the waste management in hospital to implement AI. This budget plan is crucial because it guarantees that all required spending for research, technological upgrades, travel, awareness campaigns, data analysis tools, and other charges are properly allocated and accounted for. It acts as a financial road map, helping the project team to properly manage resources, track expenses, and ensure that the study is completed successfully. This budget plan is essential for monitoring financial resource allocation, preserving fiscal discipline, and, ultimately, meeting project goals in an efficient and orderly way.

Gantt chart

	TASK	START	END	DAYS	20 21 22 23 24 25 26 27 28 29 30 31 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28
2	**PROJECT PLANNING**				
3	define the project scope and objectives	20.11.2024	25.11.2024	5	
4	identify project stakeholders	26.11.2024	29.11.2024	3	
5	form project team and roles	30.11.2024	31.11.2024	1	
6	collect the project resources	01.12.2024	05.12.2024	5	
7	**DEVELOP THE PRIMARY PROJECT PLAN**				
8	develop wbs	06.12.2024	09.12.2024	3	
9	develop wbd	10.12.2024	14.12.2024	4	
10	**DEVELOP PROJECT MANAGEMENT PLAN**				
11	set an objective to the project	15.12.2024	17.12.2024	2	
12	**PLAN SECDULE**				
13	gant chart	18.12.2024	21.12.2024	3	
14	propose budget	22.12.2024	24.12.2024	2	
15	**RISK MANAGEMENT PLAN**				
16	risk identification	24.12.2024	28.12.2024	4	
17	risk analysis	26.12.2024	31.12.2024	5	
18	risk monitors and control	28.12.2024	31.12.2024	3	
19	**CONDUCT RESEARCH**				
20	conduct literarure review	01.01.2025	05.01.2025	5	
21	develop data collection plan	06.01.2025	10.01.2025	4	
22	**PROJECT CLOSURE**				
23	recommendation to hospital	11.01.2025	15.01.2025	4	
24	conduct project research	16.01.2025	18.01.2025	2	
25	finalize the relevant document	19.01.2025	20.01.2025	1	

Activity 2

Features and operational goals of AI in waste management at Asiri Hospital
Features of the AI system

A. Automatic waste classification
- Uses sensors and computer vision to identify and sort waste into categories such as medical, recyclable and general waste. Ensures segregation of hazardous materials for safe disposal.

B. Data collection and analysis
- Tracks waste generation patterns using real-time data from sensors. Provides detailed reporting on waste types, volumes and recycling rates to aid decision-making.

C. Predictive analytics
- Uses AI algorithms to predict waste trends based on historical data, enabling better waste disposal and recycling planning.

D. Integration with Hospital Systems
- Works with existing hospital management systems to synchronize data and improve workflow efficiency. Can be integrated with inventory systems to identify waste sources and minimize material waste.

E. Real-time alerts
- Send alerts for immediate attention to issues such as improper waste disposal or overflowing waste containers.

F. Green recommendations
- Suggest ways to reduce waste and increase recycling, thus contributing to sustainability goals.

Operational areas

G. Waste collection points
- Install smart bins throughout the hospital to automatically sort waste at the source (e.g., patient rooms, laboratories, and cafeterias).

H. Central Waste Management Facility
- AI systems streamline waste sorting and processing, reducing staff workload and ensuring compliance with medical waste regulations.

I. Supply Chain and Inventory
- Identifies overuse or waste of supplies, helping the hospital optimize inventory and reduce waste at the source.

J. **Recycling Operations**
   - Ensures that recyclable materials are identified and directed to appropriate recycling centers, thereby reducing waste sent to landfill.

K. **Environmental Advisory and Reporting**
   - Assist in record keeping for audits and ensure compliance with health and environmental regulations through automated monitoring.

L. **Staff Training and Education**
   - Support staff with AI-based tools to raise awareness of good waste disposal practices. These functions and operational areas allow Asiri Hospital to improve waste management processes, reduce costs and effectively achieve sustainability goals.

Project Management Plan

AI in Waste Management at Asiri Hospital

Introduction

This Project Management Plan outlines how the AI-driven waste management system will be implemented at Asiri Hospital. It includes the processes, strategies, and resources needed to complete the project successfully, ensuring that it meets the objectives of improving waste sorting, recycling, and disposal efficiency.

Project Goals and Objectives

Goals	Objectives
Improve waste sorting accuracy using AI.	Implement AI for automatic sorting of waste.
Promote sustainability by reducing landfill waste.	Reduce the environmental impact of the hospital's waste.
Ensure safe disposal of medical and hazardous waste.	Train staff to use the new system effectively.
Optimize waste collection and disposal schedules.	Monitor AI system performance and make necessary adjustments.

Project Scope

   - Installation of AI-based waste sorting system.
   - Staff training for the new system.
   - Data collection and analysis to optimize waste management processes.
   - Regular system monitoring and reporting.

Cost Management

Estimated Budget- [331,500/=]

Cost Breakdown	Cost Control Measures
AI system purchase and installation	Monitor expenses regularly to stay within budget.
Staff training	
Ongoing maintenance and updates	Explore cost-effective AI solutions and potential funding options.
Project management and consultation fees	
Survey creation and distribution	
Research materials	
Hardware upgrades	
Data collection expenses	
Refreshments	

Quality Management

Quality Standards	Quality Assurance Activities
The AI system must meet industry standards for waste sorting accuracy, efficiency, and safety.	Regular system testing during implementation.
System must be reliable and compatible with Asiri Hospital's infrastructure.	User feedback collection to ensure the system is working as intended.
	Continuous monitoring and adjustment to optimize system performance.

Communication Plan

Information must be sent and received through a variety of verbal and non-verbal techniques. You employ communication skills when you give a presentation at work, collaborate with your co-workers, discuss a concern with your manager, or get clarification from a customer regarding a project. They are crucial to creating fruitful business connections. (Short, 2024)

Verbal communication

Verbal communication refers to efficiently expressing your ideas orally, or through talking. In the realm of business, effective verbal communication is crucial. The value of verbal communication cannot be overstated. Whether it is in a weekly meeting or a presentation to stakeholders. People always remember someone who communicates effectively, charismatically, and with clarity.

Non-Verbal Communication

The production and perception of any signal, other than voice, that is used to communicate information to another person is referred to as nonverbal communication. The majority of nonverbal communication is described in terms of speech modification strategies like changing one's voice volume or pace, but not in terms of the explicit coding and grammar found in spoken language. Nonverbal behaviors are regarded as essential components of the communication process, both in terms of production and perception.

Effective communication among stakeholders is key to the success of the project.

- **Project Team**

  Weekly meetings to discuss progress, issues, and next steps.

- **Hospital Staff**

  Regular updates via emails or notice boards to ensure everyone is informed.

- **Management**

  Monthly progress reports and review meetings to discuss the overall project status.

- **External Partners**

  Regular check-ins with AI vendors and consultants to ensure smooth implementation.

Risk Management

Risk Identification	Risk Mitigation Strategies	Risk Monitoring
High initial costs AI systems can be expensive.	**High initial costs** Secure funding or grants, and consider phased implementation.	Regular progress reviews to identify any new risks.

Staff resistance	Staff resistance	Adjust the project plan as needed to address emerging issues.
Staff may be reluctant to adapt to new technology.	Provide training and clear communication about the benefits of the new system.	
Technical difficulties	**Technical difficulties**	
AI systems may not integrate smoothly with existing hospital systems.	Work closely with AI vendors to ensure compatibility and troubleshoot issues early.	

Resources Management

Human Resources	Physical Resources
AI system experts (vendor support).

Hospital IT team for system integration.

Hospital waste management staff for training and system usage. | AI software and hardware.

Training materials for hospital staff. |

Key Stakeholder Impact on Hospital Success

Stakeholders play a significant role in shaping the success of a hospital by influencing its operations, strategic decisions, and overall service quality. Below is an outline of key stakeholders and their impacts

Stakeholders	Impact on hospital Success
Patients	Drive demand for quality healthcare services. Provide feedback that helps improve service delivery. A hospital's reputation is directly linked to patient satisfaction.by the patient satisfaction the hospital goodwill also increases due to patient satisfaction .Satisfied patients are likely to recommend the hospital, boosting patient inflow and trust in the health sector.
Medical Staff (Doctors, Nurses, Technicians)	Deliver critical care, which is the core of hospital operations. Their skills and performance directly affect patient outcomes and hospital reputation. High employee satisfaction leads to better productivity and reduced staff turnover. Skilled doctors attract more patients, enhancing the hospital's credibility.
Management and Administrators	Ensure efficient operation of the hospital, from finances to resource allocation. Drive strategic initiatives such as AI adoption and sustainability projects. Oversee compliance with health and safety regulations, ensuring legal and ethical operations. Effective administrators can implement cost-saving measures without compromising service quality.
Local Community	The relationship between the hospital and the local community can have a significant impact on its success. A successful collaboration can result in community support, collaborative research projects, internship opportunities, and a pool of prospective staff. Community engagement creates trust and strengthens the hospital position as a valuable community asset.

Government and Regulators	Through accreditation, funding, and compliance requirements, government agencies and regulatory bodies have an impact on the hospital operations. Regulation adherence and proactive engagement with government entities ensure access to resources and the hospital reputation for quality health.
Financial Institutions and Investors	Provide funding for infrastructure and technology upgrades. Assess the hospital's financial performance for future investments. Investors might fund AI-driven innovations to enhance healthcare delivery.
Suppliers (Medicines, Equipment, Services)	Timely supply of quality medical products ensures uninterrupted services. Collaboration with sustainable suppliers aligns the hospital with environmental goals. Partnering with eco-friendly waste management vendors supports sustainability efforts.

Each stakeholder contributes uniquely to the hospital's success. Strong collaboration and effective communication with stakeholders are essential to align their expectations with the hospital's goals, leading to improved service delivery, financial stability, and long-term sustainability.

Analysis of the challenges that must be faced to ensure the success of a hospital in the healthcare sector

Hospitals, especially facilities like Asiri Hospital, face various challenges that can affect their ability to provide quality care, effectively manage their operations and achieve financial stability. Here are the main challenges in the healthcare sector of the asiri and their impact

	Challenge	Impact
Financial constraints	Rising operating costs, limited funding and late payments from insurers or patients can strain hospital budgets.	Difficulty in upgrading facilities, hiring qualified staff or adopting new technologies, which can reduce the quality of care

Labor shortage	Difficulty recruiting and retaining qualified healthcare professionals, such as doctors, nurses, and specialists.	Increased workload for existing staff, leading to burnout and reduced efficiency.
Technology integration	Adopting advanced technologies such as AI, telemedicine, or electronic medical records (EMR) can be expensive and complex.	Delayed technology implementation can lead to inefficiencies and limit a hospital's ability to compete.
Regulatory Advisory	Meeting stringent healthcare regulations and standards regarding patient safety, data privacy and waste management.	Non-compliance can result in fines, legal issues and damage to the hospital's reputation.
Raising patient expectations	Patients expect personalized, high-quality and timely healthcare services.	Failure to meet these expectations can lead to dissatisfaction and loss of patients to competitors.
Access to healthcare	Hospitals may struggle to make healthcare accessible to remote or low-income populations due to infrastructure or cost constraints.	Limited access to underserved areas can damage a hospital's reputation and reduce its patient base.
Medical Waste Management and Sustainability	Hospitals generate a large amount of medical waste, which must be handled safely and sustainably.	Improper waste disposal can harm the environment and result in penalties or negative public reactions.
Competition from other healthcare providers	Competition from other hospitals or clinics offering similar or superior services.	Hospitals must continually innovate and improve their services to attract and retain patients.
Epidemics and Emergencies	Pandemics or emergencies can reduce hospital capacity and disrupt regular operations.	The sudden increase in the number of patients burdens resources and staff, which can compromise the quality of care.
Increasing healthcare costs for patients	The increasing costs of medical procedures and treatments can deter patients from seeking treatment.	Hospitals may experience a decline in patient numbers or an increase in unpaid bills.

Patient Data Management and Cyber security	Managing large volumes of patient data while ensuring cyber security and confidentiality.	Data breaches can lead to legal liability and damage the hospital's reputation.
Demographic changes and aging population	An aging population is increasing the demand for specialized care and chronic disease management.	Hospitals may face capacity issues or the need to invest in geriatric care facilities.

Importance of AI Research on Waste Management to Asiri Hospital

This research is important not only to me as a researcher, but also to Asiri Hospital, the wider medical community and the global effort to promote sustainability. It is essential to understand how AI can improve waste management and reduce environmental impacts, and this study aims to provide practical solutions to address these challenges.

1. Importance to the researcher

This study gives me the opportunity to contribute to solving a real-world problem using AI to improve the sustainability of healthcare. It allows me to apply my knowledge and skills to an important problem, helping me grow both academically and professionally. Working on a real-world challenge gives me practical experience that can be useful for my future career.

2. Importance for Asiri Hospital

The research helps Asiri Hospital demonstrate leadership in adopting environmentally friendly practices, especially in waste management. The results can guide the hospital in implementing AI-based solutions that reduce its carbon footprint and environmental impact related to waste. This is in line with Asiri Hospital's mission to provide quality healthcare while promoting environmental responsibility.

3. Broader impact on health and society

The study highlights how AI can support sustainable healthcare practices by improving waste sorting, recycling and disposal processes. It contributes to the global debate on the balance between technological advances and environmental protection. The research findings could inspire hospitals and other healthcare providers to adopt green AI-based solutions, creating a ripple effect across the industry.

Timescale

Duration	Start Date	End Date	Total Months
Date/Month	20.11.2024	21.01.2025	2 Months

Propose Topic – AI in Waste Management at Asiri Hospital

Project Management Process
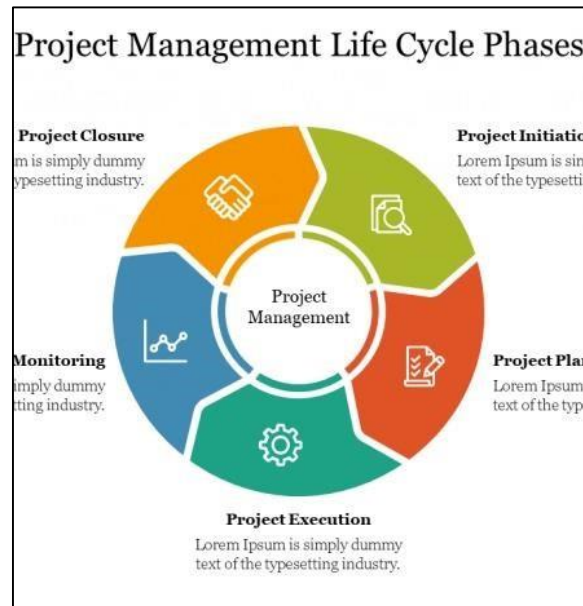
Project management is one of the most critical components of every project. This is because project management is the key activity that links all other project activities and procedures. There are several project management activities to select from. The amount of project management activities may be classified into five major processes.

1.   **Project Initiation**

The initial step of every project is called project initiation. This procedure includes all actions connected to winning a project. Pre-sales are often the primary activity at this era. During the pre-sale time, the service provider demonstrates to the customer their eligibility and capacity to fulfil the project, and subsequently wins the company's contract. The next step is to obtain comprehensive requirements. During the requirements collecting operation, all customer needs are collected and reviewed for possible implementation. Negotiations may take conducted during this activity to amend or eliminate some criteria completely.

2.   **Project Planning**

Project planning is an important part of the project management process. If the project management team gets this step wrong, the ramifications might be severe in the project's later stages. As a consequence, the project management team must closely monitor the project progress. During this phase, a project plan is created to meet project needs such as scope, budget, and schedules. The project schedule is produced when the project plan is completed. The project's resources are then assigned in accordance with the budget and timeframe. This is the most significant phase of the project in terms of expense and effort.

3.   **Project Execution**

After all documentation is finished, the project management team oversees the project to ensure that it meets its goals. When it comes to execution, each team member completes their respective job within the

specified timeframe for each activity. The project's progress will be tracked using the comprehensive project schedule. Several reporting tasks must be accomplished throughout the project's execution. The company's top management will expect daily or weekly project status reports. In addition, the customer may want to track the project's development. During project execution, it is vital to monitor project effort and expense to ensure that the project is progressing properly.

4.   **Validation and Control.**

Throughout the project's life cycle, the activities should be closely monitored and verified. Controlling may be performed mostly by following the project's basic protocols, which comprise the project plan, quality assurance test plan, and communication strategy. There may be cases when such procedures may not apply. In such scenarios, the project manager should take appropriate and required measures to keep the situation under control. Validation is a supporting activity that takes place throughout the project's lifecycle. Each activity and delivery should have its own validation criteria to assure success or completion.

5.   **Closeout and Evaluation**

When all project criteria have been completed, it is time to give over the implemented system and complete the project. If the project deliverables match the client's acceptance requirements, the project will be approved and paid for. When the project is over, it is time to assess the whole process. During this review, the project team's faults will be highlighted and corrective actions will be done to prevent them in future projects. During the project assessment phase, the service provider may learn that they did not meet the project's planned margins and may have surpassed the original timetables.

Literature Review on AI in Waste Management

Introduction

Artificial intelligence (AI) has attracted attention because it has the potential to completely transform the way waste is disposed of, recycled, and classified. The developments, uses, challenges, and limitations of AI-based waste management are examined in this literature review, with a focus on the implications for medical institutions such as Asiri Hospital.

AI Applications in Waste Management

❖ **Smart Sorting Systems**
   AI-powered sorting systems, utilizing computer vision and machine learning, can identify and separate recyclable, non-recyclable, and hazardous materials with high precision. For instance, systems like Zen Robotics and AMP Robotics use sensors and AI algorithms to sort waste more efficiently than manual processes. (al, 2020)

❖ **Hazardous Waste Management**
   In healthcare, where proper disposal of hazardous medical waste is critical, AI can detect and handle infectious or dangerous materials using sensors and automated systems. AI also ensures compliance with environmental and safety regulations. (Gupta & Sharma, 2021)

❖ **Predictive Analytics**
  AI-driven analytics tools can forecast waste generation trends, enabling better planning and resource allocation. For hospitals, this can optimize waste collection schedules and reduce costs.
  (al., 2019)
❖ **IoT Integration**
  Internet of Things (IoT) devices, combined with AI, can monitor waste bins in real-time, ensuring timely collection and reducing overflow issues. (al., 2022)

Benefits of AI in Waste Management

❖ **Efficiency and Accuracy**

 AI reduces human error and increases efficiency in waste sorting and recycling processes. By automating the classification of different types of waste, such as hazardous materials, recyclable materials, and medical waste, artificial intelligence (AI) technology can improve waste management at Asiri Hospital. It simplifies material storage and ensures efficient waste management by reducing human error, speeding up the process, and gradually increasing accuracy.

❖ **Cost-Effectiveness**

Automated systems cut labor costs and optimize resource use. By decreasing manual labour, boosting productivity, and improving waste disposal, Asiri Hospital can save money by implementing AI to automate waste sorting and management. More sustainable waste management techniques and financial savings result from this.

❖ **Environmental Impact**

 By optimizing waste management, AI can reduce the hospital's environmental footprint, making processes more sustainable. AI aids in reducing landfill dependency and improving recycling rates, contributing to sustainability goals.

❖ **Safety Improvements**

AI systems can minimize human exposure to hazardous materials, enhancing the safety of hospital staff.

❖ **Data-Driven Decisions**

By gathering information on waste types and disposal techniques, identifying areas for waste reduction strategy improvement, monitoring regulatory compliance, and enabling proactive changes to waste management policies for more efficient and sustainable practices, artificial intelligence (AI) can assist Asiri Hospital in analysing waste patterns.

❖ **Resource Optimization**

AI can predict the appropriate amount of resources required, optimise resource utilisation in waste management, increase cost-efficiency, guarantee timely waste processing, and uphold regulatory compliance.

Challenges and Limitations

❖ **Data Requirements**

AI systems rely on large datasets for accurate predictions and classifications, which may not always be available.

❖ **Technical Limitations**

Errors in waste classification and system malfunctions can occur, especially when dealing with mixed or unstructured waste.

❖ **Human Resistance**

Staff may resist adopting AI solutions due to unfamiliarity or fear of job displacement.

❖ **Large Volume of Waste**

The volume of waste produced by its large patient base, including general, medical and electronic waste, has become too much for Asiri Hospital. The volume and hazardous nature of medical waste makes its management and disposal difficult, requiring effective methods and resources. Hospital waste management is made more difficult by compliance with health and safety laws.

❖ **Manual Sorting Challenges**

At Asiri Hospital, manually sorting waste takes a lot of time and effort, which can result in errors and inconsistencies. AI-powered process automation can increase waste management's accuracy and efficiency while assisting the hospital in achieving its sustainability objectives.

❖ **Improper Disposal of Hazardous Waste**

Mishandling hazardous medical waste (e.g., syringes, bandages) can cause pollution and health risks.

❖ **Environmental Impact**

Because of inadequate segregation and disposal, waste management at Asiri Hospital has a major negative influence on the environment, leading to pollution and environmental deterioration. Hazardous waste can contaminate water and land, increasing the ecosystem's long-term risks. Ineffective waste management techniques also increase carbon emissions through processing, disposal, and transportation. By enhancing the sorting, recycling, and disposal procedures, artificial intelligence (AI) in waste management can lessen the environmental impact of hospitals overall.

❖ **Regulatory Compliance**

Failure to meet health and safety regulations related to waste management can lead to legal and financial penalties.

❖ **Rising Costs**

Inefficient waste management at Asiri Hospital is leading to increased costs in several areas. This includes increased labor costs for waste management, waste of valuable resources such as recyclable materials, and higher landfill fees for mixed waste. By streamlining the process, increasing sorting accuracy, and reducing unnecessary resource use, AI-based waste management systems can help hospitals save a lot of money. The implementation of AI systems can be expensive, particularly for specialized sectors like healthcare.

AI in Healthcare Waste Management

Healthcare generates a high volume of complex waste, including medical and electronic waste.

Medical Waste Sorting

Automated systems ensure proper separation of infectious and general waste.

❖ **Sustainability Goals**
AI-driven recycling reduces the environmental impact of healthcare institutions.
(al., 2022)

Future Directions

❖ **Improved AI Algorithms**: Developing more robust AI models to handle diverse waste types.
❖ **Affordability**: Research into cost-effective AI solutions for smaller institutions.
❖ **Integration with Policy**: Aligning AI technologies with environmental regulations for broader adoption. (Thompson, 2023)

The reviewed studies highlight the transformative potential of AI in waste management, particularly in the healthcare sector. Although there are challenges such as cost and energy consumption, the long-term benefits in efficiency, durability and compatibility outweigh these limitations. This research highlights the importance of exploring AI applications in sectors like Asiri Hospital to advance sustainable practices and set industry standards.

Objectives of the AI Waste Management Project at Asiri Hospital

1. Project Objectives

The main objective of this project is to improve the way Asiri Hospital manages its waste using artificial intelligence (AI). The hospital generates various types of waste, such as medical waste, plastic and paper, which need to be separated and disposed of properly. By using AI, the hospital aims to make the waste management process more efficient, accurate and sustainable.

2. Purposes

❖ Improvement of waste classification

Use AI technology to automatically classify waste into categories such as recyclable, non-recyclable and hazardous, thereby reducing human error and increasing efficiency.

❖ Reduction of environmental impact

Minimize the amount of waste sent to landfill and ensure that recyclables are treated properly, contributing to a greener environment.

❖ Ensure safe disposal of hazardous waste

Use AI to safely identify and dispose of hazardous medical waste, ensuring it does not harm the environment or public health.

❖ Optimize waste collection and disposal

Use AI to predict the volume of waste generated and create more efficient collection schedules to reduce costs and improve service.

❖ The promotion of sustainability

It integrates AI into Asiri Hospital's broader sustainability efforts, supporting the hospital's commitment to environmental responsibility.

Population and Sample Size

The target population of the study is the entire community of Asiri Hospital. It includes medical staff, support staff, administrative staff and other stakeholders in the hospital operations. The inclusion of this broad population aims to capture a variety of perspectives and approaches to waste management and the potential application of AI to improve these procedures. Obtaining valuable information and providing concrete suggestions tailored to the particular context of the hospital requires understanding the diverse perspectives and behaviors that exist within this population.

Example of Sampling in research methodology.
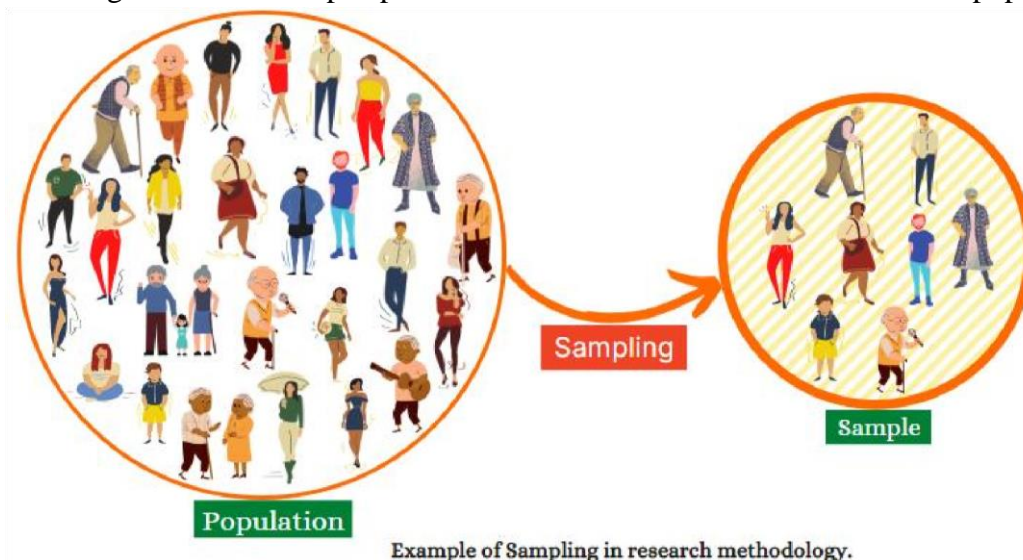
Qualitative Research

Interviews

Qualitative interviews include conversing with people or groups to get insights and perspectives on a certain issue. Researchers often utilize open-ended questions to enable participants to freely express themselves. The goal of this research is to unearth valuable, in-depth information and get a complete understanding of the participants' perspectives.

Focus Groups

Focus groups are conversations facilitated by a moderator. They bring together a small group of persons who have characteristics or experiences relevant to the study issue. Researchers get insights into common beliefs, attitudes, and group dynamics via guided discussions and exchanges among participants.

Documents

Document analysis is the evaluation of textual or visual resources like texts, images, films, or historical documents. Researchers examine these papers to understand the context, substance, and importance of the information provided within. This strategy is often utilized in historical research and content analysis.

Observations

Observational research is the systematic observation and recording of behaviours, events, or phenomena that occur in the wild. Researchers may opt to be active participants (engage with the environment) or passive observers (stay detached). Observations are important for capturing real-world behaviours and interactions.

Cultural Archive

Cultural records are historical objects, practices, or records that are unique to one culture or civilization. Researchers investigate these documents to learn about a particular group's or community's cultural practices, beliefs, and historical background. This strategy is commonly used in anthropology and cultural studies.

Quantitative Research

Experiments

An experiment involves methodically manipulating one or more independent variables while measuring the effect on one or more dependent variables. Researchers employ control groups and randomization to determine cause-and-effect correlations. Experiments are prevalent in psychology, biology, and physics.

Questionnaires

Questionnaires are organized collections of questions sent to people or groups in order to collect particular information. Researchers design questionnaires to obtain uniform data that can be compared and studied. They are widely utilized in disciplines such as market research and psychology.

Surveys

Surveys are similar to questionnaires, but they may be administered in a number of settings, including face to-face interviews, phone interviews, and online forms. Surveys, which are frequently employed in the social sciences and public opinion research, are an effective technique to collect data from vast and varied groups.

Database Reports.

Database reports are analyses of previously produced datasets or databases. Researchers utilize statistical tools to collect, clean, and analyse data from a variety of sources, including government records, company databases, and research archives. This strategy is effective for secondary data analysis.

Correlational research

Correlational studies examine the correlations between variables without altering them. Researchers utilize correlation coefficients (such as Pearson's correlation) to analyse the strength and direction of relationships. These studies reveal patterns and trends but do not establish causality. (GCU, 2024)

Different between qualitative and quantitative

Qualitative research	Quantitative research
This method involves a process-oriented inquiry	This method does not involve a process oriented inquiry
Qualitative research is holistic in nature	Quantitative Research is particularistic in nature
It is generally expressed using words	It is expressed using graphs and numbers
It has open-ended questions	It has multiple choice questions
Qualitative research needs only a few respondents	Quantitative research requires many respondents

Advantages and disadvantages

Qualitative research methods, particularly interviews and focus groups, are an important part of the research strategy because they can provide in-depth knowledge about the wastage in asri hospital private limited regarding hospital wastage and environmental issues.

Advantages of Qualitative

In-depth knowledge

Interviews and focus groups are especially useful for illuminating the underlying reasons and intricacies of people's beliefs and behaviours. They let participants to communicate their views and experiences in their own words, resulting in a more thorough grasp of the topics at hand.

Flexibility

Qualitative approaches are very versatile. Researchers might study unanticipated or unexpected patterns and ideas that develop throughout the data gathering process, providing for a more thorough understanding of the topic.

The Cultural Context

These tools are particularly useful for discovering cultural, social, and psychological elements that may impact people's environmental awareness and habits in a varied academic setting such as hospital.

Disadvantages of Qualitative

Resource-Intensive

When compared to quantitative procedures, qualitative research methods usually need more time and resources. Conducting interviews and focus groups, recording and analyzing data, and interpreting outcomes may all be time-consuming activities.

Subjectivity

Qualitative data analysis is subjective. It is reliant on researcher interpretation, which might lead to bias or differences in findings depending on the analyst's viewpoint.

Quantitative Research Methods

Questionnaires

Quantitative research approaches, particularly questionnaires, enhance traditional research by collecting organized and standardized data from a larger number of peoples. This strategy works well for acquiring quantitative data on digital device use habits and environmental attitudes from a large sample.

The advantages of quantitative

Objectivity

Questionnaires aim to decrease researcher bias. They employ standardized question and response forms to guarantee that all participants get the same questions and answers.

Statistical Evaluation

Quantitative data gathered via surveys is appropriate for thorough statistical analysis. This enables researchers to find correlations, trends, and patterns, facilitating objective and generalizable conclusions.

Efficiency

Efficiency surveys and questionnaires are useful methods of getting information from a large number of individuals. This gives for a larger view of the study issue in a fair length of time.

The disadvantages of quantitative

Lack of Depth

Typically, surveys do not enable participants to expound on their answers. As a consequence, data may be generated that lacks the depth and context supplied by qualitative approaches, thus overlooking the intricacies of participants' opinions.

Limited Exploration

Quantitative research is largely concerned with predetermined variables and closed-ended inquiries, which may restrict the investigation of unexpected themes or situations.

Data collection methods and tools

Data collection is the process of obtaining and evaluating information or data from a variety of sources in order to answer research questions, assess outcomes, and anticipate trends and probability. It is a critical phase in all sorts of research, analysis, and decision-making, including those in social sciences, business, and healthcare. Accurate data gathering is vital for making informed business choices, ensuring quality assurance, and maintaining research integrity. During data collecting, researchers must identify data kinds, sources, and methodologies. (Learn, 2023)

Data collection tools refer to the devices/instruments used to gather data, such as a paper questionnaire or a computer-assisted interview system. Data collecting tools include case studies, checklists, interviews, observations, and surveys/questionnaires. It is crucial to choose data gathering tools since research is carried out in a number of methods and for a range of goals. Data gathering is to gather high-quality information that can be examined to create persuasive and trustworthy responses to the questions addressed. Here are some examples of data gathering techniques used in research.

1. **Interview.**

Analysts or researchers conduct in-person interviews with stakeholders like as clients, customers, or subject matter experts. The strategy comprises asking precise questions about their software requirements, expectations, and concerns. Interviews provide in-depth talks, enabling researchers to acquire vital qualitative data and explanations that would be difficult to gain via other approaches.

2. **Focus groups.**

The focus group data collecting approach is similar to an interview, however it is conducted in groups rather than individually. Focus groups may be very beneficial when resources for one-on-one interviews are limited (in terms of people, money, or time), or when we need to reproduce a certain social context in order to collect data on people's attitudes and behaviours. A focus group should preferably consist of 3-10 persons, including a moderator. Depending on the study purpose and planned use of the data, all focus group participants should have certain similar characteristics.

3. **Surveys.**

Surveys are a typical type of data collection in which researchers ask participants a series of standardized questions. Surveys may be administered in a number of methods, including online, via phone, and in person. Surveys are an efficient and rapid technique to gather big volumes of data.

4. **Observation**

The observer might be a participant or an observer. This approach is easy to deploy, widely utilized, and does not need responders to write any reports afterward. The downsides of observation include unknown validity and costly organization. Checklists and direct observation are the most often used observation instruments.

5. **Case Studies**

Case studies may be used to look at a particular event in an intervention and see which elements impacted the result. They frequently combine qualitative and quantitative data. Case studies might be beneficial for conducting in-depth examinations into particular concerns raised during other monitoring initiatives. They may also be used to demonstrate statistical findings to customers who prefer narrative explanations of outcomes, as well as to share knowledge within a program or its partners.

Data collection tool

Questionnaire

The objective of questionnaires is to obtain standardized data from a large number of respondents using structured surveys. They often include a mix of closed and open-ended questions, allowing researchers to obtain quantitative and qualitative data on a certain issue. Questionnaires may help you reach a wider audience and collect a more diversified range of ideas and preferences. Consider a firm that wants to know how satisfied customers are with its goods. A questionnaire may ask, "On a scale of 1 to 10, how satisfied are you with our product?" additional question: "What features do you like most about our product?" Clients may then choose a number or provide textual comments.

I have chosen two basic data gathering methods: interviews and questionnaires. These techniques are well-suited to the research aims and nature of the study, and they provide various benefits over alternative methods that were not selected, such as Case Studies, Experiments, and Data Cleansing.

Interviews are an effective research tool because they allow for direct interaction with important stakeholders such as, Patients, Medical Staff (Doctors, Nurses, and Technicians), Management and Administrators and Local Community. This strategy enables you to go deeply into the complexities of their points of view, revealing qualitative data that gives valuable insights into the environmental effect. Questionnaire surveys provide the benefit of gathering information from a broader audience inside the hospital community, including Doctors, Nurses and staff. Surveys provide large-scale data collecting in an effective way, allowing for the assessment of awareness and attitudes on the environmental impact from the hospital wastage.

I chose a simplified technique that is consistent with the research scope and goals by avoiding Case Studies, Experiments, and Data Cleansing for this study. Case studies could have been more suited to evaluating individual projects inside the institution, but I picked methodologies that allow for a more thorough view of the broader environment. Similarly, Experiments and Data Cleansing are useful in other study settings but may be less relevant to the special emphasis on environmental effect knowledge and behaviour.

Data collection methods and tools advantages and disadvantages

Method	Advantages	Disadvantages
Interviews	In-depth information Flexibility in questioning Suitable for complex or sensitive topics	Time-consuming Limited to participants' availability Data analysis can be resource intensive
Focus Groups	Group dynamics and interaction Rich qualitative data	Limited to small, homogenous groups Difficulty in scheduling participants
Surveys	Efficient data collection Structured and standardized data	Limited to closed-ended questions Difficulty in exploring complex topics
Observation	Direct and unobtrusive data collection Real-time data	Observer bias and subject reactivity Limited insight into participants' thoughts
Case Studies	In-depth exploration of a specific case Multiple data sources	Limited generalizability Difficulty in replicating findings

Primary Data

One benefit of collecting primary data is the accuracy with which researchers gather information relevant to their study's unique aims. Researchers design their questions and data gathering procedures to elicit answers that directly address the study topics at hand. Researchers actively gather this information via methods such as questionnaires, interviews, and direct observations. Consider a study team investigating employees' experiences throughout the return-to-work process after a work-related accident. As part of their investigation, the team interviews impacted workers over the phone. The main data gathered from these interviews gives researchers with in-depth insights into the return-to-work process. They may acquire

detailed information such as the frequency of work accommodation offers and the reasons why certain workers denied them. In this context, primary data allows researchers to collect accurate and relevant information that is directly connected to their study goals.

Advantages
• Primary data is customized to the researcher's requirements at the time of collection.
Researchers have total control over the information acquired, which is more exact than secondary data. The data may be considered as legitimate due to its lack of personal bias. The researcher also claims ownership of the main study data.
He or she may opt to open it out to the public, patent it, or even sell it. Primary data is generally up to date since it is obtained in real time rather than from old sources.

Disadvantages
• The cost of primary data is much higher than secondary data. As a consequence, acquiring primary data may be problematic.
• It's time-consuming. Primary data collection may be impractical in certain cases due to its complexity and time commitment.

Secondary Data

Secondary data may take numerous forms, including information from national population censuses and government statistics compiled by agencies like Statistics Canada. Administrative data, which includes information acquired as part of an organization or agency's everyday activities, is becoming more common. In contrast to primary data, secondary data is often widely accessible and inexpensive to gather. Administrative data, in particular, benefits from high sample sizes because of its comprehensive and continuing data gathering procedures. Administrative data, like many other forms of secondary data, is gathered over lengthy periods of time, enabling researchers to follow changes as they occur. Researchers utilize secondary data for a wide range of objectives, including

Background Research.
Secondary data is a significant resource for preliminary study, enabling researchers to get a basic grasp of a topic before moving on to more concentrated primary research.

Benchmarking
Researchers typically utilize secondary data to compare their own results to existing data, enabling them to confirm their findings and make relevant comparisons.

Historical Analysis
Secondary data is a treasure trove for historical study, revealing important insights into previous patterns, events, and social processes.

Cost-Effective Analysis.
Secondary data is often a less expensive choice since it has already been obtained, saving time and resources when compared to the process of acquiring wholly fresh primary data. This cost-effectiveness is particularly beneficial for researchers operating under constrained budgets.

Advantages

• Secondary data is more readily available than primary data. Secondary data is accessible on a number of platforms, which the researcher may employ.
• Secondary data is affordable. They are cheap to get since they are periodically distributed for free.
• Secondary data collecting is faster than primary data collection.
  • It may provide new insights from existing primary data.

Disadvantages

• Secondary data may not be genuine or reliable. A researcher may need to double-check the information acquired from numerous sources.
• Before determining the vital data, researchers may have to deal with irrelevant data.
• Personal bias might lead to overstated statistics.

 • Secondary data sources may be outdated and lack new information.

Different between Primary data and Secondary data

Comparison	Primary data	Secondary data
Data	Real time data	Past data
Process	Very involved	Quick and easy
Cost effectiveness	Long	Short
Available in	Crude form	Refined form
Accuracy and reliability	More	Relatively less

Data Analysis tools

Data Analysis

Data analysis is a complicated process that may take many methods from different individuals, companies, and specialists, but it can be reduced to a single concept at its core. The thorough cleansing, transformation, and processing of raw data yields meaningful, relevant insights that influence decision-making. Data analysis aims to mitigate the inherent hazards of decision-making by giving valuable information and insights. These insights are generally given with visual aids like charts, photos, tables, and graphs to make the data more accessible and understood.

To understand the underlying notion of data analysis, consider a simple daily scenario: when we make judgments, we automatically participate in data analysis. This analysis requires looking into the past or forecasting future occurrences to guide judgments. It is the process of reviewing past or projected data in

order to make smart choices based on data-derived insights. Data analysis, in a wider sense, applies the same core premise, but on a bigger and more organized scale, to help companies and organizations make better decisions and reduce risks. (Learn, 2023)

There are multiple data analysis programs that may be used for various purposes, including Microsoft Excel, SAS, Apache Spark, and Tableau.

Microsoft Excel

Microsoft Excel is a popular, versatile, and user-friendly spreadsheet. It is best suited for basic data processing, such as cleaning, sorting, and simple computations. Excel is often used for making tables, charts, and graphs. It is user-friendly and appropriate for individuals or small groups.

Statistical Analysis System (SAS)

SAS is a strong statistical software package designed for extensive data processing and advanced statistical modelling. It is widely employed in scientific research and businesses like as healthcare, finance, and social sciences. SAS can handle massive amounts of data while also doing extensive statistical testing and predictive modelling.

Apache Spark

Apache Spark is an open-source large data processing framework. It is intended to handle and analyze massive amounts of data in distributed and parallel computer settings. Spark is used for large data analytics, machine learning, and data transformation jobs. This is particularly beneficial for firms that handle massive data volumes.

Tableau

Tableau is a data visualization application that focuses on producing interactive and shared data displays. Although it is not a standard data analysis tool, it is quite useful for displaying and understanding data. Tableau links to a variety of data sources and allows users to generate interactive dashboards and reports. (Hillier, 2024)

Why I chose these methods

The methods I chose for this research are practical and effective for solving the waste management problem with AI.

Relevance to the topic

These methods, such as case study analysis and data mining, focus directly on understanding how AI can be applied to effectively manage waste. They help uncover real-world scenarios, which is the main goal of the research.

Practical application

The methods allow me to collect useful information and ideas that can be applied to improve waste management at Asiri Hospital. This makes the research real and valuable for me and Asiri Hospital, as well as for a well-known hospital in Sri Lanka and also for the foreign hospital.

Efficient use of resources

These methods are feasible within the time, budget and resources available for the project. They allow the research to be carried   out without undue delay and cost with the help of hospital staff, administrators and stakeholders without delay.

Reliable results

By using proven techniques such as trend analysis, literature review, and relevant data collection, I can ensure that the results are accurate and reliable.

Alignment with goals

These methods are designed to answer research questions and achieve the objectives of exploring the benefits and limitations of AI in waste management.

Activity 03

Action plan
Identification of Issues during Project Management Process

As the researcher on the study concentrating on the environmental effect of waste management at asiri hospital private limited, various difficulties were clear. One of the most essential is to address data collecting restrictions. Some parties were hesitant to submit complete data owing to privacy and security concerns. To solve this problem, I implemented strong data privacy procedures and explained the need of data anonymization to relieve their anxieties. Several technical complications developed throughout the data gathering procedure, including software compatibility concerns. These challenges were remedied by collaboration with the IT support staff, which helped simplify the operation of the data gathering systems.

Another difficulty was communication and stakeholder involvement. Managing the expectations and interests of many stakeholders with diverse degrees of environmental knowledge and participation necessitated a careful balance. The answer included adapting our communication strategies and awareness campaigns to each stakeholder group's unique demands and preferences. In doing so, I guaranteed that our results and suggestions reached a larger audience and sparked genuine change within the health sector. One of the most significant obstacles faced throughout the asiri hospital private limited study project was delays, which provided an additional substantial issue. Because of the necessity of resolving environmental problems, the study project was originally scheduled for a limited time frame. Furthermore, unanticipated technical challenges, such as compatibility issues with data analysis tools and the requirement for additional rounds of data cleaning and validation, caused delays. This issue was handled by modifying the project timetable and devoting additional time to extensive data analysis and quality assurance. Effective communication with stakeholders was critical to ensuring their comprehension of timetable adjustments, which allowed us to address their worries about project delays.

Evaluate the project planning recommendations and the accuracy and reliability of the research

i.   meets the organization's needs

Alignment with objectives

The project plan should directly address the organization's specific needs and objectives. If Asiri Hospital wants to improve waste management, the recommendations should focus on technologies such as AI that can automate waste sorting and aid in recycling. If the recommendations do not align with the hospital's goals, the project risks failure.

Resource efficiency

The plan should take into account the hospital's resources, such as budget, staff, and time, and recommend realistic and achievable solutions within these constraints. If the plan proposes expensive or complex solutions that exceed the hospital's capacity, it will not be practical.

Impact on operations

The recommendations are intended to improve the day-to-day functioning of the hospital. If the plan proposes changes that could disrupt hospital services or create confusion for staff, it may not be approved.

ii.   Research Accuracy and Reliability

Reliable Sources

The research presented in the project should be based on reliable and recognized sources of information. Research on AI in hospitals should come from reputable studies or opinions of experts in the field. Using unreliable sources can lead to incorrect advice.

Valid Data

Data collected during the research should be valid and collected in an appropriate manner. If you collect data through surveys or interviews, the questions should be clear and the data should accurately reflect the views or behaviours of the participants.

Consistency

Research methods should be consistent and reproducible. If different research methods (such as surveys, interviews, or experiments) show similar results, the conclusions are more reliable. If the results vary significantly, this may suggest that the research is not reliable.

Unbiased Results

Research should be unbiased and free from personal opinions or external influences. If research is done with an open mind and the right approach, it will provide reliable information for the project.

iii.   The   feasibility of the recommendations

Practical application

Even if the research is solid, the project's recommendations must be practical and actionable. the introduction   of AI for waste management may be a good idea in theory, but it requires the hospital to implement, taking into account factors such as training, cost and system integration.

Long-term benefits

 Councils   should consider long-term sustainability. Implementing an AI system for waste management must not only be effective now, but also scalable and cost-effective in the future as the hospital grows.

iv.   Risk Consideration

Identify potential risks

 Every project plan should assess potential risks. Adopting AI in waste management can face challenges such as staff resistance, technical issues, or unexpected costs. A good plan highlights these risks and provides solutions to manage them.

Mitigating negative impacts

 The research should also explore potential downsides or challenges that may arise from implementing the recommendations. If the research does not consider risks, the project may face unexpected problems.

v.   Effective Communication

All stakeholders must understand

 Project proposals must be explained in detail to all parties involved, including hospital management and employees. The hospital may find it difficult to take   action if the results and suggestions are not communicated in an easy-to-understand manner.

The project planning guidelines should be based on solid, reliable research and closely aligned with the goals and capabilities of the organization. The hospital can successfully improve waste management and achieve its goals by ensuring that the recommendations are realistic, achievable and supported by reliable research.

To interpret findings and generate knowledge on how the research theme supports business requirements in the health sector

1. Align Findings with Business Needs

Identify Key Business Requirements

Asiri Hospital, in the healthcare sector, focuses on key business needs, including profitability, regulatory compliance, sustainability and operational efficiency. The hospital aims to reduce waste management costs, ensure regulatory compliance, achieve sustainability goals and manage operations with AI technology. These

efforts not only improve waste management processes, but also strengthen the hospital's reputation and resource allocation to provide high-quality healthcare services.

Interpretation

If research on AI in waste management shows that AI can reduce waste disposal costs and improve compliance with environmental regulations, this can be interpreted as directly supporting the hospital's waste management goals and maintaining regulatory standards. The results show that implementing AI can help Asiri Hospital reduce waste management costs, achieve sustainability goals, and ensure compliance with environmental and health regulations, directly supporting the hospital's operational needs.

2. Demonstrate the Value of Research

The study shows that using AI for waste management at Asiri Hospital can reduce costs, improve sustainability efforts, and ensure compliance with regulations. Artificial intelligence can improve sorting processes, increase recycling rates, and monitor hazardous waste disposal, leading to operational efficiency and environmental responsibility. Implementing AI systems can improve the overall performance and long-term sustainability of the hospital.

3. Provide Actionable Insights

According to the study, Asiri Hospital can benefit from implementing AI for waste management to improve efficiency, reduce labor costs, optimize waste sorting processes, reduce waste disposal costs, and align with sustainability goals. By integrating AI systems with other hospital programs and training staff, the hospital can maximize the benefits of using AI in waste management to improve overall operational efficiency and financial performance.

4. Support Decision-Making

The study highlights the benefits of using AI in waste management at Asiri Hospital, including reduced costs, improved accuracy, increased recycling rates, and improved sustainability practices. AI can streamline operations, free up resources for other critical areas, and help the hospital comply with regulations while supporting its green initiatives. Overall, integrating AI into waste management is a wise investment in the hospital's future success and reputation as an environmentally friendly institution.

To analyse the challenges to the success of a business in a health sector, you need to look at various factors that could impact the business. These challenges are

1. **Financial Issues**

Asiri Hospital's financial constraints prevent it from investing in new technologies such as AI for waste management, despite the potential benefits they offer in terms of efficiency and cost reduction. The initial investment in hardware, software, maintenance, and staff training, as well as recurring costs, present major financial challenges for the hospital. To overcome these obstacles, Asiri Hospital may need to seek additional funding sources, partner with technology companies, or implement cost-saving measures in other areas.

2. **Regulatory Compliance**

Regulatory compliance is a key issue for Asiri Hospital, especially when implementing new technologies such as AI in waste management. The healthcare industry is highly regulated to protect public health, the environment and patient safety. Failure to comply with regulations can result in fines, legal action and damage to the hospital's reputation. Close cooperation with legal experts and technology developers is required to ensure that any AI system implemented meets all regulatory requirements.

3. **Competition**

Competition in the healthcare sector is intense, with Asiri Hospital facing challenges from both public and private facilities and emerging technologies. Investing in advanced technologies such as AI for waste management can reduce costs and improve patient care, but rapid adoption by competitors can impact market share. To stay competitive, Asiri must keep up with the latest technologies, maintain industry-leading service, and ultimately lower prices without sacrificing quality. However, implementing AI technology can be costly and face stiff resistance, requiring careful management for sustained success.

4. **Technological Barriers**

Technological hurdles, such as high costs, implementation complexity, integration challenges, ongoing technical support needs, data security concerns, and staff training requirements, pose significant challenges for Asiri Hospital in adopting AI for waste management. Overcoming these hurdles will require careful planning, budgeting, and leadership to successfully implement AI solutions and remain competitive in the healthcare industry.

5. **Staff Resistance**

Employees might be resistant to change, especially when new technologies or processes are introduced, which can slow down progress.

6. **Market Demand**

Market demand is critical to Asiri Hospital's success. Changing patient preferences and expectations, advances in medical knowledge and technology, and societal trends can impact a hospital's revenue and ability to deliver high-quality services. Factors such as declining patient numbers, competition from other healthcare providers, and increasing emphasis on environmental sustainability are challenges that Asiri Hospital has faced in maintaining its competitiveness. Adapting to changing patient expectations, investing in innovative technologies, improving the patient experience, and demonstrating a commitment to sustainability are essential for the hospital to ensure its financial stability and reputation in the healthcare industry.

These challenges must be carefully managed for the business to succeed in a competitive and ever-changing environment.

Ethical Considerations

Ethical Considerations for Research on Hospital Waste Management at Asiri Private Hospital.

• Informed Consent

It is essential to ensure that all participants, including patients, doctors and staff, give informed consent. It is essential that they understand the purpose of the study, the risks involved and how their data will be used. Consent forms should be clear and easy to understand.

• Data Privacy

It is essential to ensure the privacy of individuals in this process. Personal information and responses must be stored securely to prevent unauthorized access or disclosure. Compliance with data protection rules is essential to maintain privacy.

- **Risk reduction**

   Efforts should be made to minimize any harm or discomfort that the patient may experience during treatment. This can be achieved by designing surveys and interviews that avoid problematic questions.

  - **Benefit**

     The research is   expected   to help the hospital sector by providing information on the effects and sustainable practices. The potential benefits of this study must outweigh the harm to the patient.

  - **Environmental Impact**

     It is essential that research is conducted responsibly. This means making efforts to reduce your impact on the environment, for example by using less paper and energy.

  - **Transparency**

     It is essential to ensure transparency throughout the research process. This includes declaring any conflicts of interest and freely discussing research techniques and results with others.

Roles of the Researcher

As a researcher in the study of the effect of wastage of hospital to decrease environmental harm at asiri hospital private limited, I play various important responsibilities throughout the research process. These positions are essential for the research project's success and ethical integrity.

• As Project Manager

I design and supervise all parts of study. This includes defining the project's scope, establishing goals, developing a timeframe, and allocating resources effectively. It is my responsibility to guarantee that the research remains on track and achieves its objectives.

• Data Collector

In this position, I acquire primary data. This method involves developing surveys, conducting interviews, and making observations. It is critical to approach data gathering with compassion and guarantee that participants' privacy and rights are maintained throughout.

• Data analyst

Once the data is acquired, I take on the job of a data analyst. Here, I use statistical tools and software to handle and evaluate data. I identify patterns, correlations, and trends in the data that serve as the foundation for the research's results.

• Report writer

Following data analysis, I provide a detailed study report. This paper compiles results, insights, and suggestions. Clear and succinct language is essential for making the report accessible and useful to a large audience.

• Problem solver

Research is seldom without its hurdles. In my job, I deal with any concerns or challenges that may occur throughout the study process. Flexibility, flexibility, and critical thinking are essential for discovering answers to research challenges.

• A collaborator

Collaboration is an essential component in conducting research. I collaborate extensively with other researchers, advisers, and stakeholders to ensure a thorough approach to the study. Collaboration promotes diversity and improves research quality.

Questionnaire form

To Reduces Environmental Impact from The Hospital Wastages in Healthcare sector at Asiri Hospital Private Limited.

Thank you for participating in our research on the environmental impact on the hospital waste management in healthcare sector.

aashikmahroof123@gmail.com Switch accounts

Not shared

* Indicates required question

What is your role at Asiri Hospital? *

○ Management

○ Medical Staff

○ Administrative Staff

○ Staff

○ Other: _____

How long have you been associated with the hospital? *

○ 2 years

○ 4 years

○ 6 years

○ 8 years

How familiar are you with the concept of Artificial Intelligence (AI)? *

Choose ▼

How would you rate the efficiency of the current waste management system? *

○ Good

○ very good

○ poor

○ very poor

○ Average

AI can improve waste management processes at Asiri Hospital? *

○ Yes

○ no

○ Other: _____

What types of waste are most challenging to manage at the hospital? *

○ Medical Waste

○ General Waste

○ Hazardous Waste

○ Electronic Waste

COMMENT ANY ISSUES ABOUT OUT AI IMPLEMENTATION IN WASTE
MANAGEMENT AT ASIRI HOSPITAL PRIVATE LIMITED.

Your answer

How effective do you believe the current waste management practices at Asiri   *
Hospital are in reducing environmental impact?

○ Very Effective

○ Not Effective at All

○ Neutral

Do you think implementing AI in waste management can help improve   *
efficiency?

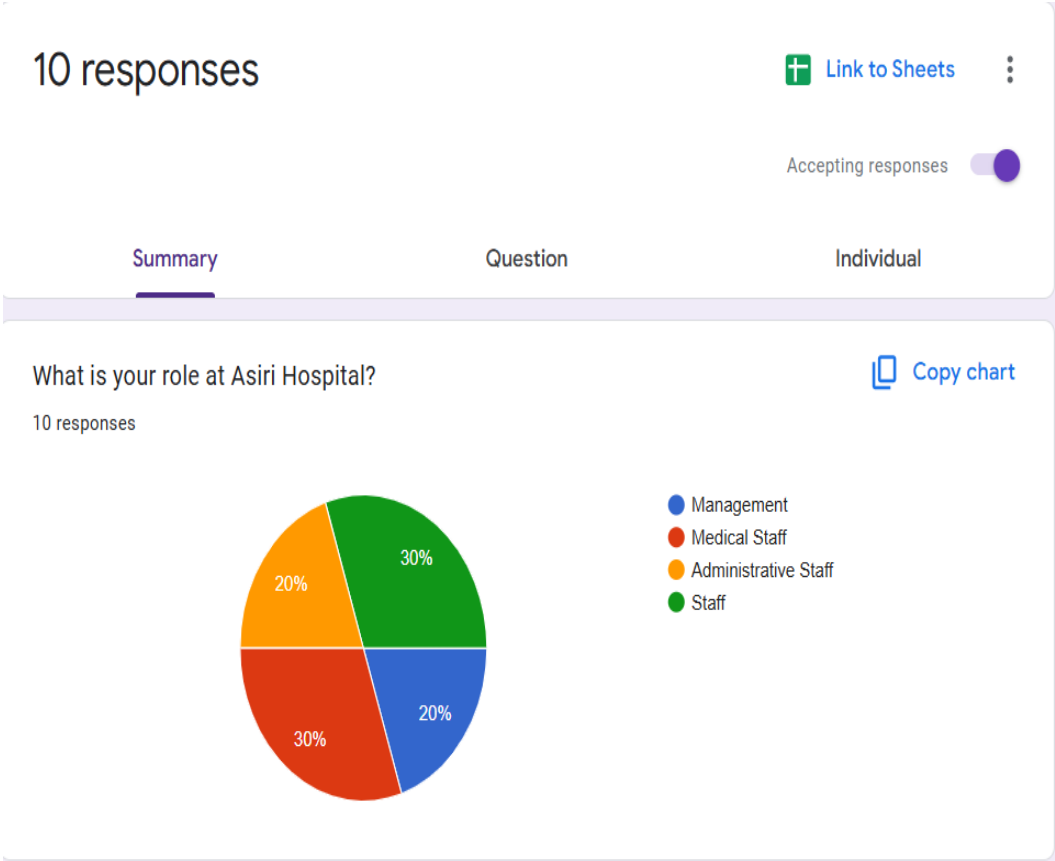○ Yes

○ No

○ Maybe

Do you believe AI waste management aligns with the hospital's sustainability
goals?

○ agree

○ disagree

○ neutral

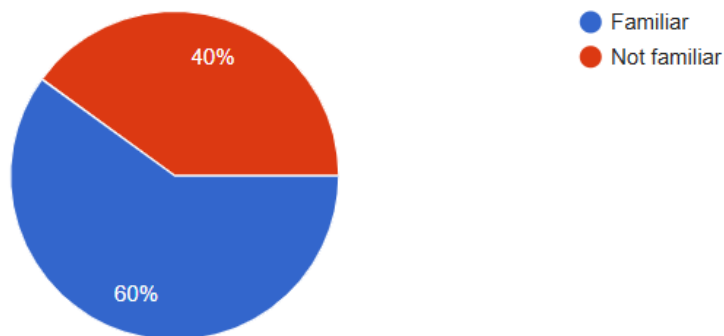**The feedback form from the technical and nontechnical staff from the health sector**

To Reduces Environmental Impact from The Hospital Wastages in Healthcare sector at Asiri Hospital Private Limited.

Thank you for participating in our research on the environmental impact on the hospital waste management in healthcare sector.

aashikmahroof123@gmail.com Switch accounts

Not shared

Draft saved

* Indicates required question

What is your role at Asiri Hospital? *

- ● Management
- ○ Medical Staff
- ○ Administrative Staff
- ○ Staff
- ○ Other: _____

How long have you been associated with the hospital? *

- ○ 2 years
- ○ 4 years
- ○ 6 years
- ● 8 years

How familiar are you with the concept of Artificial Intelligence (AI)? *

| Familiar ▼ |

How would you rate the efficiency of the current waste management system? *

- ○ Good
- ○ very good
- ○ poor
- ○ very poor
- ● Average

AI can improve waste management processes at Asiri Hospital? *

◉ Yes

◯ no

◯ Other: _____

What types of waste are most challenging to manage at the hospital? *

◯ Medical Waste

◯ General Waste

◯ Hazardous Waste

◉ Electronic Waste

COMMENT ANY ISSUES ABOUT OUT AI IMPLEMENTATION IN WASTE
MANAGEMENT AT ASIRI HOSPITAL PRIVATE LIMITED.

Your answer

How effective do you believe the current waste management practices at Asiri   *
Hospital are in reducing environmental impact?

◉ Very Effective

◯ Not Effective at All

◯ Neutral

Do you think implementing AI in waste management can help improve   *
efficiency?

◉ Yes

◯ No

◯ Maybe

Do you believe AI waste management aligns with the hospital's sustainability
goals?

◉ agree

◯ disagree

◯ neutral

Clear selection

Feedback form conclusion

10 responses

Link to Sheets

Accepting responses

Summary | Question | Individual

What is your role at Asiri Hospital?

10 responses

Copy chart

- Management
- Medical Staff
- Administrative Staff
- Staff

30%
20%
20%
30%

How long have you been associated with the hospital?

10 responses

Copy chart

- 2 years
- 4 years
- 6 years
- 8 years

10%
30%
20%
40%

How familiar are you with the concept of Artificial Intelligence (AI)?

10 responses

- Familiar
- Not familiar

40%

60%

According to this data, 6 out of 10 respondents nearly 60% of data are more familiar with the artificial intelligence concept. Because of this the health sector can reduces training cost but for the remaining 40% there are not familiar with the artificial intelligence concept. For this remaining 40% the health sector want to spent amount for the training and webinars about the waste management that implemented in the asiri hospital private limited.

How would you rate the efficiency of the current waste management system?

10 responses

- Good
- very good
- poor
- very poor
- Average

30%

40%

10%

20%
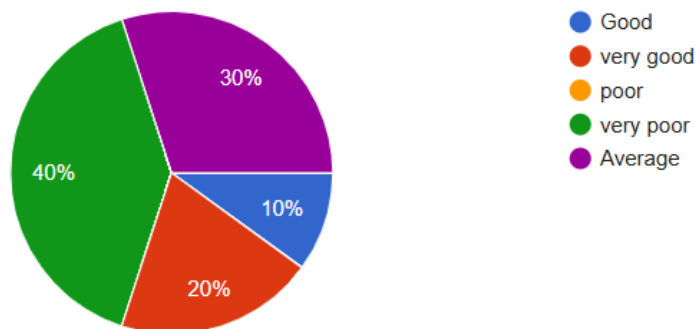
The current waste management of the asiri hospital private limited is varied according to the varied persons. Therefore 30%of people saying that current waste management average and 10% of people saying that current waste management good and 20% of people saying that current waste management very good and 40% of people saying that current waste management very poor and this the most largest percentage.

AI can improve waste management processes at Asiri Hospital?
10 responses

- Yes
- no

70%
30%
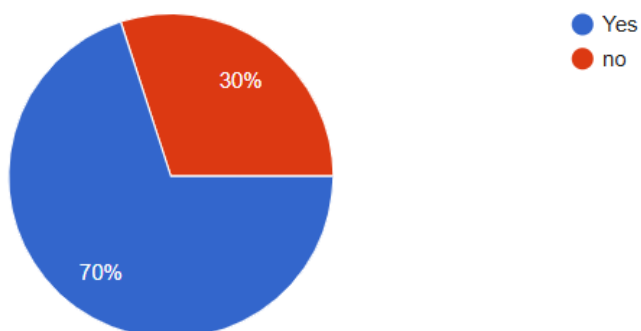
The waste management of the asiri hospital 70% are trust the ai improve the waste management but 30% are not trust the ai cant improve the waste management at asiri hospital private limited.

What types of waste are most challenging to manage at the hospital?
10 responses

- Medical Waste
- General Waste
- Hazardous Waste
- Electronic Waste

30%
20%
20%
30%
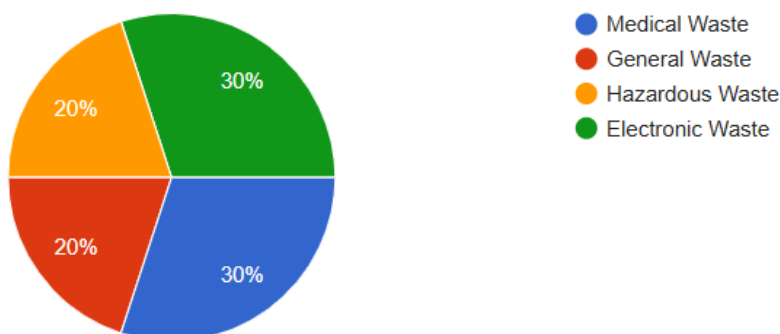
The most challenging waste in the hospital is medical waste, general waste, hazardous waste, electronic waste and the medical waste and electronic waste are same amount used in the hospital 30%.and the general waste and hazardous waste are using same amount of wastage 20%in asiri hospital private limited.

COMMENT ANY ISSUES ABOUT OUT AI IMPLEMENTATION IN WASTE MANAGEMENT AT ASIRI HOSPITAL PRIVATE LIMITED.
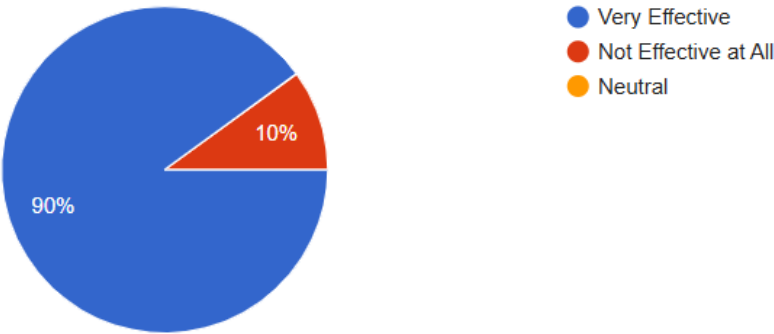
5 responses

it consumes more cost.

want to arrange awareness program

create free webinars

high cost needed

waste of time

How effective do you believe the current waste management practices at Asiri Hospital are in reducing environmental impact?   Copy chart
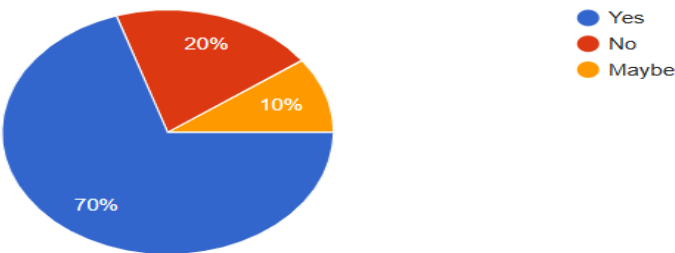
10 responses

- Very Effective
- Not Effective at All
- Neutral

90%
10%

Do you think implementing AI in waste management can help improve efficiency?   Copy chart

10 responses

- Yes
- No
- Maybe

20%
10%
70%

Do you believe AI waste management aligns with the hospital's sustainability goals?

10 responses

- agree
- disagree
- neutral

50% agree · 30% neutral · 20% disagree
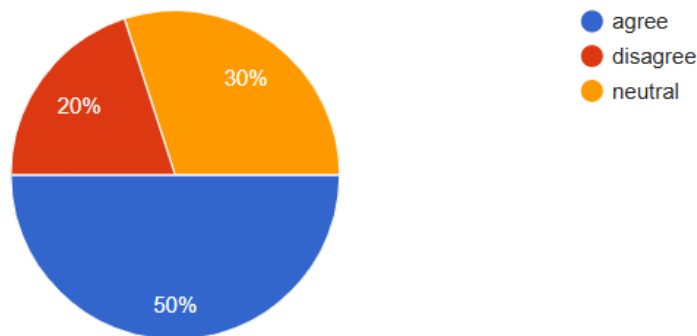
Accuracy and reliability of the different research methods applied.

Accuracy and reliability of various research methods used

A research study's reputation depends on its correctness and dependability. The environmental effect of waste management in a collegiate context was investigated using a variety of research methodologies, including surveys, interviews, data analysis, and literature reviews. Each approach brings a distinct viewpoint to the whole research. The efficacy of these strategies remains reliant on resolving the potential issues inherent in each approach.

Problems and Solutions in Research

Surveys, a typical instrument, might suffer from respondent bias and erroneous self-reporting. To mitigate this, impartial questions, confidentiality, and pilot testing may increase the dependability of survey results. Similarly, interviewer prejudice may be decreased by training, uniform scripts, and open-ended questions. To prevent mistakes in the analytical process, strict data analysis procedures such as statistical methodologies and cross-checking are essential. While beneficial, literature reviews might add bias if not done properly. Transparent criteria for picking material and identifying any biases might assist to alleviate this issue.

Validity

Different Research Methods

The use of several research methodologies, such as qualitative and quantitative approaches, improves the validity of the findings. Converging information from several sources gives a full picture of the studied phenomena, lowering the likelihood of forming incorrect conclusions.

Pilot Testing

Pilot tests are conducted before full-scale adoption to detect and correct any faults with research tools or processes. This repeated method increases the study's validity by ensuring that the instruments appropriately assess the targeted variables.

Clear operational definitions.

Clearly identifying essential concepts and variables provides a firm basis for validity. Ambiguity in operational terminology might cause misunderstanding. As a result, giving clear and unambiguous definitions improves the validity of the study by assuring uniform understanding and use of terminology.

Reliability

Random sampling.

Implementing random sampling procedures reduces bias in participant selection, which improves study dependability. Random samples improve the possibility that the study's results may be extrapolated to a larger population, which strengthens the research conclusions.

Standardized instruments.

Using standardized research equipment increases dependability by providing consistent data gathering. Standardized surveys, questionnaires, and measuring instruments promote consistency across research participants, decreasing deviations that might jeopardize the trustworthiness of the findings.

Longitudinal Studies

Longitudinal investigations spanning a long period of time give insights into temporal patterns and trends. This strategy improves study dependability by collecting data points over numerous time periods, allowing for a more thorough investigation of trends and changes across time.

Accuracy

Peer Review.

Involving external specialists in the peer review process improves the accuracy of the study. Peers review the study's design, methods, and conclusions, giving useful comments and validation. This external examination improves the accuracy and reliability of the study results.

Transparent methodology.

Transparency in approach, including detailed recording of methods and data processing methodologies, aids in research replication. When researchers successfully replicate a study with identical results, it confirms the original findings' correctness and increases the research's overall dependability and validity.

Thorough documentation

Every element of the study process is meticulously documented to assure accuracy. This involves documenting the data collecting protocols, equipment calibration, and any corrections performed throughout the investigation. Thorough documentation promotes openness and criticism, which improves the correctness of the study.

Recommendations

Purchasing durable equipment

The hospital should consider creating a purchasing strategy that prioritizes energy-efficient products such as machines. This helps to significantly minimize the environmental impact, while providing the necessary tools for educational activities or study activities for the hospital.

Improved flexibility

Based on its high appreciation for flexibility, the hospital can invest in technology and infrastructure that encourage flexible delivery of healthcare to patients. This will improve the health of the person.

Regular environmental reporting

Create a mechanism for generating frequent environmental impact reports. This information can be used to track progress, set benchmarks, and guide future elections.

Effective disposal of equipment

Implement procedures for the proper disposal of obsolete or defective digital equipment, such as recycling and safe e-waste disposal options.

Conduct Awareness Programs

Launch comprehensive awareness campaigns in the health community to educate patient, nurse, and staff about the environmental effect of wastage. These programs should emphasize the significance of eco-friendly activities, energy-efficient technology, and appropriate trash disposal procedures. Workshops, seminars, and instructional campaigns may all contribute to promote an ecologically aware society.

Conduct awareness webinars.

Use digital channels to offer webinars about sustainable digital device habits. Webinars are a flexible and accessible way to disseminate information, enabling users to engage in real-time conversations, ask questions, and get advice on adopting eco-friendly behaviours. This strategy aligns with the hospital focus on flexibility and has the opportunity to reach a wider audience.

Communication Enhancement

Improve communication channels within the hospital to regularly communicate updates, information, and best practices concerning the environmental effect ofwatage. This entails consistently communicating sustainability objectives, successes, and forthcoming events using digital channels such as websites, social media, and newsletters. Improved communication encourages active involvement in environmental conservation activities.

Sustainable Device Procurement Policy

Set up a sustainable device procurement strategy that favours the acquisition of energy-efficient devices. This strategic approach is consistent with the hospital's objective to decreasing environmental impact while retaining access to essential digital medicine. The policy should outline the criteria for picking devices with environmentally friendly features and certifications.

E-Waste Management Centre Establishment

Complete the development of an e-waste management centre at the hospital surroundings. This facility exemplifies proper electronic device disposal and recycling. Clear standards and widely accessible disposal places on hospital may encourage appropriate recycling of outmoded or malfunctioning digital equipment, therefore lowering the environmental effect of e-waste.

Regular Environmental Impact Reports

Develop a systematic strategy to providing frequent environmental impact reports, with an emphasis on hospital wastage. These reports should outline accomplishments, identify targets for development, and give data-driven insights to help guide future choices. Transparent reporting promotes accountability and continuous progress toward sustainability.

Efficient Device Disposal Policy

Implement and publicize rules for the responsible disposal of outdated equipment. To ensure that the hospital community understands the processes and actively engages in environmentally friendly disposal practices, stress recycling and safe e-waste disposal techniques.

To assess the extent to which the project recommendations meet the needs of the identified organization, such as Asiri Hospital, we need to assess whether the recommendations are consistent with the hospital's objectives and the extent to which they address specific challenges. We also need to understand the rationale behind the planning decisions made.

1. Alignment with hospital needs

Improved efficiency

If Asiri Hospital's goal is to improve the efficiency of waste management, the project's recommendation to use AI-powered classification systems makes sense. AI can automate classification, reduce human error, and increase speed, which directly helps the hospital manage large volumes of waste more efficiently. This fits the hospital's need for faster and more accurate waste processing.

Rationale

AI has been proven to improve the accuracy and speed of sorting, meeting the hospital's need for more efficient waste management.

Cost reduction

Another common goal of hospitals is cost reduction. AI can help reduce the need for manual labor, thereby reducing operational costs. In addition, AI can optimize waste management, thereby reducing the costs of disposing of unnecessary waste.

Rationale

The hospital may currently be overspending on waste management services or managing hazardous waste inefficiently. Artificial intelligence can reduce these costs by automating activities and reducing waste.

Sustainability and compliance

Hospitals are increasingly focused on sustainability. AI can improve recycling rates by accurately identifying recyclable materials, helping the hospital meet sustainability goals and comply with environmental regulations.

Rationale

By ensuring better recycling practices, AI helps the hospital meet environmental standards, which are essential for long-term compliance and corporate responsibility.

2. Address specific challenges

High volume of waste

Asiri Hospital, being a large facility, processes a lot of waste every day. Artificial intelligence can help manage this high volume by quickly sorting large amounts of waste, ensuring proper disposal and recycling without overwhelming hospital staff.

Rationale

Manual sorting is not sufficient for large hospitals that handle large volumes of waste. AI systems are designed to efficiently manage large data sets, making them a good solution for hospitals.

Staff resistance to change

One of the challenges for hospitals is employee resistance to new technologies. The recommendation to train staff in the use of AI for waste management should be considered to help overcome this resistance.

Rationale

The introduction of a new technology requires appropriate training. If the hospital ensures that staff understand and are trained on the benefits of AI, they are more likely to accept and use the system effectively.

Data and reporting

AI can also track and analyze waste data, providing reports on waste trends. This helps the hospital track its progress towards sustainability goals and make informed decisions about waste reduction.

Rationale

Hospitals need data to measure progress and make adjustments. AI's data analytics capabilities address this need by providing valuable insights into waste management practices.

3. Practical aspects of implementation

Budget and resources

AI can be expensive to implement initially, but can save the hospital money in the long run by reducing labor and disposal costs. A cost-benefit analysis should be conducted to ensure that the initial costs of the AI system are within the hospital's budget.

Rationale

The hospital should ensure that the investment in AI is justified by long-term savings. The planning decision to select AI should be based on a financial assessment of the return on investment (ROI) of the system.

Scalability

Project recommendations must be scalable. As the hospital grows, the AI system must be able to handle larger volumes of waste without significant additional cost.

Rationale

The needs of the hospital may change over time as the number of patients and the waste generated increase. The scalability of AI makes it a smart choice for long-term use.

Integration with existing systems

The AI system must integrate seamlessly with the hospital's current waste management practices. If the implementation is too complex or does not fit well with existing systems, it can cause disruption.

Rationale

The recommendation to choose a system that works well with the current hospital infrastructure helps minimize disruption and ensures a smoother transition.

4. Long-term impact and sustainability

Sustainable practices

The long-term sustainability of hospital waste management practices is important. The recommendation to use AI in waste management supports this approach by promoting recycling and reducing environmental impact.

Rationale

In addition to cost savings, the hospital's commitment to sustainability is reinforced by AI's ability to improve recycling rates and reduce waste sent to landfills.

Innovation and reputation

By adopting AI, Asiri Hospital can position itself as a leader in innovation and sustainability in the health sector. This improves their reputation and can attract patients who appreciate environmentally friendly practices.

Rationale

In today's competitive healthcare market, hospitals that embrace technology and sustainability can differentiate themselves and build a positive reputation. The project recommendations address the needs of Asiri Hospital by providing a solution that improves the efficiency of waste management, reduces costs, ensures regulatory compliance and promotes sustainability.

The rationale for each planning decision is well supported by evidence of AI's effectiveness in similar contexts, its ability to reduce operational costs, and its positive impact on sustainability goals. While the initial costs may be high, the long-term benefits of AI in waste management outweigh these, making it a strong recommendation for the hospital.

Resolutions to Issues Identified During the Project Management Process

Limitations to Data Collection
To address concerns regarding data gathering limits, particularly privacy and data security issues among stakeholders, strong data protection procedures were implemented. To alleviate these concerns, the researcher played a crucial role in articulating the significance of data anonymization. The emphasis on data protection and ethical data management fostered confidence, encouraging stakeholders to contribute more specific information for a full study.

Data Collection Technical Issues
Working with the IT support staff made it easier to handle technical obstacles, notably software compatibility concerns, throughout the data gathering process. It also assisted in identifying and resolving compatibility problems, ensuring that data collecting tools functioned properly. The speedy resolution of technical issues demonstrated the value of a collaborative approach in coping with unanticipated obstacles throughout the research endeavour.

Communication and participation of stakeholders
The challenges of managing diverse stakeholder expectations and degrees of environmental knowledge necessitated the creation of bespoke communication methods. To address this problem, the researcher developed bespoke awareness campaigns and communication methods based on each stakeholder group's unique requirements and preferences. This technique intended to improve involvement and guarantee that research results and suggestions were successfully disseminated to the whole hospital community.

Timeline Delays
Due to unanticipated technical challenges and the requirement for extra rounds of data cleansing and validation, schedule delays became a major difficulty. The answer included a comprehensive evaluation and revision of the project timetable. The study team reduced the effects of delays by devoting extra time to detailed data analysis and quality assurance. Transparent and effective communication with stakeholders was essential for expressing the updated timeframe, gaining understanding, and allaying worries about possible project delays.

Proposed Research Plan

As the researcher, I propose a thorough strategy for conducting the study on "proper waste management in healthcare in asiri hospital private limited. This strategy outlines many critical measures to guarantee a comprehensive and methodical inquiry.

1. Review of Literature.
The research method starts with a comprehensive study of the literature. This stage entails doing a comprehensive review of current research, studies, on the environmental effect. It establishes the context by offering significant insights into the present level of knowledge, identifying gaps, and shaping the theoretical framework of the research.

2. Identify the background
After establishing the theoretical framework, the following stage is to identify the particular environmental problems and obstacles associated with digital devices at asiri hospital private limited. This entails a detailed evaluation of the hospital digital infrastructure, policies, and activities that may affect the environment.

3. Evaluate the Background.

After thoroughly analyzing the hospital digital ecosystem, the next stage is to evaluate the environmental effect of wastage on hospital. It comprises an evaluation of energy use, electronic trash creation, and other environmental impacts linked with technology use.

4. Prepare the questionnaire.

The development of a structured questionnaire is an important aspect of this research technique. The questionnaire will be rigorously crafted to gather quantifiable information about the hospital community's digital device use, environmental views, and behaviours.

5. Examine the questionnaire.

The questionnaire will be properly checked and validated before being used to gather data. This stage ensures that the questions are clear, short, and capable of producing valuable results. To discover and correct any flaws, the questionnaire might be piloted with a limited sample size.

6. Collect Data

During data collection, the questionnaire is delivered to a representative sample of the hospital, doctors, and staff. Proper planning and ethical considerations will be required throughout this step to guarantee a high response rate and participant anonymity.

7. Analyze Data

Once the data is obtained, it will be submitted to a thorough quantitative examination. Statistical tools and software will be utilized to identify correlations, trends, and patterns, allowing for significant insights and conclusions to be drawn.

8. Develop an action plan.

The last phase in this research strategy is to summarize the study results into a complete action plan. Based on the study results, this plan will provide suggestions to asiri hospital private limited about how to lessen its environmental effect. It will describe practical methods and activities that the hospital may take to enhance sustainability and ecologically responsible.

Proposed Project Control Mechanism
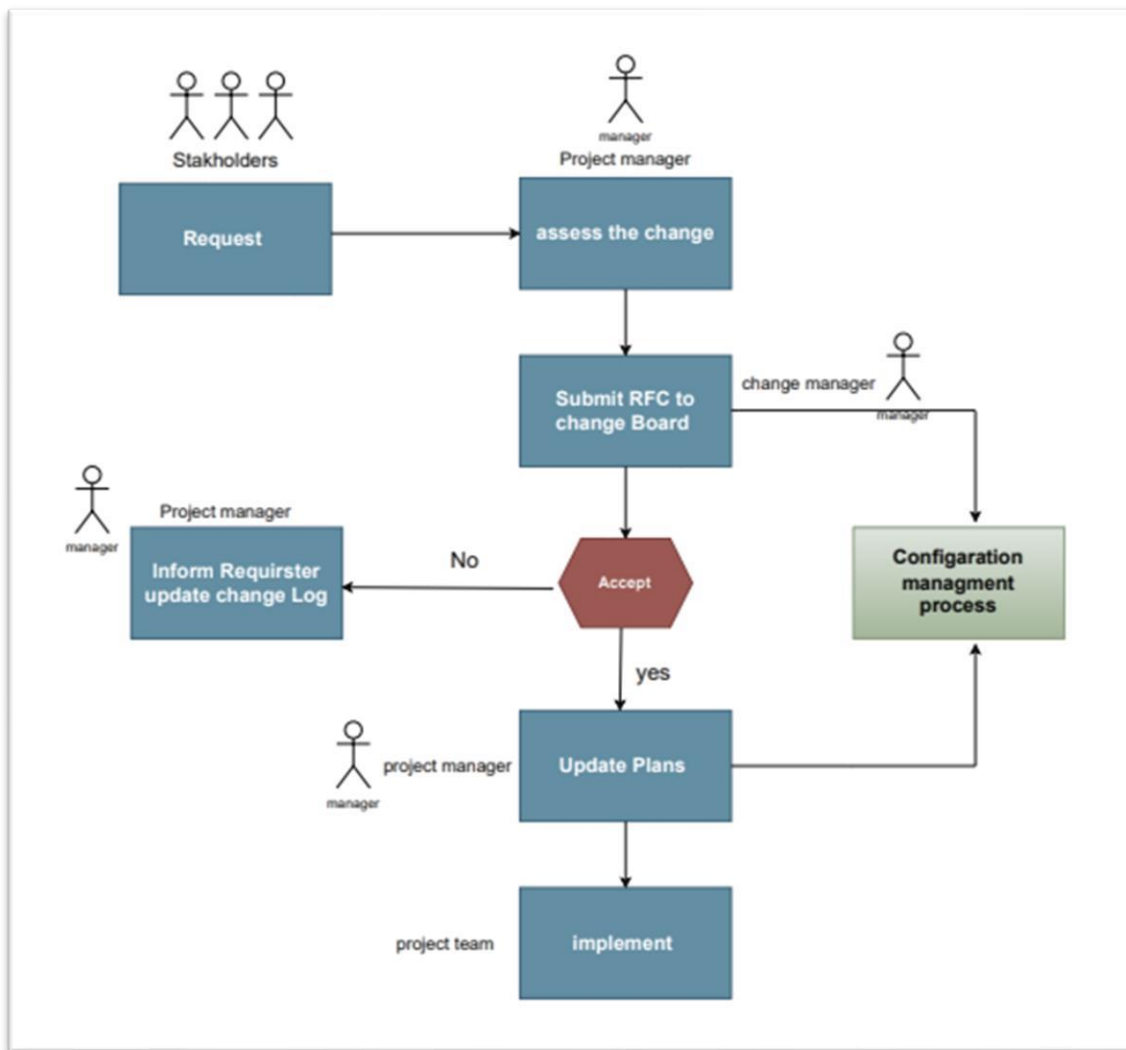
Proposed Quality Control Mechanism with Quality standards.

Research Methodology and Data Collection

This Research Methodology and Data Collection section begins with a detailed review of the research methodology, stressing its strength and compliance with existing best practices. The project's commitment to quality is shown by the fact that it begins with a thorough literature review, a fundamental step aimed at identifying and appreciating current best practices in research methodologies. Collaboration with subject matter experts will be essential for improving the rigour of the selected approach, as they will provide useful insights and improvements based on industry norms. Recognizing the project team's critical role in the methodology's implementation, thorough training programs will be created to guarantee nuanced comprehension and consistent application. A test project or feasibility study is planned to verify the selected strategy, which will serve as a vital step in fine-tuning and optimizing data gathering techniques. This precise and careful approach demonstrates the project's dedication to maintaining the highest standards in research technique and data gathering from the outset, laying the groundwork for a strong and legitimate research endeavour.

Data's accuracy and dependability

To accomplish this, a complex method with strict control mechanisms has been developed. The project will use thorough data validation processes that are specifically intended to detect and repair any flaws or discrepancies in the obtained data. A double-data input or independent data verification procedure will be executed concurrently, resulting in a strong cross-checking mechanism to increase data correctness. Standardized data collecting instruments and procedures will be employed in a systematic way to assure consistency and reliability, while statistical validation methods will be used to improve the dependability of the gathered data. The project is unrelenting in its commitment to maintaining the integrity and dependability of the data that underpins the study via these thorough steps, therefore strengthening the basis of a legitimate and robust research endeavour.

Document Management.
To serve as the safe repository for all research papers, data, and records, a centralized document management system will be methodically implemented. This system will be enhanced with features like as version control and access restrictions, which will ensure that the most current document versions are utilized while limiting access to only authorized users. Regular data backups will give further security against the loss of crucial research material. This strategic approach illustrates the project's commitment to maintaining a high degree of document control quality while also creating a safe and well-organized structure for handling project-related information.

Reporting
The project progress reports would be extensively organized, including a dedicated section on quality control, giving stakeholder's insight into the strong systems in place. Any violations from set quality standards, as well as remedial measures, will be properly recorded, promoting a culture of responsibility and openness within the project. By emphasizing these values, the project guarantees that all stakeholders are continuously informed about quality-related concerns, creating an atmosphere in which openness is not merely appreciated but actively integrated into the project's ethos.

Asiri Hospital Private Limited can utilize several ISO standards to enhance its operational efficiency, quality management, environmental sustainability, and safety standards. By using these types of ISO standards in asiri hospital private limited we can easily achieve the hospital's goals

Relevant ISO Standards for Asiri Hospital Private Limited

1.   **ISO 9001-2015 (Quality Management Systems)**
   This standard focuses on quality management and is designed to help organizations consistently meet customer and regulatory requirements. Asiri Hospital, ISO 9001 can ensure that its healthcare services are delivered with high efficiency, reliability, and patient satisfaction.

2. **ISO 14001-2015 (Environmental Management Systems)**
   This standard provides a framework for effective environmental management. By adopting ISO 14001, Asiri Hospital can systematically manage its environmental responsibilities, including waste management, energy conservation, and minimizing the carbon footprint. This aligns with the hospital's sustainability goals and enhances its green image.

3. **ISO 45001-2018 (Occupational Health and Safety Management Systems)**
   this standard focuses on creating safe and healthy workplaces by managing occupational health and

safety risks. For an asiri hospital setting, ISO 45001 helps in ensuring the safety of staff, patients, and visitors by implementing robust safety protocols.

4. **ISO 50001-2018 (Energy Management Systems)**
   This standard is aimed at improving energy performance and reducing energy costs. For Asiri Hospital, ISO 50001 can help in optimizing energy use in facilities like operating rooms, labs, and waste management units, contributing to sustainability goals.

5. **ISO 27001-2022 (Information Security Management Systems)**
   With the increasing reliance on digital patient records and data management, ISO 27001 provides a robust framework for ensuring the confidentiality, integrity, and security of sensitive information.

Future Suggestions for Asiri Hospital's AI Waste Management

❖ **Use AI in More Areas of Waste Management**

AI applications in waste management at Asiri Hospital can improve efficiency and environmental impact by predicting waste generation, optimizing resource allocation, and improving recycling efforts through advanced algorithms and automation. These improvements are consistent with the hospital's commitment to environmental stewardship and operational excellence.

❖ **Make AI Sorting More Accurate**

Improving the accuracy of AI in waste classification is essential for Asiri Hospital to improve the efficiency and accountability of waste management. Advanced technologies such as computer vision and deep learning can help distinguish between different types of waste, reducing environmental and health risks. Proper classification also optimizes recycling and reduces waste volume, thereby reducing costs and improving overall reliability. As AI evolves, Asiri Hospital can set a standard for sustainable medical waste management.

❖ **Focus on Reducing Costs**

Asiri Hospital has every interest in reducing its costs by using AI in waste management. As AI systems become more affordable, the hospital can implement advanced solutions within budget constraints. Researching cost-effective AI tools, exploring partnerships, and investing in scalable systems can maximize value while maintaining financial efficiency. Predicting waste trends, optimizing operations, and improving recycling processes with AI can generate long-term financial benefits for the hospital.

❖ **Train Staff Regularly**

Regular training of hospital staff is essential for the effective use of AI systems in waste management. Training helps employees use the AI system, solve problems and interpret information. Training staff on goals such as sustainability and cost reduction increases engagement and support. Ongoing training ensures that new employees are trained and existing staff remain informed of changes in the system. This promotes continuous improvement and innovation at Asiri Hospital.

❖ **Partner with Experts**

Partnering with technology companies and academic institutions can help Asiri Hospital improve its AI-based waste management system, leading to the development of customized algorithms, data analytics expertise, accurate prediction of waste trends, and improved recycling processes. These collaborations also position the hospital as a leader in sustainable healthcare practices and align the AI system with regulatory standards and environmental goals.

❖ Link AI with Other Sustainability Goals

Integrating AI-driven waste management into Asiri Hospital can enhance sustainability efforts by optimizing resource use and reducing costs. AI can analyze waste and energy data to identify efficiency opportunities, leading to improved operational efficiency and a greener reputation for the hospital.

❖ Monitor and Improve AI Systems

After the AI system is in place, the hospital should regularly check its performance and make improvements to keep it working well.

❖ Consider Ethical and Privacy Issues

Even though AI waste management doesn't deal with patient data, Asiri Hospital should still ensure that any collected data is used responsibly and ethically.

❖ Raise Awareness Among Staff and Visitors

Raising awareness of Asiri Hospital's waste management system can improve its efficiency. Educating staff, patients and visitors about the purpose and benefits of the system can promote responsible waste disposal. Workshops, posters and digital displays can explain the correct sorting of waste and encourage participation. Engaging staff through training programs and motivating patients and visitors can improve the performance of the system and demonstrate the hospital's commitment to sustainability.

❖ Share the AI Model with Other Hospitals

If successful, Asiri Hospital can share its AI waste management model with other hospitals, helping to spread eco-friendly practices across the healthcare sector.

Conclusion

Asiri Hospital is at an inflection point where integrating advanced technologies such as AI into its operations, particularly in waste management, can significantly improve efficiency, sustainability, and compliance with regulatory standards. As a leading healthcare provider, the hospital has the opportunity to not only improve its internal processes, but also set a benchmark for environmental responsibility and innovation in the industry. Addressing challenges such as financial constraints, regulatory requirements, technological complexity, and market dynamics requires strategic planning and a forward-looking approach.

By focusing on staff training, collaborating with technology experts, and aligning AI initiatives with broader sustainability goals, Asiri Hospital can overcome these obstacles and become a pioneer in smart waste management. Additionally, understanding and adapting to changing patient expectations and healthcare trends will allow the hospital to remain competitive and continue to provide exceptional care. Adopting these changes will not only improve operational performance, but also enhance Asiri Hospital's reputation as a modern, responsive, and patient-centered institution committed to long-term growth and environmental stewardship.by implementation of AI in the asiri hospital private limited can

keep lead by comparing with the other hospital in srilanka and this is number one hospital in srilanka by implementation of the ai in hospital in segregation in the hospital wastage.

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