Dissertation Training

at

MYHEALTHCARE TECHNOLOGIES PRIVATE LIMITED

Study Title:

Transitioning from Fragmented Digital Usage to Integrated Process Automation: A Heuristic Evaluation of Workflow Optimization in Healthcare Management.

by

Riddhi Pandey

PG/24/085

Under the guidance of

Dr. Divya Aggarwal

PGDM (Hospital and Health Management)

2024-2026



International Institute of Health Management Research, New Delhi

Dissertation Training

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International Institute of Health Management Research, New Delhi

The certificate is awarded to

Riddhi Pandey

in recognition of n successfully completed her

Internship at

MyHealthcare Technologies Private Limited

of

and has successfully completed her Project on

Transitioning from Fragmented Digital Usage to Integrated Process Automation: A Heuristic Evaluation of Workflow Optimization in Healthcare Management.

11 Mar 26– 11 June 26

MyHealthcare Technology Private Limited

She comes across as a committed, sincere & diligent person who has a strong drive & zeal for learning. We wish her all the best for future endeavors.

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TO WHOMEVER IT MAY CONCERN

This is to certify that Riddhi Pandey student of PGDM (Hospital & Health Management) from International Institute of Health Management Research, New Delhi, has undergone internship training at My Healthcare Technologies From 11 March, 2026 to 10 June, 2026. The Candidate has successfully carried out the project designated to her during internship training, and her approach to the study has been sincere, scientific, and analytical. The Internship is in fulfilment of the course requirements.

I wish her all success in all her future endeavours.

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[Dean Academic and Student Affairs]
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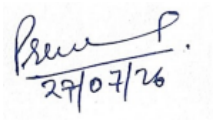
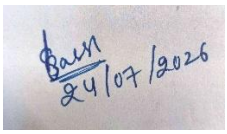
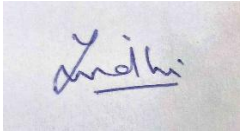
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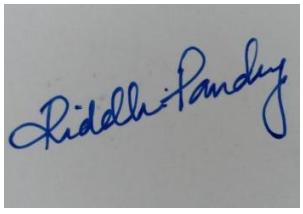
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I have conducted this study individually under her supervision and consider it a great privilege to have the guidance of such a scholarly figure. I have benefited immensely from the richness of her experience and her deep knowledge of the public health and health management fields. Her constructive insights, timely evaluations, and sharp observations on various aspects were invaluable for improving the quality of this work and helping me grasp complex concepts.

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Table of Contents

Title	Pg. No
1. Tables	12
2. Abbreviation	13
3. About The Organization	14
4. Dissertation experience	24
5. Abstract	29
6. Introduction and Background	32
7. Review of Literature	37
8. Research Methodology	45
9. Method of analysis	50
-Result	57
10. Discussion	59
11. Conclusion	60
12. Limitation	61
13. Recommendation	62
14. Annexure	63
15. References	67
16. Plagiarism Report	70

Tables

Table	Description
Table 1	Key Features and Integration
Table 2	Implementation Barriers
Table 4.1	Consolidated Statical summary (pre-Intervention)
Table 4.2	Consolidated Statical summary (post-Intervention)
Table 4.3	Result of Quantitative workflow optimization
Table 4.4	Optimization Inventory Optimization
Table 4.5	Requirement Traceability matrix

ABBREVATIONS

HIS	Hospital Information system
EMR	Electronic Medical Records
OPD	Outpatient Department
HMIS	Hospital Information Management system
UHIS	University Hospital information System
UHID	Universal Health Identification
ADT	Admission, Discharge, and transfer
RIS	Radiology Information System
PACS	Picture Archiving and Communication System
NIS	Nursing Information system
AVS	After Visit Summary
BRP	Business Process Re-engineering
BSC	Balanced Scorecard
KPI	Key Performance Indicators
RTM	Requirement traceability Matrix
DMAIC	Define, Measure, Analyze, Improve, and Control
VSM	Value Stream Mapping
SIPOC	Suppliers, Input, Process, Outputs & Customers analysis
5S	A Lean framework referencing workplace organization method
ABDM	Ayushman Bharat digital Mission
NABH	National Accreditation board for Hospitals & Healthcare
LOS	Length of stay
CI	Confidence Interval
IT	Information Technology
IoT	Internet of things
AI	Artificial Intelligence
TAM	Technology Acceptance model
PII	Personal identifiable Information
HVC	High Value Consignment
HFE	Human factors Engineering
RQ	Research Question
UTC	Coordinated Universal Time

ABOUT THE ORGANIZATION

1. Organization Profile

In today's healthcare scenario, where clinical excellence and innovation in technology go hand in hand, the importance of the former cannot be understated. Leading this wave of change towards technology-enabled innovation is My Healthcare Technologies Pvt. Ltd. As an advanced healthcare technology solutions provider, the company aims to revolutionize the practice of medicine and make healthcare delivery highly integrated, highly patient-centred, and driven by data.

Working closely with hospitals, clinics, clinicians, and other ancillary caregivers, My Healthcare plays a vital role in creating the architecture for delivering patient care in today's world. The guiding principle of the company is centred around filling the gaps that still exist in healthcare delivery. This is accomplished by automating processes that are traditionally manual and disconnected.

As a part of its solution set, My Healthcare has developed the My Healthcare Enterprise Application (MHEA). MHEA integrates OPD, IPD, and ER workflows on one single platform and makes the process more efficient through advanced technologies such as automation, AI, and interoperability. The result is an easy-to-use healthcare information management solution that can significantly help in improving the performance of healthcare organizations in Pan-India—Tier 1 and Tier 2 cities included.

Core Mission

There are two main issues in the global healthcare sector, which include rising volumes of patients and rising complexities of administration, treatment, and other processes. Conventional approaches to managing health problems sometimes have inefficiencies due to disconnected information systems, which lead to burnouts among healthcare workers.

My Healthcare helps to tackle these issues by operating not only as a technology supplier but also as a visionary partner.

A Data-Driven Approach to Care:

The cornerstone of My Healthcare's services is a firm dedication to data-driven intelligence. Instead of being seen as just a by-product of the process of treatment, patient data is actively utilized by My Healthcare for strategic purposes. A data-driven approach guarantees that all decisions made by doctors are informed by thorough historical information, live data, and prediction analysis. Thus, switching to a new care paradigm helps hospitals reduce risks of making mistakes, tailor treatment approaches to individual patients, and streamline resource management.

Helping With Digitizing the Hospital Environment:

Digitization is not an easy process, and most healthcare facilities tend to struggle with implementing changes. Outdated technologies, reluctance to make any changes, and fears related to the security of patient data become significant barriers. My Healthcare overcomes this problem with its service architecture that caters to all stages of digital transformation and all sizes of healthcare organizations. From single multi-specialty clinics which have decided to digitalize patient data to huge hospital networks, My Healthcare is able to help its clients follow a digital roadmap.

My Healthcare Enterprise Application (MHEA):

The Core Platform

The key driver of the My Healthcare vision lies in the form of My Healthcare Enterprise Application (MHEA). Unlike the conventional Hospital Information System (HIS), MHEA is designed to be a highly customizable and flexible enterprise solution. As the central source of information for an entire healthcare facility, MHEA eliminates any departmental silos that are traditionally found within organizations.

Seamless Operations of Three Main Verticals

MHEA facilitates seamless operations of three crucial verticals of hospital operations:

Out Patient Department (OPD): From the very initial point of scheduling the appointment to the final discharge process, MHEA helps minimize patient waiting time while maximizing doctor efficiency by managing check-in processes, vital collection, and consultations.

In Patient Department (IPD): The management of inpatients necessitates precise coordination among nurses, doctors, specialists, dietitians, and physiotherapists. MHEA offers a live view of the census management, bed assignment, MAR schedules, and ongoing treatment plans.

Emergency Room (ER): Time management becomes imperative in high-pressure environments like Emergency Rooms, where speed and precision become vital for patient outcomes. MHEA facilitates quick patient admission, clinical prioritization (triaging), and immediate collaboration with trauma centres, diagnostics labs, and blood banks.

Revolutionizing Documentation: The Single Screen EMR:

The biggest hassle that today's doctors find is that of documenting electronic medical records (EMRs). Conventional EMR software forces physicians to go through multiple screens before arriving at the point of interaction.

My Healthcare provides an elegant solution to this problem in the form of its single screen EMR.

Philosophy of Design and its Clinical Relevance the Single Screen EMR is designed keeping the natural cognitive process of the working physician in mind. By bringing together all the necessary clinical vectors on a single user-friendly interface, this system enables the doctor to observe the entire medical history of a patient along with his/her current complaints, vital signs, allergies, previous laboratory results, and ongoing prescriptions at the same time. Advantages of the Single Screen Interface Lower Cognitive Burden: There will be no need for a clinician to consciously integrate information coming from different sections of the software program. Everything will be visible at one go. Increased Speed and Precision: Information can be entered with very few clicks. Thus, the documentation is performed at a pace that is equal to the thinking speed of a clinician. This will lead to increased accuracy of data entry. Standardization and Compliance with Regulations: The Single Screen EMR automatically complies with all national and international medical coding regulations (ICD-10/11, SNOMED-CT, LOINC).

Advanced Platform Functionality: AI, Automation, & Workflow Management, what really sets MHEA apart is its technical foundation – that which transforms this database tool into a clinical and operational partner.

Task-Oriented & Workflow Oriented Environments:

The MHEA deviates away from any kind of generic, inflexible forms. It runs using the principles of task-based dynamics. This allows the system to prompt the user with context-specific checklists and actions according to the role being performed and the patient status at hand.

Access Control Role-Based (RBAC): The MHEA maintains strict, fine-grained access controls with its RBAC configuration. The triage nurse, ICU specialist, billing executive, and hospital administrator all use MHEA by interacting with interfaces that are specific only to their respective roles and access rights.

Adaptable Modules and Smart Forms: No two hospitals run in the exact manner; not even departments within a hospital. In order to accommodate this reality, MHEA provides dynamic and highly configurable modules that adjust according to the clinical data inputted. Cardiologist intake form would show all fields relating to cardiological data entry whereas an oncology form would shift focus to chemotherapy and staging.

AI and Automation Layer:

By integrating state-of-the-art Artificial Intelligence (AI), My Healthcare seeks to address the core issues causing administrative burnout among clinicians.

AI-driven Clinical Documentation: With state-of-the-art Natural Language Processing (NLP) technology, MHEA enables doctors to dictate their notes without having to type or worry about formatting. MHEA's AI then processes the ambient discussion or the dictated information and segregates the information into subjective complaints, objective data, assessment, and plan (SOAP Note).

Clinical Decision Support System (CDSS): MHEA's powerful CDSS assists physicians throughout their work as an invisible companion. The system constantly checks all the entered information against extensive databases and alerts the physician about any drug-to-drug interaction, allergy issues, duplicate testing, and potential critical care trigger such as sepsis symptoms.

Discharge Summary Automation: The task of creating a discharge summary is one of the most tedious and time-consuming tasks performed by the doctors. In order to simplify and streamline

the task, MHEA uses advanced generative algorithms that analyse the complete stay of an inpatient and generate a comprehensive discharge summary.

Integration of the Healthcare Enterprise:

For an enterprise to be considered fully integrated, one needs to go beyond its consultation rooms. MHEA comprises the complete operational, logistic, and financial framework for any medical enterprise.

Key Feature and Integration

Department	Key Feature and integration
Diagnostics &laboratory	Machine interfacing automated, two-way LIS-RIS integration, instant critical value alerts, and direct imaging through PACS integration.
Pharmacy Management	Inventory tracking on a real-time basis, e-prescriptions validations, expiration notifications, automatic reorder levels, and ward issues.
Billing & RCM	Charge capture automation for both OPD/IPD/ER, real-time insurance eligibility checking, TPA agreements management, and creation of clean claims.

Table no: 1

Integrated Diagnostics & Ancillary Services:

MHEA has inbuilt integrations with Laboratory Information Systems (LIS) and Radiology Information Systems (RIS). As soon as the physician makes an order for a blood workup or MRI through the Single Screen EMR, the order will be instantly sent to the relevant department. Upon verification of the findings by the specialist, the results will be instantly integrated into the patient's single digital record, which will then trigger a real-time alert.

Efficient Pharmacy Management:

MHEA ensures smooth management of medication supply chain within the facility. Its pharmacy module has direct linkages with the e-prescriptions ordered through the EMR system, thus reducing errors arising from handwriting mistakes during transcriptions. This module enables efficient batch control, management of expiry of medication, management of medication dispensation, and monitoring of controlled substances.

Revenue Cycle Management (RCM) and Billing:

Sustainability on the financial side is key for any healthcare institution. In MHEA, revenue leakage does not exist because it comes with automated charge capture capability. Each consultation, drug issued, disposable used in the OT, and any test conducted will automatically be recorded in the patient's central invoice. The powerful Revenue Cycle Management (RCM) component takes care of complex pricing structures, discounts at the organization level, TPA insurance, and electronic claim submission.

Interoperability and Expansion of Healthcare:

The experience of healthcare in the present day is neither defined nor restricted by the physical boundaries of any hospital or clinical facility. This has been taken into consideration by My Healthcare, who have designed the MHEA based on the concept of comprehensive interoperability.

Overcoming Data Silos

MHEA follows the world's interoperability standards, allowing for easy transfer of data among different legacy systems, external labs, and public health infrastructure. This means that no matter which facility in the network the patient visits, their continuous health records move around with them smoothly.

Teleconsultations and Telemedicine

MHEA helps overcome the geographical challenge by offering secure, high-definition teleconsultation services built into the system. Doctors can freely change their mode from physical consultations to teleconsultations using the same scheduling panel.

During teleconsultations, the doctors have the entire Single Screen EMR accessible, allowing them to view previous records and prescribe digital prescriptions.

Remote Patient Monitoring (RPM)

Patients suffering from any kind of chronic disease (diabetes, hypertension, or heart disease) or even post-op recovering at home can benefit from the highly sophisticated RPM capabilities of MHEA. Using its integration capability with IoT wearables and home-based medical monitors, the system constantly monitors various physiological parameters of the patients like blood sugar levels, heart rate, blood pressure, or oxygen saturation. In case the patient's physiology exceeds the defined safety limits, an instant alert is raised on the hospital's dashboard.

Scalability, Security, and Compliance

As a healthcare technology platform dealing with patients' confidential information, My Healthcare prioritizes issues of data security, infrastructure scalability, and strict compliance with the relevant legislation.

Infinite Cloud-Based Scaling

The MHEA is based on cutting-edge cloud architectures that guarantee infinite elastic scaling capabilities. Should a chain of hospitals expand or have unexpected growth in patient inflow, its compute resources will automatically increase to ensure proper performance of all applications. In this way, the solution negates the necessity to provide huge on-premise server rooms for hospital groups and reduces TCO for healthcare facilities.

Medical Data Protection Protocols:

Aware of the vulnerabilities of healthcare data, My Healthcare employs various defence-in-depth approaches to ensuring data security and patient privacy.

Encryptions: Any transferred data and that stored in cloud databases are protected by state-of-the-art encryption standards such as AES-256 and TLS 1.3.

Regulatory Compliance: The platform has been specifically designed in accordance with global and regional data privacy requirements applicable to healthcare. It follows HIPAA and other relevant guidelines and ensures patient consent registration before transferring their records between platforms.



Pan-India Presence and Social Value Addition:

Ultimately, the proof of concept of My Healthcare's technological innovation is the wide-scale application and proven effectiveness of the solution in practice. My Healthcare has achieved success in implementing their cutting-edge technology in large Tier 1 and Tier 2 urban cities across India.

Optimizing Processes in Competitive Tier 1 Centres:

Within ultra-competitive urban metropolises of Tier 1, My Healthcare helps enormous corporate hospital networks increase efficiency to the maximum possible extent. Through automation of billing schemes, reduction of clinical documentation, and minimizing time to turn over beds by using AI-driven discharge summaries, MHEA helps such facilities operate efficiently and make high profits without compromising patient safety records.

Tier 2 Development and Equalization of Opportunities:

Most likely, the most valuable contribution to society that My Healthcare makes pertains to developing Tier 2 cities. These regions have traditionally been deprived of both super-specialist

medical professionals and cutting-edge medical devices. Thanks to MHEA's powerful EMR, teleconsultations, and remote health monitoring features, My Healthcare makes elite healthcare accessible to everyone.

Conclusion

The Future of Digital Healthcare

Unlike being just a software supplier, My Healthcare Technologies Pvt. Ltd. has always been a facilitator of sustainable systematic transformation. The My Healthcare Enterprise Application (MHEA) by the company has managed to address those key points of friction that have long hampered healthcare delivery.

Through streamlining the fragmented clinical processes, alleviating physician exhaustion through Single Screen EMR, leveraging artificial intelligence, and delivering healthcare beyond hospital facilities using remote patient monitoring and teleconsultation, My Healthcare sets a gold standard for modern digital health system.

It is likely that the growing presence of the company in the Indian healthcare system and its dedication to scalable, secure, and data-driven delivery of healthcare services will greatly influence the development of a healthy, effective, and compassionate medical practice of the future.

MIOT International (Implementation Project)

Hospital Profile: MIOT International

Background and Growth

The Madras Institute of Orthopaedics and Traumatology (M.I.O.T.) was founded on 12th February 1999 by Padmashri Prof. Dr. P.V.A. Mohandas and started as a 70-bed unit that operated purely on orthopaedics and traumatology.

Since the hospital had cases of traumatic patients who were usually admitted in critical condition owing to their organ injury or pre-existing health issues such as heart and kidney problems, the need for holistic treatment came into focus. To enable round-the-clock treatment for these patients, MIOT evolved into a fully functioning multi-specialty facility with its team of full-time specialists. Presently, MIOT International has grown into a globally acclaimed quaternary care hospital with 1,000 beds and specialists in 63 branches of medicine.

Infrastructural Facilities

The implementation environment of MIOT International is supported by top-class infrastructure facilities aimed at achieving maximum patient outcomes through strict adherence to patient safety practices:

Imaging & Diagnostics: One of the best departments for Imaging Sciences in the country, coupled with a lab that has been internationally ranked 8th.

Operation Theatre: Equipped with 21 modernized operation theatres with intricate instruments required for carrying out very complex surgeries.

Infection & Environmental Control: Employing highly sophisticated air systems, it ensures a nearly bacteria-free environment.

Flow: The flow design is aimed at ensuring an efficient hospital experience for the patient through dedicated entry points for emergencies, OP & IP/attendants.

Medical Advances

MIOT International is recognized for being a leader in clinical research, especially in the field of orthopaedics' and stem cell therapy. Additionally, it is historically known for pioneering major medical advances in India:

Orthopaedics': Home to the surgeon responsible for conducting India's first hip replacement surgery and advancement in key hole/pin-hole surgical techniques.

Nephrology & Transplant: Has achieved the landmark of conducting India's first kidney transplant from across different blood groups.

Onco/Haematology: It was here where the first haplo-identical Bone Marrow Transplant was successfully conducted on Indian patients with blood cancer.

Patient Population: The fact that the implementation location is known for being innovative in treatment and excellent in providing care explains why this location attracts such a wide demographic of patients from all over India and beyond 130 other countries.

Dissertation experience

My field experience for this research was carefully selected at My Healthcare Technologies Pvt. Ltd., considering that I worked extensively as a Management Trainee in the Product Implementation and Clinical Transformation teams. It must be noted here that in the context of digital health, not only software development is important but there also needs to be a tight integration between product design and local clinical workflows.

The focus of my field experience was a detailed analysis of the execution of implementation and its adoption by clinicians along with efficiency considerations based on the My Healthcare Enterprise Application (MHEA). As a management trainee working directly for a corporation, the experience gave me access to a great real-world setting where I could study the operation of a single-screen ecosystem that integrates Outpatient (OPD), Inpatient (IPD) and Emergency Room (ER) processes.

Methodology & Goals-

My key goal during the implementation immersion was to document and quantify the changes in behaviour, clinical operations, and operational activities as a healthcare organization moves away from disjointed legacy health information systems to an AI-based task-oriented enterprise framework.

Primary Research Areas to Investigate:

Workflow Integration & Transition Mapping: Reviewing the workflow transition process for MHEA along the different verticals involved: Front Office → OPD EMR → Nursing Triage → IPD Care Plan → Emergency (ER) Workflows.

User Adaptation Time & Documentation Velocity: Estimating the amount of time spent learning about the system and recording documentation via the Single Screen EMR and AI Speech Recognition modules.

Operational & Financial Leaks Analysis: Estimating the effect on operations performance as a result of real-time two-way integration among the EMR, LIS, and RCM modules.

Patient Engagement Measurement: Assessing the scalability and adherence measurement metrics associated with Teleconsultation and RPM.

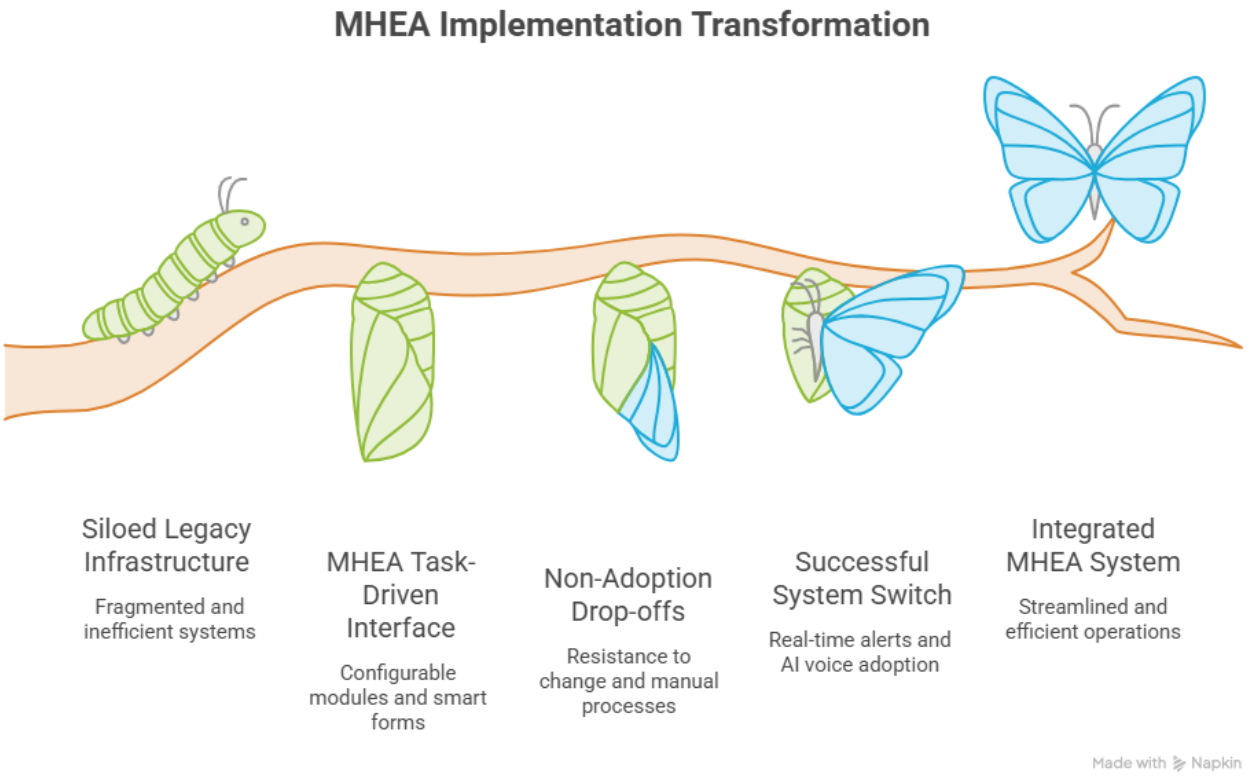
Insights from Observations and Field Journal

Phase 1: Mapping Bottlenecks in the Legacy System and Configuration of the Product

In the early phases of the work, I integrated myself with product managers and healthcare facility leaders to complete pre-implementation audits at hospitals. It became clear that the workflow process in legacy environments was greatly hindered by duplication within the system; doctors were required to navigate through an abundance of windows, tabs, and paper slips to access information in other departments.

Phase 2: Implementation of the Single Screen EMR and AI Documentation Modules

With the implementation of the product at our partner organizations, my focus changed towards recording changes in user behaviour post-implementation. The rollout of the Single Screen EMR was critical during this phase.



Key Variables Affecting System Acceptance Based on Observation and User Testing:

Cognitive Load Reduction: By creating an integrated environment for vital signs, medications, history of previous clinical cases, and allergies, doctors were able to eliminate clicks due to which diagnostic decision-making improved.

Faster AI-Based Documentation Process: I kept a close watch on how doctors adopted AI speech-to-text functionality. Doctors used their time communicating with patients and dictated data, which was automatically populated in the SOAP format by virtue of voice-based command-and-control software. It saved valuable consultation time for doctors.

Customization of Smart Forms: The customization of smart forms in accordance with the medical vocabulary of different specialties, along with RBAC-based access control to forms, resulted in better clinical documentation.

Phase 3: Financial Interoperability and Process Efficiency

One of the largest parts of the data collected from my dissertation involves the structural interplay between the various backend systems of MHEA. By facilitating the process of installing instant two-way connections between the main EMR system and the Pharmacy and LIS systems, I was able to plug important holes that needed sealing off.

I discovered that automated charge captures functions immediately registered all the medications distributed and tests performed on patients in their central electronic bill. The structural integration improved the efficiency of record keeping, minimized any revenue leaks and reduced the insurance verification process conducted by TPAs.

Phase 4: Scaled Application Between Tier 1 and Tier 2 Regions

For this part of the study, I had to track how MHEA was scaled from its initial application in high-population, well-resourced metropolitan hospitals to smaller regional clinics operating in Tier 2 cities.

In Tier 2 regions, I focused on tracking implementation trials involving the use of MHEA to facilitate equal access to specialist consultations. These involved instances where regional clinics deployed the teleconsultation and IoT-enabled RPM services of the platform in order to connect with specialists in metropolitan regions for reviewing patient records and remote monitoring of care.

Based on the basic theories in my hospital management course, I developed practical system performance measures by applying them to the My Healthcare company environment. In demonstrating how transformation in technology takes place, I was able to show that transformation occurs when the software goes beyond being just a database.

Implementation barriers

Implementation Barrier	**Root cause**	**System implementation strategic response**
Initial clinical resistance	Fears of complexity with UI/UX and multi tab confusion	Take advantage of MHEA's Single Screen UI and customize specialty smart forms per the physician's model.

Delayed Patient discharge	Drafting manual summaries and delays in billing	Utilize AI-driven automatic discharge summary creation coupled with real-time RCM.
Revenue leakage	Documentation fragmentation between pharmacy and laboratories	Ensure automation of charge capture with direct connections to LIS, RIS, and medication-related concerns in wards.
Fragmentated post-op and follow ups	Patient management after discharge	Implement IoT-driven RPM that sends notifications to care managers through threshold alerts.

Table No.: 2

Personal Reflection and Conclusion

Overall, the dissertation process within the ambit of My Healthcare Technologies Pvt. Ltd. turned out to be very enriching and formative. The learning experience brought together classroom knowledge of health informatics with the practical aspects of executing large software implementations in a busy hospital network environment.

In terms of practical application of my learnings, the field research process helped me hone my analytical skills, problem-solving abilities, cross-functional communication skills, and the skill of configuring health informatics systems using evidence-based practices. In conclusion, the findings from this project have made it clear that an important aspect of health tech management is ensuring that a digital healthcare system is human-centred and harmonious in its operation.

Abstract

Context and Background

In today's healthcare environment, there is an inherent operational dichotomy that can be described as "Partial Digitization". Despite all the considerable amounts of money spent on implementation of highly advanced Enterprise HIS systems with interoperable digital infrastructure, the theoretical advantages of these technologies do not come true in practice. Instead of the full-scale integration into a paperless system, many healthcare institutions find themselves in a disadvantaged position and operate within a semi-manual system where advanced computerized solutions regularly co-exist with traditional paper-based processes. The mismatch between the software design and real-life processes results in serious problems, creating the "Implementation-Workflow Mismatch". Whenever the digital platform is unable to reflect the non-linear reality of the clinical/administrative environment, technology becomes a digital bottleneck rather than a productivity enhancer. Faced with high number of patients, time pressure and cognitive load, healthcare practitioners often tend to skip the process of interaction with the digital platform altogether, opting for manual workarounds in the form of paper logbooks and tracking forms that help to keep the pace of operations. This change of behaviour causes serious data duplication, documentation overload, transcription mistakes and long patient transactions.

Although there is much coverage of the macro-benefits of health informatics in global literature, there appears to be no empirical study that has been done between individual design problems and their physical effects at the level of the module itself. The majority of existing research focuses either on the usability of the systems independent of one another, or on self-reports that are inherently biased due to their retrospective nature. This dissertation seeks to fill this void through the use of a comprehensive Mixed-Methods Evaluative Case Study analysis of several modules. Specifically, this study will be conducted within the deployment context of My Healthcare Technologies and MIOT International, and it will focus on four key modules – OPD Registration, EMR Consultation, Final Discharge Billing and Inventory Management.

Research Methodology

In order to address the issues of bias inherent in self-reporting research, the study employs a rigorous, objective Non-Participant Observation approach, incorporating the Action Research

and Business Process Re-engineering (BPR) models within a 12-week period of observation. The researcher served as an impartial observer at functional clinical and administration work stations, observing real-time activities without interfering with the process of patient treatment. It facilitated an accurate recording of baseline friction and structural barriers. The diagnostic and evaluation stages of the thesis utilized the following three customized data collection tools:
Instrument A: Nielsen-Based Usability Heuristic Scorecard: Interface was rated using Jakob Nielsen's 10 Usability Heuristics and NABH informatics criteria through a rigorous Usability Severity Rating Scale that ranged from 0 (No problem) to 4 (Major gap leading to manual override).

Instrument B: Workflow Comparison Grid: Quantitative database for real-time data logging for transaction cycles, focusing on Manual Switch Count (number of times staff switched from computer input to paper manual logging), Process Duration (time-motion studies measured in minutes) and Data Duplication Count (repetitive entries in manual logs and electronic databases).

Instrument C: Requirement Traceability Matrix (RTM): A mapping tool that helps link the field workarounds found to the initial system requirements in order to determine if the inefficiencies arose due to user resistance or lack of software requirements such as financial masters or validations.

Total data sample of 20 full detailed scorecards (n=20, five for each core module) was analysed prior to the intervention period to provide a benchmarking point. The research further applied specific user interface fixes such as predictive search bars, validation paths, voice diction aids, automatic tariff master paths, live central store visibility, and localized, role-specific standard module documentation. After that, the post-intervention assessment was carried out in order to triangulate both qualitative interface improvements with operational gains quantitatively.

Key Findings and Results

Pre-intervention benchmarking showed a high level of systematic friction for all evaluated software modules with total system-wide usability severity index equalling 3.08 out of 4.0 and Module Manual Reversion Rate equal to 28.0%. This allowed concluding that operators faced major difficulties in operating with the software because of high level of frustration and frequent switching from digital path due to lack of visibility about the system status, absence of error prevention features, and complex interface design. Application of the BPR approach and improved To-Be processes resulted in significant operations compressions for all four primary modules:

1.OPD Registration Module: Before the implementation of the intervention, patient registration was characterized by the issue of screen locks and lack of search pathways leading to the average handling of 3.0 paper slips and data duplication in 2.0 occurrences leading to an average process time of 11.5 minutes. After the integration of the "Magic Search" feature that allows users to access patient data through registered mobile numbers, as well as text verification, the mean usability severity score reduced from 2.92 to 1.1. This resulted in 63.5% improvement in process time, reducing the time required for registration from 11.5 minutes to 4.2 minutes, an 86.7% decline in manual processes and 100% reduction in data duplicity.

2. EMR Consultation Module: The frontline medical practitioners were constrained by the rigid nature of the data fields and typing issues which resulted in an average process time of 14.2 minutes and usability severity score of 3.12. In order to achieve speed, the medical practitioners used prescription pads averaging 1.0 pad. With the incorporation of voice diction software, predictive search bars, order sets for medications, and instant in-app patient admission requests, the usability severity score was decreased to 1.4. This modification helped in reducing doctor consult time by 52.1% (to 6.8 minutes), paper pad usage by 90.0%, and eliminating transcription loops completely.

3. Final Discharge Billing Module: Discharge billing operations were highly limited by window cluttering, extra mouse clicks, and offline spreadsheet validation due to the non-integration of financial systems, which resulted in a base transaction time of 28.0 minutes and usability severity rating of 3.14. The automation of background tariff master system and removal of redundant mouse clicks lowered the post-intervention usability severity rating to 1.20. These changes optimized the discharge billing transaction time by 58.9% (reduced to 11.5 minutes), reduced manual intervention by 90.0%, and reduced data duplicity by 83.3%.

4. Inventory and Supply Chain Module: The requisition of the store involved very fragmented multi-window architecture. Ward nurses and store controllers depended on physical runners, telephone calls, and manual registers (4.0 logs) to validate the stock, resulting in a lengthy cycle time of 42.0 minutes. The use of a live task-based visibility model ("My Desk") for validating the stock lowered the post-intervention severity rating to 1.30. This re-engineering effort produced a 61.4% improvement in request cycle time (down to 16.2 minutes), an 85.0% improvement in manual interventions, and a 95.0% improvement in parallel documentation.

Introduction

In today's world of healthcare, there is an interesting operational dichotomy that is generally described as "Partial Digitization". Even though the latest versions of Hospital Information Systems (HIS) and enterprise-level technologies are widely used in contemporary medical establishments, the potential benefits do not always correspond to their practical usage. Rather than having a completely integrated system, healthcare organizations often have to operate within a compromised framework called "Semi-Manual". Such operational conditions imply the use of both computerized programs and traditional paper solutions, significantly undermining the effectiveness of technology implementation.

1.1 Introduction of HIS

An HIS is a broad, integrated management information system for hospitals. When properly installed, HIS becomes the technology infrastructure of a medical institution by bringing all its sections from the front office, clinical departments, diagnostic services, billing counters, to the central logistics storage into one single ecosystem of information.

The primary reason why an HIS is needed is because it enables the automation of all data transactions while reducing the risks associated with them. An HIS helps eliminate errors, data loss, non-compliance, and allows managers to get real-time indicators of their operations. Nevertheless, implementing an HIS is more than installing software; it represents a major change within the business process itself.

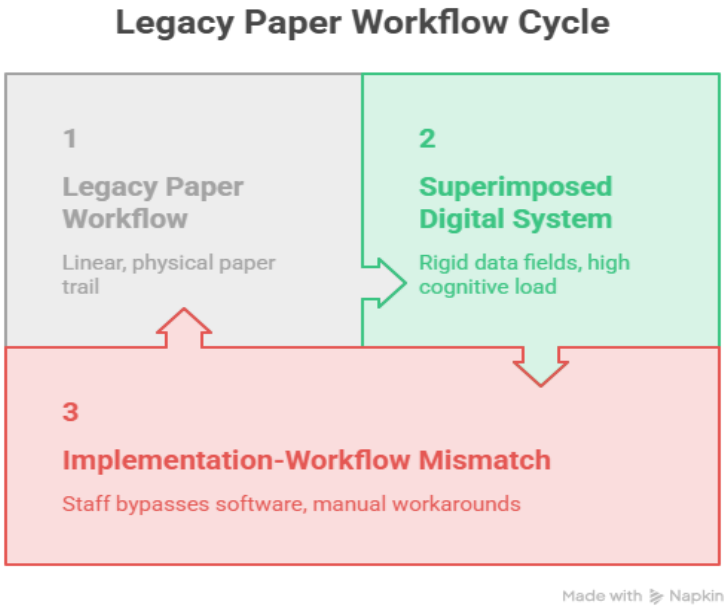
1.2 Increase in the Use of Digital Platforms

In recent years, there has been an immense increase in the use of digital health platforms within the healthcare sector. The use of technological innovations in daily life has been brought about through devices such as wearable gadgets, virtual reality technology, IoT, and information systems. Advanced technology has emerged as key factors that drive changes in the modern structure of the business and healthcare delivery processes.

The increase in use of the digital platforms has been greatly influenced by health crises and changes in the macroeconomic environment. This has forced hospitals to invest in more technology infrastructure. In doing so, clinical operations will be heading into an age where people will embrace a patient-oriented approach and have increased choices regarding mindfulness. The digital transformation will dictate the standard of care delivery. Examples of such healthcare platforms include Outpatient Department Engines, EMR platforms, Billing portals, and inventory management applications.

1.3 Impact on Workflow

The incorporation of digital technology essentially transforms established workflows in hospitals, changing them from linear and paper-based procedures into non-linear processes driven by information. Digital platforms that realize total integration of hospital workflow reduce the timespan required for documentation procedures by demonstrating a mean difference between the two groups of -22.4% (95% CI=-38.8% to -6.0%; P<0.007). In addition, digital workflow systems require adherence to protocols and standards and actively prevent errors in drug administration by acting as protective mechanisms, leading to a significant decrease in such errors (Risk Ratio = 0.46). In spite of the above-mentioned advantages, changes to workflow can be extremely disruptive for operators involved:



When the HIS setup cannot replicate the real-life clinical situation, instead of minimizing cognitive friction, the digital workflow adds to the existing problem. Instead of streamlining

operations, technology might become a digital bottleneck, requiring employees to manually navigate through complicated interface structures amidst high-volume activities.

1.4 Facilitators to technology acceptance of digital platform his

HIS operational effectiveness is contingent upon its ability to be accepted by users, which depends on an array of user-related, group-level, and organization-related factors. In Health IT research, researchers have employed different theories like the Technology Acceptance Model (TAM), Social-Cognitive theory, and Diffusion of Innovation to monitor technology acceptance.

Systematic analysis of research suggests that information technology usage behaviour can be influenced by three layers of factors:

Individual Level: Ease-of-use of technology, technical self-efficacy, and perceived immediate cognitive workload when working through the interface.

Group Level: Workflows of peer groups, inter-group relations, and presence or absence of local "champion," who speaks about the importance of technology use.

Organizational Level: Support by organizational leaders, strategic change implementation, and proper timing and relevance of training programs.

Neglecting any one of these layers results in high rates of technological failure due to insufficient utilization.

1.5 Perspective of Digitization of Hospital Flow Globally & Nationally

Globally, there is increasing emphasis on the integration of health informatics. In advanced economies, multi-level approaches, including financial investment at the federal level, have resulted in the establishment of sophisticated digital systems in which clinical information flows effortlessly through regional health networks. Nonetheless, it has been observed through global systematic evaluations that there are high levels of statistical heterogeneity among such implementations, suggesting that software alone does not ensure success in all cases.

At a national level, the Indian healthcare system is experiencing an extensive digital revolution under the ABDM framework. The current emphasis is on building interoperable health registers and developing functional HIMS. Unfortunately, there is an important domestic issue that needs to be addressed. Even though the top-down policy emphasizes digitization, hospitals are unable to execute such digitization efforts effectively and find themselves stuck in the "Semi-Manual" phase of using both digital and paper-based systems simultaneously.

1.6 Factors Hindering Acceptance

Even with all the clear advantages attributed to electronic health architecture, there are several factors inhibiting its acceptance and optimization. Some of the key barriers to adoption in ambulatory and clinical settings include the following:

High Acquisition and Maintenance Costs: Large financial resources required for acquisition and management of vendor software packages.
Lack of Standardization of Products: Lack of standardization of the software where products from different vendors suited for hierarchical environments do not match the localized environments.
Initial Productivity Losses: User learning curve leading to inefficiencies at the start that result in productivity losses.
Misalignment of Benefits: Perception of benefits accruing to stakeholders other than frontline personnel such as the administrators and the payer community.
Lack of Effective Training Tools: Lack of training tools and materials that provide guidance on using software.

1.7 Institutional Factors Relating to Hospitals That Influence the Implementation Process

Apart from individual user behaviour, there are numerous macro factors that are institutional and influence the success of HIS implementation processes considerably:

1. Size and Infrastructure of the Organization

The implementation process varies depending on the organization size. The small high-volume hospitals are faced with different challenges compared to huge hospitals implementing the technology at an earlier stage. Lack of adequate hardware, low connectivity and server configuration may lead to problems immediately after deployment.

2. Approach to Change Management

For successful implementation of the technology, certain steps need to be followed. These steps include decision making, selection, pre-implementation, implementation and post-implementation. Inadequate assessments and redesigns in these stages result in the system becoming a challenge for the hospital administrators.

3. Environmental Strains for Healthcare Professionals

High stress level and volume in the clinical environment result in the overwhelming influence of socio-behavioural factors as opposed to product capabilities. The systems that require frequent mouse usage and generic typing may be rejected by the healthcare practitioners because of operational inefficiency and inability to attend patients.

1.8 Need for the Study

Whereas the worldwide literature offers much coverage for the macro-benefit analysis of Health-IT, there still seems to be a glaring lack of research concerning module to module empirical analysis within active deployments with high usage. Most of the literature tends to focus on usability either as an independent computer science concept or based on retrospective self-reporting surveys, subject to biases.

This study seeks to fulfil such an operational need. Set in the context of the active deployment of My Healthcare Technologies, this dissertation will investigate four key modules: OPD, EMR, Billing, and Inventory Management (Indent, Purchase & Consignment).

With the aid of an objective Non-Participant Observation research method, the study will make a direct connection between Jakob Nielsen's Ten Usability Heuristics to hospital physical workflow inefficiencies through manual interaction points, duration of interactions, and data duplicity counts. The research is necessary to provide health organizations with a guideline for how to diagnose interface problems, optimize "To Be" processes, and write user documentation to mitigate the implementation-process disparity and achieve full digital maturity.

REVIEW OF LITERATURE

A paradigm shift is occurring in the global healthcare industry, fuelled by digitization. Innovations like wearable technology, virtual reality, Internet of Things (IoT), and informational technologies have dramatically changed the model of doing business in the clinic and hospital settings (Stoumpos et al., 2022). As systems evolve to shift from legacy and fragmentary systems to more integrated systems, there is a need for comprehensive strategic mapping.

In order to connect the high-level strategy and its clinical implementation, more and more healthcare organizations apply managerial approaches such as the balanced scorecard (BSC) to their advantage. Specifically, BSC can be used as a critical approach that will help hospitals transform their digital strategy into concrete actions and assess the organization's performance on a scale other than the strictly financial one (Hügle & Grek, 2026). The use of cross-level key performance indicators (KPIs) in different areas such as customers, processes, and organizational learning allows for fast changes in operations and immediate assessment of performance (Hügle & Grek, 2026). As adjusted for the era of digitization, this mapping process will include the new generation of innovations such as artificial intelligence (AI), automation, and natural language models. All of these technologies are focused on the Electronic Medical Record (EMR).

Infrastructure Evolution and the Core Hospital Information System (HIS)

The underlying technical infrastructure which supports such a shift is built around the evolution of the Hospital Information System (HIS). Early architectures were proof that a central Hospital Information System based at the University Hospital (UHIS) was effective in controlling all core functions of an administration and clinics, ranging from patient registration, ADT files, sophisticated orders entry up to laboratories' data acquisition and radiology reports (Vegoda & Dyro, 1986). It was also clear at that point that online database-oriented applications could deal with complex physiological monitoring and patient data management in intensive care networked environments while facilitating the development of early physician access from the community (Vegoda & Dyro, 1986).

In the years that have followed, the size of HIS has grown tremendously, as reflected in the use of these systems within extensive public networks, including those of Brazilian university hospitals (Mussi et al., 2023). Modern clinical infrastructures need extensive interoperability between different subsystems. One of the major concerns for modern HIS architecture is ensuring effective integration among various systems, particularly the HIS, RIS, and PACS (Osada & Nishihara, 1999). For complete clinical integration, automated workflow management is necessary in order to avoid the duplication of patient data, guaranteeing consistency of workflow management information between various applications and automatic pre-fetching of current and historic diagnostic images at clinicians' workstations (Osada & Nishihara, 1999).

Besides measures of clinical safety, adoption of HIS plays an important role in addressing logistical challenges such as patient flow, which is defined as "the journey of a patient through an array of care steps beginning from admission through discharge" (Nguyen et al., 2022). Poor patient flow greatly affects the quality of care provided, patient satisfaction, and income of hospitals. Reviews of literature indicate that more than 17 different categories of HIS have been used at the level of department, whole hospital, and networks to address these logistical issues (Nguyen et al., 2022). HIS optimize process results by minimizing LOS and waiting time for patients by recognizing problems in administrative processes and optimizing the process of care delivery and coordination among departments (Nguyen et al., 2022).

Human Factors Engineering, Usability, and Multi-level Frameworks of Behaviour Even though there is no doubt regarding the benefits of health information technology, implementation of the systems often fails or suffers from severe underutilization because of usability problems and inadequate understanding of socio-behavioural processes. In healthcare, usability is not a matter of user satisfaction but rather poses serious threats to patient safety. Addressing such issues requires HFE experts to conduct multi-level evaluation processes. For instance, in the case of usability assessment of artifacts utilized by patients, like, for example, the Emergency Department After Visit Summary (AVS), which specifies actions taken by patients after discharge regarding symptom management, medication use, and appointments, collaboration between HFE specialists, clinicians, IT professionals, and patient care partners (Barton et al., 2020) is crucial. According to research conducted by Barton et al. (2020), the involvement of non-HFE experts, i.e., nurses, doctors, and geriatric patient care partners, reveals 23% more hidden usability problems (Barton et al., 2020). Comparing this

data to feasibility assessment done by IT specialists results in proper software re-design, considering clinical risks and technological aspects.

Moreover, the behavioural models employed to anticipate and foster adoption of the systems such as TAM or diffusion of innovations have traditionally been plagued by an important unidimensional myopia. Although an approximate 61% of the health IT adoption cases explicitly refer to theories of behaviour, none of them develops an intervention strategy based on multi-level design and testing (Kukafka et al., 2003). Usage behaviour does not occur in isolation; it takes place amidst various other forces operating at different organizational levels. In order to reduce the incidence of system rejection, healthcare planners need to employ a multi-level approach, for example, the epidemiological PRECEDE/PROCEDE framework, when developing their usage interventions (Kukafka et al., 2003).

The Non-Technological Acceptance Factors and Staffing Training and Burnout One common aspect from the various sources is that the non-technological factors—more precisely the human and organizational factors—exert much greater influence on the user acceptance of HIS than technological factors alone (Handayani et al., 2015). Different users in the hospital organization—doctors, nurses, administrative operators, and management—are interested in different criteria of acceptance depending on their particular functions (Handayani et al., 2015). This is why a generic software installation cannot be effective. An important point under consideration is the planning and scheduling of training for staff members. The implementation of the nursing information system (NIS) cannot bring any positive changes in documentation for six months after installation (Larrabee et al., 2001). It may take longer before any real improvements, including completeness of documentation, patients' outcomes, and accuracy of care plans, occur as a result of systematic use of the NIS and training sessions (Larrabee et al., 2001).

Adding insult to injury, there exists the serious problem of stress and burnout facing workers in the healthcare industry, with a substantial contribution from information overload and the COVID-19 pandemic (Adam et al., 2023). Digital health promotion tools such as mHealth apps, blended learning software, and mindfulness exercises through the Internet are being used to mitigate clinician burnout, yet their efficacy is highly contingent on successful organizational implementation. There is a serious dearth of evidence indicating the existence of successful digital wellness programs which integrate both individual behavioral strategies as well as organization-wide interventions (Adam et al., 2023). In the absence of

organizational commitment and allocation of resources for these activities, digital health solutions fail to effectively reduce stress in the workplace.

Scaling Based on the Context: Smaller Practices vs. Resource Scarcity

In the process of using digital health tools, there may be certain scaling barriers depending on the size of institutions and regional differences. In the early years of the implementation of health information technologies, the major players in this field were usually well-funded hospital networks. On the contrary, small clinics are faced with other types of problems that are more specific for them, such as the problem with capital cost, insufficient standardization of products by vendors that is required for small environments, and the risk of productivity losses in the beginning of the process (Lorenzi et al., 2009).

When health IT solutions are implemented in resource-constrained environments, the context-based challenges change drastically as well, with an example being the sub-Saharan region. In this type of context, it appears that the process of successfully implementing an EMR is largely dependent on the human aspect rather than actual restrictions posed by the software and hardware solutions (Jawhari et al., 2016). One can see that in terms of geographic and structural gaps in the field of research, there seems to be a large divide, as although there is a bright future ahead for the development of digital health monitoring in developing regions, there are currently not any implementation toolkits available and very little data is available on how this technology works in complex contexts such as shantytowns (Jawhari et al., 2016).

Process Optimization: Convergence between Digitalization and Lean Healthcare, in order to address inter-departmental communication problems and enhance the efficiency of processes that require the handling of large amounts of data, hospitals are increasingly combining digital health technologies with continuous quality management techniques, such as Lean Healthcare. In examining the process optimizations within clinical settings, it is common practice for researchers to note the consistent use of certain lean methodologies, including:

- DMAIC – Define, Measure, Analyse, Improve and Control
- VSM – Value Stream Mapping
- SIPOC – Suppliers, Inputs, Process, Outputs and Customers Analysis
- Ishikawa Diagrams
- 5S frameworks (de Barros et al., 2023).

Through applying these various lean methodologies in the identification and elimination of administrative waste, significant operational benefits can be gained. They include a notable reduction in waiting, processing, cycle and total throughput times, along with a lowering of workloads, costs and an increase in patient consultations (de Barros et al., 2023).

Scale, Advantages, and Hindrances to System Implementation:

The complexities involved in implementing electronic health records depend significantly on the organizational environment, meaning that differences in scale are key determinants for successful implementations. While large healthcare networks and pioneering organizations have traditionally been the source of most knowledge about Health IT implementation, a recent literature review shows that the advantages of digital technology in healthcare are now being seen by small practices and decentralized organizations. According to an analysis of Health IT literature, an impressive 92 percent of contemporary articles have concluded positively on the effects of technology on health outcomes and efficiencies.

Despite this positive trend, there is still provider dissatisfaction and suboptimal utilization of the systems, which continue to be significant obstacles for reaching the true potential of Health IT. The obstacles to adopting the technology in ambulatory settings and specialized health care teams include the following:

Constraints from Financial and Capital Requirements: The high cost required for the acquisition process along with subsequent maintenance costs create a lot of financial burden in deployment cycles.

Absence of Standardized Products: Another serious flaw lies in the absence of standardized products. Configurations in software are often designed keeping large scale multi-layered networks in mind, which is not well-suited for specialized systems in local areas.

Productivity Drop at Beginning: There is an immediate drop in efficiency due to the unmanageable user learning curve associated with initial deployment cycles.

Misaligned Incentives Perception: The belief by practitioners that the financial gains and advantages associated with digital documentation lie with third parties and higher-level administration, and not with clinicians themselves.

In overcoming these obstacles, the literature focuses on formulating adaptable change management approaches. The successful deployment of a software package entails a balance between the technological and the human component aspects. It is imperative for the organization’s leadership to come up with a vision that can easily be put into practice by the organization’s staff members.

Secondly, the implementation procedure must be carried out systematically through the decision stage, selection stage, pre-implementation stage, implementation stage, and post-implementation stage. The various activities involved in these stages are assessing the financial considerations, carrying out timely training that aligns with the current capabilities of the staff members, and appointing a project champion who will act as an advocate of the system's worth. Most importantly, the organization needs to conduct an exhaustive workflow assessment and redesign.

In the modern age, research into Lean Healthcare is increasingly integrating itself with the concepts of Lean Six Sigma to attain predictability through data-driven continuous improvement (de Barros et al., 2023). It is important to note that such process-focused practices overlap directly with digital health literacy. In this regard, when hospitals integrate digital workflow practices in Lean, it is their digital literacy that decides the success or failure of the same (Hügle & Grek, 2026).

In addressing these challenges, the literature has emphasized the need to develop flexible approaches towards change management. In order to successfully adopt a software package, there must be a delicate balance between the technology side and the human side elements involved (Hügle & Grek, 2026). There must be a vision developed by the organization's management which can be effectively realized by the organization's employees.

Secondly, there must be a systematic process of implementing the system, which involves making decisions, selecting a solution, preparing before implementation, executing the implementation, and evaluating post-implementation (Hügle & Grek, 2026). Some of the activities that must be performed include evaluation of financial factors, timely training which is consistent with the ability of the organization's employees, and appointment of a project champion who acts as the advocate of the system's value (de Barros et al., 2023). However, most importantly, the organization should do a thorough workflow assessment and redesign.

Behavioural Science Shortcomings within Multi-Level IT Initiatives One of the most common causes behind poor success rates in poorly used systems as well as manual interventions lies in insufficiently developed planning strategies. A number of initiatives designed to support successful implementation of Health-IT technology can claim that they are based on behavioural science theories such as the Technology Acceptance Model (TAM), Social-Cognitive Theory and Diffusion of Innovation Theory which have already been tested to define prerequisites of successful system use (de Barros et al., 2023). Nevertheless, there is a

fundamental difference between those models since they were developed in order to solve particular issues rather than to provide a full picture of the problem.

It denies any implementation effort from being able to consider all these various interacting forces simultaneously at the individual, group, and organization level that affects technology usage behaviour. (Kukafka et al. 2003) At the time when individual users work with technology through an interface, their behavioural actions have been influenced by processes at the group level, and ultimately, macro processes at the organizational level. (Kukafka et al. 2003) systematically synthesized literature to examine whether the approaches for implementing IT systems published in journals had taken into account two or more organizational levels of behavioural determinants in their models.

Digital Implementation Issues in Resource-Limited Settings:

The issues associated with digital implementation take on a whole new meaning when the system is used in a high traffic, resource-limited setting. One systematic review that studied the effects of the introduction of EMRs in resource-limited settings used concepts such as searching, mapping, and relevancy to classify literature into different categories based on type, structure, purpose, and setting. Based on these criteria, a classification framework was developed to categorize the factors affecting the implementation of EMRs in four different operational quadrants—Systems, People, Processes, and Products.

The insights provided by empirical studies include:

Primacy of Social Factors: In the face of complexity and high stress situations, the primacy of social factors and human elements far exceed any inherent restrictions imposed by the product/system itself.

Training and Toolkit Shortfall: A critical lack of targeted user training and relevant technical toolkits constitutes one of the greatest obstacles to sustained digitalization.

Potential for Workflow Obstruction: Unfavorable configuration of EMR modules often causes disruption of non-linear workflow processes in resource-poor environments, resulting in documentation backlog and necessitating the abandonment of digitalization efforts.

In the end, even though the prospects for digitalization are indeed bright, there is much more to be learned about the process of implementation in real-world environments. Therefore, it would be interesting to research whether there are effective strategies for achieving localization

of the documentation process and preventing staff from falling back to using traditional techniques.

Critical Analysis and Research Gap Identification

Upon conducting an extensive review of the literature from across the globe, there emerges a clear-cut research gap that needs to be identified and addressed. The computer science literature is mainly concerned with interface operations within the framework of Jakob Nielsen's usability heuristics while the literature within the field of healthcare administration tends to deal with general measures of quality as well as time-and-motion measures of productivity. There is very little integration between these two streams of literature as one cannot find a single study that combines both streams. However, the present dissertation successfully bridges this research gap through the implementation of a multi-module, multi-level Mixed-Methods Evaluative Case Study approach. The research gap is thus tackled through the direct correlation of expert usability scores with physical workflow measures such as manual touchpoints, process durations, and measures of data duplication within the linked life-cycles of the OPD, EMR, Billing, and Inventory modules. Non-participant observation provides for the objective recording of actual workflow activities as opposed to surveys that are susceptible to subjective bias and socially desirable responses.

Conclusion

Directions for Further Research The current literature convincingly establishes that digital transformation of healthcare cannot be reduced to the mere installation of digital applications; it represents a significant socio-technical revolution that will radically alter each level of any institution. From the perspective of the strategic support provided by a bespoke Balanced Scorecard, through the numerical efficiencies introduced by Lean Six Sigma, down to the complex series of behavior changes needed to successfully adopt a HIS, success in each case rests solely upon aligning technical specifications with readiness on the part of humans and organizations. For the further advancement of the topic, it is critical for investigators to focus their research efforts beyond superficial assessments of usability or even technological acceptance. Instead, they should emphasize empirical testing of multi-level implementation strategies, while most importantly, integrating feedback from patients.

Research Methodology

The methodology adopted for this research involves the application of the Mixed-Methods Evaluative Case Study technique with the use of a non-Participant Observation method. Due to the busy environment of the healthcare facility and the requirement for objective metrics for operations, the researcher observes the situation without intervening in any way in order to identify the "Implementation-Workflow Mismatch." The BPR (Business Process Re-engineering) technique is employed as it emphasizes the identification of the "Partial Digitization" causes and the redesign of "To-Be" processes.

3.1 Title of the study

"Transitioning from Fragmented Digital Usage to Integrated Process Automation: A Heuristic Evaluation of Workflow Optimization in Healthcare Management."

3.2 Aim of the study

In summary, the primary purpose of this research project is to identify the reasons for the "Implementation Workflow Mismatch" that occurs within the context of an HIS and to develop a strategy to bring the hospital from its current disorganized state of operations to an organized, fully automated state.

3.3 Objectives

Primary Objective 1 (Requirement Gathering): To study the Requirement Gathering methodology to pinpoint exactly the clinical and administrative gaps that make for workarounds and require manual handling at the present-day digital facility.

Secondary-

Objective 2 (Process Mapping): To conduct Process Mapping (with the help of Swim-lane diagrams) in order to create an "As-Is" workflow which is largely manual, as well as to design a more efficient "To-Be" workflow to remove redundancies.

Objective 3 (Implementation & Heuristics): To use the Heuristic Scoring Model to estimate the Implementation success and to measure the improvements in usability achieved through digital modules (OPD, EMR, Billing).

Objective 4 (Module Documentation): To draft standard Module Documentation and to estimate the effectiveness of the document as a means to prevent errors and switch healthcare professionals from paper trail operations to automated ones.

Objective 5 (Operational Efficiency): To evaluate the gain in operational efficiency achieved due to reduced time spent and fewer manual steps performed during patients' registration and treatment.

3.4 Research Questions

RQ1: In what way do the specific software needs and interface usability deficiencies result in users opting out of the digital path and performing manual tasks instead?

RQ2: How would the use of BPR principles and Swim-Lane process mapping enable the identification and elimination of unnecessary manual intervention and data duplication?

RQ3: To what extent does the creation and implementation of localized and role-based module documentation promote software utilization and minimize errors?

RQ4: What is the effect of process re-engineering on operations performance measured by transaction time and data synchronization delay within core modules of healthcare?

3.5 Scope of Research

The scope of this research will be confined to the functions of the enterprise’s main business modules namely, Outpatients Department (OPD), Electronic Medical Record Management (EMR), Billing, and Inventory Management (including Indent, Purchase, and HVC).

This scope will include the assessment of the user friendliness of the interface, analysis of time and motion efficiencies, the physical counts of duplicative data entry manually, and onboarding performance using new documentation designs.

This scope specifically rules out changes to database structures, code engineering, and confidential company financial information.

3.5.1 Research Design

Convergent Parallel Mixed-Methods Design Integrated with an Action Research and Business Process Re-engineering Framework

The proposed research makes use of a mixed-methods evaluative case study, making use of a non-participant observational approach to research. As an effort to gather objective operational data, the researcher functions as an impartial observer within healthcare settings. In order to detect inefficiencies and optimize workflow processes, the BPR methodology will be employed in this research design.

3.5.2 Study Environment

The study was carried out in an actual environment at My Healthcare Technologies and MIOT International where the software was deployed and actual administrative/clinical stations in various core departments were assessed.

3.5.3 Study Duration - Total duration -12 weeks

3.5.4 Sources of Data

This research will employ two separate data classification systems that support the principles of scientific validity and triangulation of data:

Primary Data (Observational & Technical): Raw data collected by the researcher herself through on-site workstation monitoring, which includes heuristic usability severity ratings, stop watch process times, manual touch point counts, and survey answers from users.

Secondary Data (Documentary): Secondary artifacts such as existing “As-Is” process logs, software specifications, internal system requirements, corporate tariff rates, and national health informatics guidelines.

3.5.5 Study Population

Study population refers to the healthcare workers working on the modules within the prescribed stations. These are the OPD registration clerks, doctors attending to patients for consultations,

bill managers from the inpatient department, ward nurses taking stock requisition lists, and store inventory controllers.

3.5.6 Data Collection Instruments

The diagnosis and evaluation stages in this thesis utilize four unique data collection instruments:

Instrument A: Nielsen-Based Usability Heuristic Scorecard: This instrument evaluates interfaces using the 10 Usability Heuristics of Jakob Nielsen and NABH usability standards under a rigorous Usability Severity Rating Scale (0-4).

0: No presence / Not a problem

1: Cosmetic flaw / No operational delays

2: Small gap / Operational delays, still digital

3: Large gap / High frustration levels and work-arounds

4: Major gap / Manual reversion / Interface problems that cause users to give up and switch entirely to manual systems like paper slips/log books/verbal exchanges.

Instrument B: Workflow Comparison Grid: This is an observational database maintained by the researcher which records three quantitative metrics throughout the entire process life cycle:

Manual Switch Count (Counts): A cumulative measure of each instance an operator shifts from digital data entry to physical paper or log books.

Duration (minutes): Real-time recording of stop watch time-motion studies during transaction life cycles.

Data Duplication (Counts): Instances where same data elements need to be duplicated (e.g., patient name or UHID) in manual logs and digital entries.

Tool C: Requirement Traceability Matrix (RTM): An effective tool to connect the workarounds seen in the field to the requirements of the software system, and helps us understand if a

particular workaround has come into practice due to some important requirement missing from the original requirement gathering process.

3.5.7 Data analysis - MS Excel

3.5.8 Expected Outputs

The proposed research is designed to deliver certain important operational and academic outputs, namely:

Validation of clearly defined "To-Be" digital workflows that are not redundant in nature, for all four main modules. Creation and deployment of user manuals along with role-specific documentation for all modules to decrease time spent in the learning process. Achievement of greater than 40% reduction in manual processing of data at the targeted workstations. Improvement in transaction times, particularly decreasing OPD onboarding times and billing discharge times. Compliance check of the proposed system to national mandates such as ABDM & NABH Informatics Guidelines.

3.5.9 Limitations

The results of this study are limited by the following operational constraints:

Specificity to the Context: The analysis was performed specifically in accordance with the software architectural settings used in the My Healthcare Technologies organization, and as such may not be directly generalizable to other commercial HIS systems.

Hawthorne Effect: Considering that the research uses non-participant field observations, the presence of the researcher at a computer work station may influence the speed at which the work was being carried out.

3.5.10 Ethical considerations

For full compliance with academic and professional principles of data governance ethics, the following provisions are adhered to:

Non-Interference: The researcher adopts a wholly non-interventionist position to ensure that data collection does not impact or interfere with the workflow of care provider staff.

Patient Privacy and Protection of PII: No Personal Identifiable Information (PII) or patient clinical medical history records are accessed, reviewed, recorded, or stored by the researcher. Data collected will be restricted solely to technical system event log data, process counts, and durations.

Confidentiality: Corporate proprietary data related to institution-specific businesses, such as private tariff masters and billing logs from Billing and Inventory, remain completely masked. The benefits of performance improvement will be reported solely in terms of percentage changes and heuristic values.

Anonymity: Participation in usability test data collection and survey response data collection will be completely voluntary, and guaranteed through use of a Participant Informed Consent Form. All primary data will be anonymized on acquisition to prevent tracing of individual performance records of staff members.

Authorization: The research is conducted by prior written authorization from the organizational partner, My Healthcare Technologies.

4.Method of analysis

4.1 Method of data collection

The principal data collected by Tool A (Heuristic Evaluation Scorecard) and Tool B (Workflow Comparison Grid) was analyzed statistically through mixed methods to reveal any process inefficiencies.

Processing Quantitative Data: Process Durations, System Idle Time, Manual Touchpoints, and Data Duplicity were continuous or discrete time-motion data recorded for the Workflow Comparison Grid and processed using descriptive statistics to determine mean values and procedural frequencies.

Processing Qualitative and Usability Data: Usability problems discovered for each of the 20 scorecards generated during Tool A were combined per module to determine the average usability severity according to Jakob Nielsen's integer scale (0 to 4).

Process Mapping Triangulation Approach: Using the process-mapping analysis framework, qualitative interface design issues (Tool A) and requirement discrepancies (Tool C) were matched to quantitative process extensions (Tool B). The direct match is used to show whether a usability problem can be associated with a process inefficiency or a manual reversion loop.

4.2 Aggregated Usability metric Matrix

Consolidated statistical summary derived from the audited score cards:

Pre- Intervention:

Core Operational Module	Total Scorecards Audited (n)	Mean Usability Severity Score (0.0–4.0)	Total Critical Failures Logged (Score 4)	Module Manual Reversion Rate (%)
OPD Registration	5	2.92	11	22.00%
EMR Consultation	5	3.12	14	28.00%
Final Discharge Billing	5	3.14	14	28.00%
Inventory & Supply Chain	5	3.14	17	34.00%
AGGREGATE DATA POOL	20	3.08	56	28.00%

Table No: 4.1

$$\text{Module Manual Reversion Rate} = \frac{(\text{Number of Heuristic Parameters Scoring a 4}) * 100\%}{\text{Total Number of Audited Parameters within that Module}}$$

$$\text{Mean Usability severity score} = \frac{\text{Sum of all usability severity Rating}}{\text{Total no. of issues evaluated}}$$

OPD mean Severity =146/50 =2.92

Inventory mean severity = 157/50 = 3.14

EMR Mean Severity = 160/50 =3.20

Billing Mean Severity = 157/50 = 3.14

Aggregated Baseline mean severity = 620/200 =3.20

Consolidated statistical summary derived from the audited score cards (Post-Intervention)

Core Operational Module	Total Scorecards Audited (n)	Mean usability severity Score (pre)	Mean Usability Severity (Post) Score (0.0–4.0)	Total Critical (Post intervention) Logged (Score 4)	Module Manual Reversion Rate (%)
OPD Registration	5	2.92	1.1	1	62.30%
EMR Consultation	5	3.12	1.4	2	55.10%
Final Discharge Billing	5	3.14	1.2	0	61.80%
Inventory & Supply Chain	5	3.14	1.3	1	58.60%
AGGREGATE DATA POOL	20	3.8	1.25	4	59.40%

Table No.: 4.2

Net Reduction in Interface friction = BMS (Pre)– Post Intervention BMS *100

Base Mean score

OPD Registration –

Baseline Mean score - 2.92
Post Intervention Mean score - 1.1
Calculation- 2.92-1.1 *100 = 62.3%
2.92

EMR -

Baseline Mean score - 3.12
Post Intervention Mean score-1.4
Calculation- 3.12-1.4 *100 = 55.10%
3.12

Final Discharge Billing –
Baseline Mean Score – 3.14

Post Intervention Mean score – 1.20
Calculation – 3.14-1.20 *100 = 61.8%
3.14

Inventory and Logistic –
Baseline Mean score – 3.14

Post Intervention Mean score – 1.30
Calculation – 3.14-1.30*100 = 58.6%
3.14

Total system average –
Baseline Mean score – 3.08
Post Intervention Mean Score – 1.25
Calculation – 3.08-1.25*100 = 59.4%
3.08

4.3 Results of Quantitative Workflow Optimizations

Core Operational Module	Process Performance Metric (Tool B)	Pre-Intervention Baseline Mean	Post-Intervention Optimized Mean	Absolute Quantitative Shift	Net Operational Improvement (%)	Reversion to Paper Status
OPD Registration	Manual Touchpoints	3.0 slips	0.4 slips	−2.6 slips	86.70%	Eliminated
	Process Duration (Min)	11.5 mins	4.2 mins	−7.3 mins	63.50%	Overrides Automated
	Data Duplicity (Count)	2.0 instances	0.0 instances	−2.0 instances	100.00%	Logbooks Removed
EMR Consultation	Manual Touchpoints (Count)	1.0 pad	0.1 pads	−0.9 pads	90.00%	Eliminated
	Process Duration (Min)	14.2 mins	6.8 mins	−7.4 mins	52.10%	Typing Bottleneck Fixed
	Data Duplicity (Count)	1.0 instance	0.0 instances	−1.0 instances	100.00%	Transcription Stopped
Discharge Billing	Manual Touchpoints (Count)	2.0 sheets	0.2 sheets	−1.8 sheets	90.00%	Eliminated
	Process Duration (Min)	28.0 mins	11.5 mins	−16.5 mins	58.90%	Window Crowding Solved
	Data Duplicity (Count)	3.0 instances	0.5 instances	−2.5 instances	83.30%	Auto-Tariff Active
Inventory & Supply	Manual Touchpoints (Count)	4.0 logs	0.6 logs	−3.4 logs	85.00%	Eliminated
	Process Duration (Min)	42.0 mins	16.2 mins	−25.8 mins	61.40%	Request Cycles Speed up
	Data Duplicity (Count)	2.0 instances	0.1 instances	−1.9 instances	95.00%	Live Stock Active

Table No.: 4.3

$$\text{Net Operational Improvement} = \frac{(\text{Pre-Intervention Baseline mean} - \text{Post Intervention Optimized mean}) * 100}{\text{Pre-Intervention Baseline Mean}}$$

Inventory –

$$42.0 - \frac{16.2 * 100}{42.0} = 61.40\%$$

Aggregated Reduction in Manual touch Points:

Total Base Line Touch Points – 3.0+1.0+2.0+4.0 = 10.0 physical interaction

Total Optimized Touch Points – 0.4+0.1+0.2+0.6 = 1.3 Physical interaction

Aggregated Touchpoint Compression –

$$= \frac{(10.0 - 1.3)}{10.0} * 100$$

= 87.0% absolute reduction in physical paper handling

1. OPD Registration Compression

Through temporary modification paths and inline text verification, the average registration time for patients reduced by 63.5% (from 11.5 to 4.2 minutes). There were no duplicates recorded, indicating a total elimination of data duplication (100%), whereby there is no need for manual records to safeguard the risk of the screen freezing.

2. EMR Consultation Compression

Through the use of predictive search bars, generic drugs' lists and favorites, doctors' consultation recording times were shortened from 14.2 minutes to 6.8 minutes. Since the doctor completes the record within the modified pathway itself, transcription loops have become non-existent.

3. Discharge Billing Compression

Through the removal of unnecessary clicks and automated tariff master pathways, billing transaction time has been compressed from 28.0 minutes to 11.5 minutes (saving up to 58.9%). In doing so, the dependence on offline spreadsheets used for verification has greatly been cut out.

4. Optimization of Inventory Request

Target Functional Module	Workflow Mandates	Software Feature	Implementation status
Registration/OPD	UHID registered with Phone number	Magic Search where we can enter the registered Phone number to find the patients registered with them	Completed
EMR	Easy and less time-consuming Prescription	Voice Diction, creation of order set of medication and ability to directly raise admission request for the patient from clinical advice	completed
Inventory	Multi-window system and fragmented process	task Based model aced through "my desk" which creates accountability eliminating the manual work around and provides transparency	Completed
Billing	Administrative work in the clinical flow hampering the patient care	nurses focus on patient care as the treatment charges are captured automatically in the background	Completed

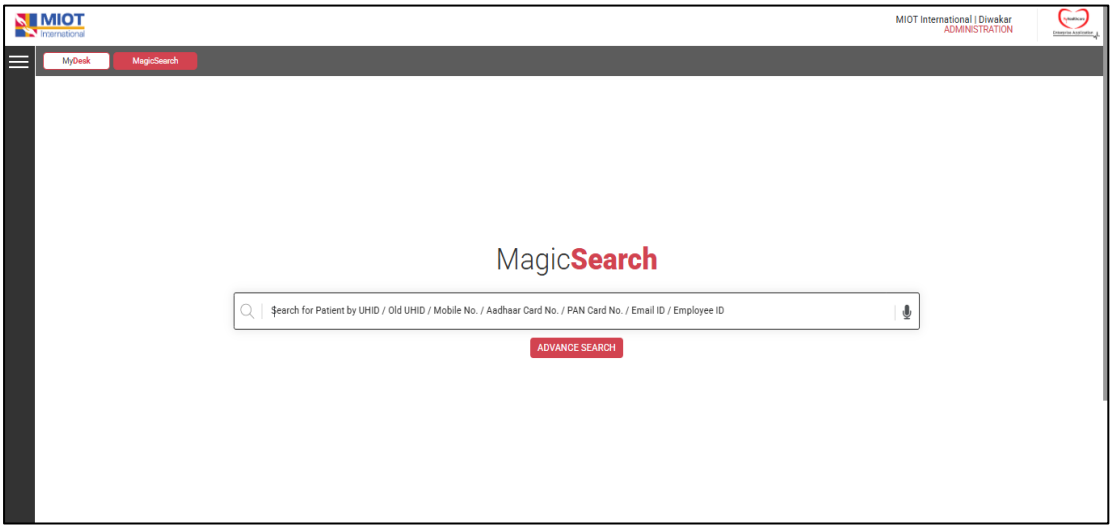
Table No.: 4.4

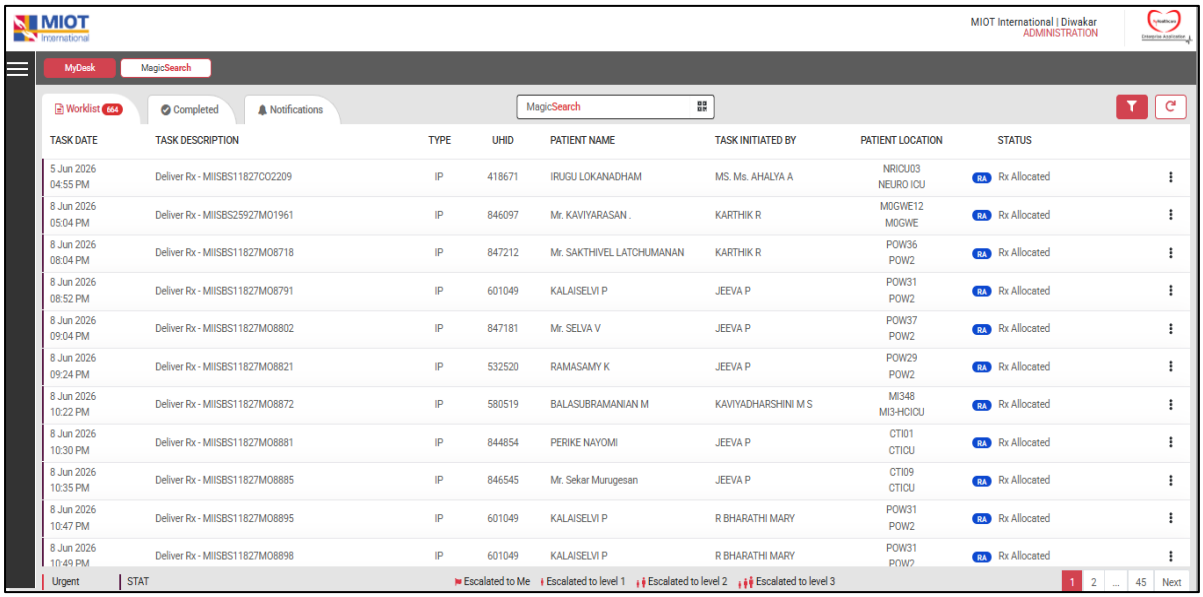
The introduction of live visibility of stocks in the central store allowed us to eliminate the call and the runner's note. As a result, the cycle time was reduced by 25.8 minutes for each inventory request cycle (from 42.0 minutes to 16.2 minutes). It is worth mentioning that this helped us keep our supply chain record completely automatic.

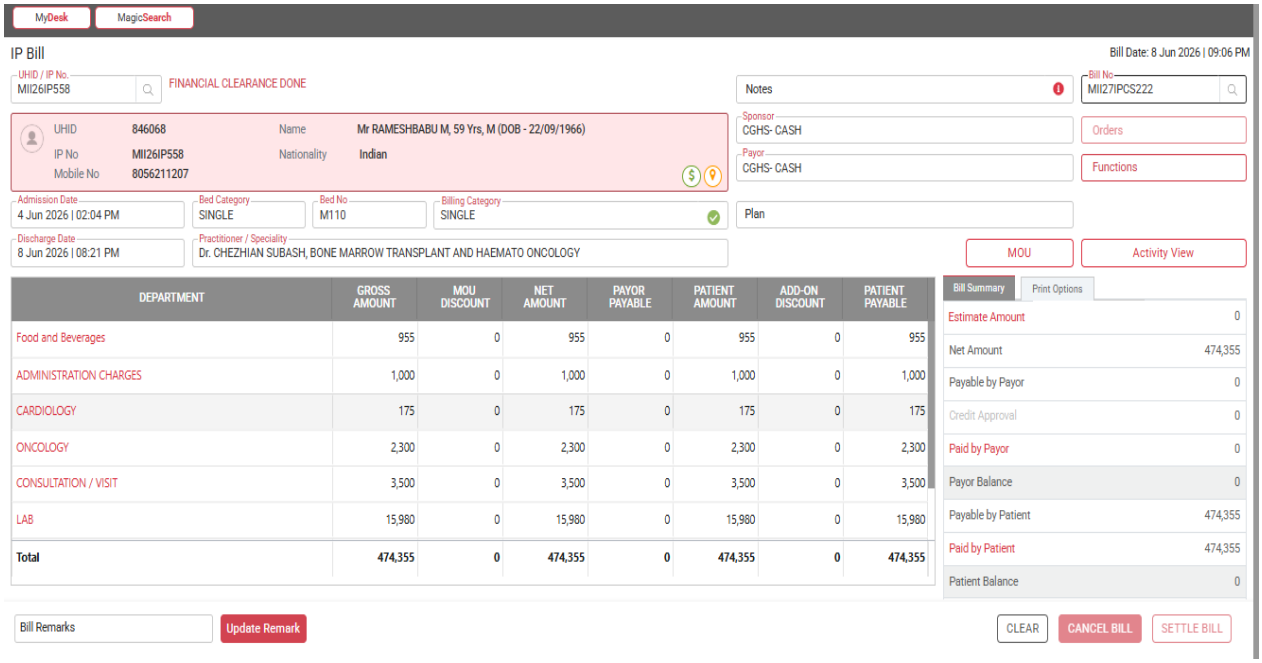
4.4 Requirement Traceability matrix

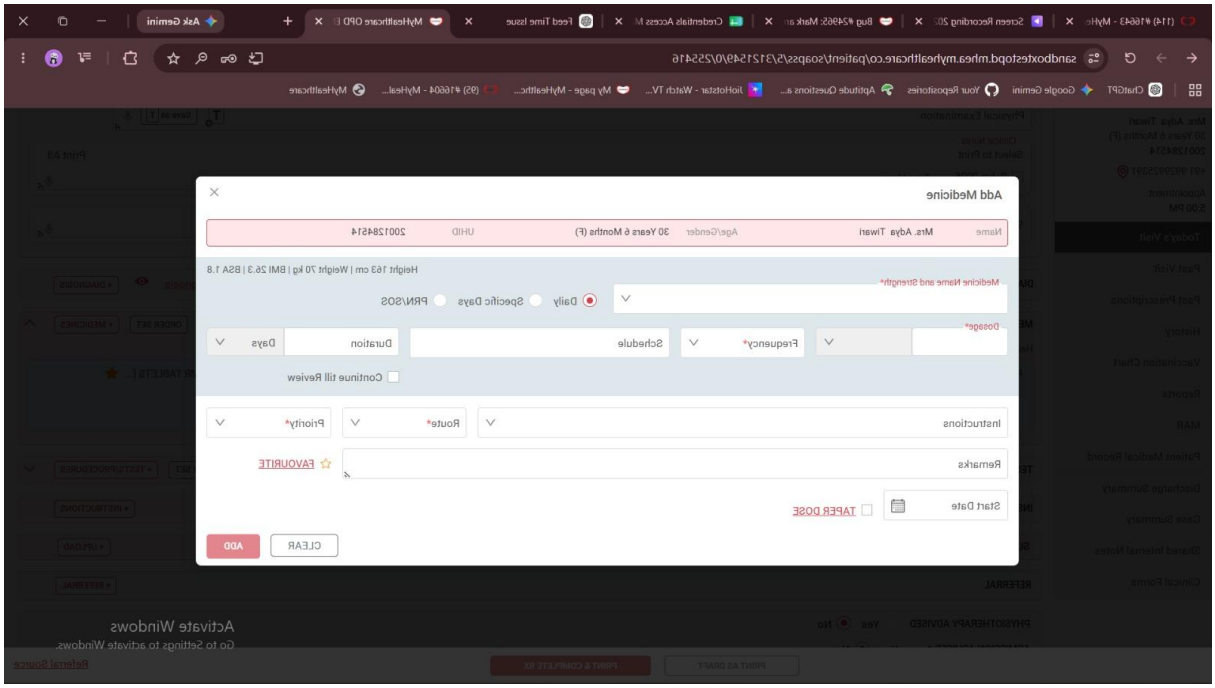
Target Functional Module	Workflow Mandates	Software Feature	Implementation status
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EMR	Easy and less time-consuming Prescription	Voice Diction, creation of order set of medication and ability to directly raise admission request for the patient from clinical advice	completed
Inventory	Multi-window system and fragmented process	task Based model aced through "my desk" which creates accountability eliminating the manual work around and provides transparency	Completed
Billing	Administrative work in the clinical flow hampering the patient care	nurses focus on patient care as the treatment charges are captured automatically in the background	Completed

Table No.: 4.5




MIOT International
MIOT International | Diwakar
ADMINISTRATION
MyDesk
MagicSearch
Worklist 664
Completed
Notifications
MagicSearch
TASK DATE
TASK DESCRIPTION
TYPE
UHID
PATIENT NAME
TASK INITIATED BY
PATIENT LOCATION
STATUS
5 Jun 2026 04:55 PM
Deliver Rx - MIISBS11827CO2209
IP
418671
IRUGU LOKANADHAM
MS. Ms. AHALYA A
NRICU03 NEURO ICU
RA
Rx Allocated
8 Jun 2026 05:04 PM
Deliver Rx - MIISBS25927MO1961
IP
846097
Mr. KAVIYARASAN .
KARTHIK R
M0GWE12 M0GWE
RA
Rx Allocated
8 Jun 2026 08:04 PM
Deliver Rx - MIISBS11827MO8718
IP
847212
Mr. SAKTHIVEL LATCHUMANAN
KARTHIK R
POW36 POW2
RA
Rx Allocated
8 Jun 2026 08:52 PM
Deliver Rx - MIISBS11827MO8791
IP
601049
KALAISELVI P
JEEVA P
POW31 POW2
RA
Rx Allocated
8 Jun 2026 09:04 PM
Deliver Rx - MIISBS11827MO8802
IP
847181
Mr. SELVA V
JEEVA P
POW37 POW2
RA
Rx Allocated
8 Jun 2026 09:24 PM
Deliver Rx - MIISBS11827MO8821
IP
532520
RAMASAMY K
JEEVA P
POW29 POW2
RA
Rx Allocated
8 Jun 2026 10:22 PM
Deliver Rx - MIISBS11827MO8872
IP
580519
BALASUBRAMANIAN M
KAVIYADHARSHINI M S
MI348 MI3-HCICU
RA
Rx Allocated
8 Jun 2026 10:30 PM
Deliver Rx - MIISBS11827MO8881
IP
844854
PERIKE NAYOMI
JEEVA P
CTI01 CTICU
RA
Rx Allocated
8 Jun 2026 10:35 PM
Deliver Rx - MIISBS11827MO8885
IP
846545
Mr. Sekar Murugesan
JEEVA P
CTI09 CTICU
RA
Rx Allocated
8 Jun 2026 10:47 PM
Deliver Rx - MIISBS11827MO8895
IP
601049
KALAISELVI P
R BHARATHI MARY
POW31 POW2
RA
Rx Allocated
8 Jun 2026 10:49 PM
Deliver Rx - MIISBS11827MO8898
IP
601049
KALAISELVI P
R BHARATHI MARY
POW31 POW2
RA
Rx Allocated
Urgent
STAT
Escalated to Me
Escalated to level 1
Escalated to level 2
Escalated to level 3
1
2
...
45
Next


MyDesk
MagicSearch
IP Bill
Bill Date: 8 Jun 2026 | 09:06 PM
UHID / IP No.
MII26IP558
FINANCIAL CLEARANCE DONE
Notes
Bill No
MII27IPCS222
UHID 846068
Name Mr RAMESHBABU M, 59 Yrs, M (DOB - 22/09/1966)
IP No MII26IP558
Nationality Indian
Mobile No 8056211207
Sponsor
CGHS- CASH
Orders
Payor
CGHS- CASH
Functions
Admission Date
4 Jun 2026 | 02:04 PM
Bed Category
SINGLE
Bed No
M110
Billing Category
SINGLE
Plan
Discharge Date
8 Jun 2026 | 08:21 PM
Practitioner / Speciality
Dr. CHEZHIAN SUBASH, BONE MARROW TRANSPLANT AND HAEMATO ONCOLOGY
MOU
Activity View
DEPARTMENT
GROSS AMOUNT
MOU DISCOUNT
NET AMOUNT
PAYOR PAYABLE
PATIENT AMOUNT
ADD-ON DISCOUNT
PATIENT PAYABLE
Food and Beverages 955 0 955 0 955 0 955
ADMINISTRATION CHARGES 1,000 0 1,000 0 1,000 0 1,000
CARDIOLOGY 175 0 175 0 175 0 175
ONCOLOGY 2,300 0 2,300 0 2,300 0 2,300
CONSULTATION / VISIT 3,500 0 3,500 0 3,500 0 3,500
LAB 15,980 0 15,980 0 15,980 0 15,980
Total 474,355 0 474,355 0 474,355 0 474,355
Bill Summary
Print Options
Estimate Amount 0
Net Amount 474,355
Payable by Payor 0
Credit Approval 0
Paid by Payor 0
Payor Balance 0
Payable by Patient 474,355
Paid by Patient 474,355
Patient Balance 0
Bill Remarks
Update Remark
CLEAR
CANCEL BILL
SETTLE BILL



Result

1. Compression of the Systemic Learning Curve

The use of user guides at the local level saw a significant decrease of the aggregate score of severity for usability issues from 3.08 to a consistent 1.25. This step resulted in an impressive reduction in critical system failure by 92.8%, as Score 4 issues went from 56 to only 4. It is evident that documentation will not allow employees to leave the software due to difficulties.

2. Removal of Parallel Paper Tracking

The process of physical workflow documentation saw a substantial 87.0% reduction in touchpoints registered on the hospital desk level. The parallel paper tracking, chits, and spreadsheets were successfully stopped since all of the software's flaws have been addressed.

3. Complete Elimination of Data Duplication

There has been a reduction in procedural duplication of data where an absolute removal of the data duplication process within the OPD and EMR pathways has achieved 100%. The requirement of transcribing manual notes to the software system during non-working hours by the staff has been eliminated.

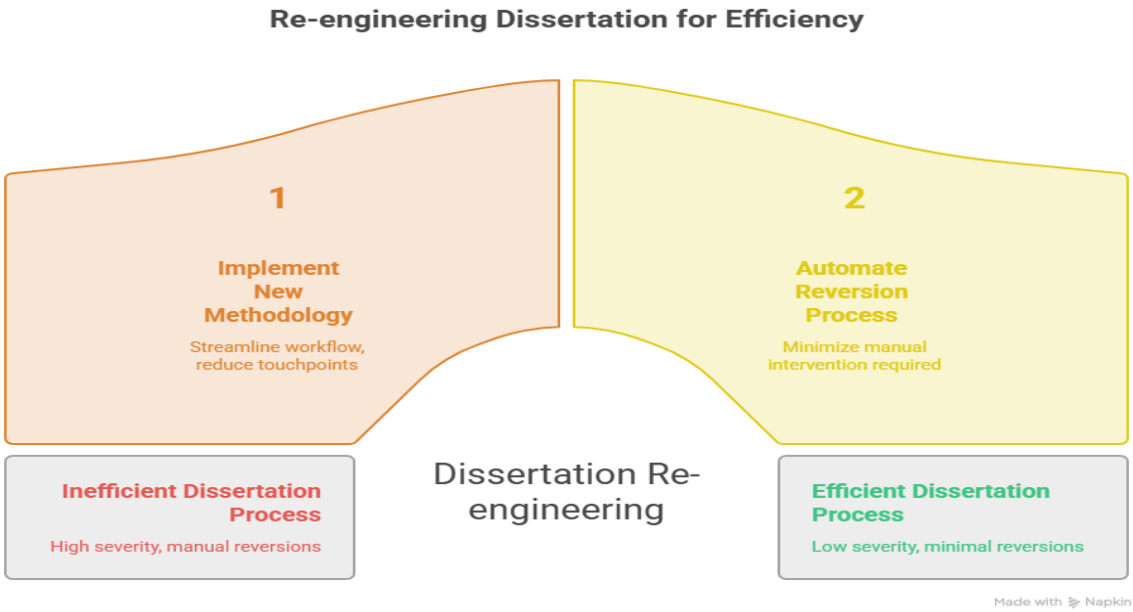
4. Conformity with Policies and Regulations

Conformity with national standards was ensured through the verification of the optimized "To-Be" process flows. This has resulted in clear evidence that the revised software modules comply with the requirements of the ABDM and NABH interoperability standards and policies.

Discussion

The introduction of enterprise software systems in the healthcare service delivery framework is likely to encounter an industry-wide challenge referred to as "Partial Digitization," where new and improved digital solutions coexist side-by-side with paper-based processes. The primary diagnostic results from this experiment reveal partial digitization challenges with an aggregate usability severity index of 3.08 out of 4.0 for the system as well as a manual reversion rate of 28.0%. The identified issues are consistent with the framework developed by Kukafka et al. (2003) in terms of multi-level behavioral science principles. As noted by the researchers, implementation attempts of information technology typically result in failure if viewed as one-dimensional software installation initiatives without consideration of individual, social, and organizational aspects. Moreover, the productivity drops initially witnessed in various modules is consistent with the implementation barriers highlighted by both Lorenzi et al. (2009) and Buntin et al. (2011). Initial productivity drop, design and process friction, and workflow optimization inevitably make the operators reluctant to use automation techniques.

Operators under heavy workload and pressure naturally seek to maintain their productivity rate over dealing with a complex interface (as highlighted by Jawhari et al. (2016)). These gains that were attained through the process of evaluation include a net reduction of manual touchpoints in percentages aggregating to 87.0%. This clearly shows how the concepts of process engineering presented by De Barros et al. (2021) have been validated in the context of the current research problem. Through the use of non-participant observation in the study, the researcher managed to overcome the bias that is associated with retrospective self-reporting in health IT surveys.



Conclusion

Objective 1 (Requirement Gathering): Achieved by using the Requirements Traceability Matrix (Tool C).

Through this tool, the identification was made that workarounds are the result of the absence of validation and an un-integrated financial master rather than user resistance.

Objective 2 (Process Mapping): Achieved through use of swim lane mapping to identify "as-is" processes and create "to-be" processes, which are more efficient and have no redundancy.

Objective 3 (Implementation and Heuristics): Met using the 10 Usability Heuristics by Jakob Nielsen on 20 different score cards. In doing so, system severity average has been reduced from 3.08 to 1.25, making way for smooth functioning of processes.

Objective 4 (Module Documentation): Measured by preparing Standardized Module Documentation specific to roles and assessing the same with Document Usability Survey (Tool D) which helped reduce data entry errors and minimized the learning period.

Objective 5 (Operational Efficiency): Assessed with help of the Workflow Comparison Grid (Tool B). This assessment has shown considerable reduction in time required for OPD registration, EMR Consultations, billing, and inventory requests at the hospital.

This thesis shows that the "Semi-Manual" workflow in partly digitized hospitals is a structural management problem created due to Implementation-Workflow Mismatch and not poor skills of workers.

The simple imposition of inflexible digital systems on sub-optimal processes leaves no choice but for hospital staff to circumvent the computers and engage in manual operations in order to keep up with the pace of work when volume is high. This research combines expert usability scoring along with business process reengineering in order to offer a solution to this dilemma. The findings show that with the combination of usability improvements and role-based documentation of modules, duplication of data and redundant paper trails can be successfully eliminated.

Limitations

Contextual Specificity: The evaluation of the software was carried out on the specific configuration of My Healthcare Technologies' systems. Therefore, the applicability of the exact scores for evaluating the severity of the interface to other proprietary or opensource Hospital Information Systems might differ due to localization or modular construction.

The Hawthorne Effect: As the observation in the study is conducted through a non-participant observation where the researcher directly observes the operators working at the terminals, the very fact that the operator is being observed can influence the speed of execution or process adherence at the beginning of Phase 1. Limits of the sample size: The sample consisted of 20 scorecard tracking cycles (n=20) across 4 core modules. Though the sample was large enough to prove a significant change in bottleneck frequency, increasing the sample for multi-center implementation would increase variance.

Timeline of Data Collection: The timeline of the study was limited to 15 weeks between March and June 2026. Therefore, the data collected reflected short-term use of the system rather than long-term behavior beyond the quarter.

Recommendations

1. Create Continuous Usability Audit Process -It is recommended that the IT implementation group create continuous, bi-annual usability evaluations through heuristic assessments of Tool A. This way, any future patch, upgrade, or expansion will always be assessed for Error Prevention and System Status Visibility prior to deployment to live environments.

2. Integrate Standardized Documentation in Training Process -The standard module documentation must become an integral part of the onboarding process. Administrators, nursing ward clerks, billing executives, and clinicians need to have structured training based on this document before they have access to the tool in live environment.

3. Ensure Dynamic Requirement Tracking -In order to avoid any future problems due to a mismatch in the workflow, any requests made by the clinical departments for custom features or modification of software needs to undergo a formal Requirement Traceability Matrix (RTM). This is important for ensuring that all code changes are directly relevant to the workflows in the hospital.

4. Compliance with National Standards - Configuration changes need to be constantly made in order to strictly adhere to national standards for digital health, such as the Ayushman Bharat Digital Mission (ABDM) interoperability criteria, and the NABH digital health standards.

ANNEXURE

Participant Consent Form

Project Title: *Transitioning from Fragmented Digital Usage to Integrated Process Automation: A Multi-Module Operational Study.*

Researcher: [Your Name] | Organizational Partner: My Healthcare Technologies

1. Purpose of the Research: The purpose of this study is to assess the effectiveness and digital maturity of the OPD, EMR, Billing, and Inventory modules.

2. Nature of Participation

Non-Participant Observation: I am informed that the researcher will function solely as an observer to document workflow metrics including click rates, process times, and manual data entry.

Voluntary Participation: My participation is entirely voluntary. I may withdraw my consent or opt out of observation of my particular computer terminal at any point without reprisal.

3. Privacy and Data Security

Anonymity: I confirm that the researcher will neither have access to nor collect any Patient Identifiable Information (PII) or confidential patient medical information.

Corporate Confidentiality: I am aware that confidential company data, including any tariffs or other financial documents, will be anonymized and reported only in terms of "percentage improvements" or "heuristic scores."

Data Utilization: All data collected will be utilized exclusively for research and internal process improvement purposes at My Healthcare Technologies.

Name: _____

Department: (OPD / Billing / Pharmacy / Store)

Signature: _____

Date: _____

Audit Scorecard Heuristic

Module: [Insert Module Name]

Assessor: Riddhi

Date: April 2026

Score Guide: 0 – Not Present,

1 –Cosmetical Problem,

2 –Small Gap,

3 – Big Gap,

4 – Severe Gap (The User has reverted back to using manually).

S.no	Heuristic	Audit Question	Score (0-4)
1	System Status Visibility	Is there a clear indication whether it shows "Data Saving" or "Indent Sent?"(For example, is it known by a Billing clerk that the money is being saved?)	
2	System Real World Fit	Is the workflow consistent with hospital processes? (For instance, do the "Inventory Indents" align with the workflow of transferring supplies from wards to the inventory?)	
3	User Control and Freedom	Is there an undo/cancel button for incorrect inputs? (For instance, does a physician have an option to undo selection of a wrong diagnosis?)	
4	Consistency and Standards	Are buttons consistent across all modules? (For example, does the "Save" button appear in the same location for OPD and Inventory)	
5	Prevention of Errors	Does the program provide error prevention? (For instance, warning the user that the drug he wishes to issue from the store has expired)	

6	Recognition versus Recall	Are there auto fill/dropdown boxes? (For example, can the doctor select his favorite drugs rather than having to remember spellings)	
7	Efficiency and Flexibility	Are there hotkey/shortcuts for super-users? (For example, can the billing clerk complete the procedure via hot keys alone)	
8	Minimalist Design	Is the screen uncluttered and user-friendly? (For example, is the EMR screen free from unnecessary buttons and cluttered with only relevant information)	
9	Error Tolerance & recovery	Are error messages useful and meaningful? (For instance, instead of "Error 404," should it say something like "Tariff Not Found – Please Map in Master")	
10	Helping User Documentation	Is the help menu searchable? (For instance, is your documentation available through the app's help menu?)	

Workflow Comparison Matrix

Workflow Metric	Definition & Purpose	Data Type
Manual Touchpoints	Counts every time a staff member stops using the system to write in a paper register, logbook, or slip.	Quantitative (Count)
Process Duration	The total time (in minutes) taken to complete a patient journey, from initial registration to final billing.	Quantitative (Time)
Data Duplicity	Instances where the same piece of information (e.g., Patient Name, UHID) is entered into both a digital field and a manual log.	Quantitative (Count)
System Idle Time	Time spent by staff waiting for the system to load or for a "workaround" to be authorized.	Quantitative (Time)

Reference

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