



**UTS**

UNIVERSITY  
OF TECHNOLOGY  
SYDNEY

**Assignment 1, Part B:**  
**High-level project delivery plan**

**MAYO CLINIC**  
**DIGITAL**  
**TRANSFORMATION**

**Revolutionising Healthcare with an Advanced  
Hospital Management System**

36101 Leading Data Science Initiatives

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## Executive Summary

The **Health Management System (HMS)** project aims to provide a robust, efficient, and user-friendly platform to facilitate the management of health-related services and patient data. As the healthcare industry undergoes rapid digital transformation, our proposed HMS will ensure that medical professionals and patients can interact seamlessly through an intuitive interface, thus streamlining operations and enhancing patient care.

**Purpose:** The primary objective of the HMS project is to oversee the overall vision, strategy, and success of the health management platform. The system is designed to meet the growing demands of the Mayo Clinic, ensuring efficient data management, secure patient information storage, and swift service delivery.

**Key Stakeholders:** This project involves various stakeholders, from healthcare professionals and IT experts to patients. Their feedback and requirements have been pivotal in shaping the project's direction and ensuring its alignment with the industry's best practices.

**Project Team:** Our dynamic team comprises dedicated individuals specialising in various domains, including Project Management, Systems Architecture, UX Design, Frontend and Backend Development, Quality Assurance, and more. This multi-disciplinary approach guarantees a comprehensive system built upon collective expertise.

**Methodology:** Adopting an Agile-Waterfall hybrid methodology development process, our team ensures flexibility, prompt response to stakeholder feedback, and timely delivery of project milestones. This iterative approach facilitates continuous improvement and alignment with the evolving needs of the healthcare sector.

**Benefits:** Once implemented, the HMS will:

- Enhance patient experience through quicker service and better accessibility.
- Provide healthcare professionals with real-time data, enabling better decision-making.
- Ensure high levels of data security and patient confidentiality.
- Streamline administrative tasks, resulting in cost savings and efficiency.

**Conclusion:** The Health Management System is more than just a digital platform; it is a step towards revolutionising healthcare management by harnessing technology's power. By prioritising user experience and operational efficiency, the HMS project promises a future where healthcare is more accessible, efficient, and patient-centric.

## Project Description

Our project aims to implement an efficient Hospital Management System (HMS) to tackle the increasing challenges faced by the Mayo Clinic in managing paperwork and records. As the Mayo Clinic expands, the current manual processes are leading to inefficiencies, jeopardising patient care, prolonging administrative tasks, and potentially causing delays in patient appointments. Transitioning to a robust HMS not only streamlines operations but also augments the quality of healthcare delivery by ensuring timely access to accurate patient records.

## Project Justification

The justification for this project is rooted in the pressing need to modernise and digitise the clinic's operations. The reliance on paper-based records poses challenges in terms of accuracy, efficiency, and security (Zhang et al., 2018). The inefficiencies in the current systems hinder the clinic's ability to manage patient records effectively. The project aims to address these issues by implementing an advanced HMS.

### KEY DRIVERS:

- **Digitisation of Patient's Internal Records:** The transition from paper-based records to a computer-based system will significantly improve the accuracy, efficiency, and security of the data, making it less error-prone and more effective (Okoro et al., 2013).
- **Creation of a Safe Digital Data Store:** Adherence to stringent data privacy rules, such as the Health Insurance Portability and Accountability Act (HIPAA), ensures the secure storage of patient medical information in a digital format.
- **Enhanced Patient Care with Electronic Medical Records (EMR):** Faster access to patient information facilitates quicker diagnoses and more informed treatment decisions.
- **Improved Personnel Efficiency and Streamlining Hospital Operations:** Automating administrative operations allows hospital staff to dedicate more time to patient care, reducing the paperwork burden and giving better access to patients' information.
- **Cost Reduction through Efficient Management and Communication:** Streamlined data management and communication can significantly diminish operational expenses. Moreover, considering the human relationships, the new system will be designed to be intuitive and user-friendly, ensuring minimal disruption to the daily activities of the staff and offering patients a more seamless experience.

## Project Objectives

### Project Deliverables: SMART Model Statements:

1. **Develop and Deploy Computer-Based HMS System (SMART):**

- **Specific:** Create a comprehensive computer-based Hospital Management System (HMS) to replace manual processes.
- **Measurable:** Achieve a 90% reduction in paper-based patient records within one year of HMS rollout.
- **Achievable:** Ensure the seamless transfer of all patient records to the digital HMS system without any data loss.
- **Relevant:** Enhance patient care and administrative efficiency through expedited and secured access to digitised patient records.
- **Time-bound:** Deploy the HMS system across all clinic locations within 15 months.

## 2. Thorough Staff Training (SMART):

- **Specific:** Provide comprehensive training to staff involved in the HMS implementation.
- **Measurable:** Ensure 95% of all staff members are proficient in using the HMS system within three months of training.
- **Achievable:** Develop training programs that cater to different roles within the clinic.
- **Relevant:** Equip the workforce with the necessary skills to adapt to the new system and improve overall efficiency.
- **Time-bound:** Complete staff training within the first six months of HMS implementation.

## 3. Implement Data Analytics Module (SMART):

- **Specific:** Integrate a data analytics tool within the HMS for insights into patient care and resource management.
- **Measurable:** Achieve a 15% improvement in resource allocation based on insights derived from the data analytics module within six months post-deployment.
- **Achievable:** Utilise advanced analytics tools to derive meaningful insights from patient data.
- **Relevant:** Enhance decision-making processes by offering quantifiable data-driven insights for optimal patient care.
- **Time-bound:** Integrate the data analytics module during the development phase and refine it post-deployment.

## 4. Proactive Communication with Stakeholders (SMART):

- **Specific:** Implement a proactive communication plan to keep relevant stakeholders informed at every stage.
- **Measurable:** Monitor stakeholder feedback and adjust communication strategies accordingly.

- **Achievable:** Establish clear channels for communication and provide regular updates on project progress.
- **Relevant:** Foster transparency and collaboration by ensuring stakeholders are well-informed.
- **Time-bound:** Communicate regularly with stakeholders throughout the project's duration.

By formulating SMART model statements for each deliverable, we aim to provide a clear and comprehensive understanding of what is expected to be delivered, minimising confusion and ensuring alignment with project goals.

## Key Stakeholders

The success of the Hospital Management System (HMS) project relies on effective collaboration and engagement with key stakeholders. In addition to power/interest, defining roles and responsibilities is crucial for ensuring that each stakeholder contributes meaningfully to the project's success (Blazek, 2016).

### 1. Patients:

- **Roles/Responsibilities:** Actively participate in providing feedback during the development process, ensuring that their needs and concerns are considered. Attend training sessions and adapt to the new system.
- **Engagement Strategy:** Regular communication regarding data protection, the benefits of the system, and any significant updates.
- **Power/Interest:** High interest as their data and experience are directly impacted; however, low power in the decision-making process.

### 2. Hospital Management:

- **Roles/Responsibilities:** Oversee the entire project, providing strategic direction and ensuring alignment with organisational goals. Engage in regular discussions with the project team, making critical decisions and facilitating communication between different stakeholders.
- **Engagement Strategy:** Regular project updates and discussions, including challenges, successes, and adjustments.
- **Power/Interest:** High power due to their authoritative role and high interest because of their vested interest in the project's outcomes

### 3. Doctors, Nurses, and Clinic Staff:

- **Roles/Responsibilities:** Act as system end-user, providing insights into the daily operational needs. Participate in training sessions and offer feedback for system improvement. Ensure the smooth integration of the HMS into daily workflows.
- **Engagement Strategy:** Training sessions for system usage and regular feedback meetings.



- **Power/Interest:** High interest due to daily system interactions; high power because their user experience can drive system adjustments.
4. **Government Regulatory Authorities:**
- **Roles/Responsibilities:** Validate compliance with healthcare standards and regulations. Review and approve the system's security measures. Provide guidance on legal and ethical considerations related to patient data.
  - **Engagement Strategy:** Regular audits and compliance checks. Share updates on compliance achievements during constructive feedback sessions.
  - **Power/Interest:** High power and low interest; focus on system safety and security.
5. **IT Department:**
- **Roles/Responsibilities:** Lead the implementation of the HMS, ensuring technical requirements are met. Responsible for system maintenance, updates, and addressing any technical issues. Collaborate with other stakeholders for a seamless integration process.
  - **Engagement Strategy:** Continuous technical training on the system's architecture and providing them with required resources and tools.
  - **Power/Interest:** High interest in maintaining system stability and functionality and low power regarding their technical domain expertise.

Table 1: Stakeholder interest/ power matrix

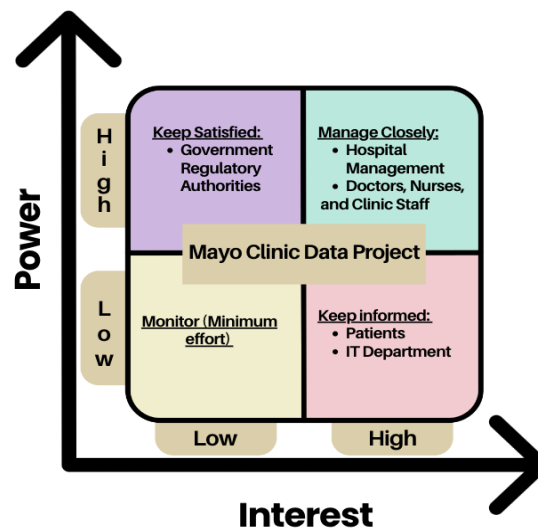


Table 2: Stakeholder Communication Approach

| Quadrant | Stakeholders | Communication Content | Communication Channel | Communication Frequency |
|----------|--------------|-----------------------|-----------------------|-------------------------|
|----------|--------------|-----------------------|-----------------------|-------------------------|

|                |  |  |  |   |
|----------------|--|--|--|---|
| Manage Closely | - Hospital Management<br>- Doctors, Nurses, and Clinic Staff | - Requirement Gathering<br>- Sign off<br>- User Testing  | - Jira<br>- Confluence<br>- Outlook<br>- Teams | - Weekly (Scheduled)<br>- On the occasion of necessity. |
| Keep Satisfied | - Government Regulatory Authorities                          | These Stakeholders do not directly impact the project and all communications will be internal. | -  | -   |
| Keep Informed  | - Patients<br>- IT Department                                | These Stakeholders are the clients of our clients and the communication will move internally.  | -  | -   |

*Table 3: Communication Objectives & Methods*

| Objective                           | Method         | Frequency | Responsible Party        |
|-------------------------------------|----------------|-----------|--------------------------|
| Update on HMS Implementation Status | Email          | Weekly    | Project Manager          |
| Gather Medical Staff Feedback       | Meetings       | Bi-weekly | Medical Liaison Officer  |
| IT System Integration Updates       | Email          | Weekly    | IT Lead                  |
| Patient Experience Feedback         | Surveys        | Monthly   | Patient Care Coordinator |
| Regulatory Compliance Reporting     | Formal reports | Quarterly | Compliance Team          |

Table 3 outlines the specific communication objectives and methods for the HMS implementation. It specifies the primary goals, communication methods, frequency, and the responsible party, ensuring that all stakeholders stay informed throughout the project's progression.

### Scope Statement

The Scope Statement outlines the boundaries and objectives of the Hospital Management System (HMS) project for Mayo Clinic. To provide more details, a high-level plan is devised for each inclusion and exclusion.

#### Inclusions:

##### 1. Digitalisation of Patient and Internal Hospital Records:

- Conduct a comprehensive examination of existing paper-based records and devise a phased approach for digitisation.
- Implement a secure and user-friendly interface for digitised records access.

##### 2. Development of a Secure Digital Data Store:

- Implement advanced data security measures, including encryption and access controls.
- Regularly conduct security audits to ensure the integrity and confidentiality of stored data (Ali et al., 2018)



### 3. **Improving Patient Care Using Electronic Medical Records:**

- Collaborate with healthcare professionals to identify critical functionalities for enhancing patient care.
- Develop interfaces that enable prompt and accurate access to electronic medical records.

### 4. **Improving Hospital Personnel Efficiency and Streamlining Hospital Operations:**

- Conduct workflow analysis to identify bottlenecks and areas for improvement.
- Implement automation tools to simplify administrative tasks and improve overall efficiency.

### 5. **Cost Reductions Achieved via Improved Management and Communication:**

- Implement a centralised communication system to reduce delays and enhance collaboration.
- Utilise data analytics to identify areas for cost reduction and optimise resource allocation.

#### **Exclusions:**

##### 1. **Changes in Infrastructure or Hardware Improvements:**

- Conduct an infrastructure assessment to ensure compatibility with the proposed HMS.
- Implement software solutions that work seamlessly with the existing infrastructure.

##### 2. **Extensive Customisation in addition to Functional Needs:**

- Define clear customisation boundaries during the requirements-gathering phase.
- Prioritise customisation requests based on critical functionality and impact.

##### 3. **Migration of Data from Legacy Systems (Unless Otherwise Stated):**

- Clearly define data migration requirements and potential barriers.
- Develop a detailed data transfer strategy, including validation and testing processes.

##### 4. **Staff Training (Unless Otherwise Specified):**

- Identify specific training needs for different user groups.
- Develop a comprehensive training program, including hands-on sessions and user manuals.

#### **Constraints and Assumptions:**

##### 1. **Budget and Time Restrictions:**

- Regularly monitor project expenses against the budget and adjust as necessary.
- Implement a robust project management framework to adhere to the specified timeline.

##### 2. **Critical to User Testing and Training:**

- Integrate user testing at key milestones to gather feedback for continuous improvement.
- Conduct regular training sessions to ensure staff proficiency in using the HMS.

##### 3. **Compliance with Regulations and Data Privacy:**

- Establish a dedicated compliance team to monitor adherence to healthcare regulations.
- Regularly update security protocols to align with evolving data privacy standards.

##### 4. **Scope Modifications Require Formal Approval via Change Control Processes:**

- Implement a change control board to evaluate and approve scope modifications.

- Clearly document and communicate changes to all relevant stakeholders.

By integrating these high-level plans with each aspect of the scope statement, the project ensures a clear understanding of project boundaries, objectives, and the approach to handling specific inclusions, exclusions, constraints, and assumptions.

### Approach to Cost Management

To effectively manage project costs for Mayo HMS implementation, a comprehensive approach is outlined, covering the establishment of a cost management team, budget planning, forecasting, control of project costs, and proactive risk management:

#### 1. Cost Management Team Establishment:

- Form a dedicated Cost Management Team comprising financial experts, project managers, and supervisors from each clinic location.
- Define roles and responsibilities within the team, ensuring a clear understanding of budgetary control and monitoring.

#### 2. Strategic Budget Planning:

- Collaborate with department heads and stakeholders to determine budget requirements for the HMS project.
- Designate budgets, prioritising critical project segments like digital transformation, software development, and security measures.

#### 3. Cost Monitoring and Control:

- Introduce an advanced cost-tracking mechanism employing state-of-the-art project management utilities.
- Conduct regular reviews with the Cost Management Team to track expenses, identify variances, and implement corrective actions if necessary.

#### 4. Periodic Cost Reports:

- Generate periodic cost reports detailing budget allocations, actual expenditures, and forecasted costs.
- Share these reports with investors and stakeholders to maintain transparency and gather feedback.

#### 5. Risk Identification and Mitigation:

- Utilise detailed cost reports to identify potential risks and their impact on the project budget.
- Develop mitigation strategies in collaboration with the Cost Management Team to address identified risks promptly.

#### 6. Forecasting Techniques:

- Implement forecasting techniques, including trend evaluation and predictive analysis.
- Continuously analyse project trends, adjusting forecasts based on evolving project dynamics and external factors.

#### 7. Optimisation Strategies:

- Regularly assess the impact of cost risks on the project and optimise strategies accordingly.
- Implement measures to enhance cost-effectiveness without compromising project quality or timelines.

## 8. Continuous Improvement:

- Establish a continuous improvement framework within the Cost Management Team.
- Conduct regular post-project evaluations to identify areas for improvement in cost management practices.

## 9. Stakeholder Communication:

- Maintain open and transparent communication with stakeholders regarding cost management.
- Solicit feedback and insights from stakeholders to ensure alignment with organisational objectives (Novoa et al., 2018)

By implementing this high-level plan, Mayo Clinic aims to ensure effective cost management, transparency, and proactive risk mitigation throughout the HMS project, ultimately contributing to its overall success.

## Cost Estimation

To ensure the successful execution of our Hospital Management System (HMS), the funds must be allocated judiciously and transparently (Phillips & Costa, 2007). "Table 4: Estimated Cost" provides a meticulous breakdown of the projected costs of each role, factoring in the total hours of effort and their respective hourly rates.

*Table 4: Estimated Cost*

| Resource                             | Total Effort (Hours) | Cost (USD/Hour) | Total Cost |
|--------------------------------------|----------------------|-----------------|------------|
| <b>Project Manager</b>               | 1560                 | 50              | \$78,000   |
| <b>Scrum Master</b>                  | 880                  | 37.5            | \$33,000   |
| <b>Business Analyst</b>              | 1920                 | 31.25           | \$60,000   |
| <b>DevOps Engineer</b>               | 1760                 | 56.25           | \$99,000   |
| <b>Backend Developers (AWS) 1</b>    | 1760                 | 56.25           | \$99,000   |
| <b>Backend Developers (AWS) 2</b>    | 1760                 | 56.25           | \$99,000   |
| <b>Frontend Developers (React) 1</b> | 1760                 | 56.25           | \$99,000   |
| <b>Frontend Developers (React) 2</b> | 1760                 | 56.25           | \$99,000   |
| <b>Quality Assurance 1</b>           | 1760                 | 50              | \$88,000   |
| <b>Quality Assurance 2</b>           | 1760                 | 50              | \$88,000   |

|  |              |       |             |
|--|--------------|-------|-------------|
| <b>Quality Assurance 3</b>             | 1760         | 50    | \$88,000    |
| <b>UX Designer</b>                     | 1240         | 43.75 | \$54,250    |
| <b>System Architect</b>                | 1520         | 75    | \$1,14,000  |
| <b>Totals</b>                          | 21200        |       | \$10,98,250 |
| <b>Total cost</b>                      | \$10,98,250  |       |             |
| <b>Potential Technology Investment</b> | \$ 100,000   |       |             |
| <b>Contingency (30%)</b>               | \$343,000    |       |             |
| <b>Estimated Budget</b>                | \$ 1,441,250 |       |             |

For stakeholders seeking a more granular understanding of these financial allocations and team organisation, please refer to “Table 8” and "Table 9" in the appendix, which offer an in-depth decomposition of the project's expenses and time allocated.

### Approach to Time Management

Building upon the outlined approach to time management, the following high-level plan includes specific milestones and strategies to ensure adequate project progress and adherence to the proposed timeline, as a well-planned and properly implemented project is more likely to achieve its intended goals and objectives (Janson, 2023)

#### Key Milestones

- **Project Charter Approval (Week 2)**
- **Finalised Requirements Approval (Week 6)**
- **System Design Approval (Week 10)**
- **Development Completion (Week 20)**
- **Pilot Deployment Success (Week 24)**
- **Full-Scale Deployment Readiness (Week 28)**
- **System Evaluation Completion (Week 32)**
- **Project Completion and Handover (Week 34)**

#### 1. Initiation (Week 1-2):

- Define project objectives, scope, and key stakeholders in collaboration with relevant teams.
- Assign teams and roles, ensuring a clear understanding of individual responsibilities.
- Conduct an initial requirements assessment to establish a solid foundation for subsequent project phases.

#### 2. Requirements Gathering (Week 3-6):

- Engage Mayo Clinic stakeholders for comprehensive requirement-gathering sessions.

- Analyse current processes and systems to identify gaps and opportunities for improvement.
- Document both functional and non-functional requirements, ensuring alignment with organisational goals.

### **3. System Design (Week 7-10):**

- Develop an architectural plan that outlines the overall structure of the HMS.
- Create prototypes for interfaces to provide stakeholders with a visual representation of the system.
- Plan data migration and integration strategies to facilitate a smooth transition to the new system.

### **4. Development and Testing (Week 11-20):**

- Implement fundamental modules of the HMS, focusing on core functionalities.
- Conduct rigorous testing and quality assurance to identify and rectify any issues.
- Review stakeholder feedback and make necessary adjustments to enhance system performance.

### **5. Deployment (Week 21-24):**

- Conduct a pilot test at one clinic location to validate system functionality.
- Monitor and address any issues that arise during the pilot phase.
- Prepare for full-scale deployment based on the insights gathered from the pilot.

### **6. Training and Adoption (Week 25-28):**

- Implement comprehensive training programs for staff to ensure proficiency in using the HMS.
- Ensure a seamless transition to the new system, providing ongoing support as needed.
- Monitor and address any user adoption challenges promptly.

### **7. Evaluation and Optimisation (Week 29-32):**

- Continuously monitor system performances and gather feedback from users.
- Enhance efficiency, security, and usability based on user input and identify areas for improvement.
- Evaluate the overall success of the project and prepare for the final handover.

### **8. Completion (Week 33-34):**

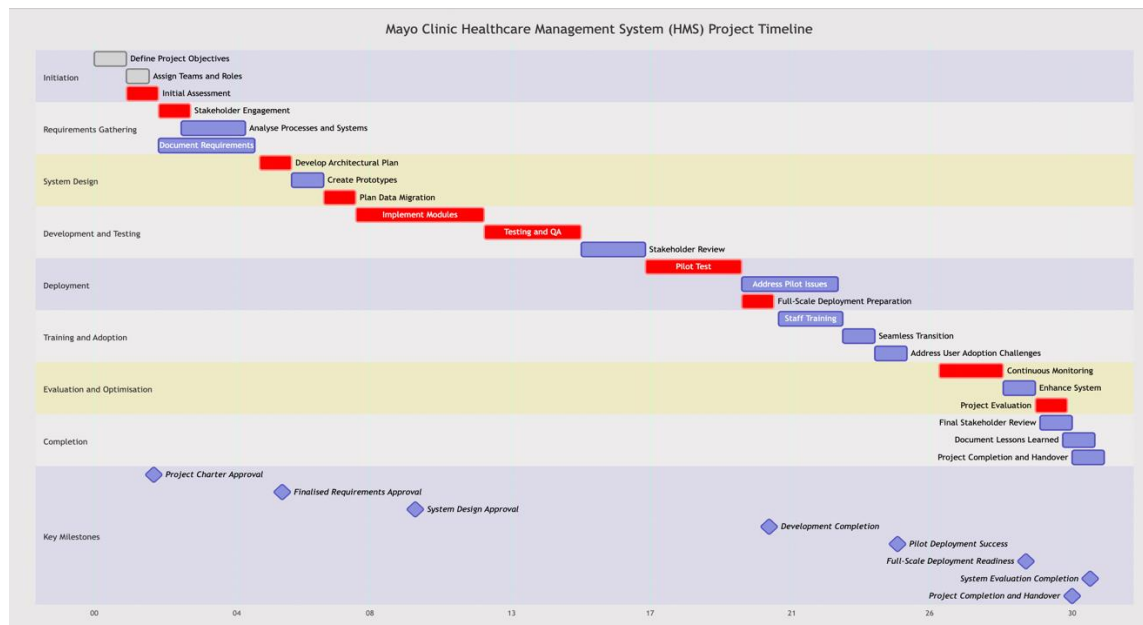
- Conduct a final review with stakeholders to assess project outcomes and achievements.
- Document lessons learned and areas for future improvement.
- Prepare for the official project completion and handover.

**Ensuring effective time management: To manage project timelines effectively, we will utilise the following tools and techniques:**

- **Project Management Software:** Utilisation of software like Microsoft Project or Trello for tasks like creating Gantt charts and tracking tasks.
- **Regular Status Meetings:** Weekly team meetings will be held to review progress, identify bottlenecks, and adjust the schedule as necessary.
- **Time Tracking Tools:** The team will use time tracking tools to monitor hours spent on specific tasks and identify areas where adjustments are needed.

- **Proactive Risk Management:** Anticipating and strategising against potential time-related risks for uninterrupted progress.

Table 5: Gantt Chart for the project timeline



The Gantt chart illustrates the Mayo Clinic's Healthcare Management System (HMS) implementation timeline. It outlines vital phases from initiation to completion, highlighting crucial milestones like approvals and evaluations. Each phase details specific tasks, ensuring a structured and smooth system transition. This chart offers stakeholders a clear and concise roadmap, emphasising the project's systematic approach to achieving digital healthcare management success.

## Approach to Risk Management

### 1. Scope Creep:

- **Risk:** Unplanned changes in project scope.
- **Mitigation:**
  - Define and document the project scope and out-of-scope items clearly in the project charter.
  - Establish a strict change control process to evaluate and approve scope changes.
  - Continuously reaffirm the approved scope with all project stakeholders.

### 2. Technical Challenges:

- **Risk:** Encountering technical difficulties or compatibility issues.
- **Mitigation:**
  - Conduct a thorough technical assessment before the implementation phase.



- Engage experienced IT professionals and vendors with a proven track record in healthcare system development.
- Establish a dedicated technical support team for quick issue resolution.

### 3. Data Security and Privacy:

- **Risk:** Potential data infringements and breaches of privacy.
- **Mitigation:**
  - Implement robust data security measures, including encryption, access controls, and regular security audits.
  - Ensure compliance with healthcare data regulations such as HIPAA.
  - Conduct staff training to familiarise them with data security protocols and practices.

### 4. Resistance to Change:

- **Risk:** Staff resistance to digital HMS adoption.
- **Mitigation:**
  - Provide comprehensive training programs to familiarise staff with the new system.
  - Implement change management strategies, including communication plans and user support.
  - Involve key stakeholders, including doctors and nurses, in the decision-making process to address concerns proactively.

### 5. Budget Overruns:

- **Risk:** Budgetary oversights lead to additional costs.
- **Mitigation:**
  - Develop a detailed budget with a contingency fund to account for unforeseen expenses.
  - Regularly review and adjust the budget based on project progress and changing requirements.
  - Implement a transparent budget tracking system accessible to relevant stakeholders.

### 6. Infrastructure Failures:

- **Risk:** Breakdowns in hardware or network operations.
- **Mitigation:**
  - Implement redundancy and disaster recovery solutions to minimise downtime.
  - Conduct regular infrastructure assessments to identify potential issues.
  - Establish a proactive maintenance schedule for critical hardware components.

### 7. Data Migration Issues:

- **Risk:** Data loss or corruption during migration.
- **Mitigation:**
  - Execute strict data authentication and migration trials to detect and amend problems at an early stage (Breck et al., 2019).

- Establish data backup provisions for crucial information prior to initiating the migration.
- Ensure contingency strategy to revert actions in case of unforeseen migration challenges.

By addressing these potential risks with proactive mitigation strategies, Mayo Clinic aims to minimise the impact of uncertainties, ensuring a smooth and successful implementation of the Hospital Management System (HMS). Regular risk assessments and continuous monitoring will be integral to the risk management approach throughout the project lifecycle.

## Approach to Quality Management

### 1. Quality Standards:

#### a. Data Accuracy:

- **Approach:**
  - Ensure precise data entry and storage through regular audits and validation checks.
  - Implement data validation rules to maintain accuracy at the point of entry.
- **Responsibility:**
  - The Quality Assurance Team will conduct regular audits.
  - Data entry personnel will be trained on accurate data input practices.

#### b. System Reliability:

- **Approach:**
  - Employ real-time error-tracking mechanisms.
  - Closely monitor system uptime and overall performance metrics.
- **Responsibility:**
  - The Quality Assurance Team will track and analyse system errors.
  - IT support will ensure high system reliability.

#### c. Usability:

- **Approach:**
  - Conduct user tests to assess user-friendliness and productivity.
  - Gather feedback from users throughout development phases to align with user needs.
- **Responsibility:**
  - The Quality Assurance Team will oversee usability testing.
  - End-users will actively participate in User Acceptance Testing (UAT).

#### d. Data Security:

- **Approach:**
  - Regularly assess system security measures.

- Implement encryption and access controls to protect sensitive patient data.
- **Responsibility:**
  - Security experts will conduct regular security assessments.
  - IT Department will be responsible for implementing and maintaining security measures.

**e. Performance:**

- **Approach:**
  - Monitor system responsiveness under different loads.
  - Implement performance testing under various conditions.
- **Responsibility:**
  - The Quality Assurance Team will oversee performance testing.
  - IT Department will optimise system performance based on test results.

**f. Scalability:**

- **Approach:**
  - Assess the system's capacity to handle growing data and user loads.
  - Plan for scalability in the system architecture.
- **Responsibility:**
  - IT Department will conduct scalability assessments.
  - System architects will design for scalability.

**2. Ensuring Quality:**

- Establish a dedicated Quality Assurance Team for continuous validation.
- Involve end-users in UAT for valuable feedback and actionable insights
- Schedule regular audits to validate data integrity, security measures, and regulatory alignment
- Administer performance tests across varied conditions to affirm system resilience.
- Collaborate with external experts for unbiased security evaluations at regular intervals.
- Establish a feedback loop with staff to gather insights for continuous improvements.
- Maintain detailed documentation for transparency, reference, and audit purposes.

With the adoption of these quality management protocols, Mayo Clinic is committed to ensuring the Hospital Management System (HMS) consistently adheres to the highest benchmarks in accuracy, reliability, usability, security, performance, and scalability throughout its operational timeline.

## Planning Approach

### 1. Project Initiation:

- **Project Charter:** Draft a project charter to clarify the project's objectives, scope, stakeholders, and plan. This paper will serve as a reference point throughout the project lifecycle.
- **Engage Key Stakeholders:** Prioritise communication with key stakeholders such as patients, medical staff, and IT departments, ensuring their perspectives shape the project.

## 2. Requirements Gathering:

- **Collaborate Closely with Medical Staff:** Engage deeply with medical personnel to define specific HMS requirements.
- **Assess Existing Data Sources and Data Quality:** Conduct a thorough assessment of existing data sources to understand the quality of data that will be migrated to the new system, as accurate information is vital for patient care and administrative processes.

## 3. Task Definition and Work Breakdown:

- **Define Project Phases:** Clearly define distinct phases of the project, such as planning, development, testing, deployment, optimisation, etc., allowing better control and focus on specific aspects at different stages.
- **Breakdown of Specific Tasks and Activities:** Break down each phase into specific tasks and activities, outlining what needs to be accomplished in detail to ensure a granular understanding of project requirements and help in resource allocation.
- **Establish Task Dependencies:** Identify dependencies between tasks to create a logical sequence of activities for efficient project execution, avoiding bottlenecks and delays.

## 4. Resource Allocation:

- **Form a Cross-Functional Project Team:** Assemble a diverse team with expertise in different areas, including healthcare, IT, project management, and data security. A cross-functional team ensures a well-rounded approach, considering various perspectives and skills needed for a successful HMS implementation.
- **Allocate Personnel, Budget, Hardware, and Software:** Clearly allocate resources, including personnel, budget, and necessary hardware and software. Transparent allocation ensures that each aspect of the project has the required resources for effective execution. In this regard, 'Table 4: Resource Allocation' delineates the number of individuals required for each role, their respective titles, and their key responsibilities within the project framework. This allocation not only provides clarity on human resource management but also streamlines the execution process, ensuring every task is addressed by a competent team member.

Table 6: Resource Allocation

| No. required | Role                        | Responsibility  |
|--------------|-----------------------------|---|
| 1            | Project Manager             | Oversees the overall vision, strategy, and success of the HMS.  |
| 1            | Scrum Master                | Facilitates the Agile development process, ensuring the Scrum team's productivity.  |
| 1            | Business Analyst            | Gathers and defines project requirements to meet stakeholders' needs.   |
| 1            | DevOps engineer             | Responsible for configuring and managing the infrastructure as code, orchestrating containerisation, implementing CI/CD pipelines, and ensuring the reliability and scalability of the website. |
| 2            | Backend Developers (AWS)    | Develops and maintains the server-side components on AWS.   |
| 2            | Frontend Developers (React) | Designs and develops user interfaces using React.   |
| 3            | Quality Assurance           | Ensures system quality through testing and validation.  |
| 1            | UX Designer                 | Enhances the user experience and interface design for the HMS.  |
| 1            | System Architect            | Responsible for designing the project's technical infrastructure and ensuring that all components work cohesively to meet performance, scalability, and security requirements.                  |

## 5. Progress Tracking and Monitoring:

- **Utilise Project Management Tools:** Implement project management tools like Microsoft Project or Trello for Gantt charts, task tracking, and resource allocation for real-time visibility into project progress, facilitating effective monitoring and adjustments.
- **Define Key Performance Indicators (KPIs):** Establish measurable metrics to evaluate project success against predefined benchmarks.
- **Hold Regular Status Meetings:** Conduct regular status meetings to discuss progress, challenges, and potential adjustments, ensuring that all team members are aligned and aware of the project's current status.

Table 7: Detailed Team communication plan

| Communication Method            | Frequency         | Purpose   | Participants     | Responsible Person |
|---------------------------------|-------------------|---|------------------|--------------------|
| <b>Project Kick-off Meeting</b> | Once at the start | Introduce team members, set expectations, and discuss project objectives. | All team members | Project Manager    |

|   |                              |   |   |                        |
|---|------------------------------|---|---|------------------------|
| <b>Daily Stand-up Meetings</b>                            | Daily                        | Discuss what was done the previous day, what's planned for today, and any blockers. | Scrum Master, DevOps Engineer, Backend Developers, Frontend Developers, Quality Assurance                   | Scrum Master           |
| <b>Stakeholder Update Meetings</b>                        | Bi-weekly                    | Update stakeholders on project progress, gather feedback.                           | Project Manager, Key Stakeholders   | Project Manager        |
| <b>Sprint Planning Meeting</b>                            | Start of each sprint         | Plan the work to be completed during the sprint.                                    | Scrum Master, DevOps Engineer, Backend Developers, Frontend Developers, Quality Assurance, Business Analyst | Scrum Master           |
| <b>Sprint Review Meeting</b>                              | End of each sprint           | Review work completed during the sprint, showcase deliverables.                     | All team members, Key Stakeholders  | Scrum Master           |
| <b>Sprint Retrospective Meeting</b>                       | End of each sprint           | Reflect on the sprint, discuss improvements for next sprint.                        | Scrum Master, DevOps Engineer, Backend Developers, Frontend Developers, Quality Assurance                   | Scrum Master           |
| <b>Technical Meetings</b>                                 | As needed                    | Discuss technical challenges, solutions, and best practices.                        | DevOps Engineer, Backend Developers, Frontend Developers, System Architect                                  | System Architect       |
| <b>UX/UI Design Reviews</b>                               | As needed                    | Review and finalise design components.  | UX Designer, Frontend Developers  | UX Designer            |
| <b>Risk Assessment Meetings</b>                           | Monthly                      | Discuss potential risks, mitigation strategies, and risk response.                  | Project Manager, Scrum Master, System Architect   | Project Manager        |
| <b>Quality Assurance Reviews</b>                          | End of each sprint/As needed | Discuss bugs, improvements, and testing results.                                    | Quality Assurance, DevOps Engineer, Backend Developers, Frontend Developers                                 | Quality Assurance Lead |
| <b>Documentation and Reporting</b>                        | End of each phase/milestone  | Update project documentation, report on progress, challenges, and changes.          | Business Analyst, Project Manager   | Business Analyst       |
| <b>Email Updates</b>                                      | Weekly                       | Provide summarised project updates.   | All team members  | Project Manager        |
| <b>Collaboration Tools (e.g., Slack, Microsoft Teams)</b> | Continuous                   | Day-to-day communication, sharing of documents/resources, quick updates.            | All team members  | All team members       |

- **Tool Selection:** For best results, the specific tools for communication are selected: Teams for meetings, Outlook for daily communications, JIRA for task tracking
- **Documentation:** All meetings will have clear agendas sent in advance, and minutes will be taken and shared afterward.
- **Feedback Loop:** Encourage an open feedback loop. Team members should feel comfortable raising concerns, giving feedback, or suggesting improvements.
- **Flexibility:** The communication plan should be flexible. While it serves as a guide, adjusting based on the project's needs is essential.



By implementing this communication plan, all stakeholders and team members shall be on the same page throughout the project's lifecycle.

## 6. Change Management:

- **Assess the Impact of Project-Related Changes:** Evaluate the potential impact of changes to help understand the implications and make informed decisions.
- **Develop a Communication Plan:** Create a detailed communication plan outlining how the information will be disseminated to stakeholders. It ensures that relevant information reaches the right stakeholders at the right time.
- **Provide Comprehensive Training:** Develop and implement training programs for staff affected by changes introduced by the HMS, keeping a smooth adoption and utilisation of HMS.

## 7. Risk Management Integration:

- **Continuously Assess Potential Risks:** Regularly assess potential risks to the project and its objectives. Continuous risk assessment enables proactive mitigation, minimising the impact of potential issues.
- **Implement Mitigation Strategies:** Develop and implement strategies to mitigate identified risks, ensuring that the project team is prepared to address challenges as they arise.

## 8. Quality Assurance:

- **Define Quality Standards and Metrics:** Establish clear quality standards and metrics for the HMS to provide a benchmark for ensuring the quality of deliverables.
- **Conduct Regular Quality Reviews:** Regularly review project deliverables against established quality standards to maintain a high level of quality throughout the project.

## 9. Documentation and Reporting:

- **Maintain Comprehensive Project Documentation:** Keep detailed documentation of project activities, decisions, and outcomes; it serves as a reference point and provides transparency for all stakeholders.
- **Generate Regular Progress Reports for Stakeholders:** Generate and share progress reports with stakeholders at predefined intervals to keep stakeholders informed and engaged in the project's development.

## 10. Continuous Improvement:

- **Establish Feedback Mechanisms:** Create channels for collecting feedback from team members, stakeholders, and end-users, providing valuable insights for ongoing improvements and adjustments.
- **Conduct Post-Project Evaluations:** After project completion, conduct evaluations to assess the overall success and areas for improvement informing future projects and contributing to organisational learning.

By streamlining this approach, it ensured that the project was executed with clarity, stakeholder collaboration, effective resource management, and continuous quality assurance.

### Chosen Methodology with Justification

The Mayo Clinic has strategically adopted an Agile-Waterfall hybrid methodology to execute the Hospital Management System (HMS) project. This hybrid model combines the best of both Agile and Waterfall methodologies, leveraging their distinct advantages to maximise the project's success.

#### Justification:

1. **Flexibility and Iterative Development (Agile):** Agile methodology is incorporated to introduce flexibility and facilitate iterative development, given the evolving nature of the healthcare landscape, which demands adaptability to changing requirements. Agile's iterative approach allows continuous improvement and adjustment based on evolving needs, ensuring that the HMS aligns with the clinic's dynamic operational landscape (Kumar & Bhatia, 2012).
2. **Risk Assessment and Proactive Mitigation (Agile):** Agile's focus on iterative cycles enables early identification and assessment of risks. The project team will proactively address potential challenges, fostering a culture of risk management. This ensures that risks are not only identified early but also mitigated promptly, minimising their impact on project objectives.
3. **Data Security and Predictability (Waterfall):** The Waterfall methodology is strategically integrated to address critical aspects of data security. Patient records are of utmost importance, requiring a meticulous and predictable approach to transformation into the digital space. Waterfall's sequential phases provide a structured path, ensuring the safety and integrity of sensitive healthcare data throughout the transformation process.
4. **Enhanced Predictability and Clear Objectives (Waterfall):** Waterfall's phased approach enhances predictability by clearly defining objectives and deliverables at each stage. Waterfall's step-by-step nature guarantees clear objectives for each phase, ensuring milestones are achieved with accuracy in line with Mayo Clinic's standards (Thesing et al., 2021). Clear objectives enable efficient progress tracking and ensure that milestones are achieved precisely.

5. **Optimised Efficiency (Hybrid Approach):** The hybrid model ensures a strategic balance, utilising Agile for dynamic aspects such as requirements gathering, risk management, and stakeholder engagement while employing a Waterfall for the structured execution of data transformation and system design (Lalmi et al., 2021). This approach optimises project efficiency, allowing for seamless integration of both methodologies to achieve the project's overarching goals.
6. **Initiation, Assessment, and Design (Combined Approach):** The initiation phase benefits from Agile's flexibility and stakeholder engagement, allowing for a rapid assessment of requirements, risks, and costs. As the project progresses to the design phase, the Waterfall methodology takes the lead, providing a structured framework for designing and reviewing the project in detail. This combined approach ensures a holistic strategy throughout the project lifecycle (Thesing et al., 2021).

The chosen Agile-Waterfall hybrid methodology is a strategic decision tailored to the unique demands of the Hospital Management System project. By leveraging the strengths of both methodologies, Mayo Clinic aims to achieve a harmonious balance between adaptability and predictability, flexibility and structure, ultimately ensuring the successful implementation of the HMS for the benefit of patients, healthcare providers, and the clinic as a whole.

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## Appendix

Table 8: Time allocated

| Total Time Allocated |      |      |
|----------------------|------|------|
| Particulars          | Days | Hrs  |
| Discovery            | 20   | 160  |
| Sprints              | 220  | 1760 |

Table 9: Breakdown of cost based on resource and time (Table 4)

| Resource                          | Discovery (Hrs) | Sprints (1-22) (Hrs) | Total Hours | Cost Per Day (USD) | Cost Per Hr (USD) | Total Cost (USD) |
|-----------------------------------|-----------------|----------------------|-------------|--------------------|-------------------|------------------|
| <b>Project Manager</b>            | 160             | 1400                 | 1560        | 400                | 50                | \$ 78,000        |
| <b>Scrum Master</b>               | 0               | 880                  | 880         | 300                | 37.5              | \$ 33,000        |
| <b>Business Analyst</b>           | 160             | 1760                 | 1920        | 250                | 31.25             | \$ 60,000        |
| <b>DevOps engineer</b>            | 0               | 1760                 | 1760        | 450                | 56.25             | \$ 99,000        |
| <b>Backend Developers (AWS) 1</b> | 0               | 1760                 | 1760        | 450                | 56.25             | \$ 99,000        |

|                                      |    |      |      |     |       |              |
|--------------------------------------|----|------|------|-----|-------|--------------|
| <b>Backend Developers (AWS) 2</b>    | 0  | 1760 | 1760 | 450 | 56.25 | \$ 99,000    |
| <b>Frontend Developers (React) 1</b> | 0  | 1760 | 1760 | 450 | 56.25 | \$ 99,000    |
| <b>Frontend Developers (React) 2</b> | 0  | 1760 | 1760 | 450 | 56.25 | \$ 99,000    |
| <b>Quality Assurance 1</b>           | 0  | 1760 | 1760 | 400 | 50    | \$ 88,000    |
| <b>Quality Assurance 2</b>           | 0  | 1760 | 1760 | 400 | 50    | \$ 88,000    |
| <b>Quality Assurance 3</b>           | 0  | 1760 | 1760 | 400 | 50    | \$ 88,000    |
| <b>UX Designer</b>                   | 40 | 1200 | 1240 | 350 | 43.75 | \$ 54,250    |
| <b>System Architect</b>              | 80 | 1440 | 1520 | 600 | 75    | \$ 1,14,000  |
| <b>Total Cost</b>                    |    |      |      |     |       | \$ 10,98,250 |