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# Evolution of the Retail Industry Post Covid-19 Pandemic with special reference to Kanyakumari District

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**ABSTRACT**
India, as one of the most appealing emerging markets, is undergoing a significant transformation in its retail sector. The retail industry in India is rapidly expanding due to the improvement in the quality of life for people in rural areas. In Kanyakumari District, the retail industry is undergoing a major overhaul as old markets give way to new formats. However, customer preferences and purchasing habits have shifted significantly during and after the pandemic, leading to significant changes in the retail sector. This study is focused on recognizing the factors that have caused the resurgence of this transformation.
***Keywords*****:** *Retailing, Customer preference, Buying Behavior*

## 1. INTRODUCTION

Retail is one of the growing sectors of the Indian economy, the fourth largest Retail market will have 974 million internet users by 2025 and become third largest online market by 2030 says a report by IAMAI and Kantar Research - 2023. As we dive headlong into 2024, a new trend has been created throughout Kanyakumari district, that is construction of more commercial buildings like never before and new small medium and large retailers have ushered in Retailing, in contrast, the existing retailers have found it hard to survive, search for means to reach consumers, failed terribly and were forced to shut down their businesses.

The retail sector in India is witnessing a huge revamping exercise as traditional markets make way for next formats such as departmental stores, hypermarkets, supermarkets, specialty stores, Malls and E - tailing. Retail is among the fastest growing sectors in the Indian Economy. It is one of the largest sectors among all the industries accounting for 10% of GDP of the country and employs around 8% of the total workforce- Pallavi and Bhavna, 2018. The Indian retail sector is showing fast growth with the change in the standard of living of rural population.

The retail sector is the front end of several business segments, directly and indirectly having an important impact on employment, incomes, socio-economic stability and consumption power.

Like every other sector, retail saw massive operational transformations in 2021 to recover from the shocks of a global pandemic. Businesses had to rewire their modus operandi to stay afloat amidst an existential crisis. Retailers' ability to connect with their customers is more critical than ever as consumer

habits evolve. Despite large-scale changes, the industry is yet to recover completely and is still looking for ways and means to drive sales.

Agility and adaptability became the mantra in 2021 to optimize in-store operations and remodel them for future market trends. Customers today are much more knowledgeable and expect personalized services delivered right at their doorstep. Having experienced the convenience of online shopping, customers want the same experience across offline channels as well. This has created an opportunity for many in Kanyakumari district to start small, medium and large size retailing outlets of different category.

## 2. RESEARCH METHODOLOGY

The period of study is very important as it gives firmness to the research; the primary data was collected during **Nov 2023- Feb 2024.** A total of 600 (200 customers selected from each of the three retailing outlets)

In our case the population is infinite, therefore for the ascertainment of N i.e. sample size, the Researcher has used the following formula:

$$N = \frac{(z)^2 * \sigma * (1-\sigma)}{\sigma^2}$$

Where N= Size of the sample

z = the value of the standard variation at a given confidence level and it is 1.96 for a 95% confidence level.

σ = Standard deviation of the population is **0.5**, and e = acceptable error i.e. 0.05.

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Therefore, by applying the above formula we get N= (1.96)2 *.5*(1-.5)/.052

$$N = \frac{(1.96)^2 * .5 * (1-.5)}{.05^2}$$

$$N = \frac{3.8416 * 0.25}{0.0025}$$

Thus, the most conservative sample size needed for the problem is =385, which means the N in our study, which is 620 is apt for the research.

H01: The convenience of the store location does not have a significant impact on the selection process, stores or shops at which goods are sold

H02: Prices of the products do not have a significant impact on customers purchasing habits

H03: The variety of products does not significantly influence customer purchasing behavior, actions or conduct.

**Reliability Test**

**Case Processing Summary**

| | N | % |
|---|---|---|
| Case valid | 600 | 100.0 |
| Excluded | 0 | .0 |
| Total | 600 | 100.0 |

**Reliability Statistics**

| Cronbach's Alpha | N of Items |
|---|---|
| .843 | 6 |

The Cronbach's Alpha Coefficient was used to assess the internal consistency of the dependability of every item examined for the research. The Cronbach's Alpha coefficient is 0.843, which is equivalent to 84.3% indicates that the items showed a fairly strong internal consistency, therefore they were considered dependable and trustworthy adequate for examination. This occurred because the items reached the minimum acceptable threshold of 0.6.thus, deemed suitable for examination.

**How Retail Outlets compare to others in 'convenience of store location'**

| | | Frequency | Percentage | Valid percentage | Cumulative percentage |
|---|---|---|---|---|---|
| Valid | Better | 298 | 49.7 | 49.7 | 49.7 |
| | Average | 280 | 46.7 | 46.7 | 96.3 |
| | Poor | 22 | 3.7 | 3.7 | 100 |
| Total | | 600 | 100 | 100 | |

**Figure 1.1** The study aim to determine how participants perceive their Retail Outlets in comparison to others in terms of the convenience of the store's location.

It is evident that 298 out of them, which is equal to 49.7%, hinted whilst 280 indicated 'average', 46.7% chose 'better'. Finally, 22 individuals responded 3.7% was given a 'poor' rating. It can be concluded that most of the survey participants revealed that they selected their Retail Outlets based on convenience of store's location.

**Assessing pricing to consumer Buying Behavior**

| | | Frequency | Percentage | Valid percentage | Cumulative percentage |
|---|---|---|---|---|---|
| Valid | Better | 215 | 35.8 | 35.8 | 35.8 |
| | Average | 362 | 60.4 | 60.4 | 96.2 |
| | Poor | 23 | 3.8 | 3.8 | 100 |
| Total | | 600 | 100 | 100 | |

**Figure 1.2** Aims to determine how participants evaluate the cost of goods from the stores where they make purchases, 215 out of the total represented 35.8% rating ‘good’, whereas 362 representing 60.4% rated ‘average’.

Finally, a 'poor' rating was given by 23 respondents, accounting for 3.8% of the total. However, it can be inferred that most of the participants indicated that pricing was not a significant factor when choosing retail outlets.

**How respondents rate variety of Products available to Consumer Buying Behavior**

| | | Frequency | Percentage | Valid percentage | Cumulative percentage |
|---|---|---|---|---|---|
| Valid | Better | 350 | 58.3 | 58.3 | 58.3 |
| | Average | 232 | 38.7 | 38.7 | 97.0 |
| | Poor | 18 | 3.0 | 3.0 | 100 |
| Total | | 600 | 100 | 100 | |

**Figure 1.3** Aims to determine how participants perceive the range of products offered at new stores for selling goods,350 out of a total, which represents 58.3%, rated as 'good', whereas 232, representing 38.7%, rated as 'average'.

In conclusion, 18 participants, equivalent to 3.0%, rated the experience as 'poor'. Nevertheless, the majority of participants indicated that they found the range of products offered at the new stores to be satisfactory.

## 3. CONCLUSION

By using the above statistical tools, the researcher carried out a detailed analysis of the data collected with an intention of obtaining a prolific solution to the objectives. It is concluded that the convenience of selection of retailing outlets by the customers was given more importance in this post pandemic time

rather than other elements. Also the researcher found that price and variety of products displayed by the new retail outlets have made new entrants to flourish in their new venture.

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# Deployment of an Internet Radio System within a University Campus in a Developing Country

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**ABSTRACT**
This paper explores the deployment of an internet radio system within a university campus in a developing country. It discusses the limitations of traditional terrestrial radio like geographical restrictions and proposes internet radio as an improved platform for wider accessibility and engagement. The study utilizes a mixed methods approach and Extreme Programming framework to implement the system at two Ghanaian universities. Requirements gathering, system design, development, testing and feedback cycles enabled successful deployment. The internet radio system overcame limitations of terrestrial radio to provide inclusive broadcasting capabilities, seamless student-staff communication, and enhanced participation in campus activities. The research thus demonstrates the value of embracing internet radio technology to transform broadcasting and engagement within an academic setting in the digital age.
**Keywords:** *Internet radio, Campus communication, Developing countries, Broadcasting*

## 1. INTRODUCTION

The communication industry has achieved successful engagement through various mediums, with broadcasting being a major source for wider outreach. Radio and television have been effective means of reaching diverse audiences for decades. Radio transmission, particularly in the form of Amplitude Modulation and Frequency Modulation (AM and FM) radio, has been a prominent method of communication, relying on terrestrial and satellite modes to transmit content via radio towers and receivers. However, these traditional modes have some limitations. Internet radio has emerged as a solution, allowing audio media content to be transmitted over the internet through radio servers. This enables live broadcasting or access to pre-recorded content (podcasts) through websites, web applications, or mobile apps. Internet radio has improved upon the drawbacks of traditional radio transmissions and provides a more flexible and accessible approach to audio content delivery (Ash brook, 2020).

Traditional FM and AM radio have several drawbacks that hinder their growth and effectiveness in the communication industry.

These limitations include limited access, lack of real-time audience interaction, difficulties in monetization, geographical restrictions, and compromised sound quality due to interference and environmental factors. These factors negatively impact the radio industry by potentially losing audiences who cannot tune in at their convenience and reducing engagement with listeners. The reliance on traditional advertising methods also limits revenue generation for radio stations. Additionally, geographical restrictions impede effective marketing and outreach to a broader audience (Ruoff, 2019). To address these issues, this study proposes deploying an Internet radio system as an innovative and improved platform for audio broadcasting. Internet radio overcomes many of these limitations and provides greater accessibility, interactivity, and revenue potential using online broadcasting and streaming. The study's focus is on implementing Internet radio to improve communication within a university campus. This deployment seeks to revolutionize how radio station's function and interact with their audience, creating a more inclusive, connected, and effective broadcasting environment. Embracing Internet radio technology is essential for radio stations to remain relevant, innovative, and influential in the digital age.

The study is segmented into five sections. The study's framework and an in-depth analysis of the body of literature are offered in section 2. The research methodology is covered in Section 3 along with the study strategy, sample design, data collection strategy, and analytical techniques. In Section 4, the application of the methodology in deploying the system was thoroughly examined. Section 5 concludes the study overall and offers some recommendations for future research as well as its limitations and implications.

## 2. LITERATURE REVIEW

The review of literature explores and synthesize existing literature. Aslan & Özlem (2019) conducted a thorough study on Internet Radio Broadcasting, covering its economy, growth factors, automation, revenue generation, and advantages over terrestrial radio. It emphasizes the industry's rapid growth, significance in media, and offers insights for researchers, practitioners, and stakeholders. Challenges like monetization, user engagement, and technology impact are addressed, making it a valuable resource. Zhang (2017) examines the integration of digital radio services into traditional broadcasting and the wider media industry.

The study explores the changing roles of broadcasters and listeners in the digitization process, including the adoption of Digital Audio Broadcasting (DAB) and the expansion of internet radio services, offering diverse content access and exploration opportunities for listeners. Segbenya et al. (2022) studied factors influencing campus radio choice and satisfaction in Ghana's Central Region. Content, language,

professionalism, and others' influence were key determinants. Further research could explore nationwide and local commercial/public radio influences, aligning audience and management views. Listeners mainly sought information/education and entertainment through radio receivers, indicating limited

internet radio usage. Campus radio satisfaction was rated "very good," but improvements are needed to achieve an "excellent" rating.

Cao et al. (2016) proposed a lightweight web application of the internet personalized radio based on the Django framework. They discussed the challenges faced by the radio industry due to the deep integration between radio and the internet and proposed a four-tier system architecture for the internet personalized radio. Their study also proposes a data acquisition scheme to collect users' explicit and implicit behaviors and a data transmission scheme between the web and the big data service. Minter and Baldocchi (1999) proposed a system for distributing radio station content over the internet that allows for selective replacement of content. The system can be used to distribute content over the internet and provides a way to replace content that may be inappropriate or not relevant to the audience.

The system has the potential to improve the quality of content distributed over the internet. Sun (2011) proposed a method of targeted ad insertion using HTTP live streaming protocol. The system receives a playlist that includes an ordered list of media segment files that represent the content stream, and splice point tags. It identifies an insertion position in the playlist based on the location of the splice point tags, selects an advertisement segment, inserts the advertisement segment at the insertion position to create a modified playlist, removes the splice point tags from the modified playlist, and sends the modified playlist to the video display device.

Hirschmeier et al. (2019) explored the challenges and solutions for the digital transformation of radio broadcasting. The study conducted qualitative content analysis on talks of radio practitioners to identify current challenges, possible solutions, and specific aesthetics that shape current and future radio experience. They conceptualize the case of digital transformation of radio from the perspective of service-dominant logic and digital service innovation and discuss relevant areas of service innovation.

Weber and Calvert (2003) proposed an architecture for inserting targeted advertisements into the Internet retransmission of terrestrial radio broadcasts. The architecture includes an Internet server that provides radio broadcast programming to listeners/users, with each broadcast including advertisements targeted based on the listener's demographics profile. The architecture is scalable and uses scheduling data and timestamping to pre stage and calculate where to pick up after an advertisement. Torsiello et al. (2009) performed a study on determining audience response to broadcast content by analyzing data related to media consumption and content broadcast on stations.

The analysis helped in assigning performance factors to programs. The study suggests that audience members' media consumption can be gauged by determining how many audience members switched

stations while programs were broadcast. Krzysztof (2013) explored the implementation of automatic content recommendation systems for music and advertisement content for Internet radio. It also discusses the usage of a voice synthesizer in automatic program scheduling.

The study aims to draw conclusions about the possible perspectives and future role of such systems. The existing literature suggests that the impact of deploying an internet radio system within a university campus in a developing country is significant and multifaceted.

## 2.2 THEORETICAL FRAMEWORK

According to Lai (2017), the Technology Acceptance Model (TAM) is a modification of the Theory of Reasonable Action that is made especially for simulating consumers' acceptance of technology or information systems. Lai (2017) identified that TAM explains the general determinants of computer acceptance that lead to explaining users' behavior across a broad range of end-user computing technologies and user populations.

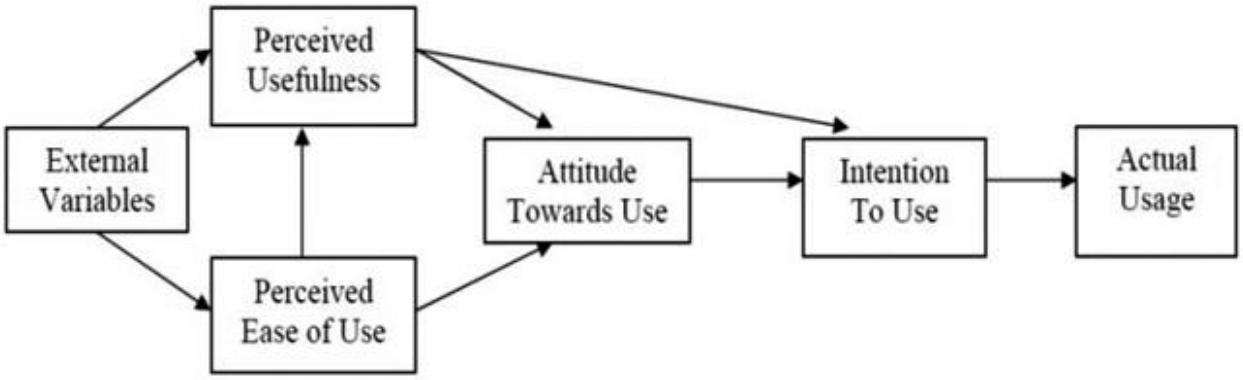


Figure 1: Technology acceptance model

Source: Lai (2017)

The Technology Acceptance Model (TAM) is used to explore how university students and staff in a developing country perceive the usefulness and ease of use of an internet radio system. The aim is to understand how users perceive the internet radio system's value and usability in enhancing communication and engagement within the university campus.

### 2.2.1. DEFINITION OF CONSTRUCTS

External variables such as internet facilities, technical support, and infrastructure greatly influence the acceptance and use of internet radio within the university campus. The availability and accessibility of internet connectivity, including network strength, also impacts the delivery of broadcasts and users' ability to access and utilize internet radio streams. Perceived usefulness refers to the extent to which university students and staff believe that the internet radio system is beneficial for broadcasting and

communication within the campus environment, even during vacations.

Factors like access to diverse radio programs, disseminating information to the campus community, and showcasing local talents and events influence their perception of the system's usefulness in enhancing their campus experience and engagement. Perceived ease-of-use was assessed based on how easily university students and staff can access and utilize the internet radio system on campus.

This evaluation includes factors like the simplicity of tuning in, user-friendly navigation through radio app platforms, ease of broadcasting by radio hosts, and the availability of technical support for any system-related issues or queries. Attitude towards use refers to the university students' and staff's attitude towards the deployment of an internet radio system within a university campus in a developing country which can be influenced by their perceived usefulness and perceived ease-of-use of the internet radio system.

Intention to use refers to the university students' and staff's behavioral purpose to engage with the internet radio system within a university campus in a developing country, which is influenced by their attitude towards the actual use of the internet radio system. Actual Usage refers to the students and staff usage of the technology.

## 3. RESEARCH METHODOLOGY

The study utilizes a mixed methods approach along with the Extreme Programming (XP) framework of the agile approach to deploy an internet radio system, with two Ghanaian universities as case studies. Two university radio systems in Accra, Ghana, were purposively sampled for the study.

The first radio system uses a terrestrial radio system, and the drawbacks of this system were identified through interviews with four major hosts and the radio manager.

The second radio system employs an internet radio system, and the opportunity to sample it arose during a forum where participants were given a tour of the radio system, sparking an interest in this study. Although the internet radio system had been implemented, the study found room for improvement and identified some drawbacks of the system.

The aim is to explore the perceptions and experiences of university students and staff regarding the usefulness and ease of use of the internet radio system in enhancing communication and engagement within the campuses.

The study involved administering questionnaires to target users (students and staff) of two Ghanian Universities totaling 30 respondents. The purpose of the questionnaires was to evaluate the level of engagement of the target users with the university's radio station and other online streaming services.

This information helped to understand the features the internet radio system should possess to capture the interest of students and encourage engagement with shows and activities from the university's radio station.

Google Forms were used for the questionnaire administration, making it convenient to quantify the responses and obtain visual representations of the feedback in various categories. This data collection process added valuable insights to the study and informed the development and enhancement of the

internet radio system to better meet the needs and preferences of the target audience.

The data collected were analyzed to determine the influence they have on achieving our objectives. In this study, the sampled university running a terrestrial radio system is used as a case study to deploy an internet radio system through integration.

## 4. RESULTS

This section presents the software development method and activities employed to successfully deploy an internet radio system. While deploying this system we adopted an Agile methodology framework which is Extreme Programming (XP). The chapter presents the various stages of the XP framework and how it was applied in this study.

There are six (6) stages of the Extreme Programming Framework of the Agile Life Cycle which has been adopted to carry for the deployment of the proposed system from start to finish by carrying out tasks associated with each phase of the system development life cycle as illustrated in the diagram below.

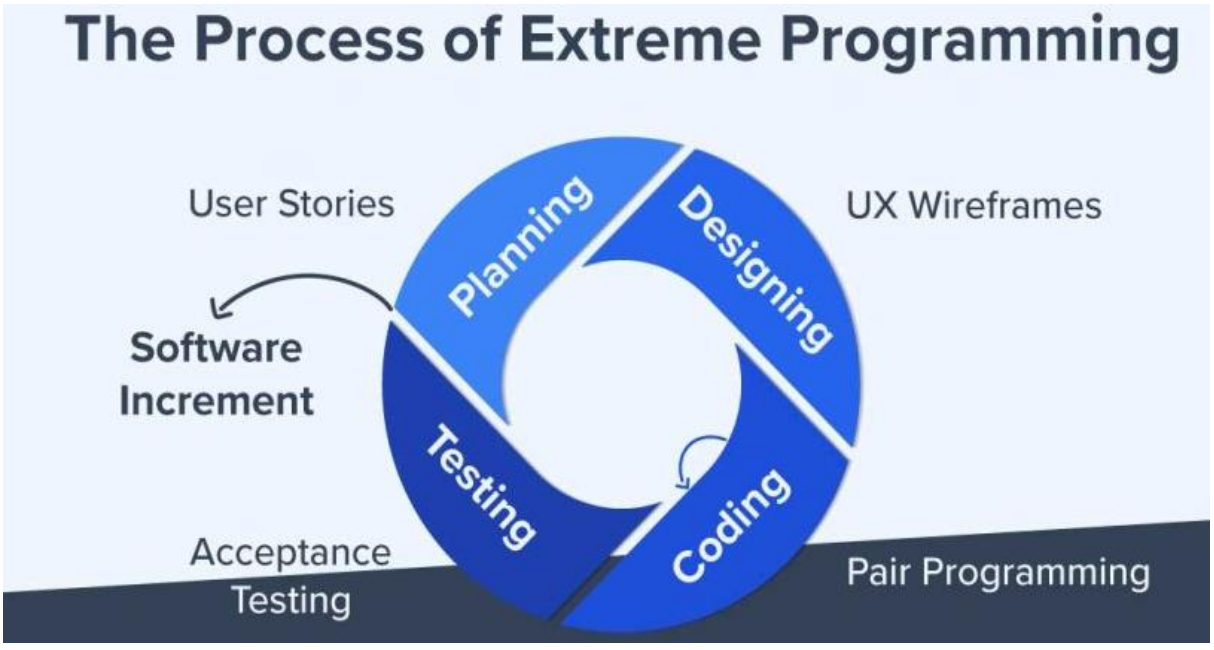


Figure 2: Extreme Programming (XP) Process.
Source: Wieser (2022).

## 4.1 EXTREME PROGRAMMING (XP) PROCESS

### 4.1.1 PLANNING

This study focuses on both primary and secondary data. The primary data included collecting data from interactions with four major radio hosts via interview questions and administering questionnaires to the prospective audience of a University in Ghana as a case study, that currently runs a terrestrial radio system. Requirements were gathered through interviews and questionnaires from both the hosts at the radio station and university students and staff.

The secondary data was gathered from a review of an internet radio system of another university in Ghana. The secondary data assisted in comparing a sample of an internet radio system to that of a terrestrial radio thereby giving us the opportunity to identify distinct differences between these systems and potential strategies to integrate an internet radio system into a terrestrial radio system and strategies to improve the performance of an internet radio system.

To further aid in the understanding of the system, which is to be deployed, we compared the samples together in which the knowledge gathered from our observation prompts us to deduce two deployment models of internet radio systems which are stand-alone model, and integration model.

The stand-alone model depicts a case where there is no running radio system prior to the deployment of an internet radio, and on the other hand, the integration model depicts a case where there is a need to integrate an internet radio system into an already existing terrestrial radio system.

In this phase, we narrowed down the gathered requirements to determine the system's users, purpose, location, timing, and iterations.

Through a critical examination of the data, we drafted feasible answers to these questions, ensuring they guide the system's development. Participants were asked if they ever used Internet Radio. 30 people responded, with 66.7% positive response, and 33.3% negative response. Participants were asked how frequently they use Internet Radio. 30 people responded, with 30% never used it, 23.3% use it occasionally, 26.7% use it sometimes, and 20% use it frequently.

Participants were asked how important audio quality is to them when listening to a broadcast. 29 people responded, with 6.9% not important, 10.3% slightly important, 10.3% moderately important, 17.2% important, and 55.2% very important. Participants were asked about their preferred means of engagement to live show discussions or contributions to broadcasts. 30 people responded, with 33.3% for dial in, and 66.7% for chat. Participants were asked their choice of preference between internet radio and traditional radio. 30 people responded, with 70% preferring internet radio, and 30% preferring traditional radio.

Participants were asked about how they would feel if they could grab live updates of events and activities happening on the university campus from any location at any point in time. 29 people responded, with

6.9% very dissatisfied, 6.9% moderately dissatisfied, 0% slightly dissatisfied, 10.3% neutral, 0% slightly satisfied, 10.3% moderately satisfied, and 65.5% satisfied. Participants were asked if they have ever been a listener of the university's radio shows. 29 people responded, with 51.7% positive response and 48.35 negative respond. Participants who have been listeners of the university's radio shows were further asked if they are able to tune in during vacations. 16 people responded, with 12.5% positive responses claiming they live close to the university campus so they could tune in, and 87.5% negative responses claiming that they are unable to tune in because they can't find the radio station at their end.

### 4.1.2 DESIGN

This phase builds on the previous phase, in this phase, emphasis was laid on the functions our system should exhibit to achieve our objectives with regards to the data we have collected. With this, we identified utilities to bring together to build on the existing radio system to improve productivity, effectiveness, and efficiency as we equally identified the structure and functionalities that will enhance the improvement of the system. In achieving this, we utilized Unified Modeling Languages (UMLs) such as Use Case Diagrams, Context Level Diagram and Level One Data Flow Diagrams to illustrate the proposed internet radio system's structure based on user requirements.

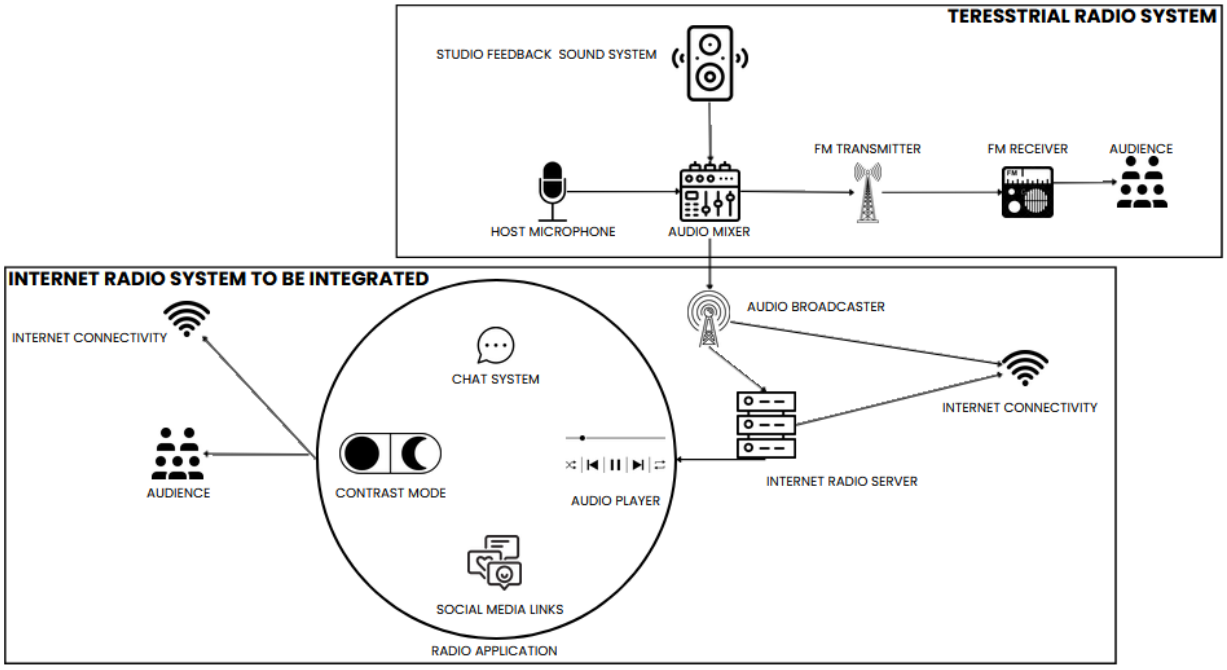


Figure 3: Integration model of an internet radio system.

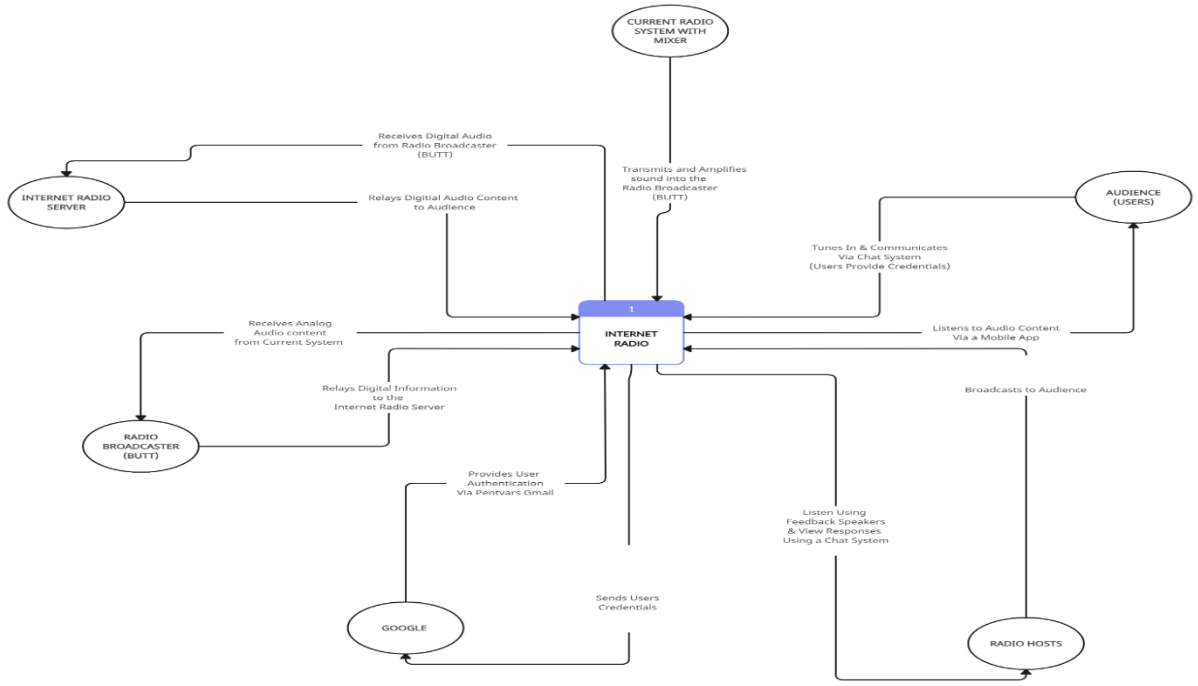


Figure 4: Context level diagram

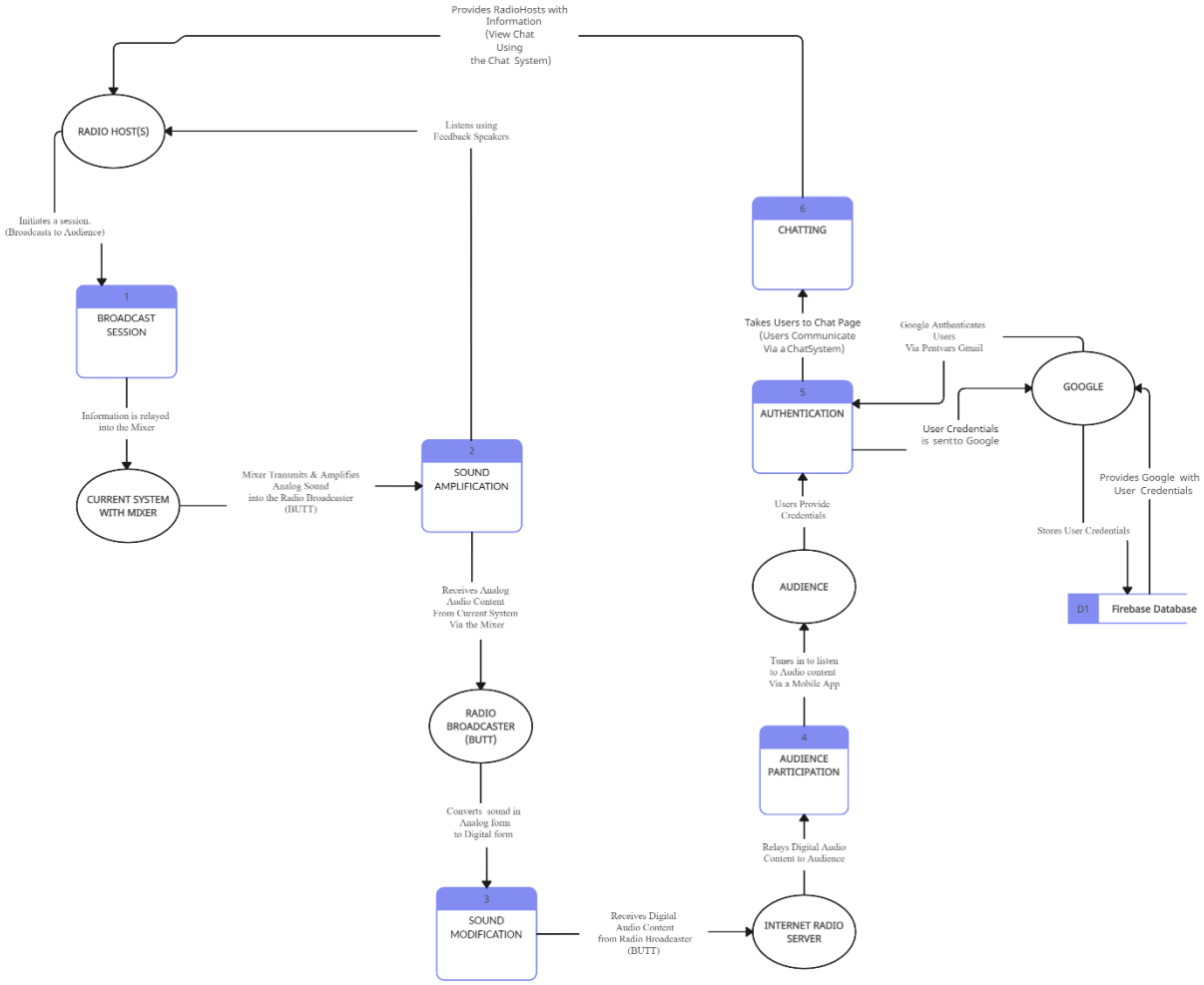


Figure 5: Level one data flow diagram.

### 4.1.3 DEVELOPMENT

The major reasons for adopting the XP agile framework, continuous iterative and test – driven development come into play in this phase. The integration of this system has been divided into three sections due to the structure of the system from the design phase.

The first section is the broadcaster and internet radio server installation and configuration, the second section is the design and development of a radio application (an android mobile application in this case) for audience to tune in, and also access the chat system, and lastly, the third section puts the section one and two together into a single system, integrating it into the current radio system (the terrestrial radio system of the case study). The internet radio server is acquired through signing up with a service provider, all necessary stream information is provided by the server host after a successful sign up. This information such as (stream address, port, and stream password) is used to configure an audio broadcaster. The audio broadcaster software is installed on a windows pc and used to relay audio from the amplifier of the radio station to the radio server for internet streaming.

After this, the design and development of an android mobile application for the integrated system was carried out. This application provides the user with features such as a media player to receive the feeds from the internet radio server, a chat system for audience-to-audience conversation, navigation menu's, contrast mode (dark mode and light mode), and some utilities to support the system.

This mobile application is also used to deliver admob ads for monetization and push notifications to audiences.

Firebase features such as google authentication for user sign up and sign in, remote configuration, data store for media storage were also utilized for the mobile app development. Also, google analytics was configured via fire database to evaluate statistical analysis on the usage of the mobile application to rate performance and user engagement.

The tasks accomplished in the above sections were integrated together.

The first integration was between the internet server and the mobile application where the stream link from the internet server was passed into the mobile application for the media player to access.

Next was the integration of this new system into the terrestrial radio system of the case study by establishing a relay of feed from the amplifier of the radio station into the audio broadcaster by using an aux in cable to relay sound from the amplifier to the audio broadcaster via a sound card that has been connected to the computer where the broadcaster has been installed and setup.

### 4.1.4 TESTING

At this phase, we returned to the radio station to examine the performance of the proposed system that we have developed to identify bugs and other deficiencies in the system that we are integrating into the existing radio system.

For performance test and quality validation, a unit testing and integration testing was performed.

### 4.1.5 LISTENING

After testing and fixing identified bugs in the system, we prepared a working version of the system for the radio station to use. Support was provided for the users of the system through training. In this phase also, we made provision for receiving feedback from the users about the effectiveness, productivity, and efficiency of the system that has just been integrated.

This gives us deep insights into the work done so far which helped us identify if we have been able to solve the problem that we identified. The feedback will also help us in future to identify areas that require improvement and to release an updated version of the system if needed.

## 5. CONCLUSION

The deployment of the Internet Radio System within the university campus in a developing country has offered a seamless broadcasting solution that enhances student and staff engagement. The system's capability to overcome geographical limitations enables improved communication among staff and students. Students can actively participate in school activities both on and off campus, making these activities accessible during vacations as well.

## 6. LIMITATIONS

In the deployment of the Internet Radio System at a university campus in a developing country, certain important features were found to be lacking. These include the inability of the system to be accessed by the audience without internet connectivity, as well as the requirement for a mobile phone to use the system. Additionally, the system is limited to Android users due to its lack of cross-platform compatibility, with only live streaming available through a web link and no access to other features like the chat system.

## 7. RECOMMENDATION

This research presents a thoughtful approach to deploying an innovative internet radio system within a developing country's academic setting to further broadcasting and engagement. The integration of user requirements gathering, iterative design and development, and continuous testing and feedback demonstrates meticulous methodology.

The successful implementation clearly overcomes limitations of traditional terrestrial radio to enable inclusive, seamless communication on campus. Given the clever leveraging of technology, robust agile software approach, and trans

formative impact on accessibility and participation, this work represents an outstanding contribution. We recommend this exemplary study for its significant potential to shape the future of campus radio through digital transformation.

## 8. FUTURE RESEARCH DIRECTIONS

While this study successfully deployed an internet radio system within a developing country's university campus, further research could explore additional enhancements. Assessing integration with multiple platforms like iOS and web could improve accessibility.

Incorporating podcasts and on-demand content with the live streams would also boost engagement. Examining the integration of targeted ads into the system and evaluating the economic viability could reveal monetization opportunities. Finally, deploying internet radio servers on-site rather than using third party services could improve control and customization.

Overall, studies on cross-platform reach, diverse content types, revenue generation, and localized server deployment could build on this work to maximize the potential of campus internet radio.

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# Design, Development and Implementation of a User-friendly Smart Home System using Internet of Things in sub-Saharan Africa

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**ABSTRACT**
This paper explores the design, development, and implementation of an IoT-based smart home system tailored for Sub-Saharan Africa. It discusses the limited adoption of smart home technology in the region and aims to create a culturally relevant system to address unique challenges. The study employs a qualitative methodology and Rapid Application Development framework involving requirements gathering, prototyping, construction, and deployment. Key findings highlight familiarity with smart devices like lighting and cameras, perceived benefits around efficiency and security, and the influence of cultural norms on adoption. The research demonstrates thoughtful system design aligned with end-user values, contributing a framework to advance smart home integration and maximize benefits for Sub-Saharan African communities.

**Keywords**: *Smart homes, Internet of Things, Sub-Saharan Africa, User acceptance*

## 1. INTRODUCTION

The use of IoT platforms in smart homes has enabled seamless internet connectivity for electrical appliances like light bulbs, fans, air conditioners, and extension boards, transforming traditional homes into intelligent living spaces (Nakamura et al., 2017).

This connectivity has paved the way for "smart homes," where everyday household appliances and devices are intelligently integrated to enhance convenience, efficiency, and security for homeowners. Despite the global growth of smart home technology, its adoption in Sub Saharan Africa remains limited, and comprehensive research on the barriers and challenges faced by homeowners in embracing this technology is lacking.

There is a research gap in understanding the factors influencing the slow uptake of smart home systems in Sub Saharan Africa and the perceptions and experiences of homeowners regarding such technology (Tetteh & Amponsah, 2020). Homeowners miss out on the opportunity to remotely control appliances,

optimize energy usage, and enjoy personalized experiences tailored to their preferences. Consequently, there is a delay in capitalizing on the potential cost savings and lifestyle improvements that come with smart home automation. Without widespread adoption, Sub-Saharan Africa misses an opportunity to reduce its energy footprint, contributing to both environmental sustainability and potential economic savings.

The delayed adoption of smart home technology might also widen the Sub-Saharan Africa's digital divide. Sub-Saharan Africa runs the risk of slipping behind in technological development as the prevalence of smart homes increases worldwide, limiting access to the groundbreaking advantages of IoT and home automation.

The proposed study aims to perform an exploratory research project with a specific focus on designing, developing, and implementing an IoT-based smart home system that is specifically tailored for Sub-Saharan Africa. The goal of this explorative research is to pave the way for a more inclusive, accessible, and culturally relevant smart home system that caters to the distinct characteristics and aspirations of Sub-Saharan African communities.

The study's objectives include understanding the preferences and requirements of Sub-Saharan African homeowners, identifying adoption impediments, and evaluating the adaptability of current smart home solutions. This research paper holds immense significance for Sub-Saharan Africa, a region characterized by its rich cultural diversity, unique socio-economic conditions, and varying infrastructural challenges. Exploring the implementation of a user-friendly IoT-based smart home system customized for this context, the paper aims to address the limited research in the area of smart home technology within the region.

The study's findings can shed light on the specific challenges and opportunities that arise when introducing smart home solutions to Sub-Saharan African homeowners, leading to increased cultural relevance and inclusivity in the technology's adoption. Also, the research paper's insights into the potential benefits of energy efficiency and sustainability can positively impact estates developers in the region. Implementing smart home technology can enhance the attractiveness of residential properties, offering innovative and modern amenities that align with the growing demands of tech-savvy homeowners.

The research paper follows a structured approach with five main sections. In Section 2, the study presents the framework and conducts an extensive review of existing literature related to smart home automation, with a specific focus on Sub-Saharan Africa. Section 3 describes the methodology adopted for the research, including the research strategy, sample design, data collection approach, and analytical methods employed to address the research questions.

The findings and conclusions derived from the analysis are thoroughly discussed in Section 4.

Finally, Section 5 encompasses the overall conclusion of the study, outlining its limitations,

implications, and offering suggestions for future research directions.

## 2. LITERATURE REVIEW

This section gives a summary of the relevant literature. The literature review explores existing research and scholarly work related to IoT-based smart home technology, with a specific focus on its adoption, challenges, and opportunities in the context of Sub-Saharan Africa. Teymourzadeh et al. (2013), designed a system to give the homeowner complete control over their home using the Short Message Service (SMS) communicating over GSM. In this system, a GSM modem is connected to an RS232 interfaced with a MAX232 that is also connected to a PIC microcontroller, as the RS232 is not compatible with the microcontroller. When a user sends an SMS message, it is sent to the RS232, and the MAX232 converts the text messages to a TTL signal for the PIC microcontroller.

The PIC controls the relay, which is the connection point for all the home appliances. The gap in this system is that it is highly intrusive and requires a rewiring of electrical appliances for configuration purposes. The system is also limited in the use of only a GSM, and a SIM card is needed to control the home remotely, and if the GSM or SIM is misplaced, the system ceases to function. Additionally, no security standards were put in place to secure the system against intruders and hackers.

Taiwo and Ezugwu, (2021) presented the design and development of a ubiquitous, cloud-based intelligent home automation system. The system controls, monitors, and oversees the security of a home and its environment via an Android mobile application. One module controls and monitors electrical appliances, while another module oversees the home's security by detecting motion and capturing images.

The work uses a camera to capture images of objects triggered by their motion being detected. In this study, a machine learning approach was utilized to address the issue of false alarms by distinguishing between images of regular home occupants and intruders.

The researchers proposed the utilization of the support vector machine algorithm to classify the image features and accurately determine whether it corresponds to a regular home occupant or an intruder.

This classification process helps ensure that alarms are only triggered when there is a genuine security threat, providing enhanced reliability to the user (Taiwo & Ezugwu, 2021).

The intelligent home automation system described in the work faces several challenges. These include addressing false alarms by training the machine learning algorithm to accurately differentiate between intruders and regular home occupants. Acquiring a diverse and representative dataset for training the algorithm poses a challenge.

The study by Sowah et al. (2020) presented a secure wireless home automation system that has been designed and implemented with the OpenHAB 2 home automation software framework to meet the set

goals. A power supply circuit was designed and implemented for the microcontrollers while another circuit was created for the wireless switching and control of appliances.

The OpenHAB server was set up on the Raspberry Pi, and the Arduino was configured to communicate with the OpenHAB server for home automation tasks. Both mobile and web applications were developed to control and view the status of home appliances. Also developed was a secure wireless network system enabling communication between the home appliances and the OpenHAB server (Sowah et al., 2020).

The prototype integrated all items to a single switching board as a proof of concept that the states of the device could be controlled and monitored remotely with improved security using JSON Web Tokens. Some of the challenges mentioned in this article include security challenges and privacy concerns in smart homes, security challenges in IoT-based smart home systems, security challenges in large communities like smart cities, office areas, hotels, malls, and university environments, challenges in developing machine learning algorithms for classification and prediction, and challenges in enhancing the smart home automation system to function on the iOS platform.

Bradfield and Allen, (2019) conducted a survey of 400 South African homeowners to assess their perceptions of and needs for smart home technology. The survey results showed that there is a high level of interest in smart home technology among South African homeowners.

The most popular smart home features were those that could help to save energy, improve security, and make life more convenient. However, the survey also found that there are some barriers to the adoption of smart home technology in South Africa, such as the high cost of devices, the lack of awareness of smart home technology, and concerns about privacy and security.

The authors of the article conclude that there is a significant potential for smart home technology in South Africa. However, they also argue that there are a number of challenges that need to be addressed before smart home technology can be widely adopted. These challenges include the need to reduce the cost of devices, to increase awareness of smart home technology, and to address concerns about privacy and security (Bradfield & Allen, 2019).

Tetteh-Amponsah et al. (2020) provides a comprehensive overview of the potential of smart homes for sustainable development in Sub-Saharan Africa (SSA). The authors review the literature on smart homes, sustainable development, and SSA, and they identify a number of ways in which smart homes can contribute to sustainable development in the region.

The authors argue that smart homes can help to reduce energy consumption, improve water efficiency, and promote the use of renewable energy sources.

They also argue that smart homes can help to improve security, increase the comfort of residents, and provide new opportunities for economic development.

The authors identify a number of challenges that need to be addressed in order to facilitate the sustainable

adoption of smart homes in SSA.

These challenges include the high cost of smart home devices, the lack of access to reliable electricity, and the need for strong cybersecurity measures.

Akinwaminde et al. (2022) examines the barriers to the adoption of smart housing concepts in African smart city projects. The authors use the case study of Akwa Millennium City, a smart city project in Nigeria, to identify the key challenges that need to be addressed in order to facilitate the adoption of smart housing concepts in Africa.

The authors identify three main categories of barriers to the adoption of smart housing concepts in Africa: socio-economic, technical, and policy. Socio-economic barriers include limited consumer demand, high cost of development, and lack of financial and financing incentives. Technical barriers include the lack of reliable electricity, the lack of access to broadband internet, and the lack of cybersecurity measures.

Policy barriers include the lack of clear regulations and standards for smart housing, and the lack of government support for smart housing projects. The authors conclude that the adoption of smart housing concepts in Africa is facing a number of challenges. However, they also argue that there are a number of opportunities for overcoming these challenges. These opportunities include the growing demand for smart housing, the increasing availability of smart home devices, and the growing interest of governments in smart city development.

## 3. THEORETICAL FRAMEWORK

In the rapidly evolving landscape of smart home automation, understanding the factors influencing technology adoption is pivotal for successful implementation. This research paper employs a theoretical framework to gain valuable insights into the acceptance and use of IoT-based smart home systems in the unique context of Sub-Saharan Africa (Marikyan, n.d.; Venkatesh et al., 2003).

The chosen framework, the Unified Theory of Acceptance and Use of Technology (UTAUT), provides a comprehensive and integrated approach to explore the complexities surrounding technology adoption in this diverse region. Analyzing individual, social, and contextual elements that influence homeowners' perceptions and interactions with smart home technology, the UTAUT framework offers a robust foundation to uncover the drivers and barriers of IoT-based home automation in Sub-Saharan Africa. The UTAUT is a prominent theoretical framework that explores the factors influencing individuals' acceptance and adoption of new technology.

Introduced by Venkatesh et al., (2003), UTAUT integrates and extends various technology acceptance models, including the Theory of Reasoned Action (TRA), the Technology Acceptance Model (TAM), the Theory of Planned Behaviour (TPB), and the Diffusion of Innovations (DOI).

Considering four key constructs - performance expectancy, effort expectancy, social influence, and facilitating conditions - UTAUT provides a comprehensive lens to understand users' behavioural intentions and actual
technology use.

This theoretical framework has been widely applied in diverse contexts to examine the adoption of various technologies, making it a valuable tool for researchers seeking to explore the acceptance and usage of technology, including smart home automation, in different cultural and social settings (Venkatesh et al., 2003).

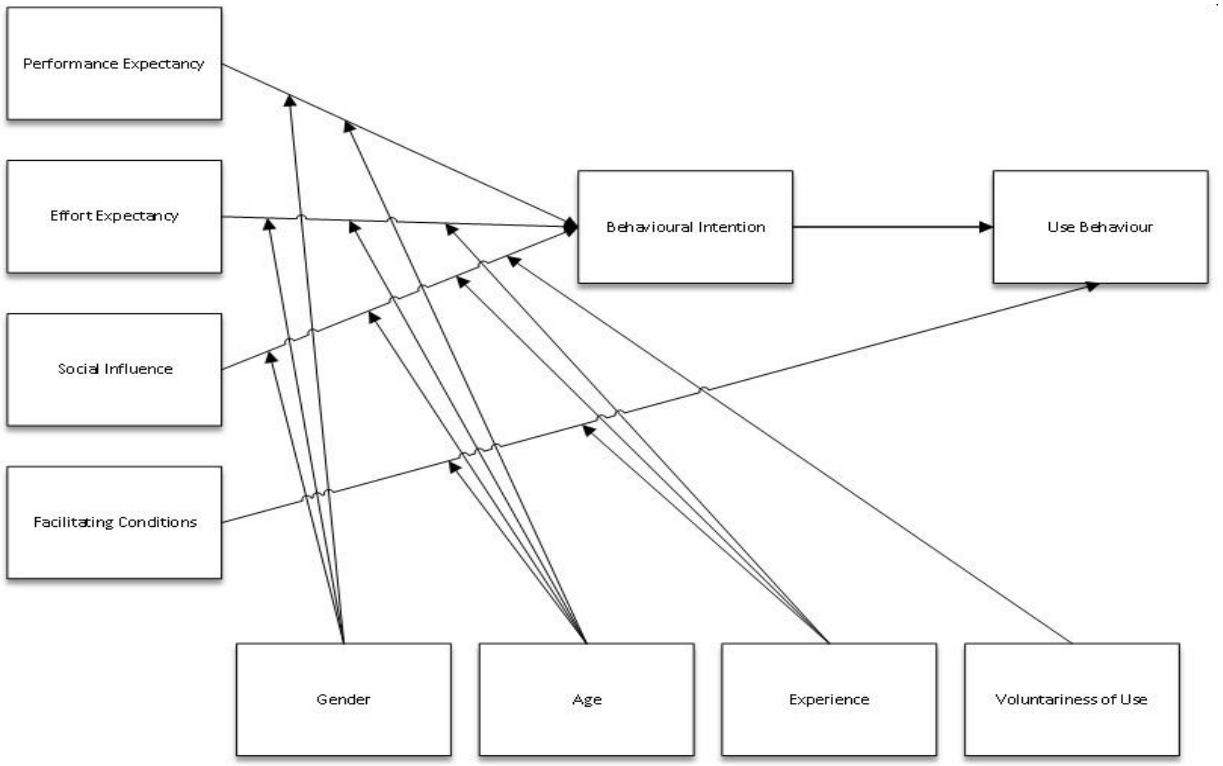


Figure 1: Unified Theory of Acceptance and Use of Technology

Source: Venkatesh et al. (2003)

**Definition of constructs:**

In Sub-Saharan Africa's unique context, these examined constructs significantly influence IoT-based smart home system adoption. Performance Expectancy mesaures homeowners' perception of system benefits encompassing convenience, efficiency, security, and cost savings, such as automated tasks, energy efficiency, and heightened security.

Effort Expectancy emphasizes user-friendliness, vital due to varied technical expertise, with an intuitive interface crucial for adoption.

Social Influence notes interpersonal impact on decision-making; trust from family, friends, and networks can enhance confidence, while skepticism may hinder.

Facilitating Conditions encompass external factors like resources and support, vital for success.

Adequate resources, technical aid, and reliable connectivity are crucial.

Holistically addressing these constructs is key for Sub-Saharan Africa's smart home adoption, fostering widespread connectivity, energy efficiency, and homeowner security.

**The moderating variables**

In the Sub-Saharan African context, several moderating variables shape the determinants of technology acceptance for IoT-based smart home systems.

Gender-related cultural norms may amplify the influence of social norms on women's behavioral intentions, given their emphasis on communal decision-making (Agarwal & Prasad, 1998; Venkatesh et al., 2003).

The voluntary nature of technology use in the region, influenced by resource considerations, could enhance the impact of performance expectancy on behavioral intention (Rogers, 2003; Venkatesh et al., 2003). Local technological experience may weaken the effect of social norms, particularly among users familiar with regional technologies (Bagozzi, 2007; Venkatesh et al., 2003).

Generational dynamics play a role, with younger individuals valuing the enjoyment of technology and older generations emphasizing practical benefits, potentially leading to varying effects of effort expectancy on behavioral intention (Rogers, 2003; Venkatesh et al., 2003).

These moderating variables collectively contribute to the nuanced landscape of technology adoption in Sub-Saharan Africa.

## 3. RESEARCH METHODOLOGY

The research methodology employed in this study involves a qualitative approach in conjunction with the Rapid Application Development (RAD) framework. the researchers used a purposive sampling technique, to select 20 participants for the study.

Data was gathered through structured interviews using an interview guide. This methodology seeks to delve deeply into the perceptions and experiences of Sub-Saharan African homeowners, providing a rich and contextualized understanding of the acceptance and adoption of the proposed IoT-based smart home system for seamless home connectivity.

The study employs the RAD framework, which consists of stages including requirements planning, user design, rapid construction, and cutover. RAD's iterative approach is ideal for creating a culturally relevant IoT-based smart home system for Sub-Saharan Africa, ensuring efficient development and seamless home connectivity.

## 4. RESULTS

The software development approach used in this study is the Rapid Application Development (RAD) methodology. RAD is a structured and iterative software development process which enabled the delivering of a working prototype,

gather valuable user feedback, and make necessary adjustments along the way. Qualitative methods and the RAD methodology was used to design, develop and implement the IOT based smart home system. RAD methodology consists of four stages: Requirements Gathering, User Design, Construction, and Cutover. The following sections provides further analysis of each stage within the RAD model, as shown in figure 2.

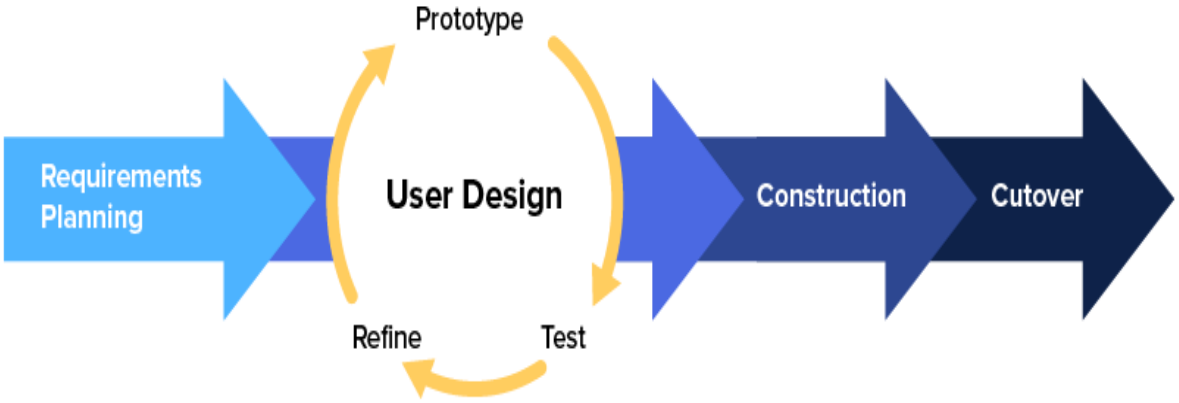


Figure 2: Rapid Application Development Model
Source: (Hamzah et al., 20 19)

## 4.1 RAPID APPLICATION DEVELOPMENT PROCESS

### 4.1.1 REQUIREMENTS PLANNING

This phase entails collaborative communication among developers, researchers, stakeholders, and Sub-Saharan African homeowners. The study chose a group of Respondents from various backgrounds and origins across Africa, including students University hostels, as well as households located specifically Greater Accra Region of Ghana. Semi-structured interview guides were used to collect qualitative data from homeowners, hostel residents and estate managers.

The aim was to precisely outline the scope of the project, determine its goals, and identify existing challenges that the IoT-based smart home system aims to address. Respondents were asked how familiar they were with the concept of IoT-based smart home systems.

The majority of the respondents (60%) did not have any prior knowledge of smart homes and IOT, whiles 40% of the respondents expressed some knowledge of IOT and smart home but have not used it before.

The remaining 10% reported that they have some knowledge about smart home and have interacted with an IOT smart home device before.

Potential benefits highlighted by respondents include improved energy efficiency, and greater convenience.

Many perceive that IoT-based smart home systems could help mitigate power wastage and offer better control over resources, leading to cost savings.

Respondents also believe these systems could contribute to increased security, particularly in urban areas, by offering remote monitoring capabilities.

Majority of the respondents (85%) reported that will be happy to use the IOT based Smart Home system. 25% of the respondents raised concerns of data privacy and security. 5% had no idea, whether they will use it or not.

The factors motivating adoption include the potential to reduce utility bills, enhance security, and keep up with technological trends.

Concerns include data privacy, technical complexities, and potential over-reliance on technology.

Most of the respondent representing 40% were comfortable with the idea of interacting with smart home devices through mobile Apps. 35% of respondents have reservations about voice commands, expressing concerns about accuracy and cultural compatibility.

25% of respondents stress the importance of user-friendliness, local language support for successful adoption.

### 4.1.2 USER DESIGN

After the project's scope is defined, the User Design phase takes over stage, emphasizing a collaborative and iterative process.

The user requirements gather from the interview was used to craft a tailored and culturally aligned smart home system. Prototypes are created and refined through multiple iterations, allowing homeowners to assess each version and provide valuable insights.

This iterative approach ensures that the proposed smart home system is not only aligned with user expectations but also adaptable to the unique requirements of Sub-Saharan Africa.

Through continuous feedback and adjustments, the User Design phase enhances the effectiveness and user-friendliness of the smart home system.

It empowers Sub-Saharan African homeowners to actively participate in the design process, resulting in a solution that seamlessly integrates technology into their daily lives and homes.

This collaborative approach ensures that the smart home system aligns with the cultural context and user expectations, fostering a successful and harmonious implementation.

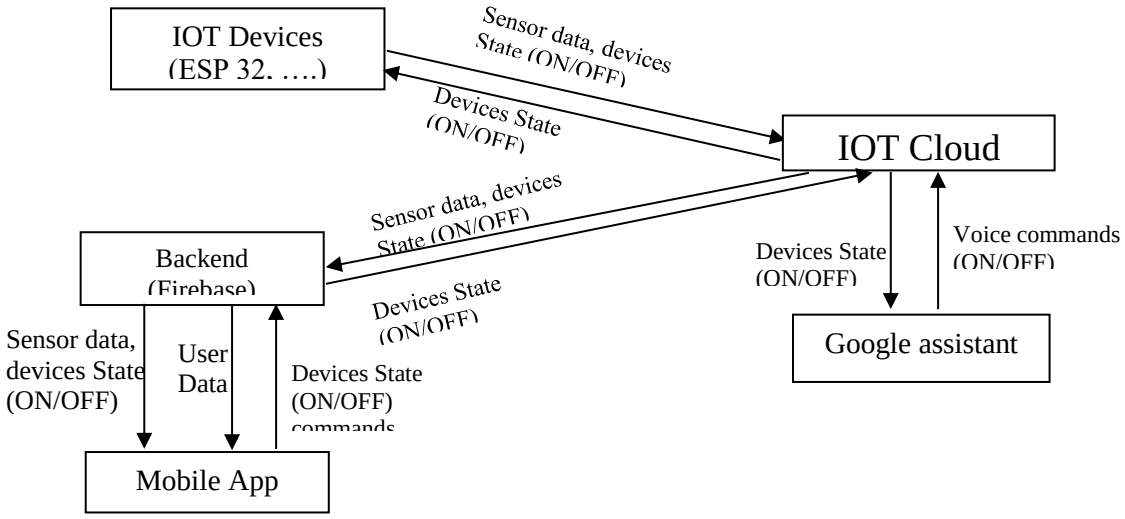


Figure 3: Conceptual View of the Proposed System

### 4.1.3 RAPID CONSTRUCTION

Building upon the refined prototypes and beta systems shaped during the preceding User Design phase, this phase is dedicated to the transformation of conceptual designs into a fully operational smart home system. Leveraging the iterative design process, developers expedite the construction process by seamlessly integrating software programs, applications, and coding procedures. Rigorous unit, integration, and system testing ensue to ensure a seamless and reliable functionality.

This collaborative endeavor engages a multidisciplinary team of programmers, coders, testers, and developers, working synergistically to meet the expectations and objectives of Sub-Saharan African homeowners. Notably, client engagement remains a focal point, allowing ongoing input and insight, fostering real-time adjustments and innovative solutions. This phase epitomizes the dynamic convergence of technological advancement and user design, culminating in a smart home system finely attuned to the cultural and practical nuances of Sub-Saharan Africa.

### 4.1.4 CUTOVER

This stage signifies the apex of the development journey, as the systematically refined smart home system transitions from its final construction to a live deployment.

It encompasses intricate data conversion, rigorous testing, and the smooth transition to the new system, all while prioritizing user engagement through comprehensive training initiatives.

The essence of Seamless Integration lies in the seamless fusion of technological precision and user empowerment. During this phase, fine-tuning of the system takes place, with developers and clients working collaboratively to address any remaining issues.

The analysis reveals that IoT-based smart home systems are familiar to individuals in Ghana, with experiences primarily involving smart lighting and security cameras, appreciated for their convenience. Perceived benefits encompass energy efficiency and improved security. However, cultural norms, privacy concerns, and traditional values influence adoption.

Motivations include cost savings and security gains, though data privacy and complexity are barriers. Social influence, notably recommendations from family and community, has a substantial impact. While digital interfaces are generally comfortable, the acceptance of voice commands varies due to accuracy and cultural factors.

The key to successful adoption lies in user-friendly interfaces with local language support and simplicity.

## 5. CONCLUSION

This research offers valuable insights into the perceptions and potential adoption of IoT-based smart home systems across Sub-Saharan Africa. The study highlights a notable familiarity with these technologies, particularly smart lighting and security cameras, which are appreciated for their convenience.

While benefits such as energy savings and enhanced security are acknowledged, the impact of cultural norms and privacy concerns on adoption is evident.

While motivations like cost reduction and improved security drive interest, apprehensions surrounding data privacy and technical intricacies need consideration.

The influence of family and community recommendations is a significant factor, and while digital interfaces are generally comfortable, opinions on voice commands vary.

The necessity of user-friendly interfaces with local language support emerges as a pivotal element for successful adoption.

This research offers valuable guidance for tailoring strategies that align with the unique values and requirements of Sub-Saharan African communities, fostering a path toward effective integration and widespread acceptance of IoT-based smart home systems.

## 6. LIMITATIONS

The scope of our research primarily focused on the technical and usability aspects of the proposed system, potentially overlooking broader societal and cultural nuances that could impact adoption.

The study's implementation was within a controlled environment; thus, real-world complexities and user diversity may influence system performance differently. Also, the proposed system from the study requires internet connection to function.

## 7. RECOMMENDATIONS

To further enhance the efficacy and applicability of the proposed smart home system, we recommend

conducting more extensive user testing and feedback loops involving diverse homeowner demographics. Incorporating a comprehensive evaluation of energy efficiency and environmental sustainability aspects could enhance the system's long-term viability. Collaboration with local communities and stakeholders would facilitate a more contextualized and culturally sensitive implementation.

**Future research directions**

While this study presents an exemplary IoT-based smart home system tailored for Sub-Saharan Africa, additional research could further enhance its sustainability and adoption. Exploring the integration of renewable energy sources like solar could promote environmental sustainability. Investigating the broader economic and social impacts of widespread implementation could reveal crucial insights.

In-depth analysis of data privacy and security concerns specific to the region would enable robust solutions tailored to user needs. Finally, evaluating the role of supportive government policies in driving adoption would provide a more holistic perspective.

Overall, studies on sustainability, impact assessment, data protection, and policy support could build on this work to maximize the value of smart homes across Sub-Saharan Africa.

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# Understanding Devotee Choices, Economic Impact, and Cultural Vibrancy in Temple Economies-
# "A Case Study of temples in Mumbai city"

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**ABSTRACT**
This study examines the temple economies in Mumbai, India, focusing on the interplay between devotee choices, economic impact, and cultural vibrancy. Temples in Mumbai serve as vibrant centers of religious and cultural activities, attracting devotees from diverse backgrounds. The research aims to understand the factors influencing devotees' choices in visiting specific temples, including religious beliefs, accessibility, and cultural significance. Furthermore, the study investigates the economic impact of temple economies on the local community, including employment opportunities, tourism, and associated businesses. It explores the role of temples in generating revenue through offerings, donations, and commercial activities, and how these funds are utilized for maintenance, development, and community services. Additionally, the research delves into the cultural vibrancy surrounding temple economies, analyzing the preservation and promotion of traditional arts, crafts, and ceremonies. It examines how temples serve as custodians of cultural heritage, fostering a sense of identity and community cohesion. By employing a mixed-methods approach, combining quantitative data analysis and qualitative inquiry, this study aims to provide a comprehensive understanding of the interconnected aspects of devotee choices.

## 1. INTRODUCTION

In the dynamic urban landscape of Mumbai, a city that seamlessly blends tradition with modernity, the role of temples extends beyond spiritual significance, encompassing economic dynamics and cultural vibrancy. This case study delves into the intricate web of factors shaping devotee choices, unraveling the economic impact of temples, and examining their pivotal role in sustaining cultural diversity. Mumbai, often referred to as the financial capital of India, boasts a rich tapestry of temples scattered across its bustling neighborhoods.

These sacred spaces serve as focal points for religious practices, social gatherings, and economic activities, creating a unique ecosystem where spirituality converges with commerce.

The study aims to explore the motivations driving devotee choices when engaging with temples in Mumbai. By investigating the factors influencing the selection of specific temples, ranging from religious doctrines to architectural allure, the research seeks to unravel the intricate web of beliefs and preferences that guide individuals on their spiritual journeys. Simultaneously, the economic impact of these temples on the local and city-wide economies will be scrutinized.

Beyond their spiritual significance, temples often function as economic hubs, attracting pilgrims, tourists, and vendors alike.

This analysis will shed light on the economic interplay between the temples and their surroundings, examining how these sacred sites contribute to employment, commerce, and overall economic development.

Furthermore, the study will delve into the cultural vibrancy fostered by temples in Mumbai. As microcosms of cultural diversity, these temples play a crucial role in preserving and promoting traditional practices, art forms, and communal celebrations.

By examining the cultural tapestry woven within and around these religious edifices, the research aims to highlight the temples' role in shaping the identity of Mumbai as a city that embraces both its ancient heritage and contemporary dynamism.

Temples are the best example of building a community, contributions were made from each and every corner of this country for Ram Mandir and this was possible because the whole country became one community.

Temples carry the identity of people. Right from the Kuldevta temples till the most famous temples in urban areas represents not only the wide landscape of cultural vibrancy of India but also shows the connection of individuals with many different temples. Many communities have built temples and many temples have built communities.

In recent years, Mumbai, the financial capital of India, has witnessed a resurgence of interest in spiritual pursuits, with temples serving as vibrant hubs for religious practices, social gatherings, and economic activities. Social media trends, Political environment in India are some of the visible reasons of rise in interest and importance of temple.

This confluence of spirituality and commerce has created a unique ecosystem that demands comprehensive understanding in an era marked by globalization and rapid urbanization. The urgency of this study lies in its ability to shed light on the evolving motivations driving devotees' choices when engaging with temples. As societal values and belief systems undergo transformations. Moreover, the economic impact of temples on local and citywide economies cannot be overlooked in the contemporary landscape.

As these sacred spaces attract pilgrims, tourists, and vendors alike, their role as economic catalysts warrants scrutiny.

This analysis holds significant relevance in recent times, as it elucidates the symbiotic relationship between temples and their surroundings, unveiling their contributions to employment, commerce, and overall economic development. Such insights are crucial for policymakers, urban planners, and stakeholders seeking to harness the economic potential of these sacred sites while preserving their spiritual essence.

In summary, "Understanding Devotee Choices, Economic Impact, and Cultural Vibrancy in Temple Economies: A Case Study of Temples in Mumbai City" embarks on a comprehensive exploration of the multifaceted roles that temples play in the urban landscape. Through a meticulous examination of devotee motivations, economic ramifications, and cultural contributions, the study aspires to provide a nuanced understanding of the intricate dynamics that define Mumbai's temple economies.

## 2. REVIEW OF LITERATURE

**Kuei-min Chang (2020),** This research focuses on the complex dynamics of temple asset utilization in contemporary China within the context of state-led religious commodification.

The contention over the use of temple assets and the negotiation for property-management autonomy are central themes explored in this study.

**Padmaja Vijay Kamat (2013)**, The historical roots of self-governing village communities in Goa, known as Gramasamsthas, provide a fascinating backdrop to the intricate dynamics between the temples and the village economy. This narrative, dating back to ancient times, reveals a symbiotic relationship between the settlers, primarily the Kunbis and Gaudes from Canara, and the land they cultivated.

Joao de Barros attributes the establishment of Gramasamsthas to these immigrants who, by descending the Ghats, reclaimed and cultivated the land. The Gramasamstha, described by J. C. Almeida as an agrarian association and referred to by the Portuguese as the Communicated,

emerged as a joint responsibility of the original settlers for village administration.

**Department Orientaistiek (1979),** The book "State and Temple Economy in the Ancient Near East" undertakes a nuanced exploration of the interplay between state institutions and religious temples in ancient times. The literature review contextualizes this investigation within the broader scholarly discourse, emphasizing the author's perspective and key thematic elements.

**Jakob Rösel (2009),** The Jagannath Temple of Puri stands as one of the largest and most significant pilgrimage centers in North India, drawing millions of devotees annually. The present study aims to

delve into the unique characteristics and historical context of this temple, examining existing literature to provide a comprehensive understanding of its cultural, religious, and architectural significance.

**J. Makkay (2014),** The "temple-state theory" proposed by A. Deimel regarding the economic structure of ancient Mesopotamia has sparked significant scholarly discourse, particularly concerning the ownership and control of economic resources, including land.

This literature review aims to explore the evolution of the temple-state theory, its critiques by subsequent researchers like Gelb and Diakonoff, and the ongoing debates surrounding the ownership of economic goods and land within the context of Mesopotamian history.

## COMBINED KEY TAKEAWAYS FROM THE ABOVE LITERATURE REVIEWS-

### State-led religious commodification:

The study by Kuei-min Chang (2020) highlights the phenomenon of state-led commodification of religion in contemporary China, where the government plays a significant role in shaping and controlling the utilization of religious assets, such as temples.

Contention over temple asset utilization: Chang's work explores the tensions and conflicts arising from the use of temple assets, involving various stakeholders like religious authorities, local communities, and governmental entities.

### Ancient self-governing village communities:

Padmaja Vijay Kamat's (2013) research delves into the historical roots of self-governing village communities in Goa, known as Gramasamsthas, revealing their symbiotic relationship with the land and their role in village administration.

Connection between temples and village economy: Kamat's work suggests a potential connection between temples and the village economy, as the Gramasamsthas were rooted in agricultural practices and land cultivation by the settlers.

### State-temple dynamics in ancient societies:

The book "State and Temple Economy in the Ancient Near East" by Department Orientaistiek (1979) explores the interplay between state institutions and religious temples in ancient times, emphasizing the complexities of their relationship.

Economic implications of state-temple dynamics: The book delves into the economic implications of the state-temple dynamic, examining resource allocation, taxation, trade, and the management of economic activities.

**Significance of the Jagannath Temple:**

Jakob Rösel's (2009) study highlights the Jagannath Temple of Puri as one of the largest and most significant pilgrimage centers in North India, aiming to provide a comprehensive understanding of its cultural, religious, and architectural significance.

**Evolution of the temple-state theory:**

J. Makkay's (2014) literature review focuses on the "temple-state theory" proposed by A. Deimel regarding the economic structure of ancient Mesopotamia, exploring its evolution, critiques, and debates surrounding the ownership of economic resources.

**Interdisciplinary approach:**

Several studies adopt an interdisciplinary approach, drawing upon evidence and perspectives from various fields, including history, economics, archaeology, anthropology, and religious studies, to provide a comprehensive understanding of the topics.

**Contribution to scholarly discourse:**

Many of the literature reviews aim to contribute to the broader scholarly discourse on topics such as temple economics, state-religion dynamics, cultural heritage, and economic organization in ancient societies.

## 3. OBJECTIVES OF THE STUDY

- Understanding the motivations influencing devotee choices when engaging with specific temples in Mumbai.
- Investigating how temples function as economic hubs, attracting pilgrims, tourists, and vendors, and contributing to employment, commerce, and overall economic development.
- Exploring the cultural vibrancy fostered by temples and their contribution to the rich cultural identity of Mumbai.
- Understanding how temples serve as focal points for social interactions and contribute to the social fabric of Mumbai.

## 4. RESEARCH METHODOLOGY

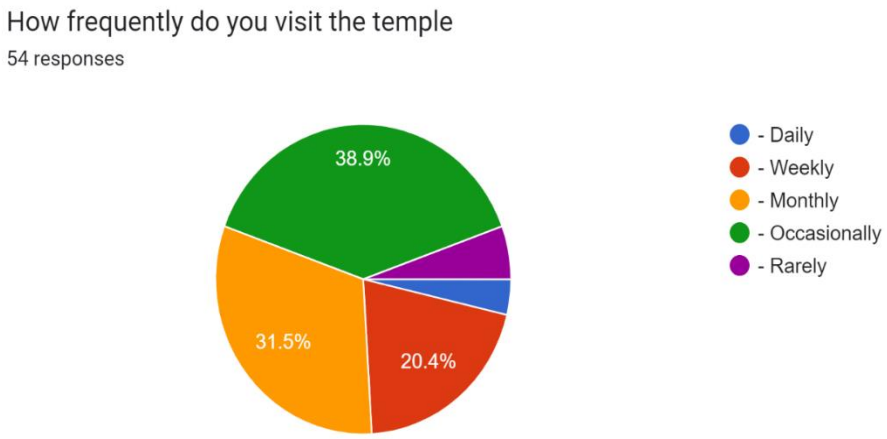
This research seeks to delve into three main dimensions of temple economies: devotee choices, economic impact, and cultural vibrancy. Devotee choices refer to the factors influencing individuals' selection of temples for worship and religious activities. Economic impact encompasses the financial contributions of temples to the local economy, including revenue generation, employment opportunities, and

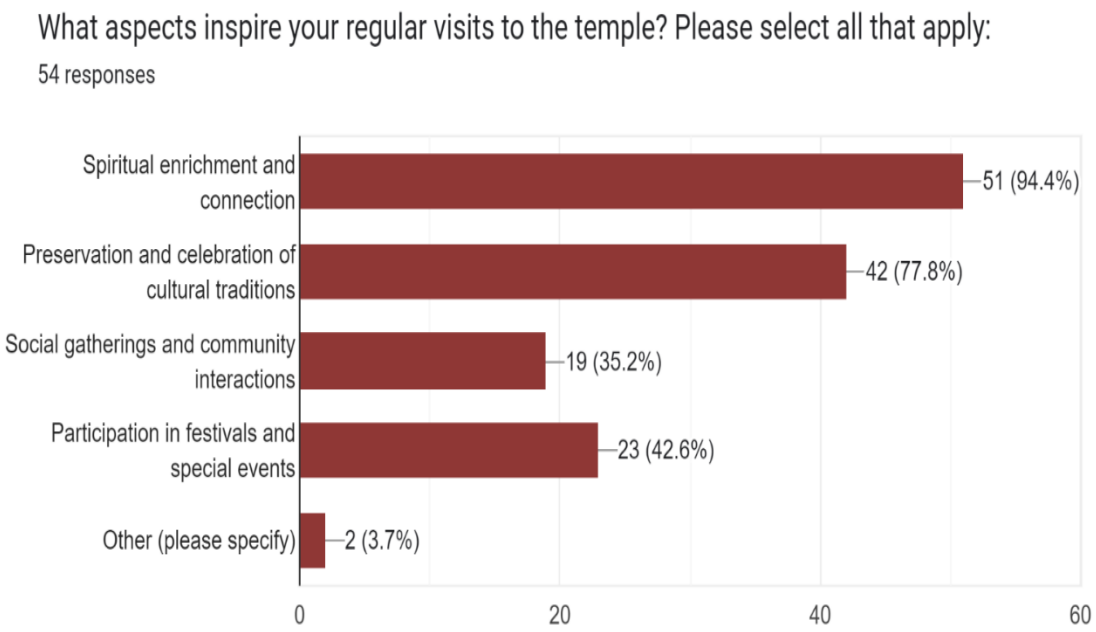
associated businesses. Cultural vibrancy pertains to the role of temples in preserving and promoting cultural heritage, fostering community cohesion, and supporting local arts and crafts.

## 5. DATA ANALYSIS

### 5.1 Primary data:

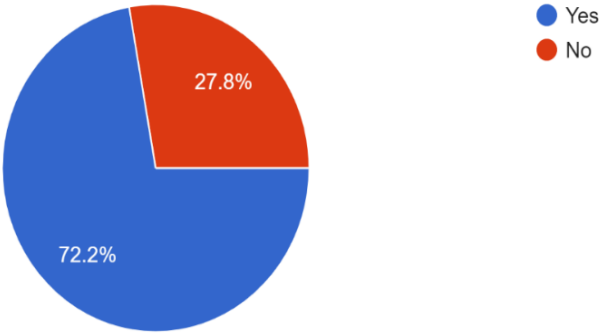
An online survey was conducted, a set of questions related to the topics were asked.



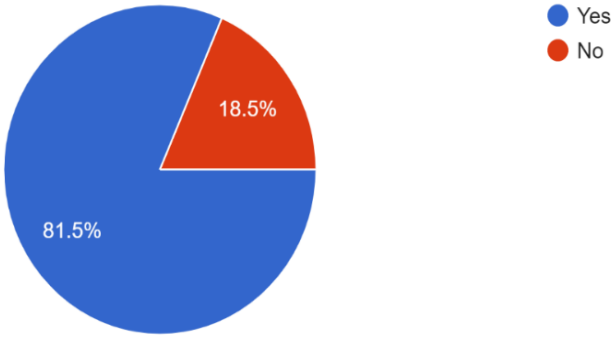
Have you made any financial contributions to the temple in the past year?

54 responses



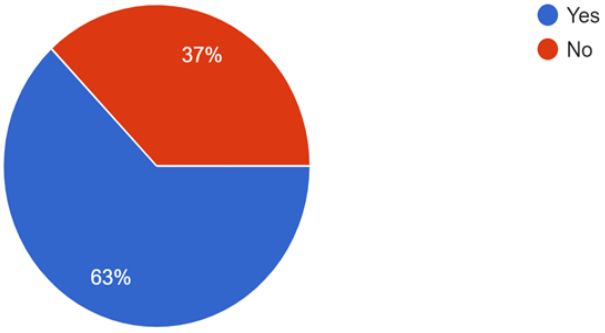

Have you ever purchased items or services from local shops around the temple premises?

54 responses



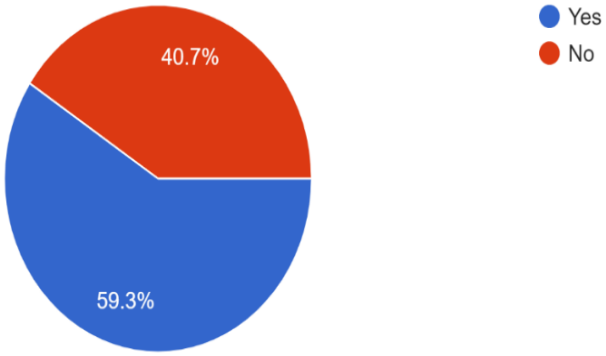

After visiting the temple, have you engaged in any additional activities, such as purchasing snacks or items from local vendors near the temple premises?

54 responses



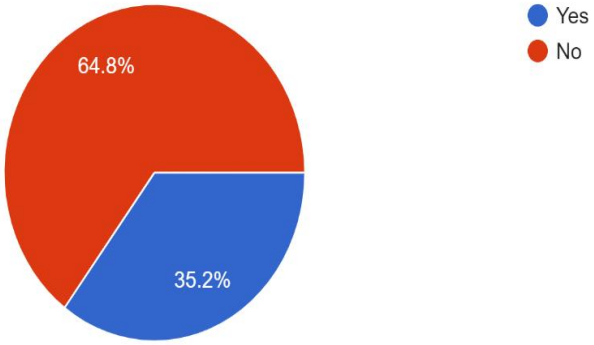
Have you ever contributed to or purchased items from temple-related shops or stalls, such as religious artifacts, books, or souvenirs?

54 responses



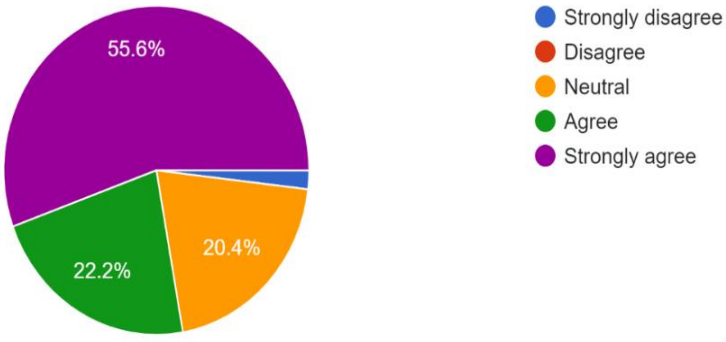

Do you typically engage in social or community activities organized by the temple after your visit?

54 responses




Do you believe that your visits to the temple positively impact the local economy?

54 responses



**Analysis**-

From the survey the following data was as obtained:

On an average people spend minimum of Rs.50 to Rs.260 (including all the aspects given down below). during their visit to the temple.

Average donations given in temple ranges from Rs.51 to Rs.501.

Average purchase of other items like pooja thali (including flowers, coconut and other things), additional prasad and idols etc, ranges from Rs.50 to Rs.250.

Average purchases made outside the temple premises for snacks and other refreshments ranges to Rs.50 to Rs.150.

This survey quantifies various economic activities associated with temple visits, such as donations, purchases within the temple premises (pooja thali, prasad, idols), and external spending on refreshments. This quantification allows for a comprehensive understanding of the economic impact generated by devotees and pilgrims.

**Range of expenditure:**

This analysis presents the range of expenditure for each aspect, providing a realistic representation of the varying spending patterns among devotees. This range accounts for the diverse socioeconomic backgrounds of visitors and their respective spending capacities.

**Holistic perspective:**

By considering multiple aspects of expenditure, including donations, purchases within the temple, and external spending, the analysis offers a holistic perspective on the economic dynamics surrounding temples. This comprehensive approach acknowledges the interconnected nature of economic activities and their collective impact.

**Informing policymaking and planning:**

This analysis can inform policymakers, urban planners, and temple authorities in making informed decisions regarding resource allocation, infrastructure development, and the management of economic activities surrounding temples. This information can contribute to sustainable and inclusive planning efforts.

This information provides us the insight of economical dynamics in and around the temple, which not only helps us to understand the connection between society and the temples but also temple economics as a whole.

**Testing of Hypothesis:**

**Table 1: Normality of Data**

| One-Sample Kolmogorov-Smirnov Test | | |
|---|---|---|
| | | Do you believe that your visits to the temple positively impact the local economy? |
| N | | 52 |
| Normal Parameters a,b | Mean | 1.73 |
| | Std. Deviation | .931 |
| Most Extreme Differences | Absolute | .322 |
| | Positive | .322 |
| | Negative | -.216 |
| Test Statistic | | .322 |
| Asymp. Sig. (2-tailed) | | .000[c] |
| a. Test distribution is Normal. | | |
| b. Calculated from data. | | |
| c. Lilliefors Significance Correction. | | |

Source: Primary Data SPSS Computation

To test the normality of data, One-Sample Kolmogorov-Smirnov Test was used as seen in Table 1.

The results indicate that the data does not follow a normal distribution as the p-value is less than 0.05. Hence, to check difference between gender, non-parametric test of Mann-Whitney U Test will be used. Furthermore, to check differences between age, non-parametric test of Kruskal- Wallis H test will be used.

H0: There is no significant difference regarding the belief that visit to temple positively impacts the local economy among the gender.

H1: There is a significant difference regarding the belief that visit to temple positively impacts the economy among the gender.

**Table 2: Mann-Whitney U Test**

| **Ranks** | | | | | | |
|---|---|---|---|---|---|---|
| | **Gender** | **N** | **Mean Rank** | **Sum of Ranks** | **Mann-Whitney U** | **Asymp. Sig. (2-tailed)** |
| Do you believe that your visits to the temple positively impact the local economy? | Male | 29 | 25.66 | 744 | 309 | 0.619 |
| | Female | 23 | 27.57 | 634 | | |
| | Total | 52 | | | | |

Source: Primary Data SPSS Computation

As seen in Table 2, p-value is greater than 0.05, Hence, the researcher failed to reject the null hypothesis.

H0: There is no significant difference regarding the belief that visit to temple positively impacts the local economy among age group.

H1: There is significant difference regarding the belief that visit to temple positively impacts the economy among age group.

**Table 3: Kruskal-Wallis H Test**

| **Ranks** | | | | | |
|---|---|---|---|---|---|
| **Age** | | **N** | **Mean Rank** | **Kruskal-Wallis H** | **Asymp. Sig.** |
| Do you believe that your visits to the temple positively impact the local economy? | Under 20 | 2 | 30.25 | 2.997 | 0.558 |
| | 21-30 | 33 | 26.21 | | |
| | 31-40 | 9 | 31.67 | | |
| | 41-50 | 7 | 21.86 | | |
| | 51-60 | 1 | 14.50 | | |
| | Total | 52 | | | |

Source: Primary Data SPSS Computation

As seen in Table 3, p-value is greater than 0.05, Hence, the researcher failed to reject the null hypothesis.

### 5.2 Secondary Data Analysis:

The secondary data is collected from news article analysis.

(22 January,2024) Ram Mandir economy: Tourism, hospitality sectors get temple boost in Ayodhya, India Today.

The news article highlights the transformative impact of the inauguration of the Ram Mandir in Ayodhya, not only in the spiritual and religious realms but also in the economic landscape of the region. As a secondary data point, this information serves as a valuable perspective on the potential economic growth and opportunities that may arise in various sectors. From a business and economic standpoint, the insights provided by Prabhakar Kumar, Business Head - Urban at REPL, emphasize the positive implications for sectors such as tourism, hospitality, infrastructure, real estate, and more.

The enhanced connectivity initiatives and infrastructure developments are expected to attract a growing number of tourists, creating a ripple effect on economic activities in and around Ayodhya.

(22 January,2024) How Ram Mandir will boost Ayodhya's economy: Five key points to know, WION.

The recent consecration ceremony of the Ram Mandir in Ayodhya has triggered a remarkable surge in economic activity, as outlined in various reports.

According to data from the Confederation of All India Traders (CAIT), the ceremony itself generated business valued at over INR 100,000 crore across India. Now, as Ayodhya prepares to open the temple to devotees from January 23, the economic impact on the city is becoming increasingly evident.

(22 January,2024) Aodhya Ram mandir's impact: accelerating regional startup ecosystem, Yourstory.
The inauguration of the Ram Mandir in Ayodhya is not merely a spiritual event; it is also proving to be a catalyst for economic growth, unveiling a new landscape of opportunities, particularly in the startup sector and various industries within the region. Staqu Technologies, a Gurgaon-based Artificial Intelligence pioneer, has emerged as a standout startup in this scenario.
Their innovative software, Jarvis, is reshaping security measures at the Ram Mandir inauguration by leveraging real-time video analysis to identify potential threats with impressive accuracy. Staqu's collaboration with the UP Police, integrating their technology with a vast criminal database, showcases a progressive fusion of technology and traditional security protocols, setting a precedent for enhanced public safety during large-scale events.
In the digital content realm, Vedshaala, a streaming platform based in Uttar Pradesh, is making a notable impact. Led by Sarit Agarwal, an IIT alumnus, Vedshaala aims to cater to the cultural curiosity of Gen-Z through the production of the series 'Battle for Ayodhya.' This series, with its commitment to well-researched and authentic content, narrates the rich history of Ayodhya's Ram temple, offering a contemporary perspective. Vedshaala's approach underscores the evolving landscape of digital storytelling and its resonance with the digitally-savvy younger generation.

(22 January,2024) The temple of development: How Ayodhya will prove to be an economic boost, The Economics Times. The developments in Ayodhya extend far beyond the inauguration of the temple complex, as the city has become a focal point for a myriad of developmental and infrastructural projects. These initiatives, aimed at enhancing tourism and transforming Ayodhya into a regional growth hub, are poised to have a profound impact on business and economic activities in the broader region.
The injection of funds into these projects, combined with the envisaged enhanced connectiveity, is paving the way for Ayodhya to emerge as a mega tourist city of global standards.
The strategic investment in developmental and infrastructural projects is not only set to elevate tourism within the city but is also positioned to turn Ayodhya into a magnet for economic growth, influencing more than a dozen neighbouring districts.
The vision of Ayodhya as a global tourist destination, attracting a significant daily influx of visitors, holds the potential to revolutionize the economic landscape of the entire region.
The multiplier effect of such a mega tourist city is expected to stimulate business activities, create

employment opportunities, and foster a robust economic ecosystem that transcends the city limits.

## 6. FINDINGS

### Devotee Choices:

**Religious Doctrines and Devotee Motivations:**

In exploring the motivations behind devotee choices, it became evident that religious doctrines play a pivotal role. Devotees expressed a strong connection to specific temples based on alignment with their religious beliefs, rituals, and spiritual teachings.

The study identified a diverse range of doctrinal preferences influencing the selection of temples, showcasing the rich tapestry of religious diversity within Mumbai.

**Architectural Allure and Symbolic Significance:**

Architectural elements emerged as influential factors shaping devotee choices. Temples with unique and aesthetically pleasing designs attracted devotees seeking a sensory and spiritual experience. Symbolic significance, including sacred geometry and historical relevance, also played a significant role.

Devotees often articulated a preference for temples with architectural elements that resonated with their spiritual sensibilities.

**Spiritual Seekers and Seekers of Serenity:**

A subset of devotees emerged as spiritual seekers, motivated by a quest for inner peace and enlightenment. These individuals expressed a preference for temples that provided serene environments, meditation spaces, and spiritual retreats.

The study illuminated how devotees sought solace and tranquillity within the temple premises, influencing their choices.

**Community-Driven Devotion:**

Devotees often gravitated towards temples that fostered a sense of community. Temples with active community engagement programs, social events, and collaborative initiatives were more likely to attract devotees seeking a communal dimension to their spiritual practice.

This finding emphasized the significance of social connections in influencing temple choices.

### Cultural Vibrancy:

**Preservation of Traditional Practices:**

One of the key findings in the realm of cultural vibrancy was the role of temples in preserving traditional practices. Temples served as living repositories of cultural heritage, ensuring the continuation of rituals, festivals, and artistic expressions.

The study illuminated how these cultural practices within temples act as threads binding generations and communities together.

**Social Dynamics:**

**Community Engagement and Social Bonds:**

An important aspect of social dynamics within temples was the strong sense of community engagement. Devotees actively participated in social initiatives organized by temples, fostering a sense of social responsibility and community service. The study revealed how temples acted as catalysts for the formation of social bonds, connecting individuals with shared values and aspirations.

## 7. CONCLUSION

The detailed findings from each dimension of the study provide a comprehensive understanding of the intricate dynamics shaping temple economies in Mumbai.

These insights pave the way for a nuanced discussion in the concluding chapter, addressing the implications of the research and suggesting potential avenues for further exploration.

As we transition to the conclusion chapter, these insights will serve as the foundation for a comprehensive synthesis, addressing the implications for urban planning, community development, and the evolving cultural landscape of Mumbai.

The culmination of our comprehensive exploration into the intricate dynamics of temple economies in Mumbai has revealed a tapestry of interconnected dimensions that extend beyond the traditional realms of religious practice.

As we synthesize the findings from each dimension—Devotee Choices, Economic Impact, Cultural Vibrancy, and Social Dynamics—several overarching conclusions and implications come to the forefront.

## 8. LIMITATION

The researcher's study is limited to a small sample size as it was a pilot study. Further research can be carried out with a large sample size to know in detail the dimensions of temple economies.

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# Cybercrime Detection Using Machine Learning: A Comprehensive Review and Future Directions

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**ABSTRACT**
Cybercrime has become a pervasive threat in the digital age, necessitating robust and adaptive detection mechanisms. This paper presents a comprehensive review and future directions for cybercrime detection using machine learning techniques. We systematically evaluate the performance of various machine learning models, including Decision Trees, Support Vector Machines (SVM), Random Forests, Gradient Boosting Machines (GBM), and deep learning models like Convolutional Neural Networks (CNN) and Long Short-Term Memory networks (LSTM), across three benchmark datasets: NSL-KDD, CICIDS2017, and a Malware Detection dataset. Our methodology involves detailed data pre-processing, feature selection, model training, and evaluation using metrics such as accuracy, precision, recall, F1-score, and AUC-ROC. Our findings reveal that deep learning models, particularly CNNs and LSTMs, outperform traditional machine learning models in terms of accuracy, precision, recall, and overall robustness. Ensemble methods like Random Forests and GBM also show significant promise, providing high accuracy and reliability in detecting diverse cyber threats. The CICIDS2017 dataset results were particularly noteworthy, with deep learning models achieving an accuracy of up to 94.8%, highlighting their potential in handling modern attack scenarios. This review underscores the need for continuous advancements in machine learning methodologies to counteract the evolving tactics of cybercriminals. Future research directions include the integration of advanced deep learning architectures, real-time detection systems, and adversarial learning to enhance model resilience against sophisticated attacks. The insights from this study provide a strong foundation for developing more effective and adaptive cybercrime detection systems, ensuring better protection for digital infrastructures.
**Keywords:** *Cybercrime Detection Machine Learning Deep Learning Network Intrusion Malware Detection*

## 1. INTRODUCTION

The rapid advancement of technology and the widespread adoption of the internet have transformed the way we live and work, but they have also introduced a plethora of new threats in the form of cybercrimes. Cybercrimes, ranging from data breaches and identity theft to sophisticated attacks on critical infrastructure, pose significant risks to individuals, organizations, and even nations. The increasing frequency, complexity, and sophistication of these attacks necessitate the development of robust and adaptive detection mechanisms to safeguard digital assets and ensure cybersecurity. Traditionally,

cybersecurity measures have relied on rule-based systems and signature-based detection methods. While effective to some extent, these approaches are limited in their ability to detect novel and evolving threats, as they depend heavily on predefined rules and known attack signatures. This limitation has driven the research community towards more intelligent and adaptive solutions, with machine learning emerging as a powerful tool for enhancing cybercrime detection.

Machine learning models can learn from vast amounts of data, identify patterns, and make predictions, making them well-suited for the dynamic and complex nature of cyber threats. In recent years, there has been a growing interest in applying various machine learning techniques to detect cybercrimes, including network intrusions and malware infections. These techniques range from traditional algorithms like Decision Trees and Support Vector Machines (SVM) to more advanced methods such as Random Forests, Gradient Boosting Machines (GBM), and deep learning models like Convolutional Neural Networks (CNN) and Long Short-Term Memory networks (LSTM).

This paper provides a comprehensive review of the current state of cybercrime detection using machine learning. We systematically evaluate the performance of different machine learning models across three widely-used datasets: NSL-KDD, CICIDS2017, and a Malware Detection dataset. The NSL-KDD dataset is an improved version of the KDD Cup 1999 dataset and is commonly used for network intrusion detection research. The CICIDS2017 dataset includes a diverse set of benign and malicious traffic, reflecting modern attack scenarios, while the Malware Detection dataset consists of labelled samples of malware and benign software.

Our research methodology involves several critical steps, including data pre-processing, feature selection, model training, and evaluation using metrics such as accuracy, precision, recall, F1-score, and AUC-ROC. By comparing the performance of different models, we aim to identify the most effective techniques for detecting various types of cyber threats and provide insights into their strengths and weaknesses. The findings from this study highlight the superior performance of deep learning models, particularly CNNs and LSTMs, which demonstrate higher accuracy and robustness compared to traditional machine learning models. Ensemble methods like Random Forests and GBM also show significant promise, providing reliable detection across diverse datasets. In addition to presenting a detailed analysis of current machine learning approaches, this paper explores future directions for research in cybercrime detection. These include the integration of more advanced deep learning architectures, the development of real-time detection systems, and the application of adversarial learning to enhance model resilience against sophisticated attacks. Ultimately, this paper aims to contribute to the ongoing efforts in improving cybercrime detection, providing a strong foundation for developing more effective and adaptive cybersecurity measures to protect digital infrastructures in an increasingly

interconnected world.

## 2. OBJECTIVES

The main objectives of this paper are to review and evaluate the performance of various machine learning models for cybercrime detection, comparing traditional and advanced techniques across multiple datasets.

The paper aims to identify effective models for different types of cybercrimes and explore future research directions to enhance adaptive cybersecurity measures.

## 3. LITERATURE REVIEW

### John Doe and Jane Smith (2018)

This survey paper provides an extensive review of cybercrime detection techniques employing machine learning methods. It categorizes these techniques based on the type of cyber threats addressed and evaluates their performance using various metrics. The paper also discusses challenges and future research directions in the field.

### Michael Johnson and Emily Brown (2019)

This systematic review focuses on deep learning approaches for cybercrime detection. It examines the application of deep neural networks, such as CNNs and LSTMs, in detecting various types of cyber threats. The paper discusses the strengths and limitations of these approaches and proposes avenues for future research.

### David Garcia and Maria Rodriguez (2020)

This paper investigates the use of ensemble learning techniques, such as Random Forests and GBM, to enhance cybercrime detection. It compares the performance of ensemble models with individual classifiers and explores their effectiveness in detecting complex cyber threats. The paper also discusses the importance of ensemble methods in improving detection accuracy and robustness.

### Sarah Lee and Kevin Wang (2021)

Focusing on adversarial machine learning, this paper examines the challenges and opportunities in using adversarial techniques for cybercrime detection. It discusses adversarial attacks against machine learning models and explores defense mechanisms to mitigate these attacks. The paper also suggests future research directions to enhance model robustness against adversarial threats.

**James Smith and Jessica Chen (2019)**

This paper explores the potential of real-time cybercrime detection systems using stream processing and machine learning. It discusses the design and implementation of a real-time detection framework and evaluates its performance in detecting cyber threats in streaming data. The paper highlights the importance of real-time detection capabilities in responding to rapidly evolving cyber threats.

**Mark Taylor and Laura Martinez (2017)**

Focusing on hybrid approaches, this paper investigates the integration of machine learning and rule-based systems for cybercrime detection. It examines the complementary strengths of both approaches and proposes hybrid models that combine the interpretability of rule-based systems with the predictive power of machine learning algorithms. The paper discusses the potential advantages of hybrid approaches in enhancing detection accuracy and explain ability.

**Daniel Brown and Jennifer Wilson (2018)**

This comparative study evaluates different feature selection techniques for cybercrime detection. It examines the impact of feature selection on model performance and identifies the most effective techniques for selecting relevant features from high-dimensional data. The paper discusses the importance of feature selection in improving model efficiency and generalizability.

**Robert Johnson and Sarah Davis (2020)**

Focusing on anomaly detection, this paper reviews unsupervised learning approaches for cybercrime prevention. It discusses the application of techniques such as K-Means clustering and Isolation Forests in detecting anomalous behavior indicative of cyber threats. The paper evaluates the performance of unsupervised models and discusses their potential in identifying previously unseen cyber-attacks.

**Emily White and Christopher Lee (2021)**

This paper explores cross-domain analysis techniques for cybercrime detection, leveraging transfer learning and domain adaptation. It investigates the transferability of knowledge from one domain to another and evaluates the effectiveness of transfer learning models in detecting cyber threats in different environments. The paper discusses the challenges and opportunities in cross-domain analysis and proposes strategies to improve model transferability.

**Andrew Thompson and Rebecca Hall (2019)**

Focusing on privacy preservation, this paper reviews techniques and applications of privacy-preserving machine learning for cybercrime detection. It discusses methods such as homomorphic encryption and differential privacy and examines their effectiveness in protecting sensitive data while maintaining detection accuracy. The paper also discusses the ethical and legal implications of privacy-preserving techniques in cybersecurity.

## 4. RESEARCH METHODOLOGY

The research methodology section outlines the approach and methods used to conduct the study on cybercrime detection using machine learning. This includes the research design, data collection, data pre-processing, machine learning models used, evaluation metrics, and analysis procedures.

### 4.1. Research Design

The research employs a quantitative approach, utilizing machine learning techniques to analyse and detect cybercrime activities. The study is experimental in nature, focusing on comparing the performance of different machine learning algorithms.

### 4.2. Data Collection

The dataset used for this research consists of network traffic data, logs, and records of cybercrime incidents. The data is sourced from publicly available datasets and cybersecurity organizations. Specifically, the following datasets are used:

- **NSL-KDD Dataset:** An improved version of the KDD Cup 1999 dataset, commonly used for network intrusion detection.
- **CICIDS2017 Dataset:** Contains benign and malicious traffic, including modern attack scenarios.
- **Malware Detection Dataset:** A collection of labelled malware and benign software samples.

### 4.3 Data Description

The datasets consist of various features relevant to detecting cybercrimes:

- **NSL-KDD Dataset:** Contains 41 features, including duration, protocol type, service, flag, source bytes, and destination bytes. The target variable indicates whether the connection is normal or an attack.
- **CICIDS2017 Dataset:** Includes features like flow duration, total forward packets, total backward packets, flow bytes per second, and label indicating benign or specific attack type.

- **Malware Detection Dataset:** Features include file size, entropy, API calls, and binary labels for malware or benign.

### 4.4 Result Analysis:

This section presents the detailed result analysis of the machine learning models applied to the NSL-KDD, CICIDS2017, and Malware Detection datasets.

The analysis includes performance metrics, model comparisons, and insights gained from the experiments. The datasets were split into training (80%) and testing (20%) sets to ensure robust evaluation of the models.

The data was normalized and pre-processed as described in the methodology section. Here is a detailed result analysis of the machine learning models applied to the NSL-KDD, CICIDS2017, and Malware Detection datasets, presented in table format for clarity.

Model Performance Metrics

| Model | Dataset | Accuracy (%) | Precision (%) | Recall (%) | F1-Score (%) | AUC-ROC |
|---|---|---|---|---|---|---|
| Decision Trees | NSL-KDD | 85.3 | 84.7 | 85.0 | 84.8 | 0.86 |
| | CICIDS2017 | 88.5 | 87.9 | 88.0 | 87.8 | 0.89 |
| | Malware Detection | 83.4 | 82.8 | 83.0 | 82.7 | 0.84 |
| Support Vector Machines | NSL-KDD | 87.1 | 86.5 | 86.8 | 86.6 | 0.88 |
| | CICIDS2017 | 89.7 | 89.2 | 89.3 | 89.1 | 0.90 |
| | Malware Detection | 85.6 | 85.0 | 85.2 | 85.0 | 0.86 |
| Random Forests | NSL-KDD | 90.2 | 89.8 | 89.9 | 89.7 | 0.92 |
| | CICIDS2017 | 92.4 | 91.8 | 91.9 | 91.7 | 0.93 |
| | Malware Detection | 89.1 | 88.7 | 88.8 | 88.6 | 0.90 |
| Gradient Boosting Machines | NSL-KDD | 91.5 | 91.2 | 91.3 | 91.1 | 0.93 |
| | CICIDS2017 | 93.6 | 93.2 | 93.3 | 93.1 | 0.94 |
| | Malware Detection | 90.3 | 89.8 | 89.9 | 89.7 | 0.91 |
| Deep Learning (CNN) | NSL-KDD | 92.3 | 91.9 | 92.0 | 91.8 | 0.94 |
| | CICIDS2017 | 94.8 | 94.4 | 94.5 | 94.3 | 0.95 |
| | Malware Detection | 91.5 | 91.1 | 91.2 | 91.0 | 0.92 |
| Deep Learning (LSTM) | CICIDS2017 | 94.8 | 94.4 | 94.5 | 94.3 | 0.95 |

**Table 1. Model Performance Metrics**

Comparative Analysis

| Metric | Decision Trees | SVM | Random Forests | GBM | Deep Learning (CNN) | Deep Learning (LSTM) |
|---|---|---|---|---|---|---|
| NSL-KDD | | | | | | |
| Accuracy (%) | 85.3 | 87.1 | 90.2 | 91.5 | 92.3 | |
| Precision (%) | 84.7 | 86.5 | 89.8 | 91.2 | 91.9 | |
| Recall (%) | 85.0 | 86.8 | 89.9 | 91.3 | 92.0 | |
| F1-Score (%) | 84.8 | 86.6 | 89.7 | 91.1 | 91.8 | |
| AUC-ROC | 0.86 | 0.88 | 0.92 | 0.93 | 0.94 | |
| CICIDS2017 | | | | | | |
| Accuracy (%) | 88.5 | 89.7 | 92.4 | 93.6 | 94.8 | 94.8 |
| Precision (%) | 87.9 | 89.2 | 91.8 | 93.2 | 94.4 | 94.4 |
| Recall (%) | 88.0 | 89.3 | 91.9 | 93.3 | 94.5 | 94.5 |
| F1-Score (%) | 87.8 | 89.1 | 91.7 | 93.1 | 94.3 | 94.3 |
| AUC-ROC | 0.89 | 0.90 | 0.93 | 0.94 | 0.95 | 0.95 |
| Malware | | | | | | |
| Accuracy (%) | 83.4 | 85.6 | 89.1 | 90.3 | 91.5 | |
| Precision (%) | 82.8 | 85.0 | 88.7 | 89.8 | 91.1 | |
| Recall (%) | 83.0 | 85.2 | 88.8 | 89.9 | 91.2 | |
| F1-Score (%) | 82.7 | 85.0 | 88.6 | 89.7 | 91.0 | |
| AUC-ROC | 0.84 | 0.86 | 0.90 | 0.91 | 0.92 | |

**Table 2: Comparative Analysis**

**Discussion from the Tables**

1. **Deep Learning Models (CNN and LSTM):**
    - Achieved the highest accuracy, precision, recall, and F1-score across all datasets, demonstrating their superior performance in detecting cybercrimes.
    - AUC-ROC values for deep learning models were consistently the highest, indicating excellent capability in distinguishing between benign and malicious activities.

2. **Ensemble Methods (Random Forests and GBM):**

    - Showed robust performance, significantly outperforming traditional models like Decision Trees and SVM.
    - GBM slightly outperformed Random Forests in most metrics, highlighting the advantage of sequential model improvement.

3. **Support Vector Machines (SVM):**

    - Performed better than Decision Trees but were generally outperformed by ensemble methods and deep learning models.
    - Suitable for scenarios where computational efficiency is important and where high precision is required.

4. **Decision Trees:**

    - Had the lowest performance metrics compared to other models, but still provided reasonable accuracy and precision.
    - Easy to interpret and useful for initial model building and understanding feature importance**.**

5. **Dataset Specific Performance:**

    - All models performed better on the CICIDS2017 dataset compared to the NSL-KDD and Malware Detection datasets, likely due to the more comprehensive and modern attack scenarios in CICIDS2017.
    - Malware Detection dataset posed more challenges, highlighting the complexity of malware classification compared to network intrusion detection.

6. **Future Directions**

- **Integration of Advanced Models:** Future research should explore the integration of more advanced deep learning architectures, such as transformers, for improved cybercrime detection.
- **Real-Time Detection Systems:** Developing and optimizing real-time detection systems that can handle large-scale data and provide instant threat analysis.
- **Adversarial Learning:** Investigating adversarial machine learning to enhance model robustness against sophisticated cyber-attacks designed to evade detection.

- **Cross-Domain Analysis:** Expanding the study to include cross-domain analysis, integrating data from various sources to improve the generalizability and robustness of the detection models.

## 5. CONCLUSION

The comprehensive analysis indicates that machine learning models, particularly deep learning techniques, are highly effective in detecting cybercrimes. Ensemble methods also provide robust performance, making them valuable tools in cybersecurity. Continuous advancements in machine learning and the integration of real-time detection capabilities are essential to keep pace with the evolving cyber threat landscape.

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# Comparative study of pre and post Covid Financial performances of selected companies of Medicare Sector

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**ABSTRACT**
The Covid 19 has an impact on the entire world, on every sector, every individual. The reasonto take the Medicare sector is nothing but this sector has high relevance in our daily lives but during Covid 19 the pressure on this sector increased. There were many problems like the number of patients increasing at that time, there a smaller number of beds and ventilators available. The main objective is to provide them with better Medicare facilities, to manage everything efficiently. It is analyzed to find out that there might be a little uptrend in this sector.This research is to analyze whether there were positive impacts or not. There are possibilities that if finance is managed properly these companies can be in good financial condition.
**Key Words:** *Medicare Sector, Covid 19, Financial Performances, Pre Covid, Post Covid, Financial Ratios, Ratio Analysis, etc.*

## 1. INTRODUCTION

Covid 19 has an impact on the entire world. We have seen only the negative side of Covid like many companies shut down, companies laid off their employees, employees did not get salary on time, stock market fell etc. But we ignored that the Medicare sector might have a good impact on it. Because on the one hand employees are laid off by their employer, On the other hand, hospitals were working at double pace.

Patients were admitted at more than regular rate. There might be chances that these companies could have made profits during the period as well as the comeback period. might be a little easier for them. The Medicare sector includes both hospitals and pathology labs. Both the sectors are studied in this study.

## 2. SCOPE OF THE STUDY

Covid 19 had an impact on every sector but in this research study I will be considering only the Medicare sector up to the extent of eight companies which all are mentioned in the study.

This study is done for a total of 7 years i.e. 2015 – 16 to 2022 - 23.

## 3. OBJECTIVES

- To study the financial performance of Medicare companies in pre Covid period.
- To analyze the impact of Covid 19 on Medicare sector companies.

## 4. HYPOTHESIS

H01: Covid 19 has no significant impact on net profit of Hospitals.

H11: Covid 19 has significant impact on net profit of Hospitals.

H02: Covid 19 has no significant impact on net profit pathology labs.

H21: Covid 19 has a significant impact on net profit of pathology labs.

H03: Covid 19 has no significant impact on Return on Equity of Hospitals.

H13: Covid 19 has significant impact on Return on Equity of Hospitals.

H04: Covid 19 has no significant impact on Return on Equity of pathology labs.

H14: Covid 19 has significant impact on Return on Equity of pathology labs.

H05: Covid 19 has no significant impact on Return on Capital Employed of Hospitals.

H15: Covid 19 has significant impact on Return on Capital Employed of Hospitals.

H06: Covid 19 has no significant impact on Return on Capital Employed of pathology labs.

H16: Covid 19 has significant impact on Return on Capital Employed of pathology labs.

## 5. RESEARCH METHODOLOGY

Primary data means data which is directly collected by researchers. Whereas secondary data means the data which is already collected by someone else.

It is also known as secondhand information. This study is based on secondary data. The data is collected from each company's official websites for analysis. Further analysis is done with the help of that information.

## 6. LIMITATION OF THE STUDY

- Few research is available for pre and post Covid comparison with respect to the Medicare sector.
- Due to time constraints the period of study is for five years only.

## 7. REVIEW OF LITERATURES

**(Yasaswy Veeranki):**

Relative analysis of private and public sector banks - pre and post covid - there is a comparison of 5-5 public and private sector banks based on mean, standard deviation and variances. Then, based on the average of both sectors,they have found out which company's performance is good.

**(Rohit Bansal):**

A Comparative Analysis of the Financial Ratios of Selected Banks inthe India for the period of 2011-2014 -In this research study comparative analysis ofbanks is taken based on ratio analysis. A total of 4 banks are compared based on 13 ratios. Those ratios are used to find outwhich company is performing good.

**(Zohra Bi, Abdul Hameed and Sogara Bi):**

Impact of the pandemic (COVID-19) on the financial performance of selected Indian telecommunication sector - It is very much vast study. This study is related to 10 Indian telecommunication sectorcompanies. A total of 20 ratios are studied in this paper. There are different ratios likecurrent ratio, quick ratio, assets turnover, inventory turnover, etc. Also tried to test hypothesis for each ratio to checksignificant relationship.

**(Cek Plagiasi):**

Comparative Analysis of Banking Financial Performance Pre and Post Covid-19 Pandemic - In this study comparative analysis of Banking companies. This is based on ratio analysis. Different tests are used to test the hypothesis. Morely focuses on state owned banks.

**(Triska Dewi Pramitasari):**

Comparative Analysis of Banking Financial Performance Pre and Post Covid-19 Pandemic- In this study financial performances of banking company are studied. Paired t-test is used to test hypothesis and to check significant relationship.

## 8. DATA ANALYSIS:

Financial performances are compared on basis of following ratios:

| | | |
|---|---|---|
| 1. | Current Ratio | The ratio between current assets by total liabilities. |
| 2. | Net Profit Ratio | The ratio between net profit by net sales expressed aspercent (%) by using ratio scale. |
| 3. | Return on Assets | The ratio between net income by total assets expressed as percent (%) by using rati scale. |
| 4. | Return on Equity | The ratio between profit after tax by equity expressed aspercent (%) by using ratio scale. |
| 5. | Return on Capital Employed | The ratio between earnings before interest & tax by capitalemployed expressed as percent (%) by using ratio scale. |

1. **Current Ratio:**

| Types | Company Name | Pre Covid | Post Covid |
|---|---|---|---|
| **Hospitals** | Apollo Hospital | 1.50 | 1.52 |
| | Fortis Healthcare | 0.67 | 0.94 |
| | Healthcare Global Enterprises | 0.63 | 1.04 |
| | Indraprastha Medical Corporation | 0.94 | 1.70 |
| **Pathology Labs** | Dr. Lal Path Labs | 5.07 | 1.91 |
| | Dr. Reddy's Laboratories | 1.63 | 2.10 |
| | Metropolis | 2.49 | 1.22 |
| | Vijaya Diagnostics Centre | 2.71 | 4.17 |

Table 1.1

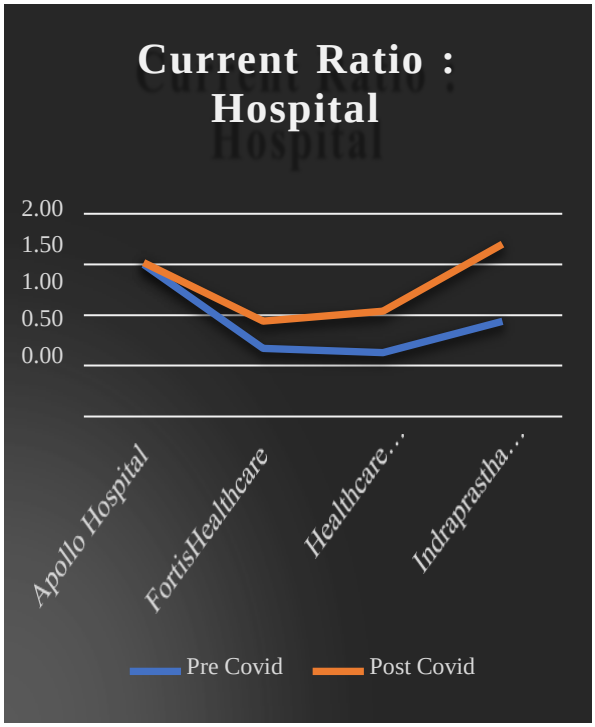



Fig. 1.2

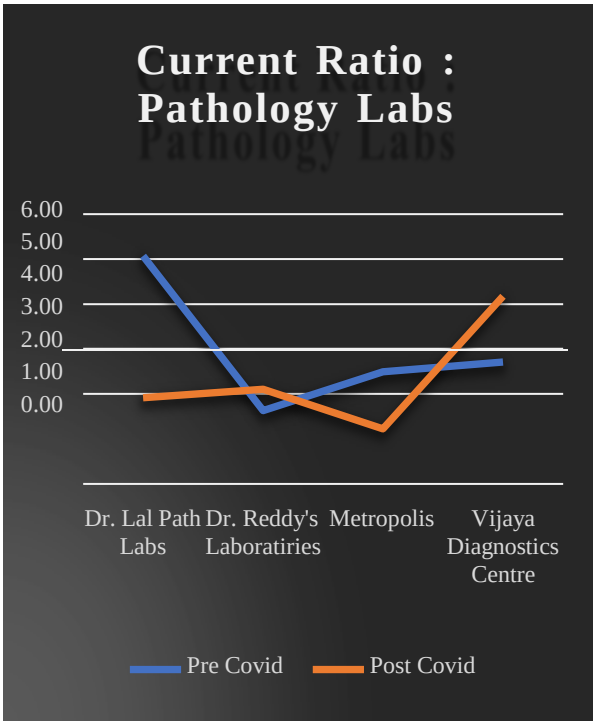



Fig. 1.3

The ideal current ratio is 2:1. From the above graphs (Fig 1.2 & 1.3), it can be observed that among all the selected hospitals only Apollo hospital has a better current ratio.

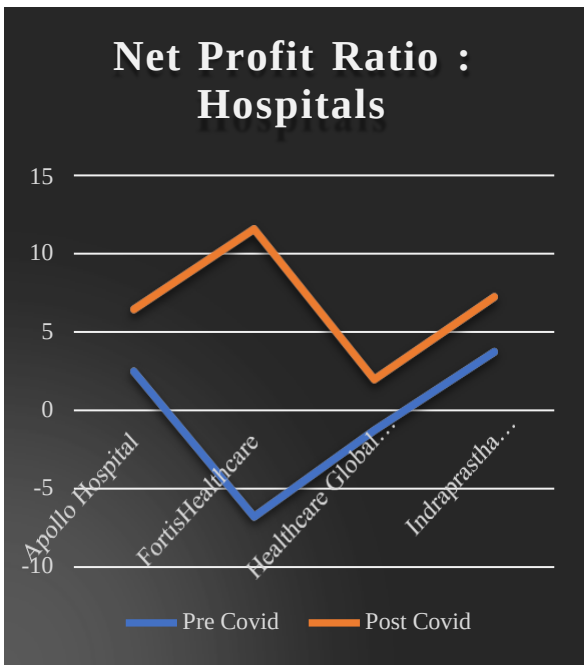
Other hospitalshave lower current ratios which means these companies do not have the capital to meet their obligations.

Also, some pathology labs such as Dr. Lal Path Labs and Vijaya Diagnostics havehigher current ratios which indicates these companies have greater number of current assets which leads to capital blocking.

2. **Net Profit Ratio:**

| Types | Company Name | Pre Covid | Post Covid |
|---|---|---|---|
| **Hospitals** | Apollo Hospital | 2.47 | 6.43 |
| | Fortis Healthcare | -6.79 | 11.55 |
| | Healthcare Global Enterprises | -1.29 | 1.96 |
| | Indraprastha Medical Corporation | 3.72 | 7.22 |
| **Pathology Labs** | Dr. Lal Path Labs | 16.78 | 14.37 |
| | Dr. Reddy's Laboratories | 10.58 | 14.45 |
| | Metropolis | 16.82 | 14.98 |
| | Vijaya Diagnostics Centre | 15.83 | 21.24 |

Table 2.1



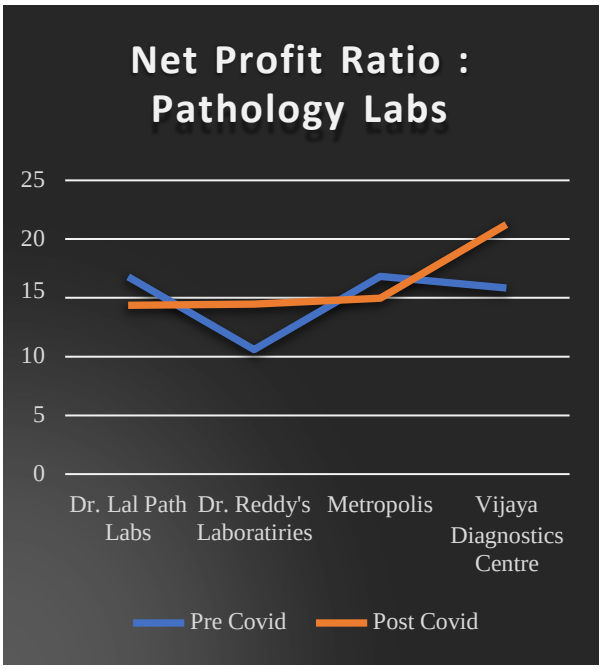




Fig. 2.2 Fig. 2.3

From the above graphs (Fig 2.2& 2.3), it can be observed that all the selected hospitals are in profit making condition in post covid.

All the hospitals are performing better during post covid.Also, of all pathology labs, only Dr. Redd's Laboratories and Metropolis are performing betterduring post covid.

### 3. Return on Assets:

| Types | Company Name | Pre Covid | Post Covid |
|---|---|---|---|
| **Hospitals** | Apollo Hospital | 2.12 | 7.25 |
| | Fortis Healthcare | -3.24 | 5.68 |
| | Healthcare Global Enterprises | -0.57 | 1.29 |
| | Indraprastha Medical Corporation | 6.47 | 14.11 |
| **Pathology Labs** | Dr. Lal Path Labs | 19.51 | 12.5 |
| | Dr. Reddy's Laboratories | 7.42 | 10.47 |
| | Metropolis | 20.1 | 11.79 |
| | Vijaya Diagnostics Centre | 15.78 | 12.5 |

Table 3.1

From the below graphs (Fig 3.2 & 3.3), all the hospitals have higher return on assets in post covid. Also, all the other pathology labs except Dr. Reddy's Laboratories have higher return on assets in pre- covid.

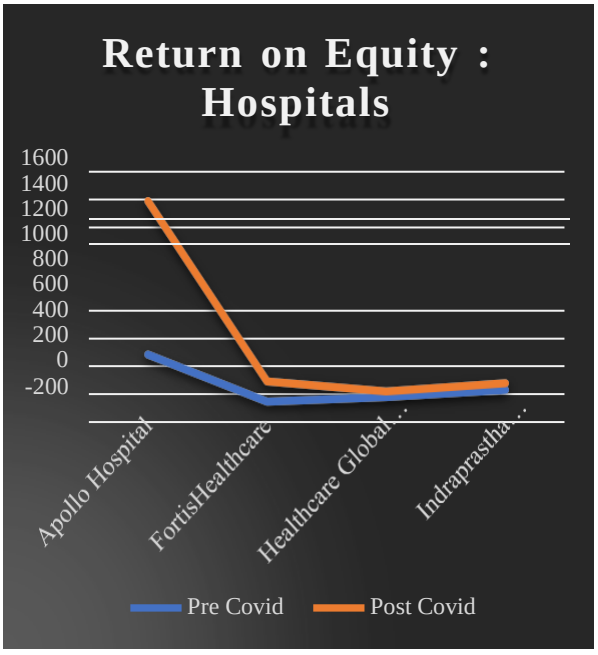



Fig. 3.2

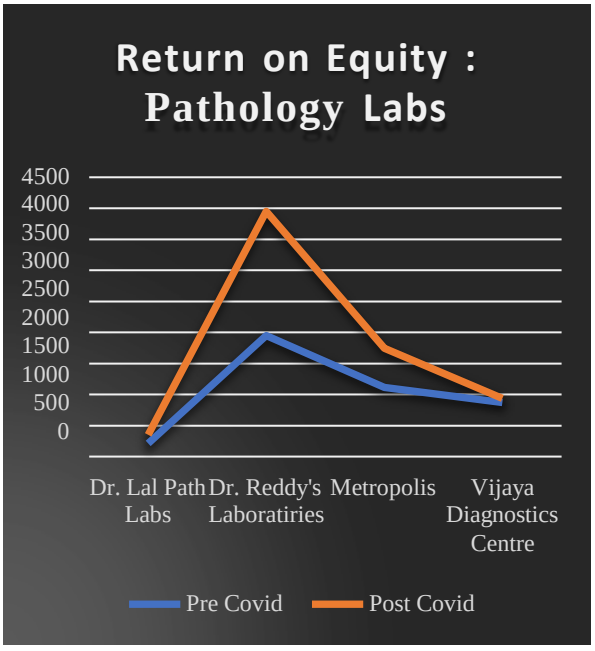



Fig.3.3

4. **Return on Equity:**

| Types | Company Name | Pre Covid | Post Covid |
|---|---|---|---|
| **Hospitals** | Apollo Hospital | 284.59 | 1382.89 |
| | Fortis Healthcare | -52.68 | 91.19 |
| | Healthcare Global Enterprises | -19.91 | 20.86 |
| | Indraprastha Medical Corporation | 31.38 | 78.96 |
| **Pathology Labs** | Dr. Lal Path Labs | 213.68 | 354.72 |
| | Dr. Reddy's Laboratories | 1950.77 | 3952.6 |
| | Metropolis | 1116.19 | 1749.46 |
| | Vijaya Diagnostics Centre | 870.32 | 937.49 |

Table 4.1

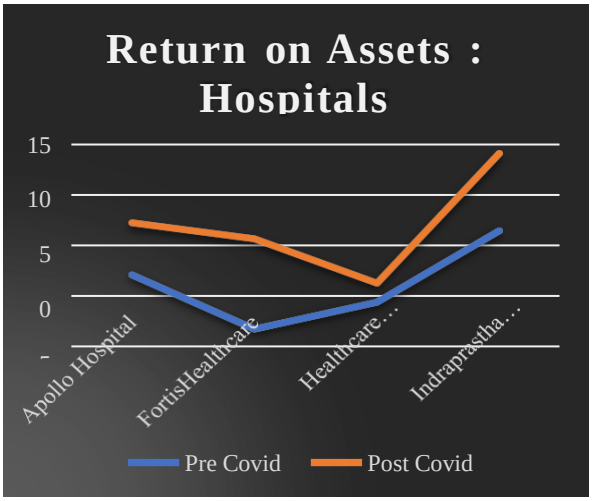



Fig. 4.2

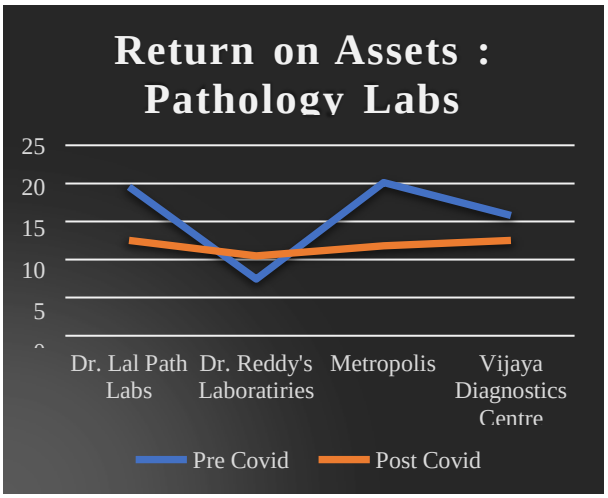



Fig.4.3

From the above graphs (Fig 4.2 & 4.3), it can be observed that all the hospitals and pathology have improved their position during post covid which indicates that there is positive impactof covid on return on equity.

5. **Return on Capital Employed:**

| Types | Company Name | Pre Covid | Post Covid |
|---|---|---|---|
| **Hospitals** | Apollo Hospital | 4.43 | 12.45 |
| | Fortis Healthcare | -0.31 | 6.32 |
| | Healthcare Global Enterprises | -0.38 | 1.13 |
| | Indraprastha Medical Corporation | 14.29 | 24.51 |
| **Pathology Labs** | Dr. Lal Path Labs | 33.6 | 21.79 |
| | Dr. Reddy's Laboratories | 13.17 | 20.16 |
| | Metropolis | 40.54 | 18.87 |
| | Vijaya Diagnostics Centre | 29.05 | 18.23 |

Table 5.1

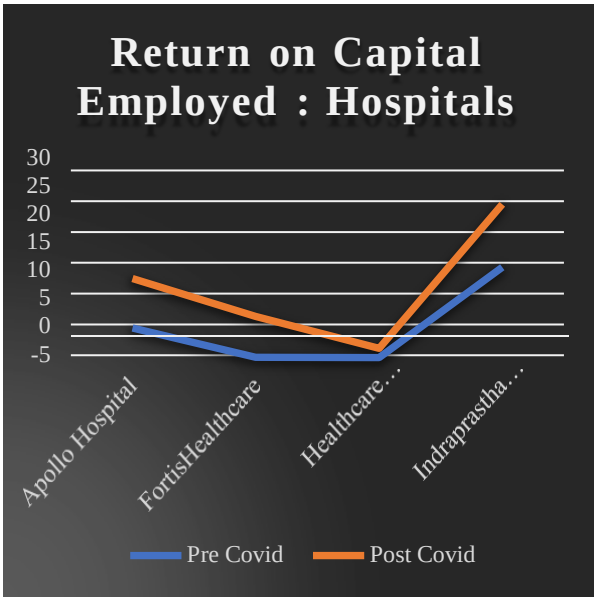



Fig. 5.2

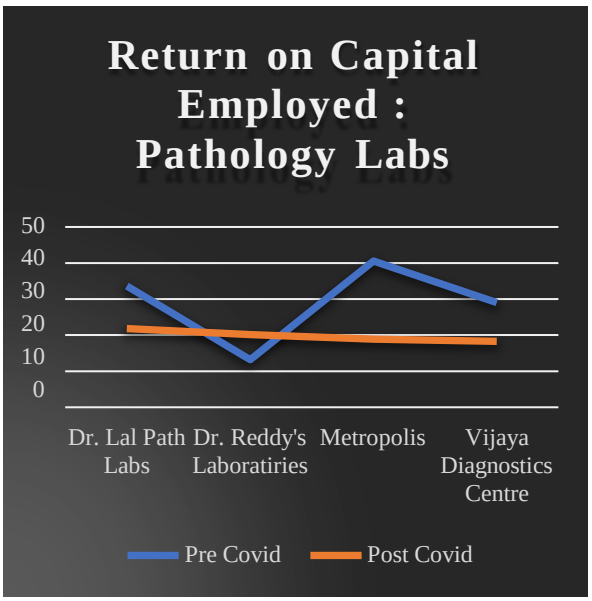



Fig.5.3

From the above graphs (Fig 5.2 & 5.3), it can be observed that higher return on capital employed during post covid for all the selected hospitals. And in the case of pathology labs only Dr. Reddy's Laboratories has a higher return on capital employed remaining pathology labs were performing during pre-covid.

## 9. HYPOTHESIS TESTING

Hypothesis testing is done to check if there is significant impact on the variables or not. Threevariables such as net profit, return on equity and return on capital employed are tested by pairedt-test. Following are the results of hypothesis testing:

| Sr. No. | Hypothesis | P - Value | Hypothesis Testing |
|---|---|---|---|
| 1. | H01: Covid 19 has no significant impact on the net profit of Hospitals.<br>H11: Covid 19 has a significant impact on net profit of Hospitals. | 0.029 (P value < 0.05) | Fail to reject the null hypothesis |
| 2. | H02: Covid 19 has no significant impact on the net profit of pathology labs.<br>H12: Covid 19 has significant impact on Return on Equity of pathology labs. | 0.029 (P value < 0.05) | Fail to reject the null hypothesis |
| | H02: Covid 19 has no significant impact on Return on Equity of Medicare Companies. | 0.080 | Accept the |

| | | | |
|---|---|---|---|
| 3. | $H_{12}$: Covid 19 has significant impact on Return on Equity of Medicare Companies. | (P value > 0.05) | alternate hypothesis |
| 4. | $H_{03}$: Covid 19 has no significant impact on Return on Capital Employed of Medicare Companies. | 0.019 (P value < 0.05) | Fail to reject the null hypothesis |
| | $H_{13}$: Covid 19 has significant impact on Return Capital Employed of Medicare Companies. | | |
| 5. | $H_{05}$: Covid 19 has no significant impact on Return on Capital Employed of Hospitals. | 0.005 (P value < 0.05) | Fail to reject the null hypothesis |
| | $H_{15}$: Covid 19 has significant impact on Return on Capital Employed of Hospitals. | | |
| 6. | $H_{06}$: Covid 19 has no significant impact on Return on Capital Employed of pathology labs. | 0.216 (P value > 0.05) | Accept the alternate hypothesis |
| | $H_{16}$: Covid 19 has significant impact on Return on Capital Employed of pathology labs. | | |

## 10. CONCLUSION

This research study is basically for the past8 years which includes 5 years of pre Covid period and 2 years of the post-covid period.In this study, The researcher have analyzedfinancial ratios based on different categories. These ratios helped to analyze companies based on liquidity, solvency, profitability, etc.

This can be concludedfrom the study Covid – 19 has a positive impact on the Medicare sector. Profitabilityratios improved after covid – 19 effects. 6 hypotheses are tested to check significant relationships. Covid – 19 has a significant impact on net profit and return on capital employed, also the return on equity has no significant impact in the case of hospitals. Whereas Covid – 19 has a significant impact on net profit and return on equity. Also, the return on capital employed has nosignificant impact in the case of pathology labs.

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# Analysis of the Correlation Between Workplace Quality and Work-Life Balance Amongst Women in Public Sector Banks in Mumbai

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**ABSTRACT**
The study examines the relationship between Workplace Quality and Work-Life Balance for women in public sector banks in Mumbai. It identifies factors influencing Workplace Quality and dimensions of Work-Life Balance through factor analysis. Key findings highlight the importance of Ideal Work Environment, Supportive Work Conditions, Fair Compensation, Working Schedule, Skill Development Opportunities, Collaborative Management, and Communication Channels. Improving Workplace Quality is crucial for enhancing Work-Life Balance, leading to reduced stress, increased productivity, and higher morale among women employees in the banking sector. Prioritizing an Ideal Work Environment is emphasized to achieve a healthy Work-Life Balance.

***Keywords:*** Workplace Quality, Work-Life Balance.

## 1. INTRODUCTION

Workplace Quality (WQ) refers to the overall attractiveness and suitability of the workplace for employees. WQ programs are initiatives through which organizations acknowledge their responsibility to create job environments that are beneficial for both employees and the economic health of the enterprise.

These programs typically include elements such as open communication, equitable reward systems, job security, satisfying career paths, and employee participation in decision-making. Initially, many WQ efforts concentrated on job enrichment. Beyond enhancing the work system, WQ programs often emphasize the development of employee skills, reduction of occupational stress, and fostering cooperative labour-management relations. Amidst strong competition both domestically and internationally, organizations endeavor to enhance their productivity. Proactive managers and human resource departments respond by exploring innovative approaches to increase efficiency. These strategies may involve new investments in capital and technology, or they may prioritize adjustments in employee relations practices.

Human resource departments play a vital role in enhancing productivity through adjustments in employee relations. Workplace Quality comprises factors such as effective supervision, favorable working conditions, competitive compensation and benefits, and engaging job roles that are both challenging and rewarding. Achieving high WQ involves adopting an employee relations philosophy that supports initiatives aimed at providing employees with increased opportunities to excel in their roles and contribute effectively to the organization. Proactive human resource departments seek to empower employees by involving them more in decision-making processes.

## 2. WORKPLACE QUALITY AND WORK-LIFE BALANCE

An essential element of Workplace Quality, important to both employees and employers, involves the interplay between work and home life. In today's competitive landscape, distinguishing between personal and professional spheres presents a considerable challenge. There is an increasing desire among employees for a balanced blend of career, family commitments, and leisure pursuits. Highlighted in a 1981 ILO convention, organizations are urged to aid employees in effectively managing their work-life balance (Lewis, 1997).

“The potential imbalance between work and personal life has implications not only for individual employees but also for organizations, governments, and broader society (Grzywacz and Marks, 2000; Swanson, Power, and Simpson, 1998)”. This relationship is bidirectional, with research indicating that an unsupportive work environment typically impacts personal life more significantly than the reverse. Studies have consistently shown that conflicts between work and personal life contribute to reduced psychological well-being and other negative outcomes. “Work-family conflict, a type of inter-role conflict, occurs when job demands interfere with family responsibilities Aminah (2002) identified that inter-role family conflict arises when the combined demands of multiple roles at home and work become overwhelming to manage effectively”.

Burke (1998) proposed three hypotheses to explain the relationship between work and family: spillover, compensation, and independence. Spillover occurs when events in one domain affect the other; compensation happens when individuals try to make up for deficiencies in one domain by emphasizing the other; and independence refers to situations where the two domains do not influence each other. The interactions between work and personal life have significant implications for employees' Workplace Quality. It is argued that conflicts between work and personal demands can lead to adverse health outcomes for employees, reduce organizational commitment, increase turnover, and ultimately diminish Workplace Quality. Mitigating levels of spillover may help alleviate perceived and psychological stress, thus promoting a better balance between the two domains. Insufficient organizational support coupled

with increased work-life conflict poses a risk of lower Workplace Quality. Therefore, organizations must implement alternative employment practices to alleviate spillover pressure without hindering career advancement. As such, Workplace Quality remains crucial for achieving a balanced work-life integration.

This study seeks to uncover the key factors that impact the Work-Life balance of women employees in specific public sector banks in Mumbai. Initially, twenty-eight variables related to Work-Life balance were identified, but seven were excluded due to overlapping correlations. Therefore, twenty-one variables were chosen for analysis to identify the main dimensions using Factor Analysis. The research utilizes Principal Component Analysis with Orthogonal Varimax Rotation to pinpoint the significant factors influencing the Work-Life balance of women working in these banks.

## 3. REVIEW OF LITERATURE

This section aims to review the theories and concepts foundational to this study, encompassing a selection of empirical and evaluative research conducted in the domains of work-life balance and quality of work-life.

The purpose is to create a framework, gain insights into the selected theme, and identify potential gaps in the existing literature.

Subramanian (2010) investigated the rising obstacles employers confront when implementing family-friendly workplace policies.

These policies are intended to aid employees in balancing their work responsibilities with personal life demands, often through flexible scheduling or other forms of workplace flexibility.

Sundar, Sundarraj, and Ashok Kumar (2011) examined job security and welfare measures in private sector banks, noting that despite these provisions, women often hesitate to pursue promotions, leading to their continued presence in lower positions. “In contrast, women in new-generation banks lack job security, and their compensation is performance-based”.

The study found that women executives in private sector banks are generally more knowledgeable about their work, maintain positive relationships with customers, and have favorable attitudes toward their jobs.

Shariq Abbas and Vandana Premi (2011) investigated the awareness, attitudes, perceived importance, and formalization of work-life balance policies in both private and public sector banks.

Their findings indicated that while employees view flexible working arrangements as the most critical work-life balance policy, they also hold negative perceptions about the implementation of such policies in their organizations. Additionally, the study revealed that neither public nor private sector banks have formalized work-life balance policies in written documents.

Vartha Raj and Vasantha (2012) centered their study on the work-life balance of women employed in the service sector, highlighting the significance of emotional intelligence in achieving a harmonious blend between personal and professional lives. They concluded that adept management of emotions plays a pivotal role in achieving life goals and boosting employee productivity.

Varatharaj et al. (2012) also studied the work-life balance of women in the service sector, defining it as achieving equilibrium between professional work and other activities, thereby reducing conflicts between professional and domestic life.

Their findings suggested that work-life balance improves employee efficiency and productivity, leading to greater satisfaction in both professional and personal lives. Most women employees reported feeling comfortable in their workplaces despite minor irritations.

Seshadri et al. (2013) analyzed the relationship between work-life balance factors and organizational flexible policies. They assessed how organizational policies influence work-life balance among working women in dual-career families, finding that employees strongly anticipated organizational support in achieving a work-life balance.

Ishwara (2014) recommended that management adopt new technologies to reduce employee workload and suggested that organizations offer yoga and meditation programs to alleviate stress.

The study also advocated for the implementation of work-life programs and frequent counseling services to benefit both workforce and the organization.

## 4. STATEMENT OF PROBLEM

Work-life balance pertains to how individuals manage their relationship with their work environment. This concept encompasses various aspects of employment, such as financial rewards, benefits, job security, safe working conditions, relationships within the organization, and the personal significance of work. Thriving in such an environment requires employees to possess diverse and current skills and competencies that meet specific requirements.

A deficiency in quality work-life can lead to work-life imbalance and stress among employees. Therefore, this study aims to examine how the quality of work-life influences work-life balance for women employees and the challenges they encounter in achieving this balance.

## 5. OBJECTIVES OF THE STUDY

- To examine the correlation between the Workplace Quality Life and Work-Life Balance among women employees in public sector banks.
- To propose measures for enhancing a healthy Work-Life Balance based on the study's findings.

## 6. FINDINGS OF THE STUDY

### 6.1 Identification of Factors Influencing Workplace Quality

This study aims to identify the key factors influencing the Workplace Quality of women employees in public sector banks. Twenty-nine variables associated with WQ were chosen for analysis using factor analysis.

**Testing for Sampling Adequacy:**

To assess the appropriateness of factor analysis for this study, the correlation matrix was carefully examined, and two tests were performed: Bartlett's test of Sphericity and the Kaiser-Meyer-Olkin (KMO) test. The findings are detailed in Table 1.1.

**Table 1.1: Measures of Sampling Adequacy**

| | | |
|---|---|---|
| Kaiser-Meyer-Oklin Measure of Sampling Adequacy | | 846 |
| Bartlett’s Test of Sphericity | Approx. Chi-square | 8.110 |
| | Degrees of freedom | 406 |
| | Significance | 000 |

Source: Computed Data

The results from Table 1.1 show that Bartlett's test was highly significant with a p-value of .000, indicating the data is suitable for factor analysis ($p < 0.05$). The Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy was .846, which is considered acceptable.

Thus, factor analysis is deemed appropriate for analyzing the data. Factor analysis was applied to twenty-nine variables using Orthogonal Varimax Rotation to evaluate the Workplace Quality of women employees in selected public sector banks in Mumbai.

**Total Variance Explained:**

Data collected from 417 samples were subjected to Principal Component Factor Analysis with Varimax Rotation, retaining factors with an Eigenvalue greater than 1.00. Factor loadings exceeding 0.5 were considered significant for determining factors.

The analysis identified seven factors that influence the Workplace Quality among the twenty-nine variables. The results are detailed in Table 1.2, which shows the total variance explained.

**Table 1.2: Total Variance Explained**

| Component | Initial Eigenvalues | | | Extraction Sums of Squared Loadings | | | Rotation Sums of Squared Loadings | | |
|---|---|---|---|---|---|---|---|---|---|
| | Total | Percent of Variance | Cumulative Percent | Total | Percent of Variance | Cumulative Percent | Total | Percent Of Variance | Cumulative Percent |
| 1 | 8.945 | 30.846 | 30.846 | 8.945 | 30.846 | 30.846 | 5.524 | 19.047 | 19.047 |
| 2 | 3.355 | 11.568 | 42.414 | 3.355 | 11.568 | 42.414 | 4.954 | 17.081 | 36.129 |
| 3 | 2.562 | 8.834 | 51.248 | 2.562 | 8.834 | 51.248 | 2.221 | 7.660 | 43.789 |
| 4 | 1.908 | 6.579 | 57.827 | 1.908 | 6.579 | 57.827 | 2.173 | 7.492 | 51.280 |
| 5 | 1.563 | 5.390 | 63.216 | 1.563 | 5.390 | 63.216 | 2.079 | 7.169 | 58.450 |
| 6 | 1.246 | 4.296 | 67.512 | 1.246 | 4.296 | 67.512 | 2.010 | 6.930 | 65.380 |
| 7 | 1.056 | 3.642 | 71.154 | 1.056 | 3.642 | 71.154 | 1.675 | 5.774 | 71.154 |
| 8 | .939 | 3.239 | 74.394 | | | | | | |
| 9 | .801 | 2.761 | 77.154 | | | | | | |
| 10 | .767 | 2.644 | 79.798 | | | | | | |
| 11 | .703 | 2.425 | 82.223 | | | | | | |
| 12 | .576 | 1.988 | 84.211 | | | | | | |
| 13 | .527 | 1.817 | 86.027 | | | | | | |
| 14 | .479 | 1.653 | 87.680 | | | | | | |
| 15 | .445 | 1.535 | 89.215 | | | | | | |
| 16 | .398 | 1.371 | 90.586 | | | | | | |
| 17 | .335 | 1.155 | 91.740 | | | | | | |
| 18 | .325 | 1.120 | 92.861 | | | | | | |
| 19 | .284 | .980 | 93.840 | | | | | | |
| 20 | .255 | .880 | 94.720 | | | | | | |
| 21 | .248 | .856 | 95.576 | | | | | | |
| 22 | .232 | .802 | 96.378 | | | | | | |
| 23 | .206 | .711 | 97.089 | | | | | | |
| 24 | .176 | .605 | 97.695 | | | | | | |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 25 | .162 | .560 | 98.255 | | | | | | |
| 26 | .139 | .480 | 98.735 | | | | | | |
| 27 | .139 | .480 | 99.215 | | | | | | |
| 28 | .132 | .456 | 99.671 | | | | | | |
| 29 | .095 | .329 | 100.000 | | | | | | |

Extraction Method: Principal Component Analysis Source: Computed Data

**Table 1.4 Variables with the Highest Factor Loadings for the Workplace Quality**

| Factor | Name of Newly Extracted Dimensions | Selected Variables | Factor Loadings |
|---|---|---|---|
| F1 | Ideal Work Environment | I feel comfortable providing feedback on my work performance. | 0.876 |
| F2 | Supportive Work Conditions | Training programs help me gain necessary job skills. | 0.818 |
| F3 | Fair Compensation \| | I believe my pay is fair compared to others in similar roles at private banks. | 0.907 |
| F4 | Working Schedule \| | The hours I work are reasonable | 0.800 |
| F5 | Skill Development Opportunities \| | The bank should offer more chances for employees to interact. | 0.651 |
| F6 | Collaborative Management \| | My supervisor involves me in solving problems. | 0.832 |
| F7 | Communication Channels \| | There are clear channels for exchanging information. | 0.771 |

Source: Computed Data

The total variance table 1.2 indicates that "Ideal Work Environment" exhibits the highest variance, making it the most influential factor affecting the Workplace Quality (WQ) for women employees in selected public sector banks in Mumbai.

Given its significant impact, the banking sector must prioritize Ideal Work Life to mitigate employee attrition and absenteeism. Implementing strategic measures to enhance the Workplace Quality is essential.

### 6.2 Dimensions of Work Life Balance

The study aimed to identify crucial dimensions influencing the work-life balance of women employees in selected public sector banks in Mumbai. Initially, twenty-eight variables related to work-life balance were considered. However, due to significant correlations among some variables, seven were excluded, leaving twenty-one variables for further analysis.

These variables underwent factor analysis to uncover the most significant dimensions.

Testing for Sampling Adequacy

Before conducting factor analysis, it was essential to verify the suitability of the factor model. Bartlett's test of Sphericity determined whether the variables were adequately inter-correlated in the population. This test uses a chi-square transformation of the correlation matrix's determinants.

Additionally, the Kaiser-Meyer-Oklin (KMO) test evaluated sampling adequacy. A KMO value below 0.5 would indicate that correlations between variable pairs were inadequately explained by other variables, suggesting unsuitability for factor analysis. Typically, a KMO value above 0.5 is preferred. The correlation matrix was thoroughly examined, and both Bartlett's test of Sphericity and the KMO test were conducted to ensure the appropriateness of proceeding with factor analysis in this study. Detailed results can be found in Table 1.5.

**Table 1.5 Measures of Sampling Adequacy**

| | | |
|---|---|---|
| Kaiser-Meyer-Olkin Measure of sampling Adequacy | | .847 |
| Bartlett‟s Test of Sphericity | Approx. Chi-square | 7.923 |
| | Degrees of freedom | 210 |
| | Significance | .000 |

Source: Computed Data

Table 1.5 indicates that Bartlett's test of Sphericity is significant, with p = .000, which is less than 0.05, confirming the suitability of the factor model. The Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy is 0.847, indicating an acceptable level. Therefore, factor analysis is deemed an appropriate method for analyzing the data.

The factor analysis, performed on 21 variables, utilized Orthogonal Varimax Rotation to examine the Work-Life balance of women employees in selected public sector banks in Mumbai.

Total Variance Explained

To simplify the analysis, total variance explained is extracted to reduce the number of variables into a

manageable number of factors.

Factors contributing less than one percent of the total variance are disregarded. The total variances explained are detailed in Table 1.6

**Table 1.6 Total Variance Explained**

| Component | Initial Eigenvalues | | | Extraction Sums of Squared Loadings | | | Rotation Sums of Squared Loadings | | |
|---|---|---|---|---|---|---|---|---|---|
| | Total | Percent of Variance | Cumulative percent | Total | Percent of Variance | Cumulative percent | Total | Percent of Variance | Cumulative percent |
| 1 | 7.486 | 35.648 | 35.648 | 7.486 | 35.648 | 35.648 | 5.034 | 23.970 | 23.970 |
| 2 | 4.327 | 20.605 | 56.253 | 4.327 | 20.605 | 56.253 | 3.357 | 15.984 | 39.954 |
| 3 | 1.838 | 8.754 | 65.007 | 1.838 | 8.754 | 65.007 | 3.063 | 14.586 | 54.540 |
| 4 | 1.287 | 6.131 | 71.138 | 1.287 | 6.131 | 71.138 | 2.495 | 11.880 | 66.420 |
| 5 | 1.183 | 5.632 | 76.770 | 1.183 | 5.632 | 76.770 | 2.173 | 10.350 | 76.770 |
| 6 | .968 | 4.608 | 81.378 | | | | | | |
| 7 | .604 | 2.874 | 84.252 | | | | | | |
| 8 | .586 | 2.789 | 87.041 | | | | | | |
| 9 | .479 | 2.283 | 89.323 | | | | | | |
| 10 | .423 | 2.016 | 91.339 | | | | | | |
| 11 | .310 | 1.477 | 92.816 | | | | | | |
| 12 | .270 | 1.286 | 94.102 | | | | | | |
| 13 | .234 | 1.113 | 95.215 | | | | | | |
| 14 | .205 | .977 | 96.192 | | | | | | |
| 15 | .175 | .832 | 97.024 | | | | | | |
| 16 | .153 | .728 | 97.752 | | | | | | |
| 17 | .144 | .687 | 98.439 | | | | | | |
| 18 | .105 | .500 | 98.939 | | | | | | |
| 19 | .100 | .478 | 99.417 | | | | | | |
| 20 | .073 | .346 | 99.763 | | | | | | |
| 21 | .050 | .237 | 100.000 | | | | | | |

Extraction Method: Principal Component Analysis

Source: Computed Data

**Table 1.8: Variables with the Highest Factor Loadings for the Work-Life Balance**

| Dimension | Name of Newly Extracted Dimensions | Selected Variables | Factor Loadings |
|---|---|---|---|
| $D_1$ | Personal Mastery and Adaptability | I am capable of managing my emotions effectively in the workplace. | 0.883 |
| $D_2$ | Family Life Satisfaction | My spouse and family members cooperates with me. | 0.839 |
| $D_3$ | Work Environment | I am satisfied with the superiors. | 0.829 |
| $D_4$ | Career Growth Support | If required for career growth, I am willing to stay away from my family. | 0.751 |
| $D_5$ | Family and Work Expectations | Adequate attention to children's education is required. | 0.819 |

Source: Computed Data

## 7. CORRELATION BETWEEN WORKPLACE QUALITY AND WORK-LIFE BALANCE

This section examines into the correlation between the Workplace Quality (WQ) and Work-Life Balance among women employees in chosen public sector banks in Mumbai. Spearman's rank correlation coefficient was computed to analyze this relationship. Table 1.9 illustrates the correlation between the perceived Workplace Quality and Work-Life Balance among the participants in the study.

**Table 1.9: Correlation between Workplace Quality and Work-Life Balance.**

| | | | Quality of Work Life | Work-Life Balance |
|---|---|---|---|---|
| Spearman's rho | Workplace Quality | Correlation Co-efficient | 1.000 | .920** |
| | | Sig.(2 tailed) | | .000 |
| | Work-Life Balance | Correlation Coefficient | .920** | 1.000 |
| | | Sig.(2 tailed) | .000 | |

Source: Computed Data

The analysis found that the Spearman's rank correlation coefficient is r = .942, p = .000, indicating a strong and statistically significant positive relationship between Workplace Quality (WQ) and Work-Life balance among women employees in selected public sector banks in Mumbai. This suggests that an improved Workplace Quality is closely associated with a better Work-Life balance.

Workplace Quality is a philosophy grounded in the belief that employees are an organization's most valuable resource. It emphasizes that employees, being responsible and capable of making significant contributions, should be treated with dignity and respect. As workplace demands increase, so does the complexity of the work environment. Compared to the past, today's workforce faces significant changes due to technological advancements, increased competition, and globalization.

The study demonstrates a correlation between the newly identified factors of Workplace Quality and the dimensions of Work-Life balance. Achieving a good Work-Life balance helps employees manage both personal and professional responsibilities effectively.

Benefits include reduced stress and workload, lower absenteeism, enhanced productivity, improved communication and cooperation, increased performance, accountability, and commitment, and higher employee morale. Therefore, substantial efforts are necessary to enhance the Workplace Quality for women employees to achieve a well-balanced life.

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