INCREASING PROFITABILITY IN THE INDIAN HEALTHCARE AGGREGATOR PATHOLOGY SECTOR

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Declaration

I hereby declare that this dissertation entitled “Increasing Profitability in the Indian Healthcare Aggregator Pathology Sector” is my own original work and has been completed in accordance with the academic requirements of the programme. The work presented in this study has not been submitted, either in whole or in part, for the award of any other degree, diploma, or qualification at this or any other institution.

I confirm that all sources of information, data, literature, and ideas used in this research have been appropriately acknowledged and referenced in accordance with the required academic referencing guidelines. Any assistance received during the completion of this study has been duly recognised in the acknowledgement section.

I further declare that the findings, analyses, interpretations, and conclusions presented in this dissertation are based on my own research and understanding, except where specific references have been cited. I accept full responsibility for the authenticity and accuracy of the work submitted.

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Abstract

The growing adoption of digital healthcare, rising awareness of preventive healthcare, and growing demand for diagnostic services have led to significant growth in the Indian healthcare aggregator sector, commonly known as the pathology sector. Though the healthcare aggregators are booming with growth, profitability is a huge concern due to disjointed operations, high customer acquisition costs, reliance on third-party diagnostic centres and lack of control on value capture. The main role of most aggregators is a middleman, causing significant revenue loss to radiology and pathology facilities. Thus, existing aggregator business models have yet to be proven sustainable and scalable in the long term. The main goal of this study is to explore the profitability issues in the Indian pathology segment of the healthcare aggregator and propose a hybrid operational model that enhances the operational efficiency, profitability, and scalability of these businesses. The research has a mixed methods design which involves quantitative financial modelling and qualitative analysis. The quantitative analysis is based on four representative models (PharmEasy style Aggregator model, Healthians style Hybrid model, Thyrocare style Centralized Pathology model, and vertically integrated model of Dr Lal PathLabs). In addition, it is proposed that a hybrid operational model for the services be developed and evaluated where in-house phlebotomy services and outsourced pathology processing services are combined with a diagnostic-centre based radiology service. The qualitative phase investigates the perceptions of the stakeholders on the inefficiencies in their operations, the leakages in margin, the control of prices, dependency on diagnosis and feasibility of implementation. The results show that the biggest source of leakage of profits in traditional aggregator models is relying on external diagnostic providers. This hybrid model is found to be cost effective as shown by the comparative analysis, which also shows that it increases the contribution margin, decreases the break-even point and increases the scalability. Compared to all of the models tested, the proposed model had the highest profitability, a gross margin of around 70%, and the smallest break-even point. The study extends the body of knowledge in the area of healthcare platform economics, Transaction Cost Economics, and Resource Based View theory by establishing a link between value capture and financial sustainability in the context of healthcare platforms and their selection of operational integration. From a practical perspective, the insights offer strategic direction for healthcare aggregators aiming to secure sustainable growth, profitability, and competitive edge in the fast-changing Indian diagnostics sector.

Keywords: Healthcare Aggregators, Pathology Sector, Profitability, Hybrid Operational Model, Diagnostic Services, Healthcare Platform Economics, Scalability, India.

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CHAPTER 1: INTRODUCTION

1.1 Background of the Study

The Indian pathology as a healthcare aggregator has been experiencing a booming growth over the past few years, owing to the growing health awareness, growing disposable income, and the growth of digital platforms. With the help of aggregators that enable diagnostic laboratories and patients to interact via web-based interfaces, the historically disorganized and unreachable pathology market has become a more structured and open ecosystem. Yet, the presence of solid demand and scaling possibilities, profitability appears to be an outstanding concern because of the presence of stiff competition, price pressure, high customer acquisition costs, and operational inefficiency. In order to continue growth and provide stakeholder value, firms in this industry need to establish strategic initiatives that are aimed at ensuring cost reduction, technology, supply chain management and improved customer experience. Also, the use of data analytics, diversification of test portfolios, and positive relationship with laboratories might be beneficial in enhancing margins. This paper discusses miscellaneous determinants of profitability and the action plans that can be undertaken to make a profit and achieve sustainable financial performance in the dynamic environment of the Indian pathology aggregation industry.

Healthcare aggregators are also significant in terms of bringing together fragmented diagnostic service providers and providing patients with the opportunity of accessing various healthcare services using a centralized system. With the help of digital technologies, these aggregators provide the opportunity to book an appointment, compare prices, collect samples at home, and establish effective communication between laboratories and patients (Tvaliashvili et al., 2024). Nonetheless, even as the healthcare aggregators become increasingly popular, it is possible to identify multiple issues with the healthcare aggregators in the pathology sector, which are associated with cost management, operational efficiency, and sustainable profitability. The financial performance of these platforms can be greatly affected by high operational costs, a high level of competition in the market and the sensitivity of consumers in terms of price. In this regard, it would be necessary to determine the business models and cost structures of the diagnostic healthcare industry in order to discover the strategies that could enhance the profitability and sustainability of operation. This chapter's literature review seeks to analyze the notion of healthcare aggregation. The diverse business model embraced in the diagnostic healthcare services and the

cost apparatus of pathology and radiology operations. Through the study of previous research and industry experience, the chapter offers a theoretical basis for the application of the innovative operational strategies. It also includes the hybrid operational models to assist healthcare aggregators in increasing efficiency and profitability in the Indian diagnostic healthcare market.

The healthcare diagnostic market in India has seen high growth, which has been driven by the rising level of preventive health awareness, digital health, and corporate wellness programs. The Indian diagnostics market is estimated to grow at a strong 14 percent CAGR over the next 5 years (The Print, 2025). Healthcare aggregators have come up as online facilitators between patients, pathology, and radiology service providers. Many aggregators struggle with profitability despite rising demand due to reliance on third-party diagnostic centres that capture a disproportionate share of revenue (Singh et al., 2026). This critical dependency makes it less scalable and value capture in the pathology sector. The fast-changing nature of the Indian healthcare sector has been influenced by the growing digitization, heightened healthcare awareness, and the demand for diagnostic services. The pathology sector is one of its most important parts as it is instrumental in the detection, prevention, and treatment planning of diseases. Over the past few years, technology integration has made it possible to develop online healthcare services that connect patients and diagnostic service providers while enhancing accessibility and convenience (The Wire, 2021). These platforms execute as intermediaries, aggregating services from different laboratories and offering users booking facilities and comparative pricing. Although, despite this substantial growth, regulatory issues, quality of service, and standardization among providers have been raised. Profitability has emerged as a central issue for aggregator platforms, with the sector becoming highly competitive. Therefore, this study seeks to explore the determinants of profitability and strategies to further improve financial sustainability in the Indian pathology aggregator industry.

The Indian pathology market is characterized by a fragmented structure with organized and unorganized market players that include small laboratories to large diagnostic chains. Although the organized sector is growing with the rising investment and the use of technology, a considerable part of the market remains unstandardized with regard to practices. There has been a significant growth in the demand for diagnostic services as more people are getting chronic

diseases and becoming aware of preventive care. Furthermore, the development of digital technologies, automation, and data analytics is also changing the diagnostic processes while making them more efficient. It is evident that regulatory gaps and a lack of uniformity in quality assurance are still significant issues that have impacted sector expansion. There is also a trend in the industry toward consolidation, where larger companies buy smaller labs to get a bigger share of the market. These changing dynamics show how important it is for businesses to have good models that can find the right balance between quality, access, and profitability in a market that is getting more competitive.

The Aggregator platforms in healthcare are a big step forward for Indian healthcare, especially in the areas of diagnostics and pathology. These platforms act as middlemen to help patients find different service providers and easily compare prices, services, and availability (Russo et al., 2024). Aggregators increase access to services, transparency, and convenience to users, particularly in urban and semi-urban regions by using digital technologies (The Wire, 2021). Furthermore, the Internet of Things (IoT) and data aggregation technologies have been integrated, which enabled better data storage, monitoring, and service delivery within healthcare systems (Kharat & Gaikwad, 2024). Scalability is also facilitated by aggregators since diagnostic providers can reach more people without investing heavily in infrastructure. However, their fast development has brought into question ethical practices, data security, and government regulation (Yadav et al., 2022). Regardless of these issues, the role of aggregator platforms in transforming the healthcare delivery models and modernizing the diagnostic services in India remains significant.

Although healthcare aggregator platforms in the pathology industry have been growing very fast, there are a number of challenges that challenge profitability. Competition in terms of prices is usually intense among platforms, and this forces the attraction of price-sensitive consumers, which results in a low margin for companies. Furthermore, high customer acquisition costs from digital marketing and promotional strategies burden financial performance. There is also an increased cost due to operational inefficiencies, such as logistics management and coordination with various laboratories. Compliance risks and operational complexities arise from regulatory uncertainties and the lack of clear guidelines for online healthcare services. Also, inconsistencies in laboratory standards and quality control can impact customer trust and retention.

The privacy of the data and the necessity to have safe data management systems introduce another aspect of financial and operational overhead. These issues have demonstrated the need to consider long-term strategies that can help increase profitability without impacting service quality and compliance.

The Indian pathology industry has several opportunities to increase profitability through strategic and technological innovations. The use of new technologies such as artificial intelligence, big data analytics, and federated learning may improve operational efficiency, diagnostic accuracy, and data security. Also, the use of IoT-based healthcare models can help optimize the process of data aggregation and enhance service delivery (Kharat & Gaikwad, 2024). Aggregators can form strategic alliances with hospitals, labs, and insurers to increase the service offerings and client numbers. Aggregators can focus on value-added services such as collecting home samples, offering preventive health packages, and creating personalized healthcare solutions to boost their income (Zhang et al., 2024). Another key issue in profitability is the improvement of the quality of service and user experience to increase customer retention. In a competitive market, aggregator platforms can be successful in the long run at reaching cost-optimization and financial sustainability by using scalable and technology-based business models.

This study holds significant academic and practical relevance in understanding the evolving dynamics of the Indian healthcare aggregator pathology sector. Academically, it boosts the small literature on digital health care business plans and ways to earn money in markets. It also combines views on regulation, technology, and market structure to offer comprehensive insight into the sector (Yadav et al., 2022). In real life, the research can help people like healthcare start-ups, diagnostic service providers, investors, and policymakers. It reflects significant issues and opportunities that inform strategic decision-making and policy development. The results could also push these aggregator platforms to follow rules to make these platforms viable, help price the services, and, at the same time, operate profitably. Since digital health care in India is developing at a fast pace, the research is good at this time. Also, it will fill some gaps and make the ecosystem of the pathology aggregator work better.

In addition, the Indian healthcare aggregator pathology sector is influenced significantly through changing the consumer behaviour and expectations related to the healthcare accessibility and personalization. In recent times, patients are highly informed and connected digitally, which has resulted in a better demand for transparent pricing, quick diagnostic results, and personalized healthcare experiences (Villalobos-Quesada et al., 2023). Digital healthcare platforms have massively contributed to this transformation through allowing users to access health services from their homes through mobile applications and various online portals. This transformation has forced pathology aggregators to focus not only on the operational efficiency thus also on the customer-centric service models. The capability to deliver a seamless booking process, real-time report access, and responsive customer support has now become an important determinant of competitiveness in the market. On the other hand, profitability is no longer dependent on the cost minimization strategies thus also on the ability in order to create better customer experience which encourages long-term loyalty and also repeat service usage.

Preventive healthcare has also taken the Second-Generation role in the future of the pathology aggregator industry in India. The increased awareness with respect to lifestyle diseases like diabetes, hypertension, cardiovascular diseases, and cancer has led to more prevalence of diagnostic testing among the population. Wellness check-ups, pre-emptive health packages and regular screening programs have become crucial sources of revenues among the healthcare aggregators (Hoffman & Ganguli, 2025). Corporate entities are also putting more collaborations with diagnostic service providers to provide worker wellness programs thus expanding new markets within aggregators. These developments have widened the diagnostic services beyond illness testing to constant health tracking and prevention. On the other hand, the pathology aggregators must now develop sustainable business models that are able to effectively address both preventive and curative healthcare requirements without loss of profitability. Another significant factor that influences the profitability of healthcare aggregators is the adoption of artificial intelligence and advanced analytics into the diagnostic operations.

AI-based technologies have the capability to enhance the precision of diagnosis, automate repetitive processes, and reduce turnaround times. In this context, AI-based systems may assist in report interpretation, predictive diagnostics, and workflow management by reducing the

operational inefficiencies. However, the use of predictive analytics helps aggregators to forecast the demand patterns of the customers and also optimize the resource allocation. Thus, applying these technologies needs massive financial investments in infrastructure, data management systems, and skilled technical personnel. Smaller healthcare aggregators sometimes struggle to take the latest technologies because of the limited capital resources (Kulkov et al., 2023). However, technological integration occurs both the challenges and opportunities within the sector. While the latest technologies may enhance the overall efficiency and profitability in the long-term, they also gain short-term financial pressure because of the high adoption and maintenance cost. Another issue in the healthcare aggregator pathology industry is the data security and privacy issue. Healthcare aggregators store, process and receive sensitive patient data such as diagnostic records, personal data and medical history.

A growing trend towards the digitalization of healthcare services has exposed organizations to cybersecurity threats, data breaches, as well as access to confidential information without authorization. The laws on data protection in the healthcare industry in India remain in their infancy thus posing a challenge to digital healthcare providers (Jain, 2023). This makes aggregators spend a lot to ensure that they have safe digital infrastructure, encryption and compliance mechanisms to securitise patient information. Such investments raise operational spending yet they are needed to ensure that customers are prepared to trust operations and to ensure that they comply with regulations. Lack of proper data privacy may result in reputational losses, legal losses, and loss of customers and will have a direct effect on profitability and sustainability in the long run. Along with that, logistics management shows a significant operational challenge for the pathology aggregators, especially in home sample collection services. Proper coordination among the phlebotomists, laboratories, transportation networks, and customers is important in order to ensure high-quality and timely service delivery.

However, delays in sample transformation or improper handling of diagnostic samples may compromise the overall test accuracy and badly impact the customer satisfaction. The complication of logistics management gains massively in geographically dispersed regions where the transportation infrastructure could be underdeveloped. On the other hand, aggregators should develop improved logistics frameworks and also invest in the route optimization technologies in

order to reduce delays and operational inefficiencies. In-house logistics management could deliver better operational control, though it also needs extra investment and workforce management (Lutfi, 2024). However, balancing operational control with the cost optimization remains a significant consideration for profitability improvement. On the other hand, the competitive landscape of the Indian pathology sector also intensifies the chances challenges faced by the healthcare aggregators. The market includes various organized and unorganized players who compete on price, accessibility, and service quality.

A huge diagnostic chain occurs with strong brand recognition, additional infrastructure and financial abilities that allows them to provide competitive pricing and adopted healthcare services. Smaller aggregators and standalone laboratories sometimes struggle to compete against these established players. As a result, most of the healthcare aggregators hugely depend on the discounts, promotional offers, and digital marketing campaigns to retain and acquire consumers. However, these strategies could gain market share in the short term and they might massively minimize profit margins in case not managed properly. Sustainable profitability needs aggregators to separate themselves through service innovation, operational efficiency, and strategic partnerships instead of depending on the price-based competition. Alliances and mergers have become a means of enhancing profitability and market growth in the pathology aggregator industry (King et al., 2022). Aggregators are also venturing into partnering with hospitals, insurance plans, drug companies and telemedicine to widen their services. These partnerships allow the possibility of cross-selling, combined care, and increased access to customers.

The insurance relationships, such as those involving insurance partnerships, can enable the aggregators to access the insured populations of patients and the level of demand of diagnostic services. Likewise, through partnership with telemedicine providers, patients will easily engage in online consultations and later proceed to diagnostic tests and treatment planning. These healthcare ecosystems not only generate value to patients but also increase the chances of revenue generation among the aggregators. Strategic alliances also minimize operational risks which is attributed to the fact that responsibilities are shared among various stakeholders in the healthcare value chain. The key concept of vertical adoption has become related in discussions that surround profitability in the healthcare aggregator pathology sector. Vertical adoption refers to the way to initialize

certain operational functions that were outsourced previously to the external service providers. For example, healthcare aggregators could develop their own phlebotomy teams, logistics operations, or mini-diagnostic facilities in order to minimize reliance on third-party providers (Åhlin et al., 2026). This adoption may improve the control over the service quality, turnaround times, and customer experiences while enhancing profit margins through minimizing intermediary costs.

Therefore, complete vertical adoption needs substantial capital investment and operational expertise. However, many aggregators are trying to determine the hybrid operational models which combine chosen in-house functions with the outsourced specialized services. In addition, this approach allows the organizations to maintain better operational flexibility while enhancing value capture along with the profitability. Another important dimension that influences profitability is customer retention and loyalty management. Acquiring new consumers through digital marketing campaigns is sometimes expensive and makes repeat customers hugely important for the healthcare aggregators (Nurjanti, 2025). Organizations which continuously deliver proper diagnostic, better and timely services and positive consumer experiences mostly retain customers as well as generate higher revenue. Personalized healthcare resolutions, loyalty programs, preventive care subscriptions, and digital engagement strategies may enhance the rate of customer retention. In addition, the use of customer relationship management might improve the rate of customer retention. Apart from that, the use of customer relationship management process and data analytics also allows aggregators to understand the customer choice and decision targeted healthcare offerings.

However, strong customer loyalty minimizes the overall market expenditure over time and also contributes massively to long-term financial sustainability. The future profitability of the Indian healthcare aggregator pathology industry is also likely to be determined by the government efforts as well as policy reforms. Health initiatives like the Ayushman Bharat Digital Mission are being put into place to enhance the digital infrastructure of healthcare and enhance interoperability of healthcare providers (Sharma et al., 2023). These efforts provide avenues in which healthcare aggregators can combine their services with national digital health systems, and increase their operations within various regions. In a similar manner, adoption of digital healthcare should be supported by the government, since it will lead to increased investment in healthcare technology

and innovation. Financial sustainability within the pathology aggregator sector also relies hugely on proper pricing strategies. Dynamic pricing in India is now hugely competitive and sometimes influenced by customer price sensitivity. Aggregators should balance affordability with profitability while ensuring the best service quality. Thus, higher discounting could attract consumers in the short-term thus may weaken financial performance as well as reduce perceived service value.

The study is aimed at analysing the determinants of profitability in the Indian healthcare aggregate pathology sector. It seeks to review digital platforms that link patients to diagnostic laboratories while covering services such as test booking, home sample collection, and report delivery. The study will be based in India, as it has a fast-growing digital healthcare ecosystem and a market structure that is more diverse. It intends to primarily explore key aspects such as pricing strategies, operational efficiency, regulatory challenges, technological adoption, and customer engagement in relation to profitability. Furthermore, the study considers the aspect of data aggregation, digital health technologies, and platform-based business models to influence financial performances. The study does not address the other healthcare segments, including telemedicine or hospital-based services, to any significant extent. The goal of the research is to provide a targeted view of profitability factors in this specific healthcare industry.

Moreover, technological innovation and shifting patient expectations, as well as increased healthcare accessibility, are likely to significantly transform the Indian healthcare aggregator pathology industry in the next few years. The increased use of digital health platforms, telemedicine services, and AI-based diagnostics is opening up new possibilities for aggregators to enhance operational efficiency and customer satisfaction (Jabarulla & Lee, 2021). Moreover, raising awareness about preventive healthcare and regular testing to diagnose the disease is most likely to boost the future demand for pathology services in both urban and rural populations. Increased use of diagnostic services will also be aided by the spread of health insurance coverage and government healthcare programs. Nevertheless, the industry still struggles with the issues related to price wars, data security, logistics, and compliance with regulations. Thus, the healthcare aggregators should develop sustainable business strategies aimed at technological growth, customer retention, service quality, and optimisation of operations. Profitability improvement and

market growth can also be enhanced through strategic alliances, vertical integration and using data to make decisions. Balancing the need to be affordable and the provision of quality healthcare services will continue to be a crucial factor towards long-term success in the competitive Indian pathology market.

Pathology services are becoming an integral part of preventive medicine and evidence-based medicine, as well as an essential support for all aspects of healthcare diagnostics. In the modern healthcare systems, diagnostic testing plays a crucial role in disease screening, treatment planning, management of chronic diseases and identifying health risks early (Makhmirzaeva et al., 2025). Pathology tests have become increasingly common and significant as more healthcare providers have embraced preventive healthcare strategies. This change has ushered in new business opportunities for healthcare aggregators wanting to build a digital platform which allows patients to engage with diagnostic providers. The rise of preventative health check-ups, business wellness, and individualized health care has also enhanced the role of pathology in the healthcare value chain. The digital healthcare ecosystem has transformed the landscape of diagnostic services delivery and consumption. Online appointment scheduling, home sample collection, electronic payment methods and electronic reporting are convenient and accessible options that are increasingly preferred by patients. Healthcare aggregators have taken advantage of this shift in consumer behaviour by developing technology-driven platforms that make patient contact and communication easier with diagnostic centres. These platforms streamline the search process, provide greater transparency, and enable consumers to make healthcare choices by comparing prices and services (Chen & Miraldo, 2022). This has made digital aggregation a big trend in the Indian diagnostics market.

Healthcare aggregation services continue to grow rapidly, but the viability of the current business models is becoming more apparent. The majority of healthcare aggregators are on commission agreements with diagnostic laboratories, whereby customer acquisition is independent of diagnostic service delivery (Elets News Network, 2026). This approach allows for quick market entry, but poses issues of value capture, retention of profits and control of operations. With increasing competition, aggregators are under increasing pressure to keep costs down, balance customer acquisition spending, ensure high operation quality and maintain profitability. Another

key development is technology-driven healthcare solutions becoming more prominent. AI, cloud-based healthcare systems, predictive analytics and digital health records are increasingly becoming a part of diagnostic workflows. These technologies boost the efficiency in the operations, lessen turnaround time and boost customer engagement (Cheruku, 2025). They also need ongoing funding and technological innovation, which can add to the financial strain of healthcare aggregation entities. As a result, companies need to develop models of operation that can facilitate technological innovation without compromising on their financial results.

There are also major shifts in consumer expectations in the healthcare diagnostics industry. Patients are increasingly looking for quick, personalised, transparent and digital healthcare experiences, with quicker report delivery (Shilpa et al., 2023). Effective coordination between healthcare professionals, digital platforms, logistics providers, and laboratories is a must to meet these expectations. The effective integration of these operational functions, therefore, has become an important factor of competitive advantage in the pathology aggregation industry. The progress made in these areas underscores the need for innovative business models that have the ability to achieve efficiency, quality services and sustainable profitability.

1.2 Overview of the Indian Healthcare Aggregator Market

The Indian healthcare aggregator market has already become one of the fastest-growing sectors in the healthcare ecosystem of the country. Healthcare aggregators are online platforms that link patients to healthcare service providers including pathology labs, hospitals, diagnostic centres, pharmaceuticals and telemedicine services through integrated online platforms (Siddiqui et al., 2024). The pathology industry healthcare aggregators have been involved in the business of being intermediaries to allow customers to shop and buy diagnostic tests. It also assists in planning sample pickups in the house, accessing computerised reports, as well as preventive healthcare services via mobile applications and websites. The high rate of digitalisation of healthcare services, rising internet penetration, rising health awareness, and evolving consumer behaviour have played a big role in the growth of this market in India (Rana et al., 2024). India’s diagnostic and pathology industry forms a major part of the healthcare aggregator ecosystem. The Indian diagnostic services market is widely separated into pathology testing and radiology services with the largest market

share being pathology. It has been reported that pathology testing generates almost 58-70% of all diagnostic industry revenues in India (Cxooutlook.com, 2021). The increase in the rates of chronic diseases such as diabetes, heart diseases, cancer and infectious diseases has also contributed to the necessity of regular diagnostic tests and preventive health care by the urban and semi-urban populations. Also, the COVID-19 pandemic increased the level of awareness of people about preventive health check-ups and digital health services, which further solidified the role of healthcare aggregators in the pathology market.

The Indian diagnostic market is very fragmented even after showing a high growth. The industry is characterised by thousands of independent laboratories and local pathology centres, whereas organised diagnostic chains have a relatively lesser market share. It is also demonstrated that standalone laboratories are estimated to have about 42-50% of the diagnostic market, whilst organised diagnostic chains take around 16-18% of the market share (Investing.com, 2021). This disjointed system has granted considerable potential to healthcare aggregators to bundle services, normalise quality, and give patients easier access to a variety of providers of pathology services with a single digital platform. In India, healthcare aggregators tend to have platform-based business models. Practo, Tata 1mg, PharmEasy and Healthians are websites that have transformed the way one goes about booking a diagnostic appointment, online booking of appointments and doorstep sample collection. (Aqeel & Gera, 2023). It also involves health packages offered at a discount and the management of these reports electronically. These aggregators work with pathology laboratories and diagnostic centres in the form of commission-based collaboration.

The business model worked as a significant aspect for the patients and service providers. It gives patients convenience, price transparency, along with accessibility, and diagnostic laboratories. It may have an enhanced reach to customers, improved operational efficiency, and sample volumes. Another significant factor that contributes to the development of the healthcare aggregator market is technological advancement (Zoričić et al., 2022). The use of artificial intelligence, cloud computing, integration of telemedicine, mobile applications and digital pathology solutions is becoming increasingly popular in the healthcare industry (Fahim et al., 2025). It helps greatly in increasing the accuracy of the diagnostic and reducing the turnaround time. The development of the healthcare aggregator and pathology market has also been affected

positively through government programs. (Digitalindia.gov.in, 2024). These efforts facilitate health care provider, laboratory, and digital health care interoperability. Moreover, the growing health insurance coverage and corporate wellness initiatives have influenced the growth in the use of diagnostic test services especially in urban populations. The Indian pathology market has proved to have high potential for growth in the future. According to market research reports, the market size of India's pathology laboratory services was approximately USD 45.4 billion, growing at 9.37% CAGR in 2025 and is likely to grow significantly in the upcoming decade (IMRAC Group, 2026). It will increase because of the rising healthcare awareness, technological progress, and the increase in the uptake of preventative healthcare. In the same way, the Indian diagnostic market as a whole is expected to experience tremendous growth due to the growing disease burden, population, and the availability of healthcare. The recent tendencies indicate that the Indian healthcare organisations have an increased usage of AI-based systems of pathology and radiology. This has been successful in assisting to fully optimise the efficiency of their work and the diagnostic powers have been observed in the literature (Pib.gov.in, 2026). The initiatives like Ayushman Bharat digital mission, digital India and increased expenditure on healthcare infrastructure have facilitated the promotion of electronic health records and digitisation of healthcare.

India has a fragmented healthcare industry consisting of both public healthcare providers and private hospitals, clinics, laboratories and retail pharmacies working separately. According to Neelakantan & Kulkarni (2023), India’s healthcare industry can be divided into three types of markets which include the government monopsony market, institutional healthcare market and retail healthcare market. This has led to an inequitable distribution of services, variations in pricing, a lack of transparency and difficulties accessing healthcare services, especially among lower-income communities. Healthcare aggregators have tried to decrease these inefficiencies by connecting the healthcare providers and bringing them together on a single platform to provide services. The rising aspect of the healthcare aggregators in India has been impacted by digital transformation. Digital transformation is one of the key factors driving the rise of the healthcare aggregators in India. In 2021, the Ayushman Bharat Digital Mission (ABDM) was launched. There have been several remarkable achievements in the construction of India’s digital healthcare ecosystem. In other words, the initiative aimed to promote efficiency, cost-effectiveness and

enhanced access to healthcare services by leveraging digital health technologies, interoperable digital health architecture, open protocols and digital public goods (Sharma et al., 2023). The establishment of ABDM serves as a robust platform for the effective operation of healthcare aggregators in terms of digital health IDs, electronic health records, telemedicine and online digital data-sharing platforms. In addition, digital healthcare initiatives such as CoWIN, Aarogya Setu, telemedicine services and online healthcare platforms contributed significantly during public health emergencies (Sharma et al., 2023). Therefore, India requires a digital integrated healthcare system. Consequently, pathology aggregators saw significant growth as they provided easy and contactless diagnostic solutions.

Pathology aggregators in India work on a platform-based business model which allows them to partner with several labs or diagnostic centres to offer services such as appointment scheduling, home collection, test processing, digital report generation and payment options. It promotes efficiency, user experience, wide geographical coverage and reduces cost associated with infrastructure requirements. The increasing number of middle-class individuals, prevalence of chronic diseases and awareness of the value of preventive healthcare contribute significantly to the rise in the demand for pathology services. In addition, technological innovation plays an important role in the development of Healthcare Aggregation in India. According to Kharat & Gaikwad, (2024), technological innovations in IoT in healthcare contribute to real-time monitoring, sharing of data, efficiency improvements, blockchain authentication, cloud computing and its impact on healthcare operations. In addition, the BAHDA (blockchain Authentication Hashing Data Aggregation) model has been proposed to achieve data integrity, security and efficiency in the healthcare industry with decentralized data aggregation techniques. There are increasing instances of data breaches and cybersecurity issues in global healthcare industries. An existing study on privacy-preserving framework for federated learning to analyse healthcare data without exchange of patients' sensitive data was proposed by Haripriya et al., (2025). Such a privacy-preserving technology will be beneficial to Indian pathology aggregators that manage large amounts of patients' diagnostics data, medical history and personal health information. Another significant factor contributing to the operation of pathology aggregators is coordination in the delivery of healthcare services. Mirza et al., (2024) found out that there is fragmentation within the healthcare delivery system in India due to the disorganized coordination of referrals, lack of continuity of

care and overcrowding of tertiary care hospitals. This study proposed the Indian Model of Integrated Healthcare (IMIH) emphasizing coordinated health systems and digital platforms, referral management systems and integrated care frameworks.

The Indian pathology aggregator market is also gaining momentum on the back of rising investments and growth of start-ups in the health technology space. Several digital health firms are now scaling into tier-2 and tier-3 cities, which are traditionally less accessible for health care. Centralised technology platforms from aggregators help to standardize pathology testing, lower turnaround time, make pricing more transparent and increase market penetration. The Indian healthcare aggregator market is growing at a rapid pace yet it still encounters certain challenges. Regulatory uncertainty, data privacy concerns, infrastructure constraints, unequal service quality and technological differences between urban and rural regions are still significant challenges. Furthermore, there is still a lack of seamless integration and exchange of data between public and private healthcare providers in India which results in fragmentation. Neelakantan & Kulkarni, (2023), pointed out that failure in unifying the market leads to inefficiencies in accessing, pricing and quality in the provision of healthcare services in India. In general, the Indian healthcare aggregator market is experiencing a swift digitalization, integration of healthcare systems, use of artificial intelligence, IoT and government-backed digital health initiatives. The growing focus on preventive healthcare, convenience for the patient, affordable diagnostics and healthcare services delivery through technology would further boost the market over the next few years.

The rise of Indian aggregators is indicative of the overall transformation taking place in the healthcare delivery system in India. Historically, patients had to visit the hospital or a stand-alone laboratory or be referred to them by their physician (Testing.com, 2021). But with high adoption of digital and availability of smart phones have provided other ways of accessing healthcare which are facilitated by the healthcare aggregators. The aggregators give consumers easy access to healthcare services and simplify navigation as they allow multiple diagnostic providers to be integrated on a signal platform (Russo, 2024). A key strength of healthcare aggregators is their potential to generate network effects. More diagnostic providers can access a platform, offering more choices for customers to access services and locations. In the same way, when patient numbers rise, diagnostic centres have a higher number of patients referred and better utilisation

levels. The partnerships have helped these aggregation platforms grow in the Indian diagnostics market to an extent. The platform model therefore values in two ways by easing interaction between various stakeholders and the reduction of information asymmetry.

In addition, growing urbanisation and changing lifestyles have been advantageous for the healthcare aggregator market. As chronic diseases are becoming more common, sedentary lifestyle and an ageing population have made regular diagnostic monitoring more of a need (Battista et al., 2025). As a result, healthcare no longer relies on the diagnosis of diseases but has also become an integral part of preventive health management through the use of diagnostic testing. For keeping up, healthcare aggregators have made investments in providing subscription-based wellness plans, yearly health packages and preventive screening programs that need continuous client or customer interaction (Team, 2025). However, the industry is still very competitive. Healthcare aggregators tend to compete on discounts, promotions and incentives to customers (Willie, 2025). Such tactics can help to increase the speed of growth, but can also put heavy strain on profit margins. In many instances, aggregators focus on acquiring market share rather than on profitability, leading to concerns about sustainability in the long run. Hence, having a clear understanding of the financial landscape of healthcare aggregators is becoming crucial for healthcare industry players, investors and policy makers looking to foster the overall growth of India's digital healthcare ecosystem.

1.3 Role of Pathology and Radiology as Cost Centres

1.3.1 Role of Pathology and Radiology as a cost centre in the Healthcare Aggregator Business

The pathology and radiology department is seen in the healthcare sector as a cost centre, since it involves high investment in infrastructure, technology, qualified staff, quality control and regulatory compliance. These departments make a revenue from the diagnostic services though also have high operating costs because of equipment purchasing and maintenance, staff, digital systems and consumables. Pathology and radiology are two essential parts of the Indian health care aggregator (pathology) industry and serve as diagnostic service providers and key functional units affecting organizational profitability and operational efficiency (Mahesh et al., 2024). A cost centre is any unit that incurs costs though does not provide revenue. Health care organizations

keep pouring funds into their diagnostic units such as pathology and radiology for continued operation. Pathology labs need sophisticated analysers, reagents, storage areas, laboratory information management system (LIMS) and lab technicians. Similarly, radiology units need expensive imaging technologies like MRI scanners, computed tomography (CT) scanners, ultrasound and X-ray (Brady et al., 2024). Such maintenance and continuous technological innovation consume lots of money. There have been a fragmented and inefficient provision of healthcare services in the country. KS et al., (2023), indicated that there are institutional, retail and government healthcare markets in the Indian healthcare market. The result is a discrepancy in pricing and access to services. In these decentralised systems, pathology and radiology departments work independently which could lead to wasted capital, equipment and resources. Healthcare aggregators try to cut down these inefficiencies by bringing various diagnostic centres together in unified operational structures.

Pathology services are critical as almost the majority of all clinical decisions are affected by the results of laboratory diagnostic reports. These factors influence patient care outcomes and the efficiency of the hospital which are directly related to diagnostic accuracy, turnaround time and reliability. Although, keeping high standards of pathology services can be a costly process with the need to procure reagents, automate systems, implement quality assurance, biohazard management systems and comply with accreditation standards. Radiology departments are also high-cost operational centres due to the high cost of imaging equipment and infrastructure. Healthcare aggregators transform the cost centre approach through centralization, digitization and scalability of operations. According to Mishra et al., (2024), the Ayushman Bharat Digital Mission (ABDM) initiative introduced in India created an efficient digital health ecosystem with a focus on interoperable digital health records. Digitization makes diagnosis easier, eliminates redundancies in services and ensures efficient use of resources at various pathology and radiology clinics. Technology-driven healthcare management systems can help save on costs in the process of diagnosis in pathology and radiology. Almaiah et al., (2022), pointed out the importance of the Internet-of-Things technology, blockchain authentication and decentralized data collection in improving the efficiency and security of healthcare operations. These technologies help aggregator platforms monitor equipment performance, patient record management, report automation and logistics in transporting samples and sharing imaging data. However, with cost centres

classification, the Pathology and Radiology departments have a significant impact on the profitability and competitive advantage of healthcare aggregators. Their effective management can enhance patient satisfaction, boost the number of diagnostics performed, minimize wastage of time and resources in the workplace while facilitating preventive healthcare initiatives.

Pathology and radiology services are among the most vital diagnostic aspects of modern healthcare systems. Both play a major role in disease diagnosis and treatment planning, but they have many differences in terms of how they operate, cost and capital. These differences need to be taken into account when assessing the profitability in the context of healthcare aggregation models and operational optimisation opportunities. Pathology services typically include laboratory testing in which specialized equipment, materials, transportation facilities and trained laboratory staff are needed (Singh et al., 2024). In contrast, pathology testing can be relatively standardized and scaled, but requires good coordination between the teams involved in collecting the samples and those responsible for laboratory processing. Transportation delays, poor scheduling and poor communications can add to costs and impact service quality. Therefore, pathology operations offer a chance for aggregators to add value in the control of customer interaction functions such as phlebotomy and logistics.

In contrast, costs of infrastructure and equipment are much higher for radiology services. Advanced diagnostics technologies such as MRI, CT, PET and ultrasound systems are expensive, need specialized facilities and trained healthcare workers (Hussain et al., 2022). Pathology services can be decentralized in terms of service delivery models, but this is not the case of radiology services that are usually dependent on the centre or the location. The combination of these features brings up the issues of funding infrastructure ownership for healthcare aggregators, especially those aiming to expand quickly while keeping capital resources low. It is important to note the difference between the cost structure of pathology and radiology, which explains the rationale for the proposed hybrid cost structure for the operational model. Although it may not be cost-effective to own the radiology equipment, there may be opportunities for better operational efficiencies and revenue capture with selective control over activities related to pathology such as sample collection and customer communication. Hence, it is crucial to grasp the different nature of pathology and

radiology as cost centres as a basis for developing more sustainable and profitable health-care aggregation business models.

1.3.2 Operational and Financial Challenges of Pathology and Radiology Cost Centres

Many challenges are impacting the Indian healthcare aggregation business from an operational and financial perspective. Diagnostic services are an integral part of healthcare delivery and yet, bring numerous challenges such as fixed costs, dependence on technology, labor, regulations and increasing demands from patients (Oluwagbade, 2025). Therefore, healthcare aggregators have to effectively manage these challenges to maximize efficiency and profitability. Modern pathology labs should have advanced analyser technologies, molecular diagnostic techniques, automation technologies, refrigeration technologies and digital reporting techniques. Likewise, radiology facilities require high-cost imaging technology such as magnetic resonance imaging, computerized tomography, positron emission tomography and ultrasound (Waheed et al., 2022). These departments are capital-intensive as the installation, maintenance, calibration and upgrading of these technologies require ongoing financial investment. Diagnostic departments also have high ongoing operating expenses apart from capital expenses. Reagents, testing kits, collection tubes, biohazard disposal solutions are all needed in pathology laboratories. The unpredictability of costs and dependence on imported supplies of diagnostic substances contribute to cost pressure.

Human resource management remains another key challenge that the service provider faces. The optimal operation of pathologists, radiologists, lab technicians, sonographers and other imaging experts plays a critical role in maintaining diagnostic quality and accuracy standards. Despite the shortage of professionals in the health care sector, particularly in rural and semi-urban areas in India, healthcare aggregators need to allocate funds for the recruitment, education, retention and development of health professionals. According to Dasaradharami Reddy & Gadekallu, (2023), artificial intelligence, machine learning, federated learning and big data technologies are extensively applied in healthcare organizations to enhance healthcare diagnostics and performance. However, these technologies require the development of adequate cybersecurity frameworks, software integration and storage and IT services. It is essential to create secure

infrastructures that ensure the privacy and safety of patients' data for diagnostic aggregators with extensive amounts of such information. One of the other challenges of operation involves the maintenance of quality assurance and accreditation. The diagnostic laboratories and imaging centres are required to meet the national & international quality standards including NABL accreditation, radiation safety standards and infection control measures. Ongoing quality audits, staff training, documentation and periodic equipment validation are required for compliance. It can cause a reputation problem, loss of trust for patients and legal consequences for the organization without adherence to these standards.

The healthcare system of India is also highly decentralized which makes it difficult to manage costs in diagnostic services. As Mor, (2025) emphasized, India does not have a standardized healthcare market as public and private health care service providers do not interact and coordinate optimally. Such an unstandardized market results in intense competition in terms of prices which puts pressure on laboratories to decrease the prices on the provided services. As the operating costs rise, pathology and radiology facilities have little choice but to offer more affordable products as they have no means to reduce their prices significantly. Competitive pricing can become a threat to profitability for smaller companies, especially in pathology and radiology. Implementation challenges related to digital integration also pose a threat. Even though the introduction of the Ayushman Bharat Digital Mission program is expected to facilitate the interoperability of health care facilities and improve digital integration, certain technological restrictions apply to these providers. Smaller pathology and radiology facilities may experience certain problems implementing EHRs and using AI technologies (Alasiri et al., 2024). This highlights that the cost centres of pathology and radiology are challenged with a complex mix of financial, technological, operational and regulatory problems.

1.3.3 The strategic importance of Pathology and Radiology in improving profitability

Pathology and radiology departments are considered cost centres though they are becoming increasingly strategic assets for healthcare aggregators to aim for long-term profitability, market expansion and competitive advantage. Diagnostic services are of paramount importance in the Indian healthcare aggregator pathology as they are in patient acquisition, healthcare integration, preventive medicine, operation scalability and revenue generation (Padole, 2021). Well-run pathology and radiology departments can enhance an organization's bottom line and the quality of care it provides. Pathology and radiology's biggest contributions to profitability are patient demand and diagnostic re-use. Chronic diseases such as diabetes, cardiovascular, cancer and infectious diseases are now becoming more common as well as the demand for laboratory and imaging diagnostics have increased significantly in India. In addition, the increase in volumes of diagnostics is driven by preventive healthcare awareness, routine health check-ups and the employer-sponsored wellness programs. They may take advantage of this demand by providing affordable, easily accessible and digitally integrated diagnostic services. Healthcare aggregators are advantageous as they bring several pathology laboratories and radiology centres under a single operational system, thus realizing the economies of scale (Adekoya et al., 2025). Centralized testing sites minimize infrastructure duplication, maximize equipment utilization and decrease cost of operation per test. Pathology and radiology have been further empowered in the healthcare aggregation models through digital transformation. Bagga et al., (2024), explained that interoperability of healthcare records, telemedicine and digital healthcare platforms contributes to creating convenient services for consumers. It becomes much easier to book an appointment with the facility, undergo home sample collection and view online reports with these digital tools. In addition, advanced systems can use artificial intelligence for diagnosing patients while providing them with high-quality care. These factors improve the retention, loyalty and competitiveness of the company in the market.

Operational optimization through technology plays an important part in boosting profitability. Ali et al., (2023), revealed that the use of IoT in healthcare systems, blockchain authentication and decentralized data aggregation increase the efficiency of work, security of information and workflow management. Pathology and radiology aggregators depend on these

tools for their scheduling, equipment maintenance, logistics optimization and lab workflows management. According to Karthiga et al., (2025), federated learning and AI for medical image analysis improves the diagnostics without infringing patients' privacy. Lastly, pathology and radiology services provide better healthcare and patient care coordination. Integrated healthcare systems improve the continuity of care, referral coordination, and access to healthcare resources (Mirza et al., 2024). The diagnostic aggregators in this context bridge the gap between hospitals, specialists, primary care physicians, and patients via a single digital platform. Improved patient management efficiency and increased diagnostics volumes (referrals) through integrated diagnostic networks. Another significant profitability driver is the healthcare services expanding to tier-2 & tier-3 cities. Access to advanced diagnostics is still a challenge for many small towns in India. Healthcare aggregators have an opportunity to profitably enter these untapped markets through hub-and-spoke, mobile diagnostics, tele-radiology and centralized lab systems. These expansion strategies broaden the market penetration though they do not involve significant risks for the infrastructure investment. Trust has a direct impact on patient retention and referrals in health care. In the fast-growing Indian diagnostic healthcare market, aggregators with solid quality and compliance with accreditation are finding competitive advantages. Therefore, the pathology and radiology departments are more than simple cost centres in the healthcare organisations.

1.4 Problem Statement

The pathology segment of healthcare aggregators in India has been paced under tremendous growth owing to the improved adoption of digital healthcare. It is also getting involved in increasing internet penetration and growing awareness in the context of preventive healthcare services. Healthcare aggregators, such as Practo, PharmEasy, Tata 1mg, and Healthians have transformed the way of offering diagnostic services. These services are provided by online test booking, home sample collection, online reports, and discounted health packages. This market is rapidly increasing but the biggest challenge healthcare aggregators are experiencing in the Indian pathology industry is the sustainability of profitability. The highly fragmented nature of the Indian diagnostic market is one of the biggest issues affecting profitability. There are over 100,000 diagnostic laboratories in India, with almost 85% being unorganised, standalone laboratories and small region players (Dutta, 2026). This disjointed market structure further enhances competition

in prices and reduces the pricing power of healthcare aggregators. Several aggregators have been relying on discounts, promotion activities and customer acquisition techniques to grow market share. After that, it drastically lowers the operating margin. These price aspects have generated a spurt in the customer base but undermine financial sustainability in the long-term.

The other major issue is the increased cost of operation in the collection of samples at home and the management of the logistics. The increasing demand for doorstep diagnostic services necessitates aggregators to have in place effective transport systems, phlebotomy-trained personnel, sample temperature check, and report delivery systems promptly (HealthCareOnTime, 2025). In urban areas like Mumbai, Delhi and Bengaluru, rising traffic jams and rising fuel expenses add to the burden of operational expenses. Delays in transportation of samples or inappropriate handling of samples can have a direct impact on the accuracy of the diagnosis and customer satisfaction (AlSahly et al., 2024). Therefore, it will eventually lead to decreased retention of repeat customers and profitability. Pathology aggregators also have a significant financial challenge in technological investment. Even though AI-based diagnostics and automation enhance efficiency in the long-term, smaller healthcare aggregators often fail to invest in advanced technologies due to the lack of funds (Pillay et al., 2025). Concurrently, data privacy and cybersecurity issues are on the rise. Besides, the healthcare aggregators handle high amounts of sensitive patient data. The adoption of secure digital systems, compliance mechanisms, and encrypted healthcare databases can massively increase operational costs. Consequently, aggregators are incurring huge costs in digital marketing, online advertising, and customer acquisition campaigns. According to industry estimates, customer acquisition costs in Indian digital healthcare platforms have risen significantly following the COVID-19 pandemic due to the heightened competition among online healthcare providers. This scenario puts profit margins under strain and decreases financial efficiency. Moreover, the pathology aggregator business is situated in the context of changing government policies and healthcare compliance needs. The digital healthcare records, diagnostic quality standards and healthcare data protection policies remain in their early stages in India.

The other key factor that impacts on profitability in the case of Indian Healthcare Aggregator Pathology is the skewed value capture between Healthcare Aggregator and the

Diagnostic service providers. The majority of healthcare networks are mainly used as an intermediary, linking patients with third party labs and radiology centres (Rajamani & Iyer, 2023). But the actual diagnostic testing facilities such as laboratory equipment, imaging systems and specialist knowledge are under the control of diagnostic centres. This has led to a significant share of the service revenue being captured by partner laboratories and aggregators to have relatively poor contribution margins. In most cases, diagnostic centres receive almost most of the package income and aggregators only get some percentage of the package income after covering their operational and marketing expenses. This imbalance undermines long-term profits and scalability of an aggregator business model. Also, the reliance on third party diagnostic providers makes for less control of operations and less standardisation of the services provided. One of the biggest problems with healthcare aggregators is ensuring a uniform quality assurance, response time and customer experience within its various partner laboratories. Laboratories can be accredited differently by various accrediting bodies based on different standards, which could create a good or bad influence on customer trust in the service and brand of the accredited laboratory (Akase & Kpera, 2024). Customer experience is among the key competitive advantages in a digital health platform and if the service is not of a high quality, it could lead to lost usage and customer loyalty. Also, with the absence of proper coordination between the aggregator and diagnostic centres, it often leads to inefficiencies in the process, thus adding to the cost of the overall service.

The other key factor is the rise in the danger of disintermediation in the digital health landscape. Mobile apps, digital health technologies and direct-to-consumer (DTC) healthcare services are quickly gaining popularity (Nagappan et al., 2024). Many diagnostic laboratories such as Dr Lal Path Labs and Metropolis Healthcare are now introducing their own online booking and home collection program (News, 2025). This helps patients to have direct engagement with laboratories bypassing the aggregator platforms. This means that healthcare aggregators may lose their ‘middle man’ status and importance in the future. As the integration of the digital healthcare ecosystem is increasing, diagnostic service providers could start to phase out the use of aggregators, putting extra pressure on competitors and diminishing the possibility of commission-based revenues. In addition, there are no integrated operational frameworks between the services in pathology and radiology which would also be conducive to financial efficiency. The majority of healthcare aggregators today operate pathology and radiology services in a disjointed way with

different service providers for each. This disorganized structure leads to higher cost, administrative difficulty and complexity in coordinating. In various scenarios, aggregators do not have the necessary control on the scheduling, logistics management, reporting systems and support functions of the various service providers. The inefficiencies make it less economical and have a negative impact

Indian healthcare aggregators have a medium-sized margin since they are excessively reliant on third-party diagnostic centres, which charge up to 90% of package revenue (Panwar, 2021). This type of pricing structure leaves limited control over cost, quality, and customer experience, while limiting profitability in most cases. Inefficiencies in value capture and fragmentation in operation are caused by the absence of vertical coordination. Therefore, Aggregators experience challenges in scaling the business and maintaining a competitive edge. It is necessary to develop an integrated hybrid way of operation to overcome this structural imbalance that would help to increase the retention of the margin while preserving the quality of offered services and adherence to regulations. The fact that accessibility and price transparency have been enhanced with the help of healthcare aggregation models, though little academic literature has shown their profitability in emerging marketplaces. The current body of literature is mostly centred on operational efficiency and adoption of digital health, yet less research has been conducted in terms of value capture asymmetry between aggregators and diagnostic providers (Chen & Miraldo, 2022). According to the Theory of Transaction Cost Economics, depending on outside partners can make it hard to keep strategic control and maintain a profit margin. The package prices are highly determined by the diagnostic centres in the Indian market, which may reach a maximum. Due to this, the aggregators are left with a small contribution margin (CRISIL, 2024). This disequilibrium poses long-term sustainability issues. Thus, hybrid models of operation that may involve a selective vertical integration with outsourced processing are required to be investigated. The proposed research aims to close the gap between theory and practice by developing a profitability model for Indian healthcare aggregators that is both scalable and financially sound.

The need for greater profitability in the Indian healthcare aggregator pathology segment is growing, as digital health platforms and diagnostic services play a crucial role in clinical decision-

making. The industry faces challenges as competition is getting tougher, prices are going up, services are being delivered in a piecemeal way, and there are gaps in the regulations. Healthcare aggregation providers are two-sided platforms that link patients and diagnostic service providers with pricing mechanisms, bargaining power, and network effects, where all play a significant role in financial outcomes (Zhang et al., 2026). These platforms offer accessibility and convenience as incentives, though they often do not make money in the long run, as they have high costs for acquiring new customers, revenue models based on commissions, and operational inefficiencies. Additionally, in India, there are no standardized regulatory frameworks for diagnostic laboratories (Gupta & Nandraj, 2023), which makes managing cost and service quality difficult. This results in gaps for operational models that cannot provide an appropriate equilibrium between service effectiveness and cost efficiency, which limits profit margins and true scalability.

Digital tools and computer-based health care are still joining to give new ways to try and means to solve some of the problems that are found in the pathology aggregator system. Computer-based health care and diagnostic computer information has the chance to make more precise, faster, and better for the money with diagnosis, yet their use needs to be paid for in infrastructure, working together with people and data management (Georgiou et al., 2021). Additionally, the services within healthcare, such as pathology and radiology, are not always integrated well, which is also responsible for inefficient service delivery and resource utilization. Failing to work well together across digital systems makes it worse to get patients the care they need (Aguirre-Duarte, 2025). Furthermore, operational and monetary costs are incurred by the aggregator platforms (Haripriya et al., 2025). Together, these pain points create a broken service ecosystem with value loss at each stage, which results in reduced profitability throughout the chain.

Pathology aggregators in India can greatly increase profitability through the implementation of strategies that have worked effectively in the insurance aggregator industry. The foundation of this change is to create open, digital-first platforms that give consumers information and choice (Ma et al., 2024). Aggregators can enable users to compare pathology service providers based on price, accreditation, turnaround time, and convenience by developing user-friendly interfaces, in particular, mobile-friendly applications. Such a high degree of transparency will decrease information asymmetry, create trust, and foster greater user

involvement. As mobile penetration is growing at a high rate, especially in Tier-2 and Tier-3 cities, the focus on mobile accessibility will result in a tremendous growth of market penetration and customer base. Therefore, the central problem faced by the Indian healthcare aggregator pathology sector is the inability to achieve sustainable profitability due to fragmented operations, limited margin retention, dependence on third-party diagnostic centres, and increasing operational and technological costs.

Although healthcare aggregators have gained momentum in India, there are still concerns about the sustainability of these business models in the long run. The majority of healthcare aggregators are intermediaries between the customer and the diagnostic service providers and have a strong dependency on third-party laboratory facilities for the pathology processing and fulfilment of diagnostics services. While that would lower the infrastructure investments that would be needed, it may also restrict the value aggregators can add to the healthcare services they provide. One of the major limitations in the existing framework is that of balancing operational functions and the retention of revenues. The aggregators will take care of the customer acquisition, managing the digital platform, scheduling appointments, coordinating logistics, customer support and home collection of samples. These activities have significant operating costs and commitment to resources. However, a significant percentage is usually captured by diagnostic centres and laboratories which actually carry out the testing procedures. Consequently, aggregators have often found that they have low retained margins in spite of meeting customer demand and performing important delivery of service functions.

Operational inefficiencies lead to margin erosion and to high overall delivery cost (CAHL, 2025). Also, with more competition in the health care platform, there have been aggressive discounting strategies and higher customer acquisition expenses, further straining profitability. In view of these difficulties, it is undeniable that there is a need to look into the emerging alternative operational structures that will be better at capturing values, prevent margin leakage and promote financial sustainability. This study proposes and tests a hybrid operational model that will maximise profitability while retaining scalability and service quality in the case of the pathology sector in the Indian healthcare entity which is an aggregator to overcome this.

1.5 Aim and Objectives

Research aim

The study aims to build a comprehensive understanding of the dynamics driving profitability in Indian healthcare aggregator pathology and find ways to increase operational efficiency and value capture mechanisms. In other words, it seeks to investigate how current aggregator-diagnostic relationships, cost structures, and service delivery models influence financial performance, and how they can be optimised with an innovative hybrid operational model. The central aim of this study is to focus on the design and empirical testing of a hybrid operation model to maximise profits, operational efficiency, and scalability of the Indian healthcare aggregator pathology industry through a restructuring of the cost dynamics and better value capture in an aggregator-diagnostic relationship

Research objective

- To analyse the cost structure of aggregator-diagnostic partnerships.
- To identify operational inefficiencies and margin leakages.
- To propose a hybrid model using in-house phlebotomy, run the sample in an outsourced lab processing, and do only the radiology test in the diagnostics centre.
- To estimate profitability improvement in the proposed model.
- To assess scalability and implementation feasibility.

1.6 Research Hypothesis

This study also focuses on achieving the following hypothesis,

H0: The proposed hybrid operational model does not significantly improve profitability in the Indian healthcare aggregator pathology sector.

H1: The proposed hybrid operational model significantly improves profitability in the Indian healthcare aggregator pathology sector compared to the traditional aggregator model.

1.7 Research Questions

What is the best way to make a cohesive hybrid system of operation between pathology and radiology services to enhance profitability, cost management, and service delivery in the Indian healthcare aggregator diagnostic sector?

RQ1: What is the costing model of the aggregator-diagnostic partnership?

RQ2: What are the existing operational inefficiencies and margin leakages in the current model?

RQ3: How can a critical hybrid model with the involvement of in-house phlebotomy, the outsourcing of the sample processing in the laboratory, and the radiology tests proposed to be supervised in diagnostic centres?

RQ4: What is the approximate profitability improvement in the proposed model?

RQ5: What is the implementation feasibility and scalability of the proposed model?

1.8 Research Rationale

The problem of last-mile connectivity is an important issue to tackle, especially in rural and semi-urban regions. To overcome this, aggregators can invest in or partner with local healthcare providers, pharmacies, and diagnostic technicians to enable home sample collection services. Phlebotomist networks and mobile collection units can be implemented to access remote populations and make them accessible even in low-infrastructure areas. The barriers to rural insurance adoption, like irregular incomes and geographic limitations, can be overcome with flexible scheduling, low-cost pricing, and efficient logistics. Reaching these underserved markets will not only spur an increase in volume but will also help in providing inclusive healthcare.

The introduction of outcome-based incentive systems is another significant strategy. Aggregators ought to establish performance metrics that are focused on service quality, customer satisfaction, and accuracy of diagnostics, as well as retention rates, instead of motivating partners by the number of tests performed (Panwar, 2021). This will prevent unwarranted testing and will encourage ethical behaviour throughout the value chain. Labs and service providers with a history of producing high-quality results can be given preferential treatment, such as being seen more, ranking higher within the platform, or even a monetary reward. In the long run, this builds a self-regulating ecosystem of value, not volume, and increases trust and long-term profitability.

Lastly, scale and standardisation can be unlocked by taking advantage of the national-level digital public infrastructure. As suggested by Purnomo (2025), the creation of unified health data systems and marketplaces where various stakeholders, such as patients, labs, hospitals, insurers, and others, can interoperate is based on initiatives such as ABDM. Such platforms can be integrated with pathology aggregators to increase their reach, guarantee data interoperability, and take advantage of the government-supported mechanisms of trust. It can also be followed by promoting the creation of a centralized healthcare aggregation platform like Bima Sugam in the insurance sphere, which will help to provide a level playing field and ensure that all accredited laboratories are present. This not only promotes competition but also provides uniformity in quality and prices throughout the industry.

Thus, the Indian pathology aggregator industry is at a crossroads where the implementation of best practices in the insurance field has the ability to fuel extensive changes in profitability and sustainability. Through digital access, open business practices, consumer education, regulatory adherence, technological inter-connectivity, last-mile connectivity, ethical incentive schemes, and collaborating with the infrastructure of the populace, aggregators can establish a strong and trust-based ecosystem (Russo et al., 2024). With the increasing competition and changes in consumer expectations, it will be the aggregators that place trust, transparency, and innovation first that will be in the best position to succeed in the long term.

Furthermore, the rationale behind this study is reinforced by the growing need to have sustainable and patient-centric healthcare delivery systems in the fast-digitalising healthcare landscape in India. The pathology aggregator industry is a vital part of preventive care as diagnostic services are a key aspect in the early detection of diseases, treatment planning, and monitoring of their long-term health. Nevertheless, the increasing consumer demand is still putting most aggregators under pressure to make profits, with fragmented operations, increasing customer acquisition costs, and reliance on third-party labs. This study is thus required to find the operational models that can strike a balance between low cost, quality of services, and sustainability at the same time.

The research is also significant since the Indian healthcare market is experiencing a booming growth in Tier-2 and Tier-3 cities, where healthcare accessibility is still low. Pathology aggregators have the influence to fill this healthcare gap by means of digital solutions, home sample collection, and connected healthcare ecosystems. However, service expansion in the long-term may prove difficult without profitable and scaled business models. This study can give strategic suggestions on the integration of technology, optimisation of logistics, retention of customers, and development of partnerships. These aspects can effectively help in the sustainable growth of the market. The study also contributes to the knowledge regarding the ways in which the digital transformation, artificial intelligence, and models of healthcare interoperability can contribute. It can help in contributing to the efficiency of the operations, along with patient trust, accessibility, and overall healthcare outcomes in the Indian pathology aggregation industry.

It is important to analyse the existing operational and cost structures of aggregator-diagnostic partnerships and determine the underlying inefficiencies that cause margin erosion to address the identified challenges. That means the existing models often depend on third-party services without sufficient control of important processes such as sample collection, logistics, and quality assurance. These limitations lead to higher operational costs and negatively affect both service reliability and customer satisfaction. Without a coordinated operational framework that integrates pathology and radiology services, it is difficult to achieve operational performance or economies of scale. With the rise in patient-centred demand, there is a pressing need to develop new models to make healthcare an efficient, coordinated, and profitable sector. Hence, this study develops a comprehensive hybrid operational model for in-house and outsourced functions that span across sectors, initiating optimal organisational cost frameworks and service information streams. This paper aims to examine how such a model could alleviate current inefficiencies, diminish margin leakages, and enhance profitability in the Indian healthcare aggregator pathology sector.

The need for this study stems from the rising significance of healthcare aggregators in the digital healthcare landscape in India along with the worries surrounding the sustainability of their profitability. Although current healthcare aggregation platforms have been successful in enhancing access to diagnosis services via digital integration and home-based healthcare solutions, there is still a lot of work to do for many to overcome low retained margin, inefficiency in operation and weak value capture mechanisms. Customer acquisition and market expansion are currently the key aspects of business models, but there is less focus on how business organisation affects profitability and sustainability. Moreover, current academic studies have been mainly looking at digital health adoption, quality of healthcare services provided and platform-based healthcare delivery with little attention given to the financial aspects of aggregator-diagnostic collaborations. Little research has been conducted that investigates margin leakages, cost allocation and other operational configurations for the pathology aggregation industry. Thus, the present study aims to explore the association of operational design with the operational design which can enhance the profitability, operational efficiency and scalability of the healthcare diagnostics industry in India.

1.9 Research Significance

A huge percentage of the population in India has no proper knowledge regarding diagnostic tests, their aim, need, and interpretation. According to Olawale et al., (2024), aggregators can fill this gap by providing simplified and multilingual educational content in video, infographic, frequently asked questions, and blog form. By clarifying when a test is required, the meaning of the results, and how to prepare for the test, users are able to make well-informed decisions. Moreover, partnerships with NGOs, local health workers, and government health programs can expand this educational outreach to underserved and rural communities. Aggregators can increase demand and make the more rational use of diagnostic services by decreasing knowledge barriers.

Compliance and regulatory alignment are also crucial in generating consumer confidence. Pathology aggregators must also be proactive in working with healthcare regulators to put in place a unified quality standard in the labs listed to the laboratories, including NABL accreditation. Credibility can also be improved by implementing transparent pricing disclosures, standardised reporting formats, and transparent redress mechanisms of grievances (Orth, 2021). Similar to the regulations of insurance aggregators established by IRDAI, the same practice can be applied to healthcare to help reduce malpractice, instances of overcharging, or misdiagnosis, and accountability throughout the ecosystem. The proactive adoption of compliance measures by the aggregators increases their chances of being trusted by users and institutional partners.

Another enabler of efficiency and scalability is technology integration. Through API-based systems, pathology aggregators can connect easily to both laboratories and hospital management systems as well as new digital health platforms like India's Ayushman Bharat Digital Mission (ABDM). This enables real-time test booking, status tracking, access to digital reports, and even electronic health records integration (Pandey, 2026). Moreover, the data analytics can be applied in personalisation of recommendations, pricing, and demand forecasting, which enhances service delivery and profitability. The importance of the study is that the factors affecting profitability in the Indian healthcare aggregator pathology market have been thoroughly examined, which is a growing part of the national digital healthcare system. The high growth of healthcare aggregators has redefined how diagnostic services are being offered in India. It is also assessed in the sense

that it is more convenient, cheaper, and accessible to the patients. Nevertheless, even with robust market expansion, some pathology aggregators still have to confront operational, financial, technological and regulatory issues that directly impact their long-term sustainability and profitability (Zoričić et al., 2022). Hence, the paper is important as it will highlight the key obstacles that influence financial performance as well as discuss strategic interventions that will result in enhanced operational efficiency and competitiveness in the market.

The research is academic in the sense that it will contribute to the growing body of literature in the area of digital healthcare management, healthcare economy, and platform-based healthcare business model. Current literature on aggregators in healthcare in India is largely aimed at telemedicine, e-pharmacies, or adoption of digital healthcare, and little research specifically investigates the issue of profitability in the pathology aggregator market. Apte et al., (2023), state that the Indian healthcare sector is rapidly going digital, and numerous digital healthcare companies cannot sustain a business model because of high operational expenses and competition. Thus, this study serves as a valuable contribution to the research gap since it concentrates on the strategies of profitability improvement in the context of pathology aggregation services. The results can be used in the following academic research connected with the economics of healthcare platforms, digital diagnostics, and healthcare operations management. Healthcare aggregator companies and providers of pathology services can also be interested in the study as it will offer insights into operation and strategic practices that will enhance financial performance. The study emphasises that customer retention, integration of technology, optimisation of logistics and management of quality of service play a significant role in ensuring sustainable profitability. Finance.yahoo.com (2025), believes that the Indian diagnostics market will experience uninterrupted growth as there is a growing demand for preventive care and management of chronic illnesses. Nevertheless, there is still high pressure on profitability due to increasing competition, price models based on discounts, and disjointed laboratory infrastructure. Hence, the study can assist healthcare aggregators to come up with more effective pricing strategies, partnership models and technology adoption plans to strike a balance between affordability and long-term revenue generation.

The other critical importance of the study is associated with access to health care and the enhancement of patient care. Aggregators of healthcare are significant in linking patients to affordable diagnostic services particularly in urban and semi-urban areas where the adoption of digital healthcare is on the rise. The research discusses the way in which digital innovation, home sample collection optimisation and integrated healthcare ecosystems can enhance operational efficiency and customer satisfaction as an aggregator. Enhanced profitability may enable the healthcare aggregators to extend services to underserved rural and remote areas where access to good diagnostic facilities is still inaccessible. According to the World Health Organisation, early detection and preventive medical care services are crucial for reducing the burden of diseases and improving the health outcomes (World Health Organisation, 2024).

Thus, a better provision and population health in India can be achieved indirectly by the enhanced financial sustainability of pathology aggregators. The work is also applicable to the context of technological development and digitalisation of the Indian health care system. However, many aggregators face challenges related to implementation costs, cybersecurity threats, and limitations in digital infrastructure. AI-based diagnostic systems can greatly enhance the accuracy of tests, operational efficiency, and turnaround time in pathology services, as per Faiyazuddin et al., (2025). The combination of the capabilities of artificial intelligence and cloud computing, predictive analytics, and the exploitation of digital health data is changing the way that pathology is conducted and diagnostic services are delivered. In this paper, the possible effects of the adoption of technology on profitability and performance in operations will be analysed. It will also analyse the strategies that can be used to balance the costs of innovation and long-term financial returns. This would help healthcare companies to make better investment decisions as far as healthcare technology integration is concerned.

The study is valuable since it not only adds to the body of knowledge but also to practice in the fast-changing diagnostics industry of the healthcare sector. Academically, the study builds on prior studies related to healthcare aggregation, platform economics and operational efficiency and examines the profitability issues as well as value capture mechanisms in the aggregator-diagnostic partnership. The study also adds to the application of the concepts of TCE and RBD to the healthcare service delivery domain. Industry insights will help healthcare aggregators,

diagnostic centres, investors and healthcare entrepreneurs streamline operations and create financial sustainability across the industry (Babatunde, 2024). The proposed hybrid operational model provides a potential solution to margin leakage, better revenue retention and improved scalability and growth without significant investment in infrastructure. Therefore, the study could aid in developing more sustainable business models and also help build the future of digital healthcare and diagnostics in India.

1.10 Structure of the Research

This dissertation comprises five chapters and an overall study of the Indian Pathology sector as an aggregator of healthcare, which covers the aspects of profitability issues and working pattern of the sector. Chapter One covers the research background where it discusses the evolving Indian healthcare aggregator market and why services such as pathology and radiology have become an integral part of the diagnostics market. The chapter illustrates how pathology and radiology are key cost centres and how there are structural profitability issues with healthcare aggregators. It also introduces research problems, research rationale, significance of the study, research aim, objectives and research questions. This chapter serves as a foundation in the conceptual and practical aspects of the study and includes an outline of the required operational and financial restructuring in the sector.

The existing literature of relevance to healthcare aggregation and diagnostic healthcare business models is comprehensively reviewed in Chapter Two. The chapter examines literature about the cost of pathology and radiology, vertical integration strategies, home sample collection services, decentralised healthcare delivery, the disintermediation process, and margin expansion mechanisms in a critical manner. In addition, the underlying theory of the research is explored in the chapter, including concepts such as Transaction Cost Economics and healthcare platform theories. This literature review also reveals some research gaps and constructs the conceptual framework that guides the research.

The methodological framework adopted for the study is explained in Chapter Three. This chapter covers research philosophy, research approach, research design, sampling strategy,

population, sampling size, and research instrument of the study. It also provides a description of a mixed methods research approach, quantitative financial and operational analysis of the healthcare aggregators and qualitative interviews with industry stakeholders. Besides, instruments used to collect data, variables, data analysis techniques, reliability and validity, ethical issues and limitations in conducting the research are presented.

Chapter Four presents the research results obtained from quantitative and qualitative investigations and analyses the results. Quantitative analysis looks at the financial and operational measures of healthcare aggregators, such as pricing models, operational expenses, margins, break-even performance, and similar metrics. The qualitative analysis focuses on stakeholder views on margin pressures, dependency of diagnostic centres, pricing control, operational inefficiencies, cost pressures, and the potential for the proposed hybrid operational model to scale. The result is then presented systematically to support the research objectives and to give insight on the actual situation of the industry.

The discussion, conclusions and recommendations of the study are presented in Chapter Five. The chapter concludes with a summary of the key results of the chapter and their critique with respect to the literature and the theory. It addresses the existing healthcare aggregator model, the inefficiencies in the model, the restrictions on profitability, and the possibility of the proposed hybrid operational model. Financial projections, break-even feasibility, policy implications, managerial implications and industry relevance are also discussed in the chapter. Lastly, the research presents a summary of limitations, recommendations and future research in the Indian healthcare aggregator laboratory pathologist's segment.

CHAPTER 2: REVIEW OF LITERATURE

2.1 Introduction of Chapter

Healthcare aggregator models can be defined as digital platforms that capture consumers (patients) and healthcare service providers (diagnostic laboratories, hospitals, and radiology centres) based on the connection they facilitate. These models combine various service providers into a single interface that allows users to read, compare, and reserve healthcare services effectively. Aggregators play a crucial role in the digital health ecosystems to create the freedom, transparency, and coordination of care (Aguirre-Duarte, 2025). Aggregators have also become significant in the Indian diagnostic and pathology industry with the growing usage of digital, preventative health concerns, and the need to utilize conveniently provided services. However, in spite of intensive growth, their profitability is limited, which requires a more profound assessment of their business and financial model.

The healthcare aggregators could be explained in the framework of the two-sided market theory and the Theory of Transaction Cost Economics (TCE). Two-sided market theory conceptualizes aggregators as two-sided markets that enable interaction of both the patient and the diagnostic provider (Zhang et al., 2026). The network effects, which get more value as more people participate, are also offered by it. These platforms reduce the search and transaction costs by centralizing the information, streamlining the booking processes, and improving the coordination of the services. Transaction Cost Economics explains how healthcare aggregators improve profitability by bargaining, reducing search and transaction costs. Digital pathology platforms minimize information asymmetry, streamline diagnostics, and improve coordination between labs and patients. This leads to lower operational costs, greater efficiency, and improved margins in the Indian healthcare aggregator sector. Although aggregators save the external transaction costs, they usually have a high dependency on independent diagnostic centres to deliver services. This dependence creates a structural constraint in capturing values, as diagnostic providers still have high bargaining power as they control the core asset of the business. As a result, the aggregators can work with low control over price and margins, which further adds to their reliance in the value chain.

Healthcare aggregators also act as digital intermediaries, enabling end-to-end service delivery across the diagnostic journey. They are also linked to diagnostic providers as they offer booking options on the Internet, compare test packages, and book services (Georgiou et al., 2021). Digital health tools, including mobile applications, cloud databases, and Internet of Things (IoT)-based diagnostic devices, also help to improve their operational efficiency. Other logistics like the collection of home samples, delivery of reports, and customer support services are also organized through these platforms, which have an easy user experience. They help to enhance operational coordination and scalability in the healthcare ecosystem by using data aggregation and standardization of service processes.

This chapter has examined literature available regarding the subject of healthcare aggregation, business model of diagnostic healthcare, cost structure in the pathology and radiology sector as well as the business strategies on how to enhance the efficiency of operations in the healthcare sector. The review has pointed to the role played by digitalisation and the emergence of healthcare aggregator platforms in changing the aspect of diagnostic service delivery which has been achieved by bringing various healthcare providers together in a unified digital environment. Other existing literature highlights the advantages of digital platforms in enhancing accessibility, transparency and service coordination in healthcare systems. The literature discussed the classic diagnostic lab model, the cost model of pathology and radiology service with the issue of vertical integration to enhance effectiveness of operations. Although these developments were made, the review showed that there were major challenges associated with cost management, operational inefficiencies and sustainable profitability in the healthcare aggregator pathology industry. The current literature is primarily concerned with digital technologies and their regulation and little consideration of profitability optimisation and operational restructuring. Thus, the proposed research is expected to fill in the identified gap as it suggests and analyses a hybrid type of operation that would enhance profitability and scalability in the Indian healthcare aggregator pathology business segment.

2.2 Concept of Healthcare Aggregation

2.2.1 Introduction to Healthcare Aggregation

Healthcare aggregator models can be defined as digital platforms that capture consumers (patients) and healthcare service providers (diagnostic laboratories, hospitals, and radiology centres) based on the connection they facilitate. These models combine various service providers into a single interface that allows users to read, compare, and reserve healthcare services effectively. Aggregators play a crucial role in the digital health ecosystems to create the freedom, transparency, and coordination of care (Aguirre-Duarte, 2025), they have also become significant in the Indian diagnostic and pathology industry with the growing usage of digital, preventative health concerns, and the need to utilize conveniently provided services. Their profitability is limited, which requires a more profound assessment of their business and financial model.

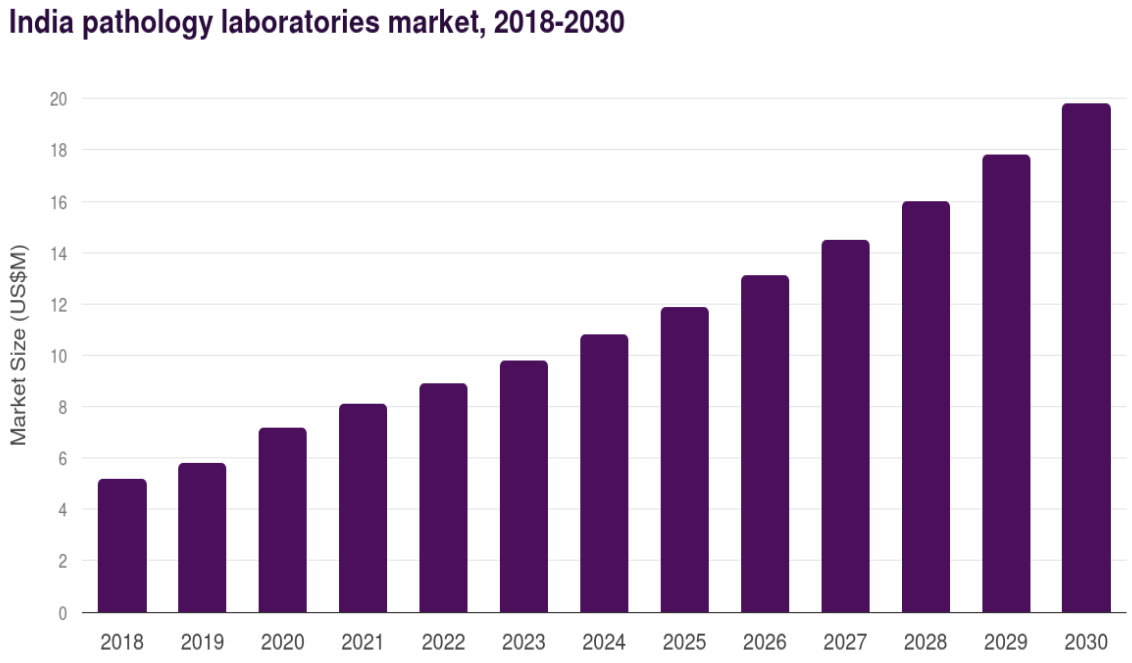


Figure 2.2.1: Indian Pathology Laboratories Market

(*Source*: Grand View Research, 2026)

The India pathology laboratories market generated a revenue of USD 10.8 million in 2024 and is expected to reach USD 19.8 million by 2030 (Grand View Research, 2026). The healthcare aggregators could be explained in the framework of the two-sided market theory and the Theory of Transaction Cost Economics (TCE). Two-sided market theory conceptualizes aggregators as two-sided markets that enable interaction of both the patient and the diagnostic provider (Zhang et al., 2026). The network effects, which get more value as more people participate, are also offered by it. These platforms reduce the search and transaction costs by centralizing the information, streamlining the booking processes, and improving the coordination of the services. Transaction Cost Economics explains how healthcare aggregators improve profitability by bargaining, reducing search and transaction costs. Digital pathology platforms minimize information asymmetry, streamline diagnostics, and improve coordination between labs and patients. This leads to lower operational costs, greater efficiency, and improved margins in the Indian healthcare aggregator sector. Although aggregators save the external transaction costs, they usually have a high dependency on independent diagnostic centres to deliver services. This dependence creates a structural constraint in capturing values, as diagnostic providers still have high bargaining power as they control the core asset of the business. As a result, the aggregators can work with low control over price and margins, which further adds to their reliance in the value chain.

Healthcare aggregators also act as digital intermediaries, enabling end-to-end service delivery across the diagnostic journey. They are also linked to diagnostic providers as they offer booking options on the Internet, compare test packages, and book services (Georgiou et al., 2021). Digital health tools, including mobile applications, cloud databases, and Internet of Things (IoT)-based diagnostic devices, also help to improve their operational efficiency. Other logistics like the collection of home samples, delivery of reports, and customer support services are also organized through these platforms, which have an easy user experience. They help to enhance operational coordination and scalability in the healthcare ecosystem by using data aggregation and standardization of service processes.

Digital transformation and evolving consumer demands have significantly contributed to the rise of aggregation in healthcare. The new healthcare consumers are gradually gravitating towards fast, transparent, and readily available services. In order to address these expectations, healthcare aggregators spend less time and effort to find appropriate healthcare providers. This

helps to establish a more effective healthcare marketplace where information is easily available and services can be accessed with ease. The other significant aspect of healthcare aggregation is that it enhances access to healthcare. Several patients experience challenges in determining trustworthy healthcare providers, price system, and quality of services. Aggregators platforms make these processes easier by displaying information in a systematic and easy way to understand format. This means that the patients are able to inquire more when it comes to making healthcare decisions and the providers are able to access a wider customer base. Healthcare aggregation is also a factor that leads to operational efficiency in the healthcare ecosystem. Aggregators facilitate the process of simplifying patient-provider interactions by incorporating booking, digital payment processes, customer support, and online record management facilities. This integration saves on the administrative loads and enhances coordination of services. Healthcare aggregation has beyond listed of services to value added services such as home sample collection, preventive medical package, teleconsultation support services, health monitoring and delivery of digital reports. These innovations prove the increased role of aggregators in developing patient-centred healthcare systems. With the rise of high-tech and data-oriented healthcare, the phenomenon of healthcare aggregation will become crucial in enhancing the accessibility and efficacy of the services, as well as the overall healthcare provision.

Aggregation in healthcare can be defined as the combination of healthcare services, providers, or data provided by various sources into one platform or system to enhance accessibility, efficiency and coordination of care. Healthcare aggregators in the digital health ecosystems context play the role of intermediaries that mediate between the patients and the healthcare providers, which include hospitals, laboratories, pharmacies, and diagnostic centres, using a single digital platform (Jain, 2023). These platforms help to book appointments, schedule diagnostic tests, compare prices, use teleconsultation and manage digital health records. Therefore, it helps to make the healthcare service delivery process easier. Healthcare aggregation is directly linked to the overall development of electronic healthcare and digital health (Abernethy et al., 2022). The introduction of eHealth in the late 1990s and early 2000s was a major change in the way healthcare is delivered by introducing digital technologies, including telemedicine, electronic health records (EHRs), and mobile health applications (Shen et al., 2025). This application significantly enhances communication, data transfer, and healthcare access to patients, healthcare providers, and healthcare institutions. These technologies effectively help to allow managing health information

effectively and develop a platform for healthcare that links various stakeholders of the healthcare ecosystem.

There are several numbers of health care system have aggregation as a main tenet regarding their purchasing strategy. For instance, when the system tries to purchase products and patients for all of their entities and locations within one purchase order, they are significantly able to hold the aggregate volume regarding the negotiation of a lower per-unit cost. The aggregation mechanisms enable integration of healthcare information across various sources, including hospitals, laboratories, wearable devices, and pharmacy systems (Kotecha et al., 2022). Thus, providing a more comprehensive picture of the health and healthcare business of a patient. These types of aggregated systems enhance the decision-making process, increase coordination among providers and decrease redundancy in the healthcare procedures. The development of healthcare aggregation models has increased in the last few years as Internet-based platforms and mobile technologies have developed further (Mishra & Singh, 2023). These types of platforms serve as digital brokers that bring services provided by other healthcare providers together and make them available in one user interface. Healthcare aggregators increase the transparency of the services, and they mitigate the information asymmetry because a patient is able to access various services through a centralised system. Similarly, they enhance the efficiency of operations through the optimal use of resources and promote the management of healthcare data more effectively.

2.2.2 Evolution of Healthcare Aggregator Platforms in India

The development of healthcare aggregator platforms in India has been closely tied to the speedy digital transformation of the health care sector and the growing adoption of online services. India has witnessed significant growth over the past decade in the adoption of smartphones, internet connectivity and digital payment systems that collectively have contributed to the growth of online healthcare ecosystems. Due to these technological developments, healthcare providers were able to use the platform-based service delivery model that enables them to connect a patient with a hospital, diagnostic lab, healthcare professional and a pharmacy via a digital platform. For example, 23 states of India are operationalizing the e-Sanjeevani platform and capturing over 75 % of India's population. India's healthcare system has long been plagued by fragmentation, a shortage of access, and a lack of coordination in services. To overcome these inefficiencies,

healthcare aggregators became digital intermediaries that streamlined healthcare access, consolidating various healthcare services into one place.

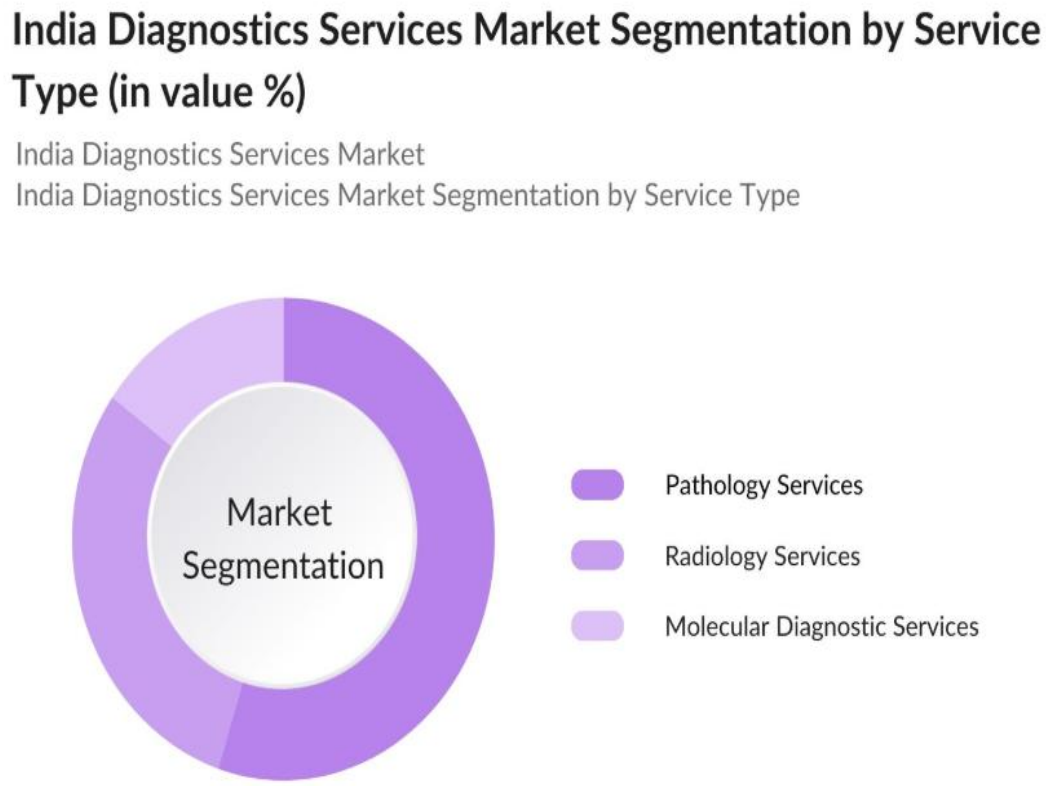


Figure 2.2.2: India Diagnostics Services Market Segmentation

(*Source*: Ken Research, 2023)

The market is further segmented by application into Infectious Diseases, Oncology, Cardiology, and Endocrinology. Infectious diseases account for the highest market share within this segment, largely due to India's high incidence of infections such as tuberculosis, dengue, and malaria. With health authorities pushing for regular screenings and diagnostics to control the spread of infectious diseases, this sub-segment remains a priority within healthcare settings. There has been huge progress in the development of molecular biological tools, optical and imaging tools such as tomography, robotics, additive and subtractive manufacturing, sensor technologies, storage of data on semiconductor chips, growth of telecommunication networks and many more. And due

to the COVID-19 pandemic, consumers are becoming highly dependent on leveraging digital healthcare services and a healthcare delivery model that prioritizes remote services. A report by Federation of Indian Chambers of Commerce and Industry (FICCI) has indicated that the adoption of e-pharmacy by Indian households has increased 2.5x during the pandemic (Paliwal et al., 2025). The awareness of preventive healthcare among consumers also aided in the growth of the healthcare aggregation services with patients increasingly looking for convenient and technologically-driven healthcare solutions. Moreover, healthcare aggregator platforms have been sustained with the incorporation of cloud computing, artificial intelligence, data analytics, and mobile healthcare apps. The technologies simplify the process of scheduling, improve patient experience, coordinate, and provide healthcare easier accessibility in urban and semi-urban settings. Healthcare aggregators, consequently, have become key players in the Indian healthcare landscape, improving transparency, convenience, and operational efficiency. However, there are still profitability, regulatory, pricing and reliance on third-party diagnostic centres issues that affect the sustainability of these platforms despite the rapid growth.

The expansion of internet access and smartphone-based networks opened up new possibilities to digital healthcare companies. The primary aim of healthcare platforms was to present the information regarding the doctors, hospitals, and diagnostic centres. These websites served as online directions which assisted patients in finding healthcare providers more conveniently. With the growth in digital use, aggregator platforms started to extend their services past sharing information but offered online booking of appointments, comparing services, and providing them with digital payment. The COVID-19 crisis also increased the rate of rise of healthcare aggregators. In this time, remote healthcare solutions were highly favoured by many patients to reduce the need to visit healthcare facilities. Also, aggregators sites added more features such as online consultants, home based diagnostic testing, digital health records, and door step healthcare support. These technologies made things easier and more acceptable to the population concerning digital healthcare services.

The introduction of advanced technologies has also been another significant step in the development of healthcare aggregators. The platforms have been facilitated by artificial intelligence, cloud computing, data analytics and mobile health applications to give personalised recommendations and enhance operational efficiency. Technology is now helping the aggregators

to study the customer preference, booking appointments in a better way and even improving the quality of service. Increased investment by private investors in the industry and medical technology firms has also been witnessed. This financial assistance has promoted innovation, growth of services, and competition in the market. Healthcare aggregators are changing to be more than middleman into all-encompassing healthcare frameworks that interlink patients, healthcare services, insurers, pharmacies, and diagnostic centres. It is anticipated that their ongoing growth will have a major impact in enhancing health care accessibility, efficiency, and patient experiences in India.

2.2.3 Functions and Operational Structure of Healthcare Aggregators

Healthcare aggregators use an integrated digital platform for healthcare service providers to connect with patients in a platform-based business model. They act as a middleman, thus linking all the required health care services, namely diagnostic testing, pathology, radiology, tele-consultation, medicine delivery, and house care service, via a centralized digital platform. The healthcare aggregator's main purpose is to enhance patient access, convenience, and coordination while minimizing inefficiencies in the healthcare delivery system. But the primary challenges are an ineffectively organised healthcare system and the ongoing lack of health workers. Healthcare education, functional literacy and overall prioritization of health are inadequate and further compound the ineffective delivery of healthcare and public health interventions. Except for systemic issues, an obvious disparity exists in the distribution of health care resources. More than 75% of healthcare infrastructure is located in metropolitan areas, even though just 27% of India’s population resides there.

One of the main duties of healthcare aggregators is to make healthcare services more easily accessible for patients. Aggregator platforms enable consumers to shop and compare different healthcare providers, receive pricing, book appointments, undertake diagnostic procedures and receive reports online. One of the main elements of care coordination is the capacity to share and communicate information effectively along the care pathway of patients. Healthcare aggregators create a seamless customer experience from service choice to delivery of reports via mobile apps

and web platforms (Chen et al., 2024). Such e-triage reduces the cost of search and improves the efficiency of healthcare conveyance systems.

Aggregators are able to control pathology service, radiology services or both services within one operating network within the diagnostic healthcare industry. Patients can request diagnostic packages online, book home samples to be collected, get a digital test report, and use customer support services, which is available on the platform. Healthcare aggregators have evolved their operations with home sample collection services. And it has become very important since there has been a rising demand for healthcare services. The aggregators usually work with third-party laboratories and diagnostic centres for processing of tests and keep the digital coordination and customer management in hand. Healthcare aggregators rely significantly on digital technologies and data management systems to manage their operations. This health care digital technology enables improved diagnostics and targeted therapeutic tools. Scheduling, workflow, report generation, and communicating with clients are achieved through cloud-based platforms, healthcare databases, AI, and interoperability platforms. With these technologies, coordination of patient activities, phlebotomist, diagnostic lab, and health practitioner activities can occur in real time. Moreover, the workflows are also streamlined to perform efficiently to reduce turnaround time and improve customer experiences. But health care aggregators are also contending with structural problems surrounding reliance on third-party diagnostic centres, cost, standardisation and operational coordination.

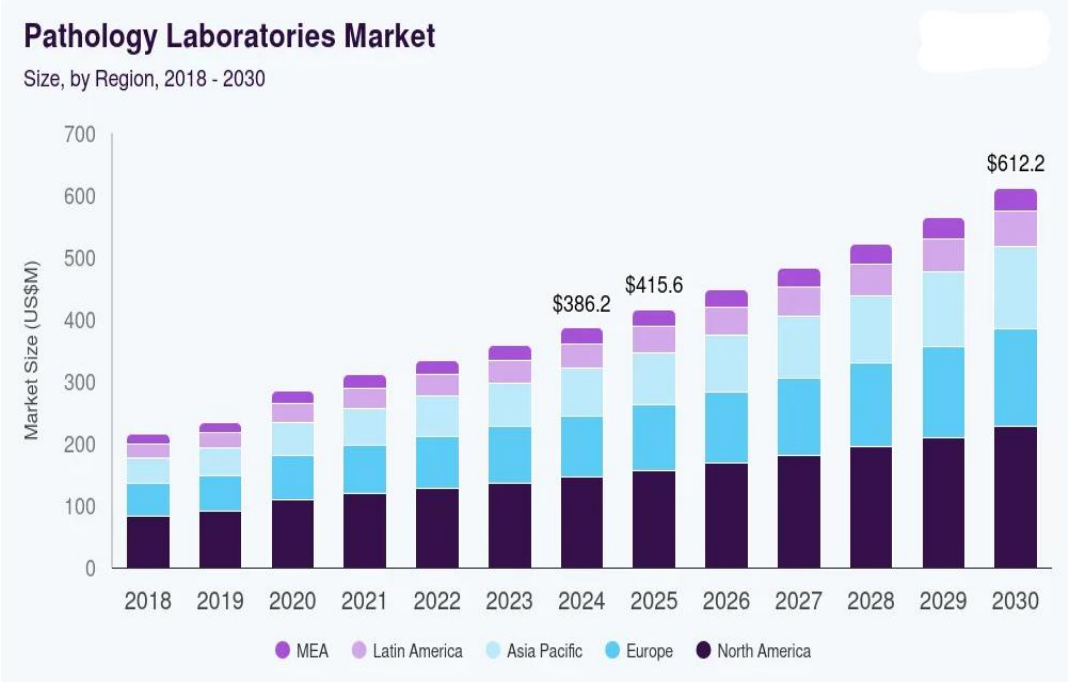


Figure 2.2.3: Expected Trends in Pathology Laboratories Market as Per Geographical Aspects

(*Source*: Grand View Research, 2025)

The global pathology laboratories market size was estimated at USD 386.2 million in 2024 and is projected to reach USD 612.2 million by 2030, growing at a CAGR of 8.1% from 2025 to 2030. The market is significantly influenced by the expansion of healthcare facilities in developing countries, the heightened demand for regular medical examinations, and enhancements in the reimbursement policies for diagnostic tests. Healthcare aggregators in India undertake various significant roles that assist them to link patients and healthcare service providers in a more efficient and organised way. Their main task is to play the role of the intermediary that unites several healthcare services into one digital platform. This will enable patients to have access to various healthcare alternatives without necessarily engaging in engagement with individual health care providers. One of the major functions of healthcare aggregators is information management. These platforms gather systematic information regarding healthcare services, the cost, availability, places and the quality of the services. Aggregators by providing this information in a structured format enable patients to make an informed choice depending on their needs and preferences. They also

make it easier to locate healthcare services as they minimise the information gap between the provider and consumers.

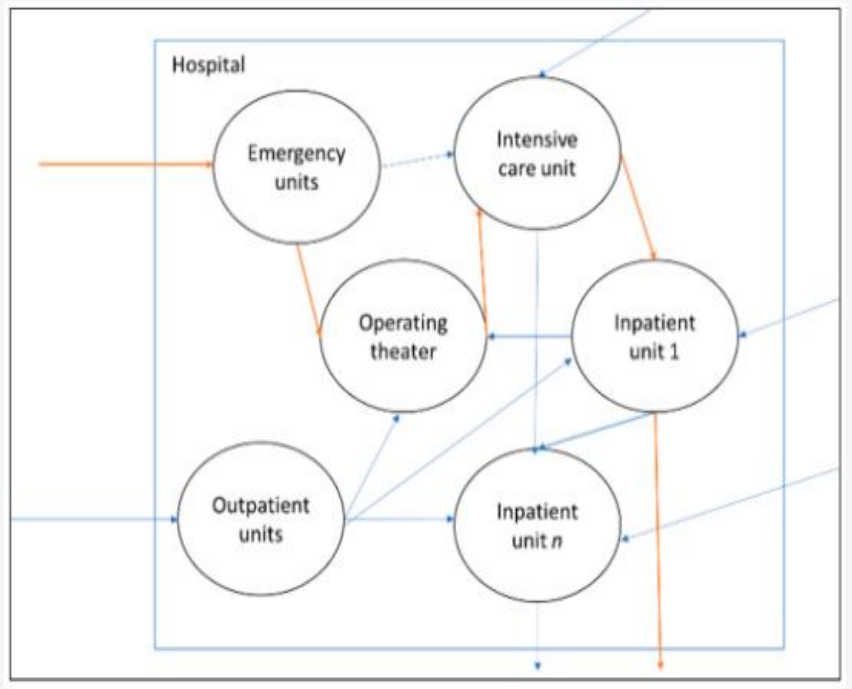


Figure 2.2.3: Hospital Organisational Structure

(*Source*: Winasti, 2023)

Another information function is service coordination. Healthcare aggregators control the communication between patients and healthcare providers by organising appointments, handling orders, collecting payments, managing customer service, and delivering reports. This integration enhances efficiency of operations and minimises administration pressure on healthcare organisations. There are also several aggregators, which can offer automatic reminders, follow-up messages, and customer support to enhance the user experience. The strategic arrangement of the healthcare aggregators is usually inclusive of three key elements such as the digital platform, service providers, and customers. The online platform is the master system which handles transactions, communication and data transfer. The actual healthcare services are provided by the service providers such as laboratories, clinics, pharmacies, and hospitals, and patients utilise the platform to get these services. Most aggregators have technology teams, customer service units, logistics providers, and data management teams to facilitate their daily activities. The functions provide effective coordination among various stakeholders. With the emergence of new digital

healthcare, healthcare aggregators are transforming to integrated platforms that integrate technology, healthcare delivery, and customer management. Their business model allows them to be more efficient, expand their market and increase their access to healthcare in various areas of India.

2.2.4 Types of Healthcare Aggregator Models

The business models of healthcare aggregator platforms vary based on the type of healthcare services offered, their structure, and how they generate revenue. The Indian digital healthcare market can be divided into tele-health, mHealth, electronic health records/electronic medical records (EHR/EMR), remote diagnostics and healthcare analytics and others (Viswanadham et al., 2021). With the rapid growth of digital healthcare services in India, a number of healthcare aggregator models have evolved in the country that bridge the gap between healthcare providers and patients. These models have been mainly developed to enhance the accessibility of health care, operational efficiency, and service coordination in the health care ecosystem. The Diagnostic healthcare aggregator model is one of the most important models of healthcare aggregation. This model mainly works with pathology, radiology and diagnostic testing services, and helps connect patients with diagnostic laboratories and imaging centres through digital platforms. Diagnostic aggregators help individuals compare diagnostic ascertainment costs, purchase diagnostic packages, schedule sample collection at home and obtain a digital report (Benda et al., 2021). The model is based on cooperation with third party laboratories and diagnostic centres, and is primarily handled by the aggregator in the field of customer acquisition, digital coordination and service integration.

Another crucial healthcare aggregation model is telemedicine and online consultation platforms. These aggregators tie patients with healthcare professionals by means of mobile apps and web-based platforms with virtual consultation systems. For instance, smart medical facilities can monitor the use and status of medical equipment, which ensures its timely maintenance and minimizes downtime (Secundo et al., 2021). During and after the COVID-19 pandemic, telemedicine aggregators have emerged as more of a priority due to the need to deliver healthcare remotely. These platforms serve as a means of overcoming geographical obstacles, making

healthcare more accessible, and allowing patients to receive healthcare from remote locations. Another emerging type in digital healthcare ecosystems is the aggregators of pharmacies and medicine deliveries. These platforms bring together pharmaceutical suppliers, as well as medicine retailers, and allow users to order pharmaceuticals, healthcare products and wellness items online. Integrated healthcare marketplace models provide a single digital platform that integrates various healthcare services, including diagnostics, teleconsultation, pharmacy delivery, preventive healthcare and insurance services. Healthcare aggregators also vary based on their business models. The key challenge for asset-light models is digital coordination and customer acquisition, relying mainly on third-party healthcare providers. On the other hand, Hybrid operational models involve hybrid approaches with selected in-house activities (such as sample collection or even phlebotomy) to enhance operational control and profitability.

2.2.5 Digital Technologies Enabling Healthcare Aggregation

The use of digital technologies plays a critical role in shaping and effectiveness of healthcare aggregator platforms. Information technology and access to the internet, along with the digital healthcare infrastructure, enabled healthcare aggregators to connect patients, medical professionals, diagnostic tests and pharmacies to centralized digital ecosystems (Secundo et al., 2021). Such technologies facilitate the co-ordination of services, workflow optimization and enhance access in healthcare. The use of cloud computing technologies and the digitalization of healthcare databases have also transformed the healthcare aggregation models, which offers the possibility of storing data on a central location and sharing it in real-time. This would mean that healthcare aggregators would be able to run their patient records, agendas, lab reports, billing systems and workflows in one single digital location through cloud. These technologies can be used to dissolve silos among healthcare organizations, diagnostic lab, and aggregator platforms, decrease delays, and simplify the coordination process.

Artificial intelligence (AI) and healthcare analytics are important technology drivers within healthcare aggregation systems. AI helps to coordinate diagnostics, make predictions, manage customers and make decisions for operations. Through data analysis, healthcare aggregators are able to understand the behaviour of their customers, how to optimize their scheduling systems,

anticipate the needs of their services and increase their operational efficiency. Real-time data processing, pattern recognition, and actionable insights are now possible with AI-powered analytics, enhancing operational efficiency and strategic planning (Nweke et al., 2025). There are also other uses of AI in automating report processing, offering digital customer support, and personalised healthcare recommendations to improve customer experience and service quality. Mobile healthcare applications and Internet of Things (IoT)-enabled systems have greatly improved the accessibility and convenience of healthcare delivery. Mobile application facilitates virtual appointment booking, Teleconsultation services, scheduling of diagnostic tests, request of home sample collection and report delivery. Recent reviews have provided an overview of the different services and applications of IoT in health care like eHealth, mobile health [mHealth], ambient assisted living, semantic devices, wearable devices and smart phones, and community-based health care (Kelly et al., 2020). Integrated digital records allow for seamless data sharing across healthcare platforms, hospitals, labs, and pharmacies. And it's helping to streamline health care and prevent duplication of care. Healthcare aggregators' operational efficiency is also boosted by the use of Electronic Health Records (EHRs) and interoperability frameworks (Carlos Ferreira et al., 2024). In addition, automation technologies enrich the workflow management, customer communication, logistics coordination and report generation in the diagnostic health care systems. While these benefits exist, there are also challenges associated with digital technologies in healthcare aggregation, such as cybersecurity, data privacy, infrastructure investments, and technology standardisation. Yet, digital technologies play a crucial role in enhancing the scalability, smoothness of operations, and efficiency of services within contemporary healthcare aggregation systems.

2.2.6 Benefits of Healthcare Aggregation

The healthcare aggregation process in modern healthcare facilities has several benefits concerning the efficiency, cost and service. Their accessibility, convenience, and coordination of health services by linking healthcare providers, diagnostic labs, and pharmacies with patients through digital platforms is improved. Healthcare aggregators play an important role in curbing inefficiencies especially in emerging healthcare markets such as India. One of the main advantages of healthcare aggregation is that it allows increased access to healthcare services (Gizaw et al.,

2022). Digital healthcare platforms empower patients to access diagnostic services, digital teleconsultation, pathology testing, delivery of medication, and healthcare information using mobile applications and online systems. It is particularly useful when people do not have a sufficient health infrastructure or expertise in semi-urban and rural regions. Healthcare aggregation helps to break down geographical barriers and enables patients to receive healthcare services remotely and more conveniently. Another aspect of healthcare aggregation is that it cuts down on healthcare search and transaction costs. Centralised digital platforms enable patients to access information about health care providers, diagnostic packages, pricing models, and quality of care. This contributes to transparency in health care delivery, with informed decision making by the consumer. Digital coordination further helps to decrease wait times, increase scheduling efficiency and enhance the delivery speed of healthcare services.

Another major benefit of healthcare aggregation is enhanced operational coordination for healthcare providers, diagnostic centres, labs and healthcare professionals. Aggregator platforms streamline appointment scheduling, home sample collection, report delivery, payment processing, and customer support services through automated workflows. With this integration, it enhances operational efficiency and minimizes fragmentation in healthcare delivery system (Bendowska & Baum, 2023). Healthcare aggregators can also help healthcare providers and diagnostic laboratories scale and expand in the healthcare market. Platform-based systems enable health providers to reach more customers without a very large physical infrastructure. Besides, aggregators also enhance customer experience by providing them with healthcare integration services, digital communications, and healthcare management systems. Additionally, healthcare aggregation can play a role in the prevention of health issues by enabling individuals to monitor their health more frequently, receive early diagnoses, and receive easier access to diagnostic services. Digital technologies and centralized healthcare coordination optimise resource use and service efficiency, while also paving the way for the future modernization of healthcare services. While there are some implementation hurdles to consider, healthcare aggregation remains a valuable tool for healthcare providers and patients in the modern digital healthcare landscape.

2.3 Business Models in Diagnostic Healthcare

2.3.1 Introduction to Business Models in Diagnostic Healthcare

In the field of diagnostic healthcare, business models describe how a pathology lab, radiology centre, healthcare aggregator, or diagnostic service provider can provide value in their operations, provide services and earn revenues. These business models shape the way health care organisations run their practices, coordinate operations, budget costs and generate profits in the health care ecosystem. Business models and decision making are important in the delivery and implementation of technological innovations in the healthcare sector, particularly for entrepreneurs, healthcare providers, managers, researchers and policymakers. For diagnostic healthcare industry business models are of special significance as pathology and radiology service business models are complex, requiring infrastructure investments, technological integration and constant quality management. Digital healthcare, high awareness of preventive health, and a need for easy access to diagnostic services have all contributed to a massive shift in the diagnostic healthcare sector (Hermes et al., 2020). These traditional systems were very much dependent on continuous physical infrastructure, on-site testing laboratories, and on-site visits of patients for the provisioning of services. But the rise of digital healthcare technologies has led to the development of platform-based healthcare aggregation systems, which connect patients, laboratories, radiology centres, and healthcare professionals in a digital network.

Understanding diagnostic healthcare business models is all about understanding the relation between operational structures, pricing mechanisms and profitability. A lot of investments are needed for diagnostic services for laboratory infrastructure, medical equipment, an artificial intelligence system, QA system and medical experts. Therefore, business models of healthcare organisations should be able to meet criteria of operational efficiency, service quality, scalability and financial sustainability (Hermes et al., 2020). Pricing policies, commission splits, logistics management and acquisition expenses of customers have a direct impact on the profitability of diagnostic healthcare providers and healthcare aggregators. Digital transformation has also changed the competitive landscape in the field of pathology and radiology. Technology-enriched healthcare platforms, such as online booking systems, home sample collection services, digital

report delivery, and integration with telehealth have emerged as vital tools for enhancing patient care. Studies show that by 2019 it is expected that there will be more than 86 million mobile connections (projected to be 1.05 billion by 2025). This will greatly ease the deployment of the personalised telemedicine service globally and greatly help in the provision of personalised health care (Jones-Esan et al., 2024). The healthcare aggregators have become the bridge between healthcare providers and recipients, enhancing accessibility and convenience for patients. However, a number of digital healthcare aggregators are still struggling with profitability due to their reliance on third-party diagnostic centres, low margin holding, lack of one-stop operations and price capping. The ever-increasing demand for scalable and technology-enabled healthcare systems has put a strain on sustainable healthcare diagnostic business models in the Indian healthcare industry.

2.3.2 Traditional and Digital Diagnostic Healthcare Models

Traditional diagnostic healthcare models in India now depend historically on the standalone pathology laboratories, hospital-based diagnostic departments, and independent radiology centres. These models mostly operate through the physical infrastructure where patients are needed to visit various healthcare facilities for consultation, sample collection, diagnostic testing, and report collection. Traditional diagnostic processes hugely rely on direct patient interaction, manual coordination, and decentralized service operations. Pathology laboratories along with the radiology centres function as the independent service providers with the limited digital integration or coordination among the healthcare stakeholders. As per the Adekoya et al., (2025), traditional healthcare models need substantial investment in the infrastructure, medical equipment, laboratory technologies, skilled professionals, and quality assurance systems.

As per the words of Akase and Kpera (2024), traditional healthcare models need higher investment in infrastructure, medical equipment, laboratory technologies, skilled professionals, and quality assurance systems. In addition, the operational structure of traditional diagnostic healthcare is sometimes associated with the high fixed costs, fragmented workflows, and limited scalability. Along with that, service accessibility in the semi-urban and rural areas remains a challenge because of the improper distribution of healthcare infrastructure across India. Traditional

diagnostic models mostly follow a fee for the service revenue structure where patients directly pay for imaging service and diagnostic service. These models always focus hugely on the physical service delivery and relied on patient football for revenue generation. Therefore, operational inefficiencies including long waiting times, lack of transparency in pricing, delayed report delivery, and improper coordination among the laboratories and healthcare providers have minimized entire service efficiency. In addition, independent laboratories sometimes deal with difficulties to maintain standardized quality, technological advancements, and competitive pricing because of the limited operational and financial resources.

On the other hand, digital diagnostic healthcare models have emerged with the increasing growth of the healthcare technology, internet penetration, and digital healthcare ecosystems in India. However, digital diagnostic models mostly operate through the platform-based healthcare aggregation process which connect patients, diagnostic laboratories, radiology centres, and healthcare professionals through mobile applications as well as online platforms (Kiran et al., 2023). These models mostly focus on enhancing accessibility, operational efficiency, customer convenience, and scalability through digital adoption. In this context, services including online appointment booking, home sample collection, digital report delivery, teleconsultation integration, and preventive healthcare packages are now the main features of digital healthcare platforms.

Digital diagnostic healthcare models simplify and enhance the patient experience with the help of technology. Patients will be able to search and find tests, make online appointments, pay tests electronically and get reports through websites and mobile applications. These sites are more convenient and help to avoid the necessity to visit doctors regularly. Fast communication between patients and service providers is also facilitated by digital models. Electronic diagnosis systems are able to hold patient records, test history, and give personalised health advice. This enhances a continuity of care and can enable the patients to monitor their health more efficiently with time. Digital models contribute to remote healthcare care, which enables testing care providers to access customers in areas with potentially limited healthcare infrastructure. Several organisations are implementing hybrid solutions by incorporating the use of traditional laboratory facilities as well as digital service delivery. This integration enables healthcare providers to continue delivering quality diagnostics, enhance access, operational efficiency, and customer satisfaction.

2.3.3 Hybrid Operational Models in Diagnostic Healthcare

Hybrid operational models in diagnostic healthcare refers to the adopted business structures which combine both in-house operational functions and outsourced healthcare services in order to enhance efficiency, profitability, scalability, and service quality (Singh et al., 2025). These models have increased massive importance in the Indian healthcare aggregator pathology sector because of the limitations of both the traditional and fully digital asset-light models. In the present healthcare ecosystem, most of the diagnostic aggregators hugely depend on the third-party laboratories and radiology centres for service delivery that sometimes minimizes the operational control, service standardisation, and profit margins. However, hybrid operational models attempt to overcome all the challenges through particularly internalizing critical operational activities while continuing to outsource specialised diagnostic processes. The hybrid model mainly combines various in-house activities including customer management, digital platform operations, home sample collection, logistics coordination, and phlebotomy services with the outsourced laboratory processing along with the radiology testing.

This approach allows healthcare aggregators to manage better control over the customer experience, service quality, and operational workflows while avoiding the hugely high capital investment needed to establish full-scale diagnostic laboratories and radiology infrastructure. As per the Transaction Cost Economics theory, hybrid operational structures allow healthcare organizations to reduce the overall dependency on the external service providers as well as reduce coordination inefficiencies within the value chain (Victor and Paulo, 2023). By controlling chosen operational functions internally, aggregators may minimize costs of transactions, enhance turnaround time and also improve profitability. One of the significant advantages of hybrid operational models is the enhancement in value capture mechanisms. In the traditional aggregator systems, third-party diagnostic centres mainly retain the majority of the service revenue as they control the overall structure of laboratory and testing abilities.

Therefore, hybrid models help aggregators to capture a huge share of operational value through in-house phlebotomy teams, logistics management, digital customer engagement, and preventive healthcare services. This enhances contribution margins while improving the

operational flexibility and service standardisation. Along with that, hybrid models support better quality control as aggregators may directly supervise the process of sample collection, transportation standards, and customer interactions. Integration of technology is important to support hybrid operation healthcare models (Kar et al., 2025). AI, cloud-based healthcare systems, and digital health records, as well as automated workflow management systems, enhance the smooth cooperation between in-house facilities and outsourced diagnostic facilities. Homely sample collection tracking systems, digital reporting, and predictive analytics allow increasing the efficiency of operations and customer satisfaction further. Hybrid operational model further enhances scalability by enabling healthcare aggregators to enter into tier-2 and tier-3 cities without spending much on a complete laboratory.

Under a hybrid model, some of the operations such as customer support, booking of appointments, sample collection and logistics can be handled by the healthcare organisation. Specialised services such as laboratory testing, using advanced imaging, or validating the given reports can be conducted by external diagnostic partners. This enables organisations to specialise in their strengths and have specialised expertise whenever they require. Flexibility is one of the significant advantages of the hybrid operational model. Without investing a lot in infrastructure, healthcare providers can tailor their operations to meet the demand in the market. This is especially applicable within the fast-growing healthcare markets whereby the demand of services in various locations and customer segments can vary. It is also able to support improved utilisation of resources through hybrid models. With internal control and external support, organisations are able to minimise bottlenecks in the operations of the organisation, increase turnaround time, and enhance the quality of services. The models are also used to enable healthcare providers to be able to expand to new geographical locations without necessarily developing full-scale diagnostic facilities in each location. With the rising competition within the diagnostic healthcare industry, hybrid operational models are emerging as a viable approach towards balancing cost-effectiveness, quality of services and business development. They offer a sustainable model that enables organisations to stay competitive and at the same time, address the changing demands of healthcare consumers.

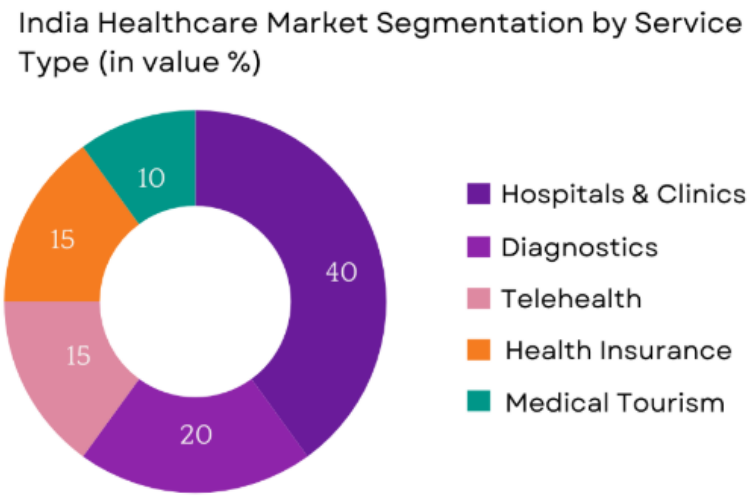


Figure 2.3.1: Indian Healthcare market segment

(*Source*: nexdigm, 2025)

2.3.4 Revenue, Pricing, and Cost Structures

Revenue generation, pricing mechanisms, and cost structures are important components which identify the financial sustainability along with the profitability of diagnostic healthcare businesses. In the Indian healthcare aggregator pathology industry, revenue models are mostly influenced through diagnostic service demand, commission-sharing arrangements, operational efficiency, customer acquisition strategies as well as the level of digital adoption within the healthcare delivery process. In addition, diagnostic healthcare providers and aggregators generate income initially through the pathology testing, radiology services, preventive healthcare packages, home sample collection services, and partnership with the hospitals, insurance companies, and corporate wellness programs (Hanna et al., 2025). In addition, traditional diagnostic centres mainly follow a direct fee-for-service pricing model where the patient pays particularly for the pathology tests, imaging services, and consultation-related diagnostics. In addition, revenue in this mode relies on the patient footfall, test volumes, and laboratory infrastructure utilisation. Therefore, digital healthcare aggregators utilize a more changeable pricing structure which includes discounted health packages, subscription-based preventive care plans, bundled diagnostic services along with the commission-oriented partnerships with the third-party laboratories. Healthcare aggregators sometimes negotiate discounted testing rates with the diagnostic providers while

earning a revenue through the service commissions, digital convenience fees, and customer acquisition margins.

As per the Mbata et al., (2024), preventive healthcare packages and personalized healthcare services are now important revenue streams for the digital diagnostic platforms as of gaining awareness related to lifestyle diseases and preventive testing. Pricing strategies in diagnostic healthcare are hugely competitive and also highly influenced through customer price sensitivity, market fragmentation, and technological advancements. In India, the pathology sector consists of both the unorganized as well as organized laboratories that resulted in massive pricing variation towards the providers. Thus, healthcare aggregators sometimes use promotional discounts, loyalty programs, and digital marketing campaigns in order to attract consumers and gain usage of the platform. However, aggressive pricing strategies could allow higher market share and customer acquisition in the short term and higher discounting may massively minimize profit margin and reduce long-term financial sustainability. However, balancing affordability with the operational profitability keeps a significant challenge within the diagnostic healthcare sector.

Diagnostic healthcare systems have complex cost structures because pathological and radiology services are capital intensive. Diagnostic organisations face high fixed and variable costs related to the laboratory infrastructure, imaging devices, reagents, quality assurance programs, the salaries of the qualified workforce, digital technologies, logistics, and applicability to regulatory standards. Radiology centres also need costly imaging equipment MRI, CT scan, and ultrasound equipment, as well as pathology labs need automated labs, lab material, and special storage equipment (Kelvin-Agwu et al., 2024). Other operational expenses of digital healthcare aggregators are associated with the technology development, cloud computing, cybersecurity system, mobile applications, customer support, and online marketing efforts.

2.3.5 Challenges and Relevance to the Present Study

The Indian diagnostic healthcare aggregator industry deals with various operational, financial, technological, and regulatory challenges which directly affect the overall profitability, scalability, and service quality (Ibeh et al., 2025). Instead of the rapid growth of the digital healthcare platforms and gaining needs for pathology and radiology services, a lot of healthcare aggregators continue to struggle with the sustainable business performance because of the fragmented market structures and reliance on the third-party diagnostic centres. In this context, one of the significant challenges is the imbalance in value capture among the healthcare aggregators and diagnostic service providers. Most of the aggregators operate as the intermediaries and also depend on the external pathology laboratories and radiology centres for proper testing and diagnostic processing. As a result, diagnostic centres retain a major part of the service revenue while the aggregator operates with the low contribution margins after covering the customer acquisition, logistics, and operational expenses.

Another major challenge is the huge operational costs that are associated with the home sample collection, logistics coordination, and customer management. Gaining customer needs for doorstep healthcare service needs aggregators in order to maintain proper transportation systems, trained phlebotomists, temperature-controlled sample handling, and timely digital report delivery. In this context, delays in the sample transportation, poor coordination, or service inconsistencies may negatively impact diagnostic accuracy and customer satisfaction. In addition, healthcare aggregators spend hugely on digital marketing, online promotions as well as consumer acquisition campaigns in an intensely competitive market environment that also minimizes profitability (Moorman et al., 2024). Technological investment and digital infrastructure management also occurs significant financial pressure within the overall diagnostic healthcare ecosystem. However, technologies including artificial intelligence, cloud computing, electronic health records, and healthcare analytics enhance the operational efficiency along with the diagnostic accuracy and their adoption needs massive investment in software systems, skilled personnel, cybersecurity frameworks and data management infrastructure.

In addition, various concerns related to data privacy, cybersecurity threats as well as regulatory compliance continue to create some operational risks for the healthcare aggregators handling sensitive information of the patients. The disintegrated nature of the Indian diagnostic market is another cause of poor uniformity of service quality and non-standardisation of services across labs and radiology centres (Srinivas and Kale, 2023). The differences in the accreditation standards, quality of reports, turnaround time, and coordination in operations may affect trust and reputation in the platform negatively. At the same time, with the spread of direct-to-consumer digital healthcare services to independent diagnostic chains, the risk of disintermediation has grown, with patients seeking the services of diagnostic providers without the assistance of aggregator services.

2.4 Vertical Integration in Health Care

2.4.1 Introduction to Vertical Integration in Healthcare

Vertical integration is a business strategy that involves a company's expansion through controlling various parts of the same supply chain in a specific industry. In healthcare, vertical integration is the integration of a group of healthcare services such as primary care, acute care, post-acute care including diagnostics, pharmacies, laboratories, telemedicine and home healthcare (Pragya Kakani, 2025). Implementing such a plan can enable healthcare organizations to cut down on reliance on third-party companies, increase coordination in operations and be more cost-effective. With the complexity and technology of healthcare delivery, the concept of vertical integration in healthcare has become crucial. Now healthcare providers are turning to more efficient and integrated service models to enhance patient care, experience and profitability. Vertically integrated diagnostic healthcare involves having a stake in healthcare diagnostic facilities, radiology centres, sample collection services, supply chain management and digital healthcare platforms (Ekaireb et al., 2024). This type of integration enables companies to have more control over pricing, quality control and service delivery.

Vertical integration is becoming more relevant in recent years as the digital healthcare aggregators of India are expanding in numbers. Most of the aggregates have started with an asset-

light business model based on third-party diagnostic centres. But the growing expenses of these operations, margin demands and reliance on external partners have pushed companies to look into vertically integrated and hybrid health care business models. Companies are investing more in their in-house diagnostic operations and decentralised healthcare services to boost profitability and customer retention (Parfrement, 2025). Hence, vertical integration is one of the important strategic measures adopted in the Indian healthcare aggregator pathology industry. It not only can boost operational efficiencies but also foster long-term sustainability and competitive edge in dynamic healthcare landscape.

2.4.2 Types of Vertical Integration in Diagnostic Healthcare (400 words)

Vertical integration in the diagnostic healthcare sector can take various shapes and forms depending on the degree of control and ownership in the healthcare value chain. These forms can assist health care organisations enhance performance, cut dependence on the workplace, and boost profitability. As one of the most prevalent forms of vertical integration, backward integration has been prevalent in diagnostic healthcare. Healthcare aggregators in this approach buy or gain control of the activities above them in the chain such as pathology labs, sample collection centres and phlebotomy services. Rather than depending on third party diagnostic partners, companies develop their own operation infrastructure for testing and sample processing. This helps to lower the cost of intermediaries and allows for greater quality and price control of services (Reza et al., 2025). Laboratory procedures have a great impact on the diagnostic accuracy and turnaround time (TAT) and are especially relevant to the pathology laboratory practices which are an important component of backward integration (Al Hammad et al., 2025).

Forward integration is growth into the downstream health care service into direct customer contact. These can range from digital platforms to mobile healthcare applications, preventive healthcare programs to directly report the delivery systems in diagnostic healthcare. Healthcare companies boost patient involvement and enhance customer retention by providing patients with a complete healthcare offering via a single platform with forward integration (Shah et al., 2025). In another form of integration, organisations manage several aspects of the health care system at the same time, called full vertical integration. In such a model, companies handle diagnostics,

logistics, home sample collection, digital booking platforms and providing customer service in-house. The integration can be full, leading to higher investment and managerial skills. On other hand, many healthcare aggregators have a partial or hybrid integration model. In these models, a combination of owned infrastructure and third-party partnership is used. In such a scenario, an aggregator can operate its own phlebotomy and digital processes and outsource radiology testing to its partner diagnostic centres. The hybrid integration is gaining momentum in India as it offers the companies the balance of control and reduced capital cost (Venkataraman et al., 2025). Overall, varied forms of vertical integration offer healthcare organisations the chance to boost effectiveness, cut down reliance on outside suppliers and increase profits in a competitive diagnostic healthcare industry.

Backward integration is one of the typical forms, in which a healthcare organisation obtains control over those activities that take place at earlier stages of the service process. A diagnostic company can create its network of sample collection, logistics, or procurement, rather than using third-party providers (Darko, 2022). This assists in enhancing quality management as well as minimising service delays. The other one is the forward integration where the diagnostic providers extend their activities to those that are nearer to the final customer. A laboratory can create its personal mobile application, customer service platform, or direct to customer tests. This enables the organisation to deal directly with the customers and enhances customer relations. Another type is the partial vertical integration where selected functions are internalised and the rest of the activities are contracted. This strategy enables organisations to gain improved operational control without several investments in all the healthcare value chain steps. Other healthcare organisations also embrace complete vertical integration whereby various functions, which may include collection of samples, laboratory tests, generation of the reports and delivery of the service are all carried out by the same organisation. All forms of vertical integration have their respective benefits based on business goals, financial strength and the business environment. The right integration strategy can assist diagnostic healthcare providers to enhance efficiency, service quality as well as long-term profitability.

2.4.3 Vertical Integration in the Indian Healthcare Aggregator Market

The Indian healthcare aggregator market has seen significant growth owing to the growing penetration of the Internet, healthcare awareness and growing demand for digital diagnostic services. Pathology, radiology and home sample collections are now available to patients at one of the healthcare aggregators, making diagnostic service delivery digital. Most of these aggregators in the beginning had asset-light business models which relied on third party diagnostic centres and labs for service delivery. But the reliance on external diagnostic partners and the resultant operational and financial issues are becoming a challenge. The healthcare aggregators typically experience reduced control over pricing, variable service quality, lagging report delivery and reduced profit margins. A large percentage of test revenues is generally kept by the diagnostic centres, thus decreasing the profit of the aggregators with commission-based systems. Industry EBITDA as a percentage of national health expenditures (NHE) fell from 11.2 percent in 2019 to 8.9 percent in 2024 (Patel & Singhal, 2026). Moreover, the sector is experiencing additional margin pressure due to higher logistics costs as well as increasing radiology testing costs and the cost of customer acquisition.

Consequently, several Indian healthcare aggregators have begun seeking vertical integration to gain more control over the operations and boost their profitability. Some companies such as Practo, Tata 1mg, PharmEasy and Healthians have started to invest in developing diagnostic facilities, home sample collection options and healthcare operations with the help of technology (Gupta et al., 2024). Some companies have taken on a hybrid approach which means that certain aspects such as phlebotomy and logistics are done in-house and other special services such as radiology and laboratory work are outsourced. The need for enhanced customer experience and scalability of operations is also contributing to vertical integration in the healthcare aggregator market in India. Standardised diagnostic quality, shortened turnaround time, better data management and trust with customers are just some of the benefits that firms can enjoy with integrated models. Moreover, having an operational control in-house helps aggregators to optimise its costs in the long run and maximise its gross margin. Thus, vertical integration is emerging as a key strategy for healthcare aggregators aiming for profitability and competitive edge in the dynamic Indian diagnostic healthcare landscape.

The Indian healthcare aggregator market is becoming an area where vertical integration is being adopted as the companies would desire to have superior control over service delivery and profitability (Heeringa et al., 2020). Most healthcare providers used to be intermediaries that linked patients to diagnostic labs and healthcare providers during the early years. This restricted their capability to manage the quality of service, cost, and customer experience. In solving these shortcomings, several healthcare aggregators have begun to incorporate the chosen operational functions into their businesses. Other companies have developed their own teams to handle customer support, appointment booking, home sample collection and logistics rather than the full reliance on their external partners. This would enable them to keep the standards of services and enhance the level of coordination between various phases of the healthcare process. Vertical integration also assists the aggregators to have stronger relationships with customers. Organisations can act more promptly to customer demands, effectively handle complaints and positively impact a more unified healthcare service experience. This will lead to more customer satisfaction and brand reputation.

2.4.4 Impact of Vertical Integration on Cost Reduction and Profitability

Vertical integration has a massive impact on the cost reduction and profitability within the healthcare industry, especially in the diagnostic healthcare services where the operational coordination, service quality, and infrastructure efficiency influence the overall financial performance. Vertical integration refers to the strategic internalization of various stages of healthcare service delivery such as sample collection, diagnostic testing, logistics management, report generation, and customer interaction (Nunes, 2024). By controlling the critical operational functions, healthcare organizations minimize reliance on external service providers and also enhance the entire value capture towards the healthcare supply chain. Minimization of transaction costs is one of the key financial advantages of vertical integration. Transaction Cost Economics theory defines outsourcing core operations as a source of inefficiency in coordination, monitoring, and costs of contract management, and information asymmetry between the service partners. Aggregators in the sphere of diagnostic healthcare, based on the third-party pathology-laboratory facilities and radiology centres, tend to encounter restrictions in revenue-sharing, lack of even coordination, and decreased bargaining power.

Vertical integration helps eradicate most of these inefficiencies because as the healthcare organisations have direct control over the processes of service delivery, the intermediary costs are also minimised and the transparency of the operational process is enhanced. Vertical integration also enhances the economics of scales that contributes massively to the cost minimization. Centralised management of diagnostic operations allows better utilization of laboratory infrastructure, testing equipment, digital systems, and workforce resources (Ognibene & Lippi, 2026). For example, adopted pathology networks may process huge testing volumes through the standardized workflows, minimizing average operational costs per test. In the similar way, a centralized logistics process for the home sample collection optimizes the route planning, minimizes delays as well as reduces fuel and labour expenses. In this context, enhanced coordination among the departments also reduces the duplication of administrative functions and operational wastage.

Another significant contribution of the vertical integration is improved service quality and consumer retention that directly support profitability growth. In addition, internal control over the diagnostic processes helps organizations in order to maintain constant quality standards, faster turnaround times, and improved customer experience. In addition, reliable service delivery improves the trust among the customers, repeat usage as well as enhances brand reputation in hugely competitive healthcare markets in India. In the digital healthcare platforms, adopted operational control allows better coordination of booking processes online, sample collection scheduling, digital reporting, and customer support services that resulted in better customer satisfaction and loyalty. In addition, vertical integration also supports better pricing flexibility and higher revenue retention (Ekaireb et al., 2024). However, healthcare organizations with the internal diagnostic abilities are less dependent on the third-party pricing structures and may provide competitive pricing while managing effective profit margins. They also might introduce various value-added services including the protective healthcare subscriptions, personalised testing packages, and integrated telehealth consultations for diversifying revenue streams.

2.4.5 Operational Advantages of Vertical Integration

Vertical integration provides various operational advantages in the healthcare industry, especially in the diagnostic healthcare services where the coordination, service quality, efficiency and the operational control are important in terms of the organizational performance. In the Indian healthcare aggregator pathology sector, vertical integration helps organizations in order to internalize important operational activities including the home sample collection, logistics management, customer support, digital coordination, and diagnostic processing. This integrated structure allows healthcare organizations to enhance efficiency of the workflow, reduce operational delays and also improve the entire service delivery. One of the initial operational advantages of the vertical integration is enhanced coordination towards the healthcare service chain (Saghafian et al., 2023). In the traditional aggregation models, various independent service providers mostly handle various operational stages including phlebotomy, transportation, laboratory testing, and report delivery. This fragmented system sometimes creates major communication gaps, delays, service inconsistencies as well as coordination inefficiencies. Through the vertical integration, healthcare organizations may centralize the operational management and also create a smoother coordination among the departments.

Centralised systems allow real-time communication, proper scheduling and highly reliable management of patient services by minimizing operational disruptions and turnaround times. Vertical integration also enhances the quality control and standardization within the diagnostic healthcare services. Independent third-party laboratories could follow various operational protocols, accreditation standards, and reporting procedures that lead to variation in customer experience and service quality (Pillai and Fox, 2025). Internalizing operational functions helps healthcare organizations to develop better quality standards, standard operating procedures, and monitoring systems towards all the service activities. This enhances better diagnostic accuracy, sample handling quality, reporting consistency, and compliance with the healthcare regulations. In addition, strong quality management improves patient trust and enhances organizations reputation in the competitive healthcare market. Another significant operational advantage is improved control over the logistics and home sample collection services. Proper sample transportation and

handling are important in the pathology services as delays or improper handling could compromise the diagnostic accuracy.

In addition, vertically integrated healthcare systems may directly supervise the transportation networks, phlebotomy teams, and route optimisation processes that ensures a timely sample collection and delivery. In this context, enhanced logistics coordination minimizes delays, reduces operational wastage and also improves the satisfaction level of the customers. In recent times, technology integration has become more reliable within the vertically adopted operational structures (Tabim et al., 2024). Healthcare organizations may adopt effective digital systems for appointment scheduling, electronic health records, laboratory information management systems, digital reporting, and customer relationship management. Apart from that, centralized digital infrastructure enhances workflow automation, real-time data sharing and better operational transparency. In this context, technologies including artificial intelligence, predictive analytics, and cloud computing might also be adopted more effectively towards all the operations, enhancing productivity as well as capabilities of making decisions.

Vertical integration is associated with several operating advantages that can enhance the general performance of healthcare organisations. There is enhanced coordination of various activities relating to service delivery. Communication is more efficient and decision making is made faster when there are various functions under control of a single organisation (El Khatib, 2022). Another operational advantage is improved service consistency. The common processes, quality requirements, and performance indicators can be shared by healthcare organisations working in various areas of operations. This helps to reduce variations in service delivery and ensure patients receive a more consistent service. One can also easily spot and resolve operational issues due to consistent processes. Planning and resource management can also be enhanced by vertical integration. The organisations become more visible of the operations and they can forecast and allocate staff, manage inventory and schedule services more efficiently. Planning in a better manner ensures that delays are avoided and better utilisation of available resources are realised. Integrated operations enable healthcare providers to react faster to the changes in customer demand and market conditions. Organisations are able to roll out new services, process enhancements and technological upgrades without being over-reliant on the external partners. This enhances the flexibility and adaptability of operations. Increased organisational control of data and flow of

information is another benefit. Integrated systems facilitate quicker information sharing across departments, enhance accuracy and minimise administrative mistakes. Vertical integration positively influences the operational performance and enhances the quality of healthcare provision to reduce opposition to the provision of services, potentially supporting the organisations' success in the longer-term.

2.4.6 Challenges and Risks of Vertical Integration

Instead of its operational and financial advantages, vertical integration in healthcare also includes various challenges and risks which could impact the performance of the organization and long-term sustainability. One of the important challenges is the high capital investment needed to internalize the operations in healthcare. Developing diagnostic laboratories, radiology centres, logistics systems, digital infrastructure, and in-house phlebotomy teams need various financial sources. Thus, smaller healthcare aggregators and start-up platforms could struggle to maintain all these investments because of the limited access to capital and operational expertise (Chakraborty et al., 2023). Another major challenge is higher operational complexity, maintaining various healthcare functions needs proper coordination among the logistics, laboratory operations, technology systems, workforce management, and customer services. Improper management may lead to some operational bottlenecks, high cost of administration and less productivity. In addition, vertically integrated healthcare systems need skilled professionals, latest technologies and constant staff training to manage the overall quality standards and regulatory compliance.

The regulatory and compliance risks are also critical issues in vertically integrated healthcare models. Healthcare organisations are subject to the accreditation standards, data privacy legislations, infection control measures, and healthcare regulations (Asamoah, 2025). The lack of adherence can lead to legal repercussions, losses in publicity and finances. Along with that, over vertical integration can foster less flexibility in organisations as organisations are restricted to liaise with other diagnostic providers or use other service models. Hence, healthcare organisations should provide a close balance between operational control, potential to invest, and flexibility in adopting vertical integration strategy in the diagnostic healthcare sector.

2.4.7 Relevance of Vertical Integration to the Present Study

Vertical integration is hugely related to the recent study as it directly addresses the overall profitability and operational challenge faced through healthcare aggregators in the Indian pathology industry. The existing aggregator model mostly depends hugely on the third-party diagnostic centuries that resulted in limited margin retention, reduced operational control, and service inconsistencies. Vertical integration delivers a strategic solution through choosing operational functions including phlebotomy, logistics management, and customer coordination while managing outsourced laboratory processing. This links closely with the proposed hybrid operational model of the research. The concept supports better value capture, best quality control, less transaction costs as well as improved operational efficiency. However, analysing vertical integration allows the study to determine the way that choosing operational control may enhance profitability, scalability and long-term sustainability within the Indian healthcare aggregator pathology sector.

2.5 Home Sample Collection and Decentralised Care

2.5.1 Introduction to Home Sample Collection and Decentralised Care

A healthcare delivery system where medical services are delivered away from the hospital or clinic is known as Decentralised healthcare. Rather than relying on a single collective health care institution, decentralised health care centres on providing health care services in a more patient-centred way. It is through digital platforms, at home and at the level of the community (Santa-Ana-Tellez et al., 2023). Home sample collection, remote consultation, digital delivery of healthcare reports and technology-based healthcare monitoring systems are the main types of decentralised care in diagnostic healthcare. Home-based diagnostics has gone a long way in the past decade with the emergence of new digital health technologies and expectations. Previously, patients had to go to hospitals and laboratories to get tested and receive results. However, the trend and digitalisation have made it possible for diagnostic companies to offer diagnostics services directly in the house of patients with the integration of healthcare platforms. This transformation

has made access and convenience easier for customers and also decreased their reliance on hospital-based systems of healthcare.

Healthcare has been adopting a patient-centred care approach, moving away from that hospital-centred approach. The current consumers of healthcare are looking for convenience, quicker service, personalized service and expect shorter waiting time. Home sample collection meets these expectations by allowing patients to have their samples collected at home instead of travelling to health care services. Since the onset of the COVID-19 pandemic, decentralised healthcare came into great importance. With the pandemic, people were concerned about getting infected, limited mobility and filled-up hospitals propelled the adoption of healthcare services at home in India (PTI., 2021). Patients felt more at ease with the use of digital healthcare platforms to book diagnostic tests and receive healthcare support remotely. This has led to the increasing demand for home sample collection and decentralised diagnosis in India. The healthcare delivery model is growing due to the growing digitization of the healthcare ecosystem and awareness of the importance of preventive healthcare.

2.5.2 Concept and Process of Home Sample Collection

Home Sample Collection is a diagnostic service model in which patients do not need to go to the laboratories or hospitals, but samples are collected by the healthcare professionals visiting their home. The service model is valuable to the decentralised health care system as it makes diagnostic testing more accessible, convenient and efficient. In most cases blood tests, preventive health checks, routine pathology and monitoring of chronic diseases can be done at home. The home sample collection usually starts with the ordering of a diagnostic test via an online healthcare portal or mobile application. Patients can choose the test packages they want, search for available hours for tests and their location information from the online healthcare system. The introduction of online payment options, easy-to-navigate interfaces and immediate booking confirmation makes booking a visit to an appointment maker easy for the digital healthcare aggregator. This integration is digital, which makes it easier for customers and cuts down on administrative tasks. Once confirmed, the trained phlebotomists are allocated to go to the patient's house to collect samples. Phlebotomists have a very significant part in the proper collection of samples, safety and

cleanliness of the patient. Their role is to take blood or other biological samples by adhering to medical procedures. Proper sampling and high efficiency in the operation is important as incorrect handling may result in loss of the diagnostic value (Nordin et al., 2024).

Samples are then taken and sent to diagnostic partner laboratories or in-house diagnostic facilities for processing and analysis. Sample transportation and logistics management are important aspects of the home-based diagnostic services. There is a need to maintain temperature, timely transport and safe handling of samples to ensure the quality of the samples is not compromised and there is no delay. Therefore, logistics systems have to be efficient in order to achieve reliable diagnostic results. Once they have been analysed in the laboratory, diagnostic reports are converted into digital files and communicated to patients via mobile app, email or healthcare portals. Delivering digital reports enhances accessibility and allows patients to get their test results faster without having to go to the centre of healthcare. Using the Aarogya Setu app, one can register for an 'Ayushman Bharat Health Account' and leverage it for interaction with participating healthcare providers (Pib.gov.in., 2025). Some sites also offer teleconsultation options that enable patients to talk with the professional physician online. The process of home sample collection services has enhanced significantly in terms of improved efficiency owing to the technology integration. AI, cloud-based healthcare systems, GPS-based logistics monitoring and electronic health records have all enhanced the linkage between patient, phlebotomist, lab and healthcare platforms (Conley et al., 2022). These technological developments are beneficial in terms of scalability of operations and the quality of the customer service in decentralised diagnostics healthcare systems.

2.5.3 Growth of Decentralised Diagnostic Services in India

The decentralisation of the diagnostic services sector has been growing at a fast pace in India, owing to the growth of the digital healthcare ecosystem and the rising demand for convenient healthcare services among consumers. Technology has revolutionized the healthcare diagnostics sector by providing the capability to book tests online, pick-up samples at home and receive reports digitally. This has led to an improvement in access to and efficiency of diagnostic health care services in urban and semi-urban areas. This growth is being driven by one of the major factors,

which is the rising smartphone and internet penetration in India. Adoption of mobile applications, mobile payment and digital financial systems has fostered consumers to frequent online healthcare platforms for diagnostic testing and health consultations. Digital healthcare services have made patients more comfortable by providing them convenience, flexibility and saving time (Ludin et al., 2025). Convenience is important for consumer choice and it is a key factor in the growth of decentralised healthcare. Modern healthcare consumers want to have a healthcare solution that reduces their travel, waiting times and visits to hospitals or laboratories. The home sample collection services alleviate these concerns by enabling patients to get medical care at their homes. This has increased even further since the COVID-19 pandemic which hastened the uptake of telehealth care services across the country.

There is an increasing emphasis on prevention and preventive health screening has led to an increase in demand for pathology testing services. In the present time, many consumers will routinely have preventive health checks to keep an eye on their chronic diseases and their health in general. Consequently, healthcare aggregators have increased their diagnostic services and their healthcare packages with an online presence and being offered as a subscription service. This has been further strengthened by the emergence of online platforms for healthcare services such as Tata 1mg, PharmEasy and Healthians. These businesses offer a complete health care package with technology-driven platforms that facilitate online consultations, medicine delivery, and even home diagnostics (Aqeel & Gera, 2023). The current market trends suggest further growth in the decentralised healthcare delivery models, such as the provision of services in preventive healthcare, monitoring of chronic diseases and digitally integrated diagnostic care.

2.5.4 Operational Benefits of Home Sample Collection

The benefits of home sample collection are significant for operations, contributing to better health service delivery, and more effective health diagnostic healthcare aggregators. Patient convenience and ease of access is one of the key benefits. Diagnostic examinations can be requested from the comfort of home instead of visiting laboratories or hospitals, thereby saving time and making it less physically cumbersome. This is especially helpful for the elderly, the working professional, chronically ill patients and for those in remote areas. Another great

advantage is the decrease in the hospital and lab congestion. Home sample collection not only helps to decongest health facilities, but it also decreases waiting times at clinics (Humphreys et al., 2022). This helps the hospitals run more efficiently and enables healthcare institutions to better manage critical medical cases.

Home-based diagnostic services also add to customer satisfaction due to the customization and flexibility of healthcare. Access to services occurs on a convenient schedule and at a convenient location, supporting increased trust and service quality. A positive healthcare experience can result in better customer retention and platform loyalty. Another advantage is home sampling which not only provides more data for healthcare aggregators but also allows them to reach a larger geographical market. The virtual care ecosystem (Ayushman Bharat Digital Mission) of India can deliver diagnostics without incurring the costs of building out physical facilities in several cities and regions (Mathew et al., 2023). This helps business scaling and market expansion. Lastly, decentralised diagnostic services support flexible healthcare service delivery, combining digital booking, home healthcare and remote reporting into a patient-centred healthcare model.

In India, health care aggregators and diagnostic platforms have developed home sample collection as a huge operational benefit. It offers a significant competitive edge through better patient convenience, less waiting time, and better access for the elderly, working people and those with poor mobility. The studies revealed that the need for home-based diagnostic testing increased significantly due to the increasing demand for door-to-door healthcare services after the outbreak of the COVID-19 pandemic (Timesofindia.indiatimes.com, 2021). Home collection services provide healthcare aggregators with flexible collection options, digital reporting, and enhanced patient experiences, contributing to customer acquisition and retention. It has also been reported by organised diagnostic chains that the sample collection at home leads to greater volume of tests and penetration in urban and semi-urban areas. Further, the route optimisation technologies and the digital scheduling systems boost the productivity of the operation by allowing phlebotomists to make more collections a day. Major players such as Dr Lal PathLabs, Thyrocare, SRL Diagnostics, and Metropolis have invested hundreds of crores in digital infrastructure (AppsyOne,

2026). As a consequence, the home sample collection increases the scalability, customer satisfaction, and revenue generation for pathology aggregators.

2.5.5 Cost Structure and Economic Implications

The aggregation of home sample collection services in the Indian pathology industry comes with both opportunities and significant economic implications. While home-based diagnostics make a product more accessible and convenient to use, there are many factors that are directly tied to the cost. Hence, the profitability and sustainability of the business go through a significant impact. It is therefore crucial to balance operational efficiency with cost optimisation to ensure a viable profit margin for healthcare aggregators. The major cost of home sample collection is the phlebotomy cost. Aggregators need to hire, train, and oversee competent phlebotomists who can professionally and safely collect diagnostic specimens. Payroll, training costs, uniforms, safety gear and employee scheduling systems are significant components of operational costs. Many diagnostic firms also have incentive compensation systems for the home collection staff to enhance service effectiveness and raise the amount of collections every day (Financialexpress.com, 2022).

The costs of logistics and transportation also make up a large proportion of operating cost. Delivering a timely pickup and delivery of samples from patient premises to diagnostic labs demands transportation networks for healthcare aggregators. Transportation costs are a major factor, especially in urban areas, and include fuel costs, maintenance costs, routing inefficiencies and urban traffic congestion. According to industry reports, route optimisation systems are increasingly becoming popular to enhance productivity and reduce the inefficiency of travelling among phlebotomists. Another vital economic aspect of decentralised diagnostic care is cold chain management. Some path specimens need to be shipped in a temperature-controlled manner in order to maintain sample integrity and diagnostic accuracy. This implies that special insulated containers of transport, a refrigeration system and monitoring systems are required which translates to increased infrastructure and maintenance costs. Inability to control the temperature may lead to spoilage of samples, inaccurate results, and damage to reputation. Studies have shown that a great number of diagnostic errors are pre-analytical as a result of inadequate sampling procedures and transportation (Financialexpress.com, 2022).

Pathology aggregator's financial structure is also impacted by technology and platform management costs. Some of the areas that require digital healthcare platforms to be funded are mobile apps, cloud storage systems, CRM software, AI scheduling tools, and cybersecurity infrastructure. These technologies can be used to support the appointment scheduling, sample tracking, report delivery and operational coordination process. However, the systems require constant improvements in technology and expenditure on maintenance. The research on digital diagnostics indicates that the operation based on technology will result in increased short-term investment in the infrastructure and an increase in the scale and quality of the services (Imarcgroup.com, 2026).

2.5.6 Challenges of Decentralised Care and Home Diagnostics

Although decentralised healthcare and home diagnostics have gained in popularity, various operational and managerial issues remain in the efficiency and sustainability of this model of healthcare. Sample collection and transport is one of the challenges in maintaining sample quality. It may be affected by improper handling, delays in transit or lack of maintenance of the temperature sensitive condition in the diagnostic results (Indian Health Fund, 2024). Thus, it is crucial for healthcare businesses to have a proper logistics network along with trained staff to handle the samples properly. The other major difficulty is staffing and training phlebotomists. Skilled healthcare professionals with the ability to adhere to proper medical procedures and keep patient and hygiene standards are necessary for home sample collection. Healthcare aggregators may have to deal with higher operational complexity and labour costs due to hiring and training qualified phlebotomists.

The process of transportation and logistics management also poses operational challenges, particularly in urban areas where population density is high and in remote rural areas. Turnaround time, transportation delays and inadequate infrastructure can have a negative impact on customer service. Additionally, rural areas may further limit service availability due to a lack of healthcare facilities and less mobile penetration (Kumar et al., 2025). Further, service availability will be even more limited in rural areas due to poor health service infrastructure and less mobile penetration. Another major challenge to a decentralised healthcare system is regulatory and data privacy issues.

Medical websites deal with massive amounts of patient details such as medical reports and diagnostic reports. Security breaches and regulatory compliance are critical in ensuring patient data remains secure (Isibor, 2024). Another important factor that can influence decentralised diagnostic services is cost management. Convenience of home sample collection comes at high cost in terms of logistics, human resources and technology integration. Failure to manage these costs effectively could lead to falling profits as volumes of testing grow. Lastly, some health care providers are struggling with trust building with their customers. Patients might doubt the effectiveness and reliability of home diagnostics services from traditional hospital-based diagnostics services.

2.5.7 Role of Home Sample Collection in Hybrid Healthcare Models

The role of home sample collection in the development of hybrid healthcare models in the diagnostic healthcare industry is significant. The hybrid healthcare models are less costly and less disruptive as they integrate and combine different operational elements from digital healthcare aggregation and selected in-house operational services to achieve efficiency, customer experience and profitability (Zychlinski, 2024). In this model, healthcare aggregation retains some functions in their own hands and keeps on doing so when they have to rely on external diagnostic partners. Home sample collection enhances hybrid healthcare models and gives more control over patient interaction and service delivery. In-house phlebotomy is an area where many healthcare aggregators are looking to cut costs on outsourcing and increase customer satisfaction. The internal sample collection management further supports coordination of logistics, laboratories and digital healthcare platforms.

Home sample collection helps to increase the scale of services as businesses can roll out tests to a broader geographical area without building up a big hospital network. Hybrid healthcare systems are further streamlined by digital booking, real-time tracking and electronic report delivery (Alubaie et al., 2024). As a result, it is a key operational piece of hybrid healthcare models that enables the integration of decentralised healthcare delivery with the addition of better cost management, operational flexibility and long-term profitability for the healthcare aggregators in the Indian pathology sector.

2.6 Disintermediation and Margin Expansion

2.6.1 Concept of disintermediation in healthcare aggregation

Disintermediation refers to the removal or reduction of intermediaries in a supply chain or service delivery process, and leads to a more direct contact between producers and consumers. Healthcare Disintermediation entails removing the usage of third-party brokers, agents, or external service coordinators. However, it also shows incorporating the services between healthcare providers and patients directly through digital media and technology (Feulner et al., 2025). This idea has become more applicable in healthcare aggregation with the swift development of digital healthcare ecosystems, online diagnostic booking systems, telemedicine services, and direct-to-consumer healthcare systems (Gu, 2024).

Indian healthcare aggregators are intermediaries between patients and pathology labs, hospitals, diagnostic centres, pharmacies, and healthcare professionals. These applications include online booking of appointments, sample collection at home, online diagnostic reports and comparison of healthcare packages. Nonetheless, overreliance on third-party diagnostic labs and logistics companies tends to decrease the profit margins of aggregators since a significant portion of the income is sent to the third-party service providers (Atmojo & Wibisono, 2023). As a result, health care firms resort to research disintermediation methods to improve the management of the company operations, reduce the transaction costs and maximise the profits. The concept of disintermediation is associated with the concepts of Transaction Cost Economics (TCE), which can be defined as the attempts of organisations to minimise the cost of coordination (Avdasheva & Geliskhanov, 2025). Studies of healthcare transaction costs indicate that dependence on outside healthcare providers may result in increased costs of coordination, inefficiency in the management of the program and monitoring costs (Nyawira et al., 2023). The problems in the pathology aggregator business include pricing, quality of service, TAT, and customer experience management due to the involvement of multiple diagnostic partners. As a result, more and more healthcare aggregators follow a selective vertical integration strategy. For example, providing in-house phlebotomy services, logistics networks, or mini-diagnostic centres can significantly limit their reliance on external partners.

Disintermediation of healthcare aggregation can also be facilitated by technological advancement and the digital transformation. Through the assistance of electronic healthcare tools, cloud computing, artificial intelligence, and interoperable electronic health systems, healthcare providers will be able to directly communicate with patients. It will also help in simplifying the diagnosis process. Based on the literature on electronic healthcare intermediaries, it is found that electronic platforms have a positive effect on the informational management, logistic coordination, and operational efficiency in healthcare markets (Wasswa et al., 2023). The activities of the government like the Ayushman Bharat Digital Mission (ABDM) in India also foster healthcare interoperability and digital integration and transition to more integrated healthcare delivery systems (Pib.gov.in, 2025).

2.6.2 Impact of third-party dependency on profit margins

In order to deliver healthcare services to patients, healthcare aggregators heavily depend on third-party diagnostic labs, logistics companies, phlebotomists, and technology vendors. This outsourcing model helps the aggregators grow at a quicker pace without investing in infrastructure. However, too much dependence on third-party service providers will result in a loss of control in the operations and a thin margin of profit. Transaction Cost Economics (TCE) claims that the more external partners are involved in the functioning of the organisation the more probable it is that the cost of coordination will increase, the bargaining power decreases, and the level of uncertainty becomes more significant (Nygaard, 2022).

The market of aggregation of test packages and bookings in the Indian pathology will represent a significant portion of the profits for diagnostic labs. Industry studies have found that the diagnostic centre could get almost 70-90% of the package’s value, with aggregators taking a small slice of the package (Nexdigm, 2025). This result is an imbalance in responsibilities, with aggregators having to accept significant operational risk, but limited financial risk. The result also shows that profits are very reliant on growth in test volumes, and not on enhancing operational efficiencies and service innovation. The pricing control of the pathology aggregator ecosystem is also impacted by dependency on third parties. Pathology laboratories may establish the fee schedule for laboratory tests on their own operating costs, accreditation requirements and market

niche. Therefore, healthcare aggregators are less capable of offering competitive prices and keeping a profit margin. Aggregators often go to extreme lengths to draw in buyers in very competitive city markets, often by cutting prices and offering promotions, which further impact the already thin profit margins. The studies regarding business models show that the commission-based digital healthcare business model is not always profitable due to high customer acquisition costs and reliance on third parties.

One of the biggest issues with third-party dependency is the difference between the quality of services and customer experience. The healthcare aggregators turn to external labs to achieve diagnostic accuracy, turnaround time, report generation quality, and interaction with patients (Kunzharikova et al., 2025). However, the aggregator is not directly accountable when it comes to delays, reporting inaccuracies or service failures on their part. It can impact customer confidence and the brand's reputation. Some studies on outsourcing in the healthcare sector tend to indicate that outsourcing might result in a decrease in the satisfaction rate, reduced accountability, and reduced operational coordination (Goodair & Reeves, 2022). In addition, the use of third-party logistics and home sample collection partners results in inefficiencies and complexity of operations. Pathology aggregators should engage the support of different involved parties like the laboratories, transportation service providers and the healthcare professionals to maintain proper handling and delivery of the samples on time. Poor coordination may result in an increase in turnaround times, operational errors, and customer dissatisfaction that may affect recurrent business and profitability.

2.6.3 Vertical integration strategies for margin expansion

Vertical integration involves a strategy whereby the organisations take control of various stages in the value chain by adding operational functions that have been outsourced to other organisations. Vertical integration has played a significant role in the healthcare aggregator pathology industry to boost profitability, enhance operational efficiency, and enhance the quality of services (Saghafian et al., 2023). The theory of business management indicates that vertical integration is beneficial to businesses as it gives them the advantage of lower transaction costs, increased coordination, increased control over operations and increased value capture in the value

chain (Patil et al., 2024). The strategy is gaining traction in the Indian healthcare aggregator market due to excessive reliance on third-party diagnostic laboratories. Besides, the logistics services pose financial and operational challenges as well. Pathology aggregators have implemented some vertical integration strategies, including building their own phlebotomy and home sample collection services. Typically, aggregators rely on their healthcare employees or diagnostic partners to collect samples, sometimes inflating the coordination expenses and impacting the consistency of services. Dedicated in-house phlebotomy staff allow for more efficient scheduling, proper sample handling, minimisation of delays, and better customer experience for aggregators. Research on integration of healthcare services shows that it enables the internalisation of key healthcare services that will result in better quality management and customer satisfaction in addition to less dependency risk (Saltkjel et al., 2023).

Another significant measure is the creation of company-run diagnostic labs or mini-processing centres. Healthcare aggregators can opt to run certain routine tests that are in high demand in-house and other specialised tests to the diagnostic partner. The hybrid model of operation enables aggregators to take a higher proportion of the test revenues. Thus, it effectively enhances their profit margins. Transaction Cost Economics (TCE) suggests that an organisation may experience Vertical Integration when the costs of relying on the markets and the risk of dependency are too high. Selective internalisation of diagnostics operations can lead to a significant improvement in the financial performance of the pathology sector. Along with third-party diagnostic centres in India, it is generating almost 70-90% of package revenues. Vertical integration also involves extensive use of technology integration (Surakshanet.com, 2024). Healthcare aggregators are putting additional capital in cloud-based systems in healthcare, artificial intelligence, customer relationship management systems, and integrated logistics systems to develop better healthcare systems (Ajayi-Kaffi et al., 2025). These technologies make it possible to coordinate the work process more effectively, automate the administration process, reduce turnaround time and enhance interaction with patients. Research shows that the digitalisation of healthcare systems can boost the effectiveness of healthcare operations, data management, and the performance of healthcare delivery in general (Al-Assaf et al., 2024). Further, vertical integration can help aggregators reinforce their brand and customer loyalty. With more control over the healthcare service process, organisations can standardise the quality of the diagnostics, pricing

models and patient experiences. This enhances trust, transparency and repeat customer retention, which are critical to long-term profitability in very competitive digital healthcare markets.

2.6.4 Role of Technology and direct-to-consumer models in profitability enhancement

The healthcare aggregator pathology industry has seen profitability improvements become a key focus of technology. Digital healthcare platforms can be used to directly reach patients via mobile apps, websites or integrated healthcare platforms. The direct-to-consumer (DTC) model helps minimise reliance on the traditional healthcare service chain and enhance the efficiency of the diagnostic healthcare sector. Healthcare aggregators can provide direct-to-consumer models of diagnostic services, home sample collection, online consultations and delivery of digital reports. Healthcare companies can gain direct access to customers and boost repeat testing volumes, build customer loyalty and retention and enhance customer satisfaction (Hinzmann, 2023). This is also a way for companies to have flexible pricing and personalized healthcare packages based on consumers' preferences.

Another aspect of technology integration that can boost the profitability is the automation of several operational processes including customer communication, report management, scheduling appointments and payment processing. AI, cloud-based healthcare systems and data analytics boost resource efficiency and aid in better decisions in healthcare companies. GPS-based logistics tracking along with digital health records transforms patient safety by providing real-time location data, geofencing alerts and emergency response features and also aids in coordination and alignment of laboratories, phlebotomists and healthcare platforms (Open Medscience., 2025). In addition, direct-to-consumer health care systems decrease administrative costs of traditional health care delivery. Digital platforms reduce the amount of paperwork, increase scalability and allow healthcare aggregators to expand their services to larger regions with a relatively small infrastructure expense (Reddy et al., 2025). Thus, the technology-enabled direct-to-consumer healthcare models play a crucial role in creating operational efficiency, engaging customers, and ensuring long-term profitability in the diagnostic healthcare sector.

2.6.5 Operational efficiency and cost optimisation through disintermediation

In healthcare aggregation, disimplementation helps to streamline operations and minimize the reliance on several middlemen in the diagnostics service chain. Typical healthcare aggregation scenarios can have multiple parties involved such as labs, logistics companies, collection centres and admin agencies. This complex structure creates delays in operation, issues with coordination and adds to overall cost of services. Healthcare aggregators can streamline the workflow and better coordinate services by cutting down on the middlemen. Companies can have better control over health care delivery by having direct control of activities such as home sample collection, customer support and logistics. Better cooperation between departments saves time and increases the customer's satisfaction *(*AL HARITH et al., 2024). Additionally, disintermediation helps to achieve cost optimisation by minimizing the costs of commission sharing and decreasing reliance on third-party service providers. Healthcare aggregators can boost the gross margins by taking on specific aspects of the healthcare operations in-house. Other potential cost reductions include optimizing the workforce, planning logistics and utilizing digital technologies in healthcare (Stoumpos et al., 2023).

Moreover, integrated operational systems are scalable and optimize resources. Healthcare technology solutions can effectively handle a high number of patients without a corresponding rise in operating expenses. Data-driven decision-making and automated workflow systems are helping companies to cut inefficiencies and boost productivity (Lyu, 2025). In this way, it not only contributes to better efficiency in the healthcare delivery chain but also to financial sustainability due to the more streamlined structures of the healthcare delivery chain, less unnecessary expenditure and better control of the diagnostic service operations.

2.7 Theoretical Underpinning

2.7.1 Introduction to Theoretical Underpinning

Theoretical underpinning provides conceptual foundation for a research study as it explains relationships between variables and supports the interpretation of the findings. In the current study, the theoretical frameworks are used to analyse the factors which influence profitability in the Indian healthcare aggregator pathology sector. Furthermore, this sector faces challenges that are related to operational efficiency, competition, consumer retention and service quality. Hence the study makes the use of theories such as Transaction Cost Economics (TCE) Theory, Resource-Based View (RBV) Theory, and Theory of Reasoned Action (TRA) to understand the issues. These theories collectively help to explain cost management, competitive advantage and customer behaviour, thereby providing a comprehensive framework for analysis of business profitability and sustainability.

2.7.2 Transaction Cost Economics (TCE) Theory

The philosophical framework of Transaction Cost Economics (TCE) Theory was put forward by Ronald Coase and later expanded by Oliver Williamson and the theory is a statement of what organizations can do to make economic transactions, i.e. the search of information, contract negotiation, monitoring of operations and agreement enforcement, more cost-effective (Hennart & Verbeke, 2022). TCE proposes that companies choose organisational management and operational aspects that lessen the transactional costs and boost efficiency. It is applied in numerous research fields, including business management, supply chain management, healthcare management, and research of digital platforms, to study the organisational performance and profitability. Healthcare aggregators run healthcare services with constant coordination among diagnostic laboratories, healthcare providers, patients and online platforms. Therefore, the TCE (Transaction Cost Economics) theory is highly relevant in the Indian healthcare aggregator pathology segment. These instructions include several transactions related costs such as appointment scheduling, service coordination, laboratory partnerships, data management, logistics, customer support and quality monitoring. Excessive transaction costs can have a

detrimental impact on transaction efficiency and lower profitability. So, the objective of pathology aggregators is to cut these costs to the minimum by integrating, automating and establishing partnerships in a strategic way (Victor & Paulo, 2023). The healthcare aggregator pathology companies use digital technologies such as mobile applications, online booking systems, electronic health records and automated reporting systems to reduce information and coordination costs and experience increased profitability. For instance, digital systems can shorten the time period and financial value of connecting patients to laboratories as well as enhance services providers and customers' communication with one another. Automated appointment setting and online payment systems further decrease the administrative expenses and enhance functional efficiency. Therefore, transaction costs are reduced, and customers' convenience is enhanced and profits improved. Improved governance structures are also emphasised as a determinant which acts as the key mechanism to minimise uncertainty and opportunistic behaviour within TCE theory. Pathology aggregators sectors have organisations that work with a number of laboratories and health providers. If adequate governance arrangements are not in place, problems can occur around reporting latency, service integrity, pricing disputes, data security and privacy concerns. In order to alleviate those risks, aggregators can write their contracts, standard operating procedures, service-level agreements and quality assurance systems (Victor & Paulo, 2023). These mechanisms of governance create trust amongst the various stakeholders and lower costs of monitoring and enforcement. In terms of the present research, utilization of TCE theory can be useful for comprehending how Indian healthcare aggregator pathology companies enhance their profits by decreasing the operational and coordination costs. The theory elucidates the analysis of factors such as digital integration, strategic partnerships, governance mechanisms and cost management that affect business performance in the pathology aggregator market.

2.7.3 Resource-Based View (RBV) Theory

The Resource-Based View (RBV) theory is one of the strategic management theories that explains how organizations gain competitive advantage by effectively using its resources and capabilities. The theory was largely developed by Barney and Wernerfelt in 1991 (Poazi Deinmodei, 2023). They claimed that a company can be successful in the long run if it can acquire valuable, rare, immutable and non-substitutable resources. RBV places more emphasis on the

internal sources of strength and strategic assets that can enhance the performance and profitability of an organisation rather than the external market conditions as it focuses on traditional business theories. The RBV theory suggests that a firm's resources can be physical systems, technology, human skills and operational systems, brand reputation or managerial ability (Kero & Bogale, 2023). Companies that can harness and leverage these resources effectively can establish a competitive edge that can be hard for rivals to match. A strategic resource can make a significant contribution to optimizing the operational efficiency, service quality, customer satisfaction and financial performance in a very competitive industry such as healthcare or diagnostics.

In the healthcare aggregator pathology sector, the association of RBV theory has grown substantially as healthcare companies increasingly operate on technology-based systems and integrated healthcare systems. Healthcare aggregators now have digital healthcare platforms and mobile apps, AI, logistics management systems and customer databases as key strategic assets. Businesses that effectively leverage these assets in their healthcare service can transform customer experience, build customer loyalty and increase the efficiency of their service. Operational capabilities including in-house phlebotomy services, decentralised network of sample collection areas, effective logistics and digital report management can also serve as strategic organizational resources in the diagnostic healthcare sector (Panchal & Trivedi, 2025). These capabilities allow healthcare aggregators to decrease reliance on third parties for their operations and provide better oversight over pricing, quality of service and customer interactions. Good business scalability is also made possible by strong operational coordination which also helps with business's long-term profitability.

The importance of the study is that the Resource Based View theory is highly applicable in the present study as it explains how healthcare aggregators can evolve their profitability by strategic operational capabilities and technology integration. The main focus of the study is on the vertical integration of the firms and hybrid healthcare models to enhance the internal resources of the firms. Operational functions within the organisation, digital infrastructure for healthcare and decentralised care systems can provide valuable organisational resources that lead to sustainable competitive advantage. Thus, the RBV theory offers a useful theoretical perspective for understanding the role that strategic healthcare resources and capabilities play an important role in

improving RBV's profitability, operational efficiency and market competitiveness through effective management of strategic healthcare resources and capabilities.

2.7.4 Theory of Reasoned Action (TRA)

The Theory of Reasoned Action (TRA) is a behavioural theory that has been developed by Fishbein and Ajzen that explains the influence of individual attitudes and social influences on behaviour and decision-making through behavioural intentions (Nickerson, 2023). According to the theory, the theory of behavioural intention which is based on two main factors such as individual attitude to the behaviour and subjective norms that fundamentally influence human behaviour (Sadeghi et al., 2024). Attitude is the positive and negative evaluation of a specific behaviour of a person whereas subjective norms is the social pressure or influence on behaviour. TRA is well established in the studies of healthcare, technology adoption and consumer behaviour because of the ability to explain the reasons of individuals to either adopt or reject certain services or technologies. The theory can be valuable in applications related to online healthcare platforms, home sampling, telemedicine and decentralised healthcare systems in the context of digital healthcare. The theory of reasoned action can be used to explain the increasing use of healthcare aggregation platforms in India. Home diagnostic services are increasingly gaining popularity with patients as they believe that the services are convenient, time-saving and accessible. Positive attitudes towards digital healthcare services have a positive influence on the behavioural intention to use healthcare platforms. Likewise, the recommendations of other family members, healthcare workers and social networks also affect consumer trust and service adoption.

The positive attitude of consumers towards decentralised healthcare and home diagnostics was further reinforced by the COVID-19 pandemic. The issue of crowding, the risk of infection and restrictions on mobility prompted patients to choose healthcare services that are not provided in person and digital healthcare platforms. The convenience of having samples collected at home and then reported digitally was permitted by consumers, resulting in a huge spike in the adoption of technology supported healthcare services began to grow significantly. TRA is relevant to the present study because it provides explanation to consumer behaviour in regards to the home sample collection and decentralising of healthcare services in the Indian healthcare aggregator pathology

sector. The theory aligns with the focus of the study which is customer satisfaction, accessibility to healthcare and customer retention. Knowledge of the behaviours of the patients is essential not just for operational efficiency but for continued adoption of digital healthcare services and building trust with consumers.

2.7.5 Business Model Innovation Theory

The Business Model Innovation Theory is used to describe how organisations re-architecture the delivery and value capture in a market condition and technology-driven shift. In contrast to conventional innovation which is mainly concerned with new products or new technology, business model innovation entails the reorganisation of organisational processes, revenue models, value chain and customer interfaces with the aim of attaining competitive advantage (Hanna & Ardon, 2023). This theoretical approach is applicable in the field of healthcare aggregator pathology where computer-based platforms have changed the classical patterns of delivery of diagnostic services. Traditional diagnostic laboratory networks are based on the physical infrastructure and testing services on referrals. The development of healthcare aggregators has brought about platform-based service delivery that involves online booking, home sample collection and digital report delivery (Gupta et al., 2024). Most aggregator systems enjoying increased accessibility to services though are experiencing profitability issues as intermediary costs are high and they rely on external diagnostic testing facilities. The Business Model Innovation Theory provides the theoretical background of the creation of alternative working models that result in the value capture increment of the diagnostic ecosystem. The hybrid model of diagnostic as suggested in the present study context constitutes a form of business model innovation since it entails incorporation of medical care that is digital as well as selective internalisation of business operations such as phlebotomy services. It can be done through re-structuring the diagnostic value chain and optimising the cost of the providers of the service in the Indian healthcare aggregator pathology industry for improving operational performance and sustainability of the industry financially.

2.7.6 The Platform Economy Theory

The Platform Economy Theory describes the processes of value creation through the interactions between several actors in a common technological infrastructure of digital platforms (Meijer & Boon, 2024). Platform businesses are not producers of goods or services as traditional firms rather they offer a platform that allows dissimilar groups of users to interact including service providers and consumers. The platforms facilitate transactions, exchange information and organize services among the players in a multi-sided market. Digital platform business model in the Indian diagnostic sector is in the form of healthcare aggregators. These platforms can be used to link patients to diagnostic laboratories, medical practitioners, pharmacy and other healthcare services organizations using mobile applications or web-based applications (Agudelo et al., 2025). Patients have the ability to search and compare prices of diagnostic tests across different laboratories; they can order home sample collections and get electronic test results using one platform. This digital coordination enhances the convenience and accessibility of healthcare while enabling the diagnostic laboratories to serve a wider range of customers. Platform-based models of healthcare also have the problem of sustainable profitability. The aggregator platforms are also likely to utilize partner laboratories to provide their services in a highly competitive environment of digitized healthcare where they compete on the price. Therefore, the Platform Economy Theory is a practical solution to understand how the value is distributed amongst the participants of the platform as well as how the aggregator firms can redefine their functional scopes to reclaim a larger share of the economic value. This theoretical approach is critical in studying the issue of profitability and identification of sustainable platform strategies within the diagnostic healthcare system.

2.7.7 Service Ecosystem Theory

The Service Ecosystem Theory offers a wider lens for interpreting the process of value creation and exchange in complex networks of actors that are involved in service. The theory is based on the concepts of Service-Dominant Logic and claims that the value is co-created during interactions between interconnected stakeholders instead of being developed by individual firms (Donaldson et al., 2025). These ecosystems are made up of organizations, customers, technology platforms and institution arrangements that are combined to provide service delivery. The diagnostic healthcare industry is a service ecosystem that is made up of a number of stakeholders

including diagnostic laboratories, healthcare aggregators, hospitals, physicians, pharmacies, insurance companies and patients. The digital healthcare platforms are becoming more of a coordinating presence in this ecosystem by enabling communication, exchange of information and integration between these actors. Diagnostic aggregators through digital infrastructure allow patients to receive diagnostic services, clinicians to use diagnostic data to make clinical decisions and labs to increase their service coverage (Baron & Haick, 2024). Therefore, profitability of the healthcare aggregator pathology industry cannot perceive at the firm level but must be considered in the greater context of interactions within ecosystems. These operational dependencies, information exchange, coordination and collaboration of stakeholders in relation to services influence the efficiency and sustainability of diagnostic services. Service Ecosystem Theory helps to understand why the improved effort in interactions, merging services and collaborative worth generation would promote efficiency in operations and introduce sustainability to profitability of the healthcare aggregator ecosystem.

2.7.8 Integration of Theories with the Present Study

The current study combines the concepts of the Transaction Cost Economics (TCE) Theory, Resource-Based View (RBV) Theory, and Theory of Reasoned Action (TRA) to create an integrated perspective on the profitability within the Indian healthcare aggregator pathology industry. Each theory describes various aspects of organisational performance and they combine to give a substantial conceptual framework through which operational, strategic, and behavioural factors contribute towards profitability. The contribution of Transaction Cost Economics (TCE) Theory to the research is that the healthcare aggregator pathology companies can enhance the level of profitability by reducing costs, and by increasing cost-efficiency. The theory is aimed at reducing costs of transactions, which include coordination cost, information cost, monitoring cost, and contractual inefficiency. The pathology industry of healthcare aggregation relies on digital technologies, automated systems, strategic alliances and governance structures that help to ensure that the operational complexities are reduced, in addition to improving the delivery of services. It helps firms to reduce the transaction costs as well since it enhances efficiency, customer satisfaction and financial performance. Resource-Based View (RBV) Theory is an additional theory of TCE that is about the resources and capabilities within, which is created to create

competitive advantage (Kero, 2023). Organisations that are exposed to RBV become long-term profitable, when the resources they possess are valuable, rare, inimitable and non-substitutable ones. Examples of critical assets in the framework of pathology aggregators include advanced digital platforms, qualified health care staff, strong lab networks, technological foundation, brand name recognition, client database and innovation capabilities. When firms use these strategic resources effectively, they can be able to distinguish themselves among those in the market and attain sustainable growth in business.

In order to introduce the behavioural perspective to the study, Theory of Reasoned Action (TRA) has been introduced, which explains customer attitudes and behavioural intentions of the healthcare aggregator services. Some of the most significant elements that can impact the profitability of pathology aggregators include customer adoption, customer trust and customer satisfaction, and customer repeated use of digital healthcare services (Kitsios, 2023). TRA proposes that attitudes, beliefs and social factors affect patient behaviour and good consumer attitudes towards the quality of services, convenience, affordability, reliability, and the ability to access the services online promote the use of healthcare aggregator websites (Lu, 2025). The greater the customer engagement and retention, the greater the revenue generation and profitability. When these theories are combined, it forms a multidimensional aspect of the current research. Operational efficiency and cost management, customer behaviour and service uptake, strategic use of resources and competitive advantage are related to TCE theory and RBV theory (Sugiarno, 2022). A combination of these theories offers a comprehensive insight into the ways of enhancing profitability within the Indian healthcare aggregator pathology industry. The combined model can be used to establish the correlation of organisational strategies and market performance. Effective cost management might not necessarily result in profitability unless companies have good internal strengths and have good relationships with the customers (Rounaghi, 2021). On the same note, a company might not make profits using the valuable resource when customers are not ready to embrace the use of digital healthcare services. The integration of these theories will allow the research to study profitability through both the operational and strategic perspectives and look at it through the consumer lens. Additionally, adding TCE, RBV, and TRA to the theoretical background of the study ensures a well-developed discussion on the nature of the factors that influence profitability and sustainability in the healthcare aggregator pathology business in India.

2.7.9 Role of Digital Platforms in Healthcare Aggregation

"When providers have to compete on results, the problem of supply-driven demand, in which available capacity leads to care with questionable benefits, will largely disappear." - Michael E. Porter, Redefining Health Care: Creating Value-Based Competition on Results

Digital platforms are at the centre of facilitating healthcare aggregation as they serve as technological systems that bridge different stakeholders within the healthcare system. These platforms combine teleconsultation, diagnostic tests, e-medical records, appointment booking, and electronic prescriptions into one digital platform. With this kind of integration, digital health platforms enable effective communication and information sharing between patients, healthcare providers, diagnostic laboratories and other healthcare organisations (Pietronudo et al., 2022). The increase in digital platforms in healthcare is mostly due to the significant use of digital technologies and the growing accessibility of healthcare data. The contemporary healthcare systems have led to the production of vast amounts of data by electronic health records, wearable gadgets, mobile health applications, and hospital information systems (Junaid et al., 2022). Regarding the help of digital platforms, these data sources can be aggregated and analysed, which enables healthcare providers to have a full picture of the health conditions of patients and the use of healthcare services.

Digital healthcare services also make medical services more accessible by breaking the geographical and logistical barriers. With the help of technologies such as telemedicine, mobile health applications, and cloud-based health systems, patients have the opportunity to consult a physician, receive a diagnostic test, and access health information remotely (Onyeabor et al., 2024). The innovations have made a great impact on the accessibility to healthcare in rural and underserved communities where there is limited healthcare infrastructure. Through telemedicine and mobile health solutions, patients can communicate with health practitioners, seek medical consultation and check their health conditions without the need to visit a health facility (Nguyen et al. 2024). Moreover, the digital platform makes the management of healthcare efficient since digital platforms make it possible to communicate and coordinate various healthcare providers in real-time. Digital integrated systems enable medical facilities to exchange patient information safely and effectively to enhance clinical decision-making and minimise medical errors. Digital technologies such as artificial intelligence, smart health wearables, and cloud computing only increase the functionality of these platforms by making them predictive, remote monitoring, and

personal healthcare provisioning. The second way that digital platforms are relevant to healthcare aggregation is to enhance patient engagement and empowerment (Hickmann et al., 2022). Patients can use digital health applications to monitor their health information, view medical records, or schedule diagnostic tests, and interact with health care professionals. This greater access to healthcare information helps patients to make more knowledgeable healthcare choices and become more engaged in the process of controlling their health conditions.

2.7.9.1 Growth and Importance of Healthcare Aggregators in India

The Indian healthcare aggregator platforms have been witnessing immense growth over the past decade and this growth has largely been attributed to the increasing internet penetration, the increased use of smartphones and the expansion of digital health ecosystem. In India, healthcare aggregators consist of online websites that deal with engaging patients with healthcare providers, including doctors, diagnostic laboratories, pharmacies and hospitals (Sharma et al., 2023). These platforms, including the booking of diagnostic tests, online doctor consultations, prescribing drugs, and health information services, integrate the services, making the process of the healthcare service easier. Some online health portals have emerged in India as a subset of this emerging health aggregator ecosystem. One such digital health platform is Tata 1mg, which sells the services as online pharmacy, laboratory tests, consultation with a doctor, and health information in the same platform (Aqeel & Gera, 2023). By integrating different medical services, such platforms will avail the patients with convenient access to healthcare services besides promoting coordination among medical practitioners.

Likewise, online health care software systems such as Driefcase offer patients with digital health record systems through which they can store, manage and exchange medical records electronically. These platforms help with creating a more connected healthcare ecosystem as they allow the sharing of data between healthcare providers and patients with a reasonable degree of security. Digital health record systems are also used in facilitating national digital health campaigns in enhancing healthcare interoperability and accessibility of data (Reegu et al., 2023). The role of governmental initiatives is also significant in increasing the pace of the development of digital healthcare platforms in India. The use of digital healthcare technologies is actively enhanced by the national programs that facilitate the expansion of digital health infrastructure and enhance access to healthcare. Digital healthcare projects promote the creation of unified healthcare

platforms that include telemedicine, diagnostic services and electronic health records to optimise healthcare provision and efficiency (Mashmool et al., 2026).

The significance of healthcare aggregators in India is that they help solve several problems that are related to the traditional healthcare system. The healthcare industry in India has been highly fragmented, and healthcare services are spread across various independent hospitals, laboratories and clinics. Healthcare aggregators can also aid in solving such fragmentation by forming digital networks that link various healthcare providers into a single platform (Shinde et al., 2024). This integration increases the ease of access to services, increases transparency in terms of pricing and quality of service, and facilitates smoother coordination of healthcare services. On the whole, the emergence of healthcare aggregators has become a part of the digital Indian health ecosystem development. These platforms will be significant in changing the way healthcare is delivered in India by enhancing its accessibility, effectiveness, and efficiency in healthcare management.

2.7.9.2 Business Models in Diagnostic Healthcare

"The highest ideal of cure is the speedy, gentle, and enduring restoration of health by the most trustworthy and least harmful way."- Samuel Hahnemann, Organon of the Rational Art of Healing (1913)

2.7.9.3 Traditional Diagnostic Laboratory Business Model

Diagnostic healthcare services have a long history of the traditional diagnostic laboratory business model as their foundation. According to this model, the diagnostic laboratories are independent healthcare service providers who perform medical tests, including pathology, radiology, and molecular diagnostics, to inform disease detection and monitoring and treatment decisions (Kulkov, 2023). These labs are usually linked to a network of centralised labs and collection sites where the samples of patients are gathered and handled. The model is founded mainly on direct visits to the patients or a referral to a physician to carry out diagnostic tests. The most frequent model of operation that takes place in a traditional diagnostic laboratory is the hub-and-speak model, with the hub being a central reference laboratory, and the spokes being several satellite laboratories and sample collection centres (Khamaksorn, 2022). The smaller centres are where samples are collected, and then the samples are taken to central laboratories to be tested and

analysed. The structure allows the laboratories to have specialised equipment and skilled personnel in central positions, but increases the service coverage by decentralised collection points. The hub-and-spoke system is also beneficial as it assists laboratories in enhancing their operational efficiency, reducing costs and also delivering quicker turnaround time of test results.

Traditional diagnostic laboratories, as far as revenue generation is concerned, depend on three major customer groups, which include individual patients, healthcare facilities, and government-funded healthcare programs. The business-to-consumer (B2C) segment deals with the direct diagnostic services in the form of walk-in patients or physician-referral patients. The business-to-business (B2B) segment comprises services of diagnosis offered to hospitals, clinics, and healthcare facilities that subcontract laboratory tests. Moreover, the laboratories can be involved in the government healthcare program (B2G) when offering diagnostic services within the framework of the national healthcare programs and the schemes of the state healthcare (Ahmadi et al., 2024). This is the traditional business model embraced by large diagnostic chains in India that have large laboratory networks. Organisations such as Thyrocare run big networks of diagnostic laboratories having several service centres and collection sites in various regions, which allows such companies to offer diagnostic services at scale (Team Bitscale, 2025). These networks aid diagnostic firms in increasing market access, enhancing access to services, and ensuring that the quality of services offered by the testing facilities is uniform.

Though the traditional model of diagnostic laboratory is popular, there are several problems in the modern healthcare environment raising critical concerns. Increase in competition, rising operation prices and the high demand of digital healthcare have stretched conventional diagnostic service providers. The patients are increasingly seeking convenient services, including online booking, sampling home collection, and electronic reports delivery (Kitsios et al., 2023). Accordingly, the utilisation of digital technologies and online platforms in the activity of the conventional laboratories is progressively gaining popularity as the leading factor in the evolving climate of the healthcare-related industry (Chandra et al., 2022). Overall, it is gradually changing to using digital technologies and platforms-based services in order to adjust to the evolving expectations of the patients and technological shifts.

2.7.9.4 Aggregator-Based and Platform-Based Diagnostic Business Models

Digital technologies created the possibility of the development of aggregator-based and platform-based business models in diagnostic healthcare. These models are based on digital platforms that link patients to various diagnostic laboratories and healthcare service providers using one integrated system. Healthcare aggregators are the mediators that bring together services provided by various labs, hospitals, and medical practitioners, and patients can receive numerous healthcare services in a single digital environment. Diagnostic models based on the use of aggregators are usually constructed on the web or on a mobile application, which allows patients to search and compare diagnostic tests among different laboratories and book them (Baron & Haick, 2024). The online test booking, scheduling of home sample collection, online payment system and delivery of electronic reports are some of the services offered on these platforms. Through the unification of work of various laboratories, these websites enhance healthcare access and transparency, allowing patients to find the prices, the quality of the services, and the place of the test and then choose the diagnostic centre. The platform-based model is also considering a larger healthcare ecosystem by uniting several parties, such as hospitals, laboratories, pharmacies, insurance firms, and healthcare technology vendors (Mbanefo & Grobbelaar, 2025). Digital platforms are the coordinating entity in such ecosystems that serve as the communication channel and medium of exchange of data between various healthcare actors (Mwogosi and Mambile, 2025). This integrated ecosystem helps healthcare providers to work in a more productive manner, besides enhancing efficiency in service delivery.

Some of the health services platforms in India have implemented this approach of aggregated diagnostic services. As an illustration, digital healthcare platforms combine online pharmacy, teleconsultation, and diagnostic testing into one platform oriented to the consumers. For example, companies such as Medlife started to expand their services not only to deliver medicine, but also to offer diagnostic services and online consultations, which offer patients the opportunity to receive all healthcare services through a mobile application (Krishna, 2020). The model of aggregator has some benefits over conventional models of diagnostic services. To begin with, it enhances convenience since it will allow patients to utilise various healthcare services through one platform. Second, it can lead to efficiency of operations in terms of minimising the use of laboratory capacity as well as lessening any unnecessary investment in infrastructure. Third, it enables medical practitioners to access more customers without developing massive physical

structures (Iria & Soares, 2023). Platform-based diagnostic models have some challenges as well. These are ensuring quality of services in partner labs, coordination of operations between various stakeholders and ensuring sustainable profitability in digital healthcare markets that are very competitive. Aside from this, aggregator-based models have been on the rise owing to the rising adoption of digital health and the rising demand for convenient healthcare services.

2.7.9.5 Emerging Hybrid Business Models in Diagnostic Healthcare

Due to the changing needs of healthcare practices and the adoption of new technologies, diagnostic healthcare providers are progressively implementing the presumed hybrid business models, which integrate the features of the traditional laboratory networks and the digital platform-based services. Hybrid models are models that combine the advantages of both methods to make physical facilities comfortable with digital healthcare systems to improve the availability of services, efficiency, and profitability of the operations (Almaiah et al., 2022). The hybrid diagnostic business model is a model that offers online services and usually incorporates centralised networks of laboratories with digital health solutions. Under this model, the diagnostic companies have their own laboratories and collection centres and at the same time team up with digital platforms to reach more people with their services (Khan et al., 2023). Social media, such as mobile apps, web-based laboratory information systems, and web-based report management systems, allow patients to make appointments, order home sample collection, and get their test results electronically.

The combination of digital laboratory information systems and healthcare platforms that facilitate diagnostic processes and enhance coordination of the work in this area is one of the key features of hybrid diagnostic models. A modern laboratory software platform can allow the labs to handle the test orders, sample tracking, billing flows, and patient information by digitally integrated systems (Adekoya *et al.* 2025). These platforms enable direct interaction between patients, laboratories, and healthcare providers, enhancing their efficiency and minimising administrative loads. Another concept that is supported by hybrid models is the idea of coordinated diagnostics, in which diagnostic service is combined with the larger healthcare process. This healthcare system significantly includes treatment planning, patient monitoring, and clinical decision-making. With coordinated systems of diagnostics, laboratory diagnostic data are exchanged between health care providers to enhance patient outcomes and optimise the use of

healthcare resources (Adekoya et al., 2025). Furthermore, hybrid business models allow the diagnostic companies to diversify their revenue base, providing a variety of services including preventive health packages, corporate wellness programs, specialised molecular diagnostics, and research collaboration. With the integration of both physical infrastructures and digital healthcare services, diagnostic providers will have the ability to increase their market reach and continue to exert operational control over the quality and service delivery.

2.7.9.6 Cost Structures in Pathology and Radiology

"It's high time we stop pretending that 'Profit' is a dirty word in Indian healthcare. If a hospital isn't profitable, it isn't sustainable. And if it isn't sustainable, the patient is the one who ultimately loses."- Syed Munavar Ali, India's Healthcare Paradox: Profit and Patient Care

The cost structure of pathology and radiology services is critical in the analysis of profitability in the healthcare aggregator pathology industry in India. The diagnostic services are managed through a complicated financial model comprising capital investments, operational costs, technology costs and regulatory compliance. The diagnostic industry comprises pathology and radiology which are important parts of clinical decision-making and healthcare provision. Research has shown that laboratory test results affect nearly 70 percent of medical decisions, underscoring the strategic value of diagnostic services in healthcare systems (Adekoya et al.,2025). The Indian diagnostic market is projected to have a value of a number of billion dollars and is expanding fast with the growth in awareness of healthcare, preventive tests and technological innovations. The section reviews the main elements of the cost structure of pathology and radiology services and their implications for profitability in healthcare aggregators.

2.7.9.7 Capital, Investment and Infrastructure Costs

Initial capital investment needed to set up pathology and radiology facilities is one of the greatest cost drivers in diagnostic services. The diagnostic facilities also require specialised equipment including laboratories, imaging rooms, sterilisation units and sample processing facilities. The facilities should meet high standards in regulatory requirements in terms of safety, hygiene and management of biomedical waste. The price of setting up a simple diagnostic lab in India can be 15 to 20 lakhs whereas advanced laboratories with explicit equipment and testing facilities could be over 1 crore of investments (Patel, 2025). Other infrastructure expenses

considered costs of infrastructure include construction or renovation expenses, interior design, specialised ventilation systems and electrical supplies necessary to support laboratory equipment.

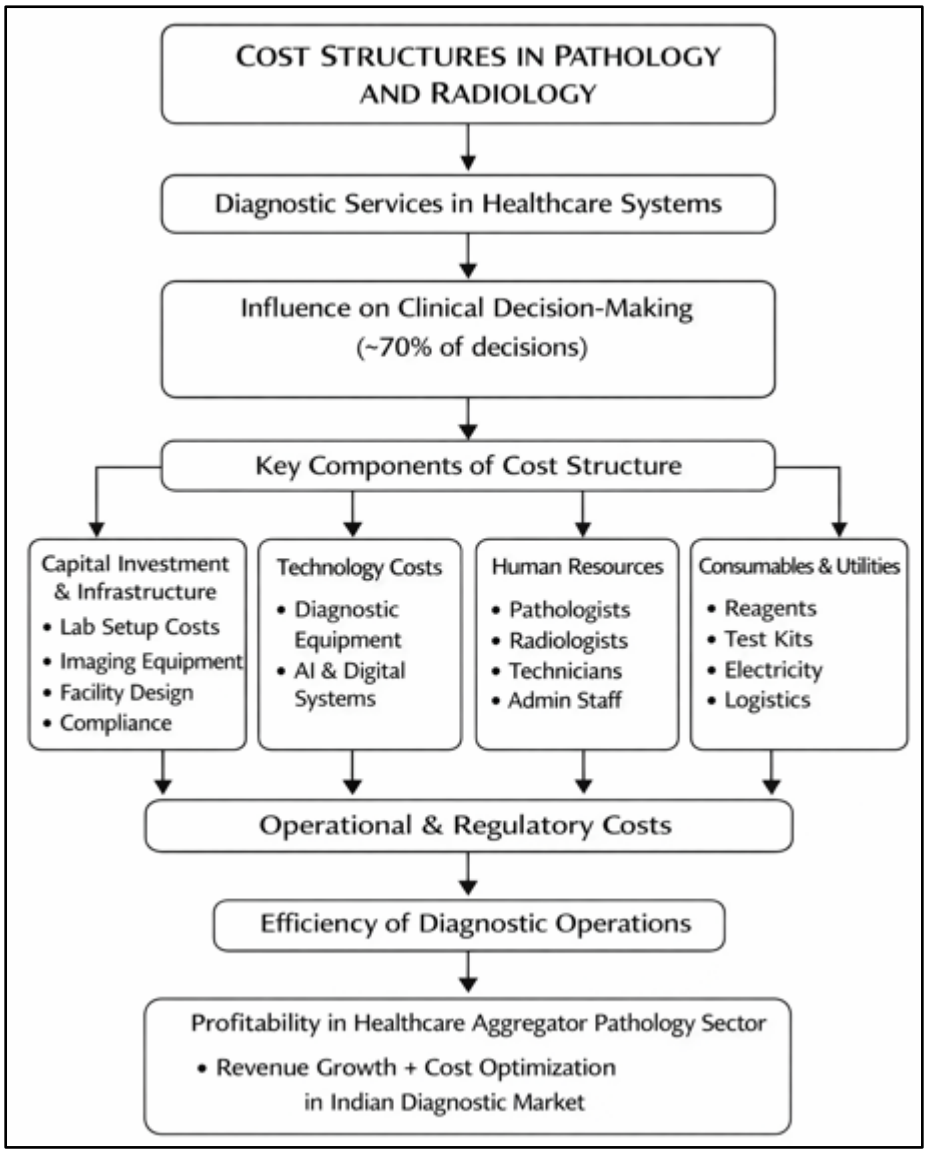


Figure 2.7.9: Cost structure in pathology and radiology

(*Source*: Author's work)

Laboratories also need to ensure controlled conditions to get precise test results and this can be achieved by means of temperature regulation systems, backup power supply and safety mechanisms. Radiology centres need even more capital investments since the imaging equipment (MRI scanners, CT scanners and ultrasound machines) is relatively expensive (Eccher et al.,2023). The cost of procuring these machines is also associated with high installation and calibration costs.

Furthermore, radiology facilities should comply with radiation safety requirements which adds to setup expenses.

2.7.9.8 Cost of Equipment and Technology

Diagnostic services depend on the use of highly sensitive medical and laboratory equipment. The largest share of operational and capital expenditure in pathology and radiology is equipment. Haematology laboratories need haematology analysers, centrifuges, spectrophotometers and automated biochemical analysers. This equipment is quite expensive given the level of technology and the testing ability. Radiology services are costlier such as MRI scanners, CT scanners, X-ray machines and ultrasound systems (Waheed et al., 2022). This imaging equipment is expensive in terms of financial investment and may also include maintenance contracts. Preventive maintenance is important to make sure the reliability and accuracy of diagnostic results. The cost of maintaining diagnostic equipment may be high, and annual maintenance contracts account for a large percentage of the equipment's initial price (Li et al.,2022). The costs associated with servicing, software updates and hardware replacement are also additional to the long-term operational cost of diagnostic centres. The growing use of digital technologies including laboratory information management system (LIMS), artificial intelligence-based diagnostic software and tele-radiology platforms has further complicated the diagnostic services technologically. Although these technologies enhance efficiency and accuracy in diagnosing cases, they are involved in the total cost structure.

Human Resource Costs

The other significant cost element in the operations of pathology and radiology is human resources. Diagnostic laboratories also need a talented workforce comprising pathologists, radiologists, laboratory technicians, administrative staff and support personnel (Lippi & Ognibene, 2025). Pathologists and radiologists are the most specialised medical workers whose salaries are a large percentage of the costs of operations. Furthermore, the laboratories should hire qualified technicians to conduct sample collection, testing and equipment repairs. Staffing costs would vary depending on the size and complexity of the diagnostic centre though they usually include several technicians and administrative personnel. Research has shown that diagnostic laboratory technicians are usually paid between 15000 and 35000 per month, whereas qualified pathologists can earn between 50000 and 1 lakh or more based on experience and place of work (Geeks for

geeks, 2025). In addition to salaries, there is also the cost of training, development of the professional and retention of the staff by the organisations. The constant change in the development of diagnostic technologies requires continuous training for healthcare professionals to keep them competent in working with new equipment and digital systems. Human resource expenses are thus critical in the decision of operational performance and service delivery of diagnostic centres.

Consumable and Reagent Costs

Reagents and consumables are a recurring operational expense in pathology laboratories. Every diagnostic test has certain reagents and chemicals as well as testing kits and lab supplies. These consumables are to be replenished immediately to ensure smooth operations of the laboratory throughout. Reagents have different prices depending on the nature of the diagnostic test to be done (Otoo and Schlappi, 2022). Common blood tests and biochemical tests use relatively low-cost reagents whereas more specialised tests (molecular diagnostics and genetic testing) have a much higher cost of reagents. Furthermore, the use of laboratories should have strict quality control criteria when utilising reagents to obtain the right test results. This usually entails acquiring quality certified reagents from certified suppliers which can make operations expensive. The consumable costs are also incurred in radiology services including imaging films, contrast agents and protective materials during the diagnostic processes (Najjar, 2024). Even though digital imaging technologies have reduced the use of physical film, other consumables still add to operational costs.

Costs of utility and operation

Another significant expense in the pathology and radiology facilities is utility costs. Diagnostic devices use a lot of power, as they need to be turned on all the time and as a result of power-consuming imaging devices. The laboratories also need a sound power supply, reserve generators and controlled climatic conditions to ensure that the equipment is operational (Shamim, 2022). The transportation of samples between collection centres and central laboratories is another cost aspect that should be closely addressed in the case of most diagnostic chains. These operational costs are important and they should be efficiently managed to enhance profitability in the large diagnostic networks.

Costs of Regulatory and Compliance

The diagnostic laboratories work in a regulated healthcare environment. Government regulation and accreditation affect costs, which contribute to the cost structure of pathology and radiology services. In India, diagnostic laboratories are required to meet a number of regulatory issues concerning the biomedical waste management, quality assurance and laboratory accreditation (Akase and Kpera, 2024). Laboratory accreditation by bodies such as the National Accreditation Board of Testing and Calibration Laboratories (NABL) is critical to ensuring that laboratories are of high quality and provide reliable diagnostic reports (Shetty and Minal, 2023). Despite the fact that regulatory compliance raises the cost of operation, it also enhances the level of credibility between laboratories and patients which allows laboratories to build partnerships with hospitals and healthcare providers.

2.7.9.9 Economic Efficiency and Profitability of Diagnostic Service

Pathology and radiology services are profitable to the extent they can balance operational costs against revenues from diagnostic tests. The average profit margin of diagnostic laboratories in India is dependent on a variety of variables including the size of operations, pricing policies and competition within the market (Lobo & Bhat, 2022). Big diagnostic chains have the advantages of economies of scale, centralised testing laboratories and a combined service model that lowers the price of testing. The role of healthcare aggregates in the pathology industry in streamlining cost structures, linking patients with diagnostic service providers, facilitating the booking process and boosting the number of tests that partner labs can perform is becoming more important.

2.7.9.10 Vertical Integration in Health Care

Vertical integration has become a prominent strategic concept in the current healthcare systems, mainly in diagnostic services and healthcare aggregator model. Vertical integration is a trend that is gaining momentum in healthcare organisations with the aim of enhancing operational efficiency, coordination of services and better performance in terms of finances. In the framework of the Indian healthcare aggregator pathology industry, vertical integration is an important factor in enhancing profitability through linking various steps of the healthcare service delivery process such as diagnostics, consultation, treatment and digital healthcare solutions.

2.8 Literature Gap

Existing literature has widely discussed digital healthcare transformation, healthcare aggregation, diagnostic services, and operational efficiency in the healthcare industry. The study has analysed the healthcare aggregators business models to look for how they can be used to enhance healthcare accessibility, digital coordination, and convenience for customers in India. The existing literature also notes the significant role played by the sectors of pathology services, healthcare prevention, artificial intelligence, and healthcare revolution by means of digital health ecosystems in the Indian healthcare market. However, in the Indian healthcare aggregator pathology sector, no great depth of focus and research on profitability and financial sustainability exists particularly in the light of the growing development of Healthcare Aggregator platforms.

Most existing reports merely examine the accessibility of healthcare, the new inventions, patient convenience and the incorporation of digital healthcare as opposed to how this can be used to enhance profitability. As an example, Sharma et al., (2023) and Kharat and Gaikwad, (2024) discussed the significance of digital healthcare infrastructure, IoT, and interoperability in improving the healthcare delivery systems. Similarly, Aguirre-Duarte (2025) also gave a narrative of the role played by healthcare aggregators in enhancing the coordination of healthcare and transparency. However, such studies provide little attention to the impact of non-efficient operations, pricing, and cost on pathology aggregators profitability. A further gap that is discovered in the literature is the lack of information specifically focused at value imbalance within healthcare aggregators and diagnostic service providers. As per the literature available, healthcare aggregators serve primarily as an intermediary between diagnostic labs and patients. However, there has been a lack of research which has analysed how the third-party diagnostic centres capture a large chunk of the revenue, and the aggregators function with a low contribution margin. The research by Rajamani and Iyer (2023) briefly touched upon some points in terms of the dependence on external diagnostic providers. However, there is still a lack of academic study on long term effects on profitability, scalability, and operations control.

The existing literature also does not have sufficient research about a model of integrated operation in the sector of pathology aggregators. Past research has addressed the individual aspects

of providing pathology services, providing radiology services, providing logistics services, acquiring new customers and providing digital health. But little work has been done on the hybrid model that involves on-site phlebotomy collection, outsourced laboratory processing, and radiology-integrated providence to achieve profitability and save operating expenses. The ongoing research report highlights that fragmented service delivery, lack of coordination with the pathology and radiology providers and the operational inefficiencies have a major impact on the financial performance in healthcare aggregator businesses.

In addition, a significant proportion of past research has focused on digital transformation and technological innovation, but not enough has been put into understanding the direct link to profitability. Earlier, Dasaradharami Reddy & Gadekallu (2023) wrote about artificial intelligence, machine learning, predictive analytics of healthcare diagnostics. Faiyazuddin et al., (2025) also discussed artificial intelligence in the diagnostics of healthcare. Another significant gap is about customer retention and behavioural aspects that can impact profitability. While numerous studies have talked about conveniences for the patient and adoption of digital healthcare, a limited number of studies analyse the contribution of customer trust and service quality to repeat usage and customer loyalty to long-term profitability in the case of a pathology aggregator. Therefore, the current research is designed to fill these gaps. This will be done through an examination of some of the operational inefficiencies, margin leakages, cost structures, technological integration, and customer-related issues that impact profitability of the healthcare aggregator in the Indian pathology industry.

2.9 Conceptual Framework

The conceptual approach used in the present study is designed to explore the factors that affect the profitability of the pathology sector in India, a healthcare aggregator. The framework is broken into three general sections including independent variables, operational variables and dependent variables. The framework relates to the internal and external conditions and events from an operational level that affect the effectiveness of the operational model hybrid and how they affect profitability growth. The independent variables are cost structure, operation efficiency, technological integration, logistics, service quality, pricing strategy, customer satisfaction and

retention. The variables represent the key organisational and market related influences on the performance of healthcare aggregator pathology companies. Operational efficiency and financial sustainability are affected by high operational cost, lack of continuity in service delivery as well as customer acquisition issues. The operational variables are the conceptual or proposed operational model in this study. These involve the field of phlebotomy, lab processing requirements, radiology tests at diagnostic centres, collection at the patient's home, coordination of workflow, and time management. These functional elements are expected to lead to better coordination, efficiency in the usage of operations, and decrease the leakages in the healthcare aggregation system. The dependent variables are profitability improvement, cost-cutting, revenue expansion, financial sustainability and competitive advantage. In the framework, a positive relationship between the effective management of operational and strategic variables and organisational profitability is assumed. It is explained that the long-term sustainability of an organisation bears also to its strategy, management team and operational management. The conceptual framework gives a structured understanding in the relationship between profitability enhancement and operational restructuring in the disease testing sector in the Indian Healthcare sector.

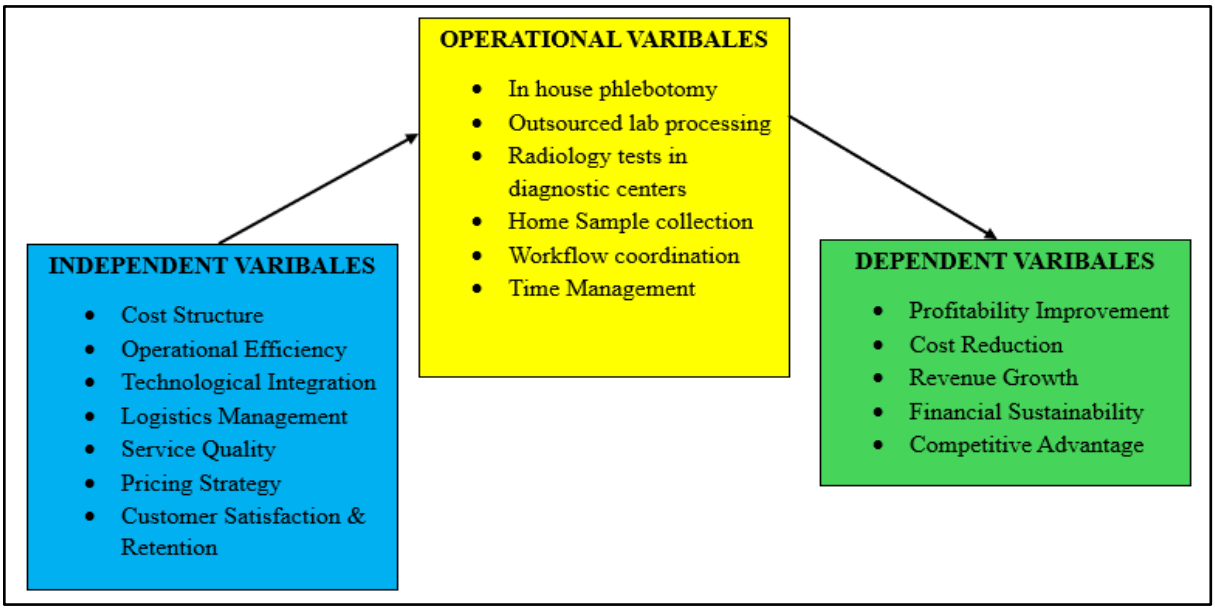


Figure 2.9.1: Conceptual Framework

(*Source*: Author's work)

2.10 Chapter Summary

This chapter critically analysed the existing literature on the profitability issues in the Indian health aggregator in the pathology sector and transformation of operations. First, the concept of healthcare aggregation was explored and the emerging role of the digital healthcare platforms in terms of delivering diagnostic services. The discussion underlined the role of healthcare aggregators in making healthcare more accessible by enabling people to book tests online, collecting their samples at home, conducting a teleconsultation and using digital integration of healthcare. Although the market has been growing at a fast rate, the available literature revealed that there are ongoing profitability issues due to operational inefficiencies, increased logistics expenses and reliance on third party diagnostic centres. The chapter also examined the business models of the diagnostic healthcare industry, especially the health care aggregation of the marketplace and commission based operational models. Previously, some research indicated that the pricing power and margin pressure experienced by many healthcare aggregators still have significant aspects related to the sharing of revenue with partner laboratories and radiology centres. This dependency in operation makes your business financially unstable and limits the long-term profits.

The literature on vertical integration revealed that the healthcare companies can achieve better operational coordination and financial results by having more control over processes of diagnosis, logistics and interaction with customers. The research emphasized the potential benefits of vertically integrated and hybrid healthcare systems, such as the ability to cut down on intermediaries, enhance quality management, and boost customer satisfaction. The same applies to the study of home sample collection and decentralised healthcare services, which suggests that technology-based diagnostic delivery systems have contributed greatly to healthcare access and convenience of patients, especially since the onset of the COVID-19 pandemic. However, decentralised health care systems provide their own set of problems in logistics, staffing, regulatory issues and cost management. The chapter also explored the idea of disintermediation and its correlation with the profitability improvement in health care aggregation. The literature indicated that the use of healthcare aggregators in direct-to-consumer healthcare delivery models could enable better margin expansion while reducing reliance on the intermediaries for better

operational efficiency. The key factors for sustainable business growth in the diagnostic healthcare industry were identified as technology integration, digital healthcare platforms and operational restructuring.

Three important theories underpinning the present study, namely, Transaction Cost Economics (TCE), Resource Based View (RBV) and Theory of Reasoned Action (TRA) were reviewed in the theoretical underpinning section. All these theories could be used to give an explanation of the role of these three elements such as operational cost reduction, strategic organisational capacities and consumer adoption behaviour in the sense of influencing profitability and business sustainability in the context of healthcare aggregation models. The overall literature review revealed that there is a huge gap in the research related to operational restructuring for the purpose of profitability in the pathology sector of healthcare aggregators in India. Current research has been mainly conducted around the adoption of digital healthcare and access to services, with little attention paid to hybrid healthcare, vertical integration and margin optimisation mechanisms. Thus, the present study seeks to fill this void by exploring ways to improve the profitability using operational control, disintermediation and hybrid integration in the Indian diagnostic healthcare industry.

CHAPTER 3: METHODOLOGY

3.1 Introduction

This chapter provides a methodological approach used in the study for improving the profitability in the Indian healthcare aggregator pathology sector. It is important to include the methodology chapter in the research report because it explains the procedures, techniques and research strategies to solve the research problem and meet the research goals (Khan et al., 2023). This current study aims at the understanding of the inefficiencies, asymmetric pricing and problems of profits in the diagnostic industry in India for the healthcare aggregator platforms. The study suggests a blended operational model combining in-house phlebotomy, outsourced lab processing and coordinated radiology to boost profitability, efficiency and scalability, overcoming these challenges. The Indian healthcare aggregator industry of pathology has been growing at a rapid rate considering its increasing healthcare awareness, digitalization and the demand for the ease of accessing diagnostic services. Even though digital healthcare platforms have been gaining market share, there are a number of aggregator firms suffering from low profitability due to over-reliance on primary healthcare centres or third-party diagnostic centres (Sharma, 2025). All these structural issues have also brought the need to investigate the current business models and design more financially sustainable working models. Thai research hence follows the systematic approach that includes the views of stakeholders along with the financial evaluation methods to be able to analyse both operational and financial aspects of the problem.

The approach used in the study is based on pragmatist research philosophy and is based on a sequential mixed research method approach. The study adopts both quantitative and qualitative design to give an overall picture of the profitability issues in the pathology aggregator ecosystem. The phenomenological or qualitative aspect of the study aims to collect real-life experiences and insights from major players including diagnostic manager, home sample collection services (HSCS), phlebotomist, radiology administrators and healthcare aggregator founders. Industry insights on aspects such as inefficiencies, lack of service coordination, pricing or value capture in the current aggregator model can be observed through the study. The quantitative aspect of the study is related to the financial modelling and profitability analysis. Financial analysis and

modelling of financial feasibility and scalability of the proposed hybrid operation model are conducted using financial tools such as contribution margin analysis, break-even analysis and scenario modelling. Combining the qualitative understanding and financial analysis provides trustworthiness and applicability of the study results (Oranga, 2025).

This study will first review various types of constraints in construction and their characteristics. Based on this understanding, a classification method will be developed to categorize constraint factors for the purpose of constraint identification and modelling. In the second stage of this study, existing constraint modelling methods will be identified based on a comprehensive review of current industry practices and academic research. Finally, once the constraint classification and modelling techniques are identified, a conceptual framework for total constraint management will be outlined. This chapter also discusses research philosophy, research approach, research design, sampling strategy, data collection methods, analytical procedure, ethical considerations and research limitations. Combined, these methodological components offer a systematic and organized approach to studying profitability enhancement opportunities within the Indian healthcare ecosystem of pathology aggregators.

3.2 Research Approach

Research approach can be defined as the systematic process used in developing knowledge and solving research questions in a research study (Dudovskiy, 2023). It is the response to a logical framework that links theory to investigation. In the present study, the research approach is abductive. This type of approach is used to explore the profitability challenges and the inefficiency in operations of the Indian healthcare aggregator pathology industry. The abductive method is deemed suitable as the research is aimed at the investigation of a relatively under-researched business model and the development of practical and theoretically grounded solutions for increasing the profitability at the same time. There is a middle ground between inductive and deductive reasoning which is abductive reasoning. The deductive method is the one that starts with an existing theory and tests a set of hypotheses in advance while the inductive method builds a theory from a set of observations (Kumar & Ujire, 2024). Abductive reasoning creates an interaction between theory and observation (Veen, 2021). This is beneficial in the study of growing

businesses or in an operational environment in which theories alone may not adequately describe the actual state of affairs in business. The pathology sector, the Indian healthcare aggregator, is a dynamic digital healthcare environment where all the factors such as technology, pricing models, coordination of operations and partnerships with diagnostics, contribute to profit outcomes. Thus, only a deductive or inductive method would not be sufficient for the complexity of the industry.

The abductive approach allows for the research to flow from the stakeholder experiences to theoretical understanding and back again, during the process of the research. Qualitative data is gathered in the first place using semi-structured interviews with key informants including diagnostic laboratory managers, radiology administrators, operational personnel (phlebotomists), and the diagnostic laboratory founders. The major operational issues are identified including pricing asymmetry, margin leakages, reliance on third party diagnostic centres, service coordination issues and customer management issues. The qualitative results give an understanding of the context where profitability constraints arise in the existing aggregator system. From these empirical observations, it is proposed that a hybrid model of operation is developed where in-house phlebotomy service is coupled with laboratory processing that is outsourced and coordinated radiology services. This model is then evaluated using quantitative financial analysis techniques to determine the feasibility and profitability. The financial sustainability of the proposed operational structure under various business conditions is analysed with financial tools such as contribution margin analysis, break even analysis and scenario modelling. The use of abductive methods in this study is thus more advantageous because it can be used to apply the theories to be evaluated in the financial domain and also on the other hand, the theories can be developed with a practical approach in the industry. The adaptability of the methodology guarantees that the suggested solutions not only fulfil their theoretical foundations but are also viable in the Indian context of healthcare aggregators such as pathologists.

3.3 Research Design

3.3.1 Exploratory Research Design

The research design establishes the decision-making processes, conceptual structure of investigation, and analytical methods used to address the study's central research problem (Olawale et al., 2023). The current research follows an exploratory research design to explore the dynamics of profitability in the Indian healthcare aggregation pathology industry. The exploratory design is suitable as the existing literature addresses some aspects in terms of operational profitability models, value-capture mechanisms, and hybrid integration strategies. The literature is mainly based on digital healthcare transformation, healthcare aggregation systems, disintermediation, and the diagnostic cost structure. Thus, the research aims at investigating operational and financial inefficiencies that limit the profitability and scalability of Indian healthcare aggregators. The Indian pathology aggregation industry is typified by disjointed service architecture, reliance on third-party diagnostic work-labs, and price imbalance. The majority of healthcare aggregators engage in business as an intermediary between patients and outside pathology laboratories and radiology centres. As a result, package revenue is retained at a considerable rate by diagnostic centres and the aggregators end up with a relatively low contribution margin following operational expenses and marketing expenses. These structural imbalances present major problems regarding margin retention, service standardisation, quality control and long-term financial sustainability.

The current research selects the exploratory research design because it helps to study the problem of profitability in the market of Indian healthcare aggregator pathology and create a new hybrid working scheme that could contribute to financial sustainability. The exploratory research design is appropriate in those situations when a study problem has not been sufficiently explored in existing literature or when new understandings and conceptual frameworks are required (Sharma et al., 2023). Although digital healthcare platforms and healthcare aggregation models have mostly been studied in the field of healthcare management, the processes of financial viability and profitability of pathology aggregators have received little attention. Most of the research is concerned with access to services, digital transformation and efficiency of healthcare delivery

instead of capturing value and efficiency on how costs are structured. Thus, an exploratory design provides the possibility of analysing the arising problems and determining the structural issues behind them, and creating new solutions to the sector (Ahmed, 2024). The exploratory design of the current study is based on a sequential mixed method design of qualitative exploration and quantitative analysis of finances. During the first step, semi-structured interviews are performed with the key stakeholders of the diagnostic ecosystem, such as the founders of healthcare aggregators, radiology administrators and managers, as well as working employees of the diagnostic centre, such as phlebotomists. Semi-structured interviews are best since participants are able to provide a lot of insight but an interview structure is still kept the same across the respondents (Karatsareas, 2022). Based on the experience as part of the qualitative phase of the research, a proposed hybrid operating model that would help improve profitability is developed. The model would involve in-house phlebotomy, outsourced lab processing at negotiated prices, and built radios in the model to capture the maximum value along the diagnostic services chain. The second stage of the research design involved the quantitative financial modelling of financial viability of this model. Thus, exploratory research provides an appropriate methodology that can be adequate to examine the dynamic and understudied nature of profitability optimisation in healthcare aggregation platforms.

3.3.2 Mixed-Methods Research Design

The general idea behind the mixed-methods research design is that it helps build a superior and more profound understanding, as it presents a more detailed image that would contribute to the description and cognition of the phenomena (Wasti et al., 2022). The research design used in this study is a mixed-methods research design, which combines qualitative and quantitative research methods. The mixed-method design is appropriate as the research problem is both operational and financial in nature and cannot be explained entirely utilising a singular methodological approach. Strategic, organisational, technological, and financial factors can influence profitability constraints experienced by Indian healthcare aggregators. In turn, the combination of the qualitative and quantitative approaches will allow the study to develop a comprehensive understanding of the operational inefficiencies and financial framework that influence profitability in the pathology aggregation segment. The qualitative part of the research

is directed at comprehending the views of the stakeholders, operational issues, and coordination problems of the services, and dependency risks of aggregator-diagnostic partnerships. Qualitative research is employed by researchers in social sciences to gain a deeper insight into the life experiences with reference to the social and cultural depositions (Muzari et al., 2022). The qualitative inquiry focus on investigating the struggles of healthcare aggregators associated with fragmented service delivery, price negotiation, logistics management, customer retention and quality assurance. Such operational facts matter since profitability in healthcare aggregation is not decided by only financial indicators, but it is also influenced by the organisational coordination, relationship with stakeholders, and service integration ability.

The quantitative element will support the qualitative results, which will offer financial assessment of the suggested hybrid operational model, measuring it. The aim of the study is to evaluate profitability improvement using financial modelling techniques that include analysis of contribution margin, cost benefit analysis, break-even analysis, profitability simulation and scenario modelling. The combination of quantitative financial analysis allows objective evaluation of cost restructuring and operational feasibility with various pricing and volume conditions. The pragmatist philosophy underlying the research is also in line with the mixed-methods design. Pragmatism advocates that there are several methodological approaches towards generating action and problem-oriented results. Given that the study aims to create a scalable and financially viable operational framework for pathology aggregators. The study be in two parts, which are closely related and involve qualitative research. The qualitative stage entails semi-structured interviews with a direct linkage to the healthcare aggregation process. The participants consist of the aggregator executives, pathology laboratory managers, radiology administrators, phlebotomists, logistics staff, and the operational staff of Tier 1 and Tier 2 Indian cities.

3.4 Research Philosophy

Pragmatism insists on the idea of comprehending the world and how to solve its problems through the use of subjective and objective techniques (Elgeddawy & Abouraia, 2024). The current research follows the pragmatist philosophy of research in order to analyse the profitability enhancement in the Indian healthcare aggregator pathology industry. Pragmatism is very

appropriate as the study aims at solving a viable business and operational issue and not just undertaking a theoretical interpretation based purely on abstractions. The pathology aggregation sector in India is characterised by several issues linked to disintegrated healthcare platforms, reliance on third-party diagnostic facilities, price imbalances, inefficiencies in operations, and leakage of margin. Therefore, the study must have a philosophical stance that will maintain practical problem resolution, the practical generation of knowledge, and evidence-based managerial decision-making.

There are scholars who believe pragmatism provide a strong philosophical basis for mixed methods research (Dube et al., 2024). The nature of profitability in pathology aggregators is too complicated to be properly studied using a single methodological or philosophical approach. Because the issue concerns relationships with stakeholders, logistics, and coordination of technology and financial performance. Regarding the scope of the current paper, the research philosophy will contribute to the creation of a hybrid business model that will enhance profitability, operational efficiency, and value capture in the healthcare aggregator platforms. Philosophy also focuses on the usefulness of research results in practice rather than confining the research to theoretical debates about healthcare aggregation and platform economics. Consequently, pragmatism allows the research to interconnect theoretical concepts and operating business realities in the pathology aggregation industry. The philosophical stance also promotes the application of the stakeholder views and quantifiable financial analysis. The research paper looks into the issues in operations that include reliance on third-party diagnostic laboratories, lack of harmony in service coordination, radiology management, cost of customer acquisition, and inefficiency in logistics. These dimensions necessitate qualitative knowledge from stakeholders' experience and organisational insights.

The choice of pragmatism is also explained by the fact that other philosophical methods can offer restricted appropriateness to the current research. Positivism is primarily concerned with objective measurements, statistical testing, and general causal relationships (Maretha, 2023). It also gives minimal insight of the operational complexity, stakeholder experiences and organisational dynamics in healthcare aggregation systems. On the other hand, interpretivism highlights the meaning, social interaction and human understanding. Although interpretivism

provides a good framework in comprehending operational experiences and stakeholder perceptions, it does not focus enough on quantifiable financial appraisal and profitability analysis. Thus, the use of either positivism or interpretivism only fails to allow the study to look at both the operational and financial aspects of the study in a holistic manner. The weaknesses are defeated by pragmatism that enables it to integrate qualitative operational learning and quantitative analysis of profitability. The philosophy justifies the use of semi-structured stakeholder interviews and financial modelling approaches. And it assesses the hybrid operation model that incorporates in-house phlebotomy, laboratory processing outsourcing, and an integrated radiology management platform. Therefore, pragmatism offers a proper philosophical basis for research profitability and scalable business solutions in an ever-changing digitalized healthcare landscape.

3.5 Population

The target audience of the current research comprises stakeholders who are directly related to the healthcare aggregator pathology sector in India. The study targets persons and organisations related to the aggregation services of pathology and radiology, coordination of diagnosis, management of operations, logistics, and administration of profits of healthcare aggregation platforms. The chosen population is appropriate as the study examines operational inefficiencies, cost structures, value-capture mechanisms and profitability issues impacting healthcare aggregators. The healthcare population also consists of healthcare aggregators, founders and executives, diagnostic laboratory managers, radiology administrators, phlebotomists, logistics staff and operational staff involved with diagnostic service coordination. Such participants have hands-on experience with how workflows and prices are negotiated, contribution margins, customer acquisition issues, logistics, service integration and reliance on third-party diagnostic centres. The research narrows down to stakeholders that are in place in Tier 1 and Tier 2 Indian cities wherein the digital healthcare services, pathology aggregation systems, and home sample collection systems are more prolifically established. These healthcare urban settings offer appropriate contexts of operation to study the trends of profitability and integration of the services in pathology aggregation systems. A subset of the respondents of the quantitative study may be the sample that is used in a qualitative strand (Dawadi et al., 2021).

The research uses the purposive sampling method to select the participants with contextually relevant professional experience and operational experience in the healthcare aggregation sector. Purposive sampling is regarded as the right type of sampling since the study involves in-depth information of individuals closely related to the diagnostic aggregation activities but not of an extensive population group. The sampling methodology will focus on those respondents who can give specific insights about cost structure, operational inefficiency, pricing asymmetry, logistics coordination, margin pressure, and service delivery issues in the context of profitability in pathology aggregation sites. As a result, the sampling technique fits into the exploratory, in which practical knowledge of the industry is critical in the analysis of an industry problem and strategizing operational solutions to the problems.

Ten participants are sampled out of a target participant pool of 21 healthcare diagnostic stakeholders. The chosen sample size is deemed appropriate in terms of qualitative inquiry, as it will be deep enough in the exploration, but will be able to facilitate thematic saturation. Data saturation in qualitative research is when further interviews fail to produce significant new themes, patterns or operational understandings. As the current research is limited to specialised industry participants who are well informed and knowledgeable about their operations, a smaller yet information intensive sample is of greater analytical worth than a large generalised sample of participants. The chosen participants include various operational levels of healthcare aggregation and, thus, enables a thorough exploration of profitability-related issues and organisational dynamics in the framework of pathology and radiology services coordination. The chosen population structure reinforces the mixed-method focus of the research as it allows to triangulate the qualitative views of the stakeholders, quantitative financial analysis, and secondary industry evidence

3.6 Sample Size

Sample size refers to the number of participants, organisations or observations selected from the target population to conduct a research study. The determination of an appropriate sample size is important since it directly impacts the reliability, validity and overall quality of the findings of the study (Ahmed, 2025). In the current study, the sample size is determined based on the mixed

method research design which combines both qualitative stakeholder interviews with quantitative financial data from healthcare aggregator companies in India. The study focuses on increasing the profitability within the Indian healthcare aggregator pathology sector through examination of operational inefficiencies, cost structures and effectiveness of a proposed operational model. This study used the requirements of a qualitative inquiry to define the sample size and the availability of financial data, as in a quantitative study. For the qualitative component of the study, a total of 10 participants are selected from the target population through purposive sampling. The group of participants primarily consists of healthcare practitioners in the diagnostic aggregation ecosystem of India. The participants include healthcare aggregator founders, diagnostic laboratory managers, radiology administrators, and operational staff such as phlebotomists involved in home sample collection services. The participants are selected since they have practical experience and industry-specific knowledge regarding operational workflows, pricing structures, service coordination, logistics management and profitability challenges within the pathology aggregation ecosystem. The selected sample size of 10 participants for interviews is considered to be appropriate for the qualitative research as the primary objective is to obtain in-depth insights rather than statistical generalisation. Moreover, smaller sample sizes are preferred when the study aims to explore experiences, perspectives, strategic decision-making process and operational challenges. As the study aims to achieve data saturation, the use of additional interviews is unlikely to generate new themes or insights (Ahmed, 2025). Since the research is based on a specific industry segment with specialised stakeholders, a smaller but targeted sample helps to provide rich and meaningful data for analysis. For the quantitative component of the study, ten financial and operational data from each of the four healthcare aggregator firms are collected. The organisations within the Indian pathology sector are selected based on the availability of relevant financial information, operational data and diagnostic service aggregation activities. The quantitative analysis involves the collection of approximately ten operational and financial indicators including package MRP, partner diagnostic cost and pathology lab processing cost. The other indicators are radiology test cost, phlebotomy cost per patient, logistics cost per test, digital or platform cost per test, total cost per package, gross margin percentage, and net margin percentage. Moreover, the volume and break-even measures such as tests conducted per month, fixed monthly operational costs and break-even volume are collected from each aggregator. The selection of the four aggregator companies is considered suitable since the study focuses on comparative financial modelling and

operational profitability analysis rather than large scale statistical analysis. Hence the combination of four healthcare aggregators for quantitative analysis and 10 industry stakeholders for qualitative interviews provides a balanced research methodology for the study and enhances precision (Gruijters & Peters, 2022). The selected sample sizes are also suitable as the study is mainly exploratory and practical in the specialised business of healthcare. The research explores issues of operational profit and integration of hybrid services in healthcare aggregation platforms and so gaining detailed information from experienced participants is more informative than obtaining a multitude of generalised responses. This qualitative and quantitative data allows the researcher to generate a well-balanced financial and operational achievable perspective. Moreover, the chosen sample structure facilitates comparing the available aggregation model and hybrid operational model to reinforce the reliability and practical relevance of the result of the study in the Indian pathology sector.

3.7 Sampling Technique

The method of selecting participants or organisations for research from the target population is called sampling technique. It is crucial to choose a suitable sampling technique as this impacts the relevance, reliability and quality of the collected data. For the present study, the researchers use the method of purposive sampling as the study aims to gather data from a specific niche of the Indian healthcare aggregator pathology sector. This research adopts a mixed research design which includes qualitative interviews as well as quantitative financial analysis. Consequently, the selection of participants and organisations is purposeful and based on relevance to the research objectives and their participation in healthcare diagnostic aggregation services (Nyimbili & Nyimbili, 2024). The study makes use of purposive sampling technique for the selection of participants who possess practical knowledge and professional experience regarding aspects such as operational processes, pricing structures and profitability challenges. Purposive sampling is a non-probability sampling technique in which the participants are selected deliberately since they have specialised knowledge relevant to the research problem (Obilor, 2023). Purposive sampling is done to select 10 industry stakeholders for qualitative components who are involved in healthcare diagnostic aggregation services. These players encompass home sample collection providers like phlebotomists, diagnostic lab managers, health care aggregator

founders and radiology administrators, amongst others. These stakeholders are chosen as they have first-hand experience across the cost structure, operational inefficiency, pricing control, dependence on diagnostic centres, logistics and profitability issues of the pathology aggregation model. Their practical involvement helps the researcher to gain insights into feasibility and scalability of the proposed hybrid operational model.

The study quantitatively gathers financial and operational information of four healthcare aggregator companies of the Indian pathology sector. These organisations are chosen because they have an active role in the pathology and radiology aggregation and have operational and financial information pertinent to the scope of the research. The selected organisations are appropriate since they render the financial and operational information needed to assess the profitability improvement in the proposed hybrid operational model. As the subject is a new one and industry-specific, a purposive sampling technique is used. The point of the study is not to generalise the findings to the whole healthcare industry, but to understand the inefficiencies in the processes and how to improve the company's profitability on healthcare aggregator pathology platforms in detail. By using purposive sampling, the researcher can focus on organisations and participants who can provide rich, relevant and meaningful resources that have a close connection with the research objectives stated. The sampling method selected for this research is appropriate for the research design and enables detailed analysis related to the profitability, operational efficiency and scalability of the Indian Healthcare Aggregator Pathology industry (Ahmad & Wilkins, 2025). The purposive sampling also supports the objectives of the study as it allows the researcher to target these organisations and professionals that are directly involved in pathology aggregation and decision making in organisations. Due to the nature of the subjects discussed in the study such as problems of profitability, restructuring of operations and selective vertical integration, it is absolutely necessary to have participants who have experience from industry in order to receive reliable and meaningful information. Purposive sampling also enables the researcher to effectively reach out to the targeted group of specialised participants to understand their knowledge of financial operations, logistics coordination, radiology partnerships and diagnostic workflow management. Hence, the sampling technique chosen enhances the relevance and applicability of the results of the research in regard to the proposed hybrid operational model (Ahmad & Wilkins, 2025).

3.8 Data Collection Method

The study adopts a mixed-method data collection method that would combine quantitative and qualitative data to fully understand the profitability forces of healthcare aggregators in the Indian diagnostic market (Taherdoost, 2022). The financial performance measures coupled with the stakeholder perspectives are used to determine the feasibility and effectiveness of the suggested hybrid operational model in the research. The healthcare aggregator companies, industry reports, and interviews with experts were employed to collect data to get a strong and triangulated set of data (Donkoh & Mensah, 2023). The quantitative element of the research had been based on the aspect of financial and operational performance of the healthcare aggregators in the market of pathology and radiology services. Approximately four healthcare aggregator firms have been sampled to provide financial and operational statistics. The selection of these organizations effectively depends on the fact that they provide services of diagnostic aggregation and have financial or operational data that are of relevance to the research. Each of the aggregators has been a subject of the research, in which a number of ten financial and operational measures indicative of the cost structure and profitability of diagnostic service packages are collected. The qualitative aspect of the research employed semi-structured interviews with about ten industry players. These interviews also involve founders of healthcare aggregators, managers of diagnostic centres, and the people working in them, like phlebotomists, who are involved in the home sample collection services. These interviews are intended to obtain deep insights into the operational challenges and the strategic issues that influence the profitability of the healthcare aggregator platforms. The interviews have been based on several major themes that are applicable to the research objectives. These are the margin pressures that the aggregators are exposed to, the extent of reliance on the partner diagnostic centres, and how much control the aggregators exert on partner pricing decisions. Data collection in this study was conducted in the chosen Tier 1 and Tier 2 cities in India, where pathology healthcare aggregator services are widely available. Semi-structured interviews with key stakeholders including aggregator founders, diagnostic laboratory managers, radiology administrators and staff (including phlebotomists) were conducted to gather qualitative data. The interviews were held within a specified time frame, February 2026 through April 2026, to provide uniformity in the responses as well as to get up-to-date industry practices. The financial and operational data were collected from four healthcare aggregator firms over the same period

for quantitative analysis. These figures were the cost structures, price models, volumes of diagnostic and profitability. The set time period and the use of specific locations in the industry ensured that the data is based on current operations and the financial reality of the Indian pathology aggregator industry.

The study additionally collects data regarding the operational coordination process between healthcare aggregators and external diagnostic service providers. This includes information related to various aspects such as appointment scheduling procedures, communication mechanisms between the aggregators and laboratories and management of patient records. The purpose of collecting such information is to properly understand how the coordination inefficiencies impact the operational costs, service quality and profitability within the healthcare aggregator platform (Nair et al., 2024). The proposed hybrid operational model aims to improve operational control and subsequently minimise margin leakages. Thus, analysis of the coordination process is quite important for evaluating the practical effectiveness of the model. Another important aspect of data collection is figuring out how digital healthcare infrastructure fits into healthcare aggregation services. Selected organisations are asked to provide data on electronic appointment systems, mobile healthcare applications, delivery of reports online, customer communication platforms and electronic payment systems. The researcher further collects data concerning software maintenance fees, customer support services and platform management for assessing the operating impact of software digitisation on the profitability of the business. As technology stresses operational cost has become the basis for healthcare aggregation platforms, it is crucial to analyse the operational cost of the technology to assess its long-term scalability and operational efficiency.

The study also provides data about the management of the customer service and the quality of patient experience in pathology aggregation services. This covers such details as how long it takes to obtain diagnostic reports, customer complaints, systems for following up patient needs, repeat bookings and patient convenience features. Such operational indicators enable the researcher to see how the quality of service and customer satisfaction directly affect profitability and sustainability of business. This information also can be used to assess the proposed hybrid from a customer experience and operation response standpoint. Besides the data of the source

organisation, the study uses secondary data from the industry to make the data collecting comprehensive. In order to uncover contextual information about market growth, pricing trends, demand for diagnostic services and healthcare diagnostics digitalisation, industry reports, healthcare market publications, company websites, annual reports, policy documents and diagnostics industry statistics across all these regions of India are reviewed. These are secondary sources that help to validate the primary data obtained from the interviews and organisational financial records. An effort is made to gather data on the operational risks and barriers in implementation of the proposed hybrid model also. The individuals who can participate in interviews are asked to include the challenges such as in workforce management, operational scalability, regulatory and infrastructure investments, and coordination difficulties. It is essential to recognize these practical constraints as profitability improvement can only occur when it is feasible and implementable in actual businesses. The researcher ensures that the data collection procedure is consistent in all the participating organisations and stakeholders, for giving the correct data. The other financial characteristics and operational metrics are gathered from each healthcare aggregator and used for comparative analysis. Similarly, the interview discussions are subject to an interview guide that is structured to include discussion of issues pertinent to the aims of the research but also provide scope for in-depth feedback.

The researcher also keeps complete direct observation notes throughout conducting interviews and organisational contact. The recording of both operational observations, participant behaviour and contextual explanations, and non-verbal information that provides an insight into issues of profitability in the provision of healthcare aggregation services are aided through these notes. The field notes can be used to facilitate further understanding of the interviews and makes qualitative analysis richer (Taherdoost, 2022). All financial and operational data gathered are classified in direct costs, indirect costs, operational expenditure, logistic expenditure, cost of processing pathology, cost of radiology coordination and customer management costs. The classification of the information helps to enhance the analytical clarity in the later stages of the research that mentions systematic profitability evaluation of the information. This structured organisation also helps in the identification of areas where operational restructuring can be done to make the activities cost effective and financially sustainable.

Furthermore, the study uses data triangulation in the data collection process so as to make the data more reliable and valid. Interviews, financial records, and industry publications, amongst other operational documents, are used to gather information which are then cross-checked for consistency. Triangulation is used to reduce the risk of bias in the answers to the questions and to enhance the reliability of the results by crosschecking operational and financial information (Donkoh & Mensah, 2023). This overall data collection process aims at delivering holistic financial, operational and strategic insights on the Indian Healthcare Aggregator-Pathology sector with relation to Profitability Improvement in the Indian Healthcare Aggregator-Pathology sector. By combining operational observations, stakeholder experiences, financial indicators and industry information, the study can come up with realistic and evidence-based recommendations concerning how to implement the outlined hybrid operational model. Hence, the chosen data collection techniques significantly contribute to achieving the research objectives and provide a thorough knowledge about profits maximization and sustainable operations in the healthcare aggregation ecosystem in India.

3.9 Data Analysis Method

The data analysis process in this study combines the quantitative and qualitative analytical techniques to examine the financial sustainability of healthcare aggregators in the Indian pathology sector. The study follows a mixed-method research design that is based on the pragmatist philosophy, and the analysis integrates stakeholder perspectives with financial measurements. This has been done to give a comprehensive understanding of the proposed hybrid operational model. The analysis model is intended to identify operational inefficiencies, margin leakages, and cost asymmetries. This is done to confirm whether the proposed hybrid structure can improve profitability and scalability in the healthcare aggregation ecosystem. The qualitative data collected through the semi-structured interviews were analysed using thematic analysis. Thematic analysis is appropriate as it allows the researcher because it allows the researcher to identify recurring patterns, strategic concerns, and operational issues expressed by participants within the diagnostic aggregation ecosystem. The interview response obtained from various professions such as the aggregator founders, laboratory managers, operational staff, and radiology administrators. The coding process involved identifying operational experiences related to profitability constraints,

pricing challenges, dependency on diagnostic centres, and the feasibility of hybrid operational integration. Thematic analysis is performed in different stages, and in the first stage interview responses are transcribed to get familiarity with the data. The open coding was applied to recognise meaningful statements and operational insights relevant to the research objectives. Thirdly, similar codes are grouped into broader categories and key themes expected in this study are operational inefficiency, scalability challenges, pricing control, workflow coordination, and customer service management. The qualitative findings help to explain the underlying operational problems that affect healthcare aggregator profitability and provide contextual support for the proposed hybrid operational model. The quantitative analysis of the study involves financial and operational analysis of selected healthcare aggregator companies. They apply the method of financial modelling, which works with the economic feasibility of the hybrid operational framework (Telukdarie et al., 2025). Contribution margin analysis helps identify the profitability of each diagnostic package, excluding variable costs (Jameson et al., 2025). Through this analysis, it will be possible to determine the existing operation models that are constraining profitability and how the proposed hybrid model can enhance a better reaction to margins. The break-even analysis is also made to identify the minimum amount of diagnostic tests or service packages that healthcare aggregates need to have to break even the cost of running the operations. To compare the financial performance of the traditional aggregation model, gross margin and net margin analysis are also used. The quantitative assessment process is enhanced with scenario analysis and sensitivity analysis. The scenario analysis looks at how various operating conditions, which include the variation in the level of test, the price structure, and the cost of logistics, influence the profitability (Ohakwe and Wu, 2025). Triangulation can be applied to integrate the results obtained from qualitative and quantitative analyses in order to enhance the reliability and validity of the research findings. The thematic analysis combined with financial data was used to achieve a holistic view of how operational restructuring, selective vertical integration, and hybrid service coordination can make firms more profitable and sustainable in the Indian healthcare aggregator pathology industry.

In addition, operational differences between the current healthcare aggregation models and the set up presented for the hybrid model, are assessed through comparative operation analysis. The researcher analyses the allocative effectiveness of the operational costs of the selected healthcare aggregators, efficiency in coordination of services and profitability performance to

determine the most financially sustainable operation method. Comparative assessment to decide if integration between in-house Phlebotomy and outsourced pathology processing and radiology coordination, can help control operations and minimize unnecessary spending. Financial assessment is also to be made using ratios to explore cost efficiency and sustainability of operations (Delapedra-Silva et al., 2022). Cost to revenue ratios, logistics costs to ratio and operational cost proportion are examined to see the effect of various cost elements on profit. This analysis is essential because, in many cases, the healthcare aggregator has margin pressure because of the high reliance on external diagnostic centres and growing operational costs. The ratio analysis therefore gives the management further clues of opportunities to improve the financial results if the operations could be optimised in these areas.

Trends evaluation techniques are also used in the analysis process in identifying the recurring operational patterns and areas beginning to affect the profiting of the various healthcare aggregators. The researcher investigates the potential for an operability of inefficiencies in the organisations considered to be paradigm cases, including delays in coordinating the organisations, high expenditures on logistic resources, and a lack of flow in the diagnostic processes to consistently impact profitability. In this way evaluation contributes to improving the trustworthiness of the results and aids in formulating general operational guidelines for the Indian pathology sector for healthcare aggregators. Moreover, this analysis involves assessing the feasibility of the proposed hybrid model in the real-world healthcare setting. From the interviews and the financial analysis, organisational readiness, operational adaptability, infrastructure needs, and scalability potential are identified, and then, they are evaluated together to decide on the long-term implementation viability (Caldecott et al., 2022). This helps to go beyond the theoretical calculation of profitability to formulate realistic recommendations for the operational elements. The final stage of analysis includes interpretation and integration of the findings relative to the objectives of the study & the conceptual model and theory used as a framework for the study. The analysed data are displayed in tabular and comparative financial statements, thematic interpretation, and operational models to make them comprehensible. This helps to develop evidence-based conclusions in terms of strategies to improve profitability in the Indian healthcare aggregator pathology sector.

3.10 Instrument

Research instruments refer to the tools and techniques used by researchers to collect relevant information for the achievement of the objectives of the study. The selection of the appropriate research instruments is important since it directly impacts the reliability, validity and quality of the research findings (Ahmad et al., 2024). This study employs a mixed method research design, with the research instruments set in line with this research design to investigate the case of profitability improvement in the Indian healthcare aggregator pathology sector. The study adopts a mixed method technique, with different instruments (operational, financial and strategic) used to solicit information from healthcare aggregator platforms and industry stakeholders. The research instruments such as a semi-structured interview guide and a financial data collection sheet were well arranged to suit the research objectives. The instruments are designed to help achieve the goal of examining cost structure, operational inefficiencies, profitability restrictions, and feasibility of the hybrid operational model. In the qualitative part, the major tool of research is semi-structured interview schedules. Semi structured interviews suit the purpose as they can be flexible, allowing participants to explain in detail their experiences of and operational practices alongside strategic thinking and positioning. In order to develop the interview schedule, it is found that the objectives of the study and the conceptual framework of the study are reviewed. It features open-ended items on profitability pressures, dependency on diagnostic centres, operational coordination problems, pricing structures, logistics management, radiology coordination, scalability problems and the feasibility of implementing the proposed hybrid operational model.

The interview schedule consists of semi-structured, with different thematic sections to ensure systematic data collection. The first one aims at gathering general information about the organisation, including the roles of the participants and what are their responsibilities in their daily work and their experiences of working with the aggregation services in healthcare. The second is the inefficiency with operations such as delays in workflow, lack of communication, logistics coordination, customer service and so on. Another section deals with financial aspects, including margin pressures, pricing restrictions, commission features, and reliance on third party diagnostic facilities. Other interview excerpts cover technology integration, digital health care processes, home sample collection processes and the feasibility of providing in-house phlebotomy services

within healthcare aggregator platforms. The qualitative interview instrument is designed to encourage participants to provide detailed operational insights and practical industry experiences. Where required, follow-up questions are asked to get a better understanding and clarity of the pathology aggregation ecosystem's operational and financial challenges. Semi-structured interviews allow for flexibility for the researcher to discuss further any new or other aspects of profitability that may arise as part of the interview (Karatsareas, 2022).

The research instrument used in the quantitative study is a data collection sheet for financial and operational data that is structured. The instrument is designed to pave a systematic way to collect measurable financial and operational information from the selected companies, which are healthcare aggregator companies in the Indian pathology industry. The consistency and comparability of data collected across different organisations can be provided because of the structured format. The financial and operational data collection sheet represents information about ten crucial quantifiable measures that are relevant for profitability analysis. These economic levers are package MRP, partner diagnostic cost (in monetary value and percentage of the MRP), pathology lab cost for processing, cost of radiology tests, phlebotomy cost per patient, cost (per patient) to the partner for logistics, cost (per patient) to the partner for the digital platform or for the individual tests purchased by the institution, total cost per package, gross margin (percentage) and net margin (percentage). These variables are significant as they have a direct impact on operational profitability and financial viability of healthcare aggregation platforms. Other indicators of instrument's volume and monetary break-even are also included such as number of tests per month, basic running costs per month, and break-even volume: test/month. These are used for financial modelling and profitability evaluation of the proposed hybrid operational model. While the unstructured data sheet enables the researcher to compare the operational performance of an individual healthcare aggregator organisation, the structured data sheet provides an opportunity to compare the operational performance, cost allocation patterns and profitability structures for various healthcare aggregator organisations. The research also employs a supporting research instrument which is document review to obtain secondary data. Secondary data sources are industry reports and healthcare market publications, company records and financial statements, annual reports, company websites, policy documents and operational reports of diagnostic aggregation services in India. These documents contain contextual and financial details on the

digitalisation of healthcare, healthcare pricing trends, operational cost of healthcare services, competition in the healthcare market and demand for diagnostic services. Presence of secondary documents provides an added value for the research findings to be complete and reliable.

In addition, the study adopts field notes as a supportive qualitative research tool in interviews and organisational engagements. Field notes are used to document operational observations by the researcher, context explanations, participant responses as well as significant non-verbal statements that relate to profitability issues and operational inefficiencies. These notes can be used when preparing for deeper interpretation of the findings from the interviews, and to enhance the richness of the thematic analysis during the stage of data analysis. Extensive attention has been paid to ensure the instruments used in the study are suitable with the research design and research philosophy used which is mixed method research. The adopted methodologies for the study are the semi-structured interviews, financial data collection sheets and document analysis, and field notes that enable the operational experiences to be integrated with the measurable financial evidence. Such a combination helps to validate and give credibility to the results through triangulation of sources of qualitative and quantitative data. Simple and professional language used for the instruments to enhance clarity and understanding by participants. Another aspect is that all data is anonymous and used only for research. Hence, the research instruments selected are suitable for the objective of the present study as it encompasses considerable operational, financial and strategic output details. This approach covers details on business benefits such as profitability improvement in the healthcare aggregator pathology sector in India. The instruments are based on systematic data collection, comparative financial analysis, thematic evaluation of the context and state assessment of the proposed hybrid operational model in the Indian healthcare aggregation ecosystem (Ahmad et al., 2024).

3.11 Variables

The variables in this study are designed to evaluate the financial, operational, and strategic factors within the Indian healthcare aggregator pathology sector. The research is aimed at comprehending the impacts of operational practices on the financial performance of healthcare aggregator platforms. The conceptual framework yields the variables that are in line with the research. To gain a comprehensive picture of how profitability works in the system, this study has a hybrid operational variable, an independent variable, and a dependent variable. The independent variables are the key operational and strategic factors affecting the performance of the healthcare aggregator. These variables include cost structure, operational efficiency, integration of technology, logistics management, service quality, pricing strategy and customer satisfaction. The total operational costs of the services of delivery of diagnostic services including radiology costs, pathology processing costs, logistics expenditure, digital platforms cost, and marketing costs are defined as the cost structure (Faiyazuddin et al., 2025). The paper appraises the contribution of the high reliance on third-party diagnostic centres to cost asymmetry. Another evaluation made in the context of this study includes the boundaries of margin retention by healthcare aggregators. Operational efficiency is the capacity of healthcare aggregators to manage operational activities, enhance the use of resources, reduce delays of services and optimise the operational performance throughout the diagnostic value chain. Another independent variable that is required in this study is technological integration. It primarily addresses the utilisation of digital healthcare, cloud-based systems, mobile applications, AI tools, and built-in healthcare technologies. The use of digital systems in making service bookings, delivery of reports to customers, and communication with customers by healthcare aggregators contributes significantly to enhancing operational scalability. The issue of logistics management is also considered a significant independent variable as diagnostic aggregation services demand the transportation of samples, the collection of samples at home, and the coordination between laboratories and clients. Inefficient logistics systems have the potential to improve operational costs and impact negatively on profitability (Chowdhury & Sultana, 2023). Additional independent variables are service quality, pricing strategy, and customer satisfaction. The quality of service is the measure of the accuracy, reliability, and consistency of diagnostic services on the platform of aggregators. Pricing strategy is the evaluation of the pricing mechanisms used by healthcare aggregators including package pricing, negotiated

laboratory rates, commission structures and the use of discounting. The levels of customer satisfaction and retention demonstrate that the platform can sustain long-term relationships with customers by providing a high-quality service (Singh et al., 2023). These variables are important because customer loyalty and repeat service utilisation directly influence long-term performance. The study also involved hybrid operational variables that play as the intervention mechanism in the proposed operational model. These variables are in-house phlebotomy, phlebotomy laboratory processing, home sample collection, radiology coordination, and time management. In-house phlebotomy refers to internally managed sample services that help to decrease dependency on external suppliers. Outsourced laboratory processing involves selectively outsourcing pathology testing services to diagnostic services at negotiable rates. Radiology Coordination is a process whereby radiology services are integrated into the aggregator platform in order to boost service reach and income streams.

3.12 Reliability and Validity

Reliability and validity are two essential components of research quality because they ensure that the findings of the study are accurate. Several procedures are implemented to strengthen the reliability and validity of the data analysis. The measures are important to ensure that the findings related to profitability improvement and hybrid operational integration in the Indian healthcare aggregator pathology sector are academically sound. Reliability is described as the ability of the research results to remain unchanged over time and under varying circumstances. The reliability is enhanced by systematic and transparent research procedures in qualitative research (Lin et al., 2025). In order to enhance reliability in research, semi-structured interview guides are pre-prepared depending on the objectives of the research. Each participant will be questioned using a set of core questions concerning the operational inefficiencies, price structure, the reliance on the diagnostic centres, and profitability problems. This standardised interview format helps in the reduction of inconsistencies in the data collection process yet gives the participants the freedom to give detailed information about their experiences. The interviews will be based on a given research time frame and documented with the consent of the participants to enhance accuracy. The gathered qualitative data will be reviewed (several times) and then coded, and thematic analysis will be performed. The additional method of reliability is the use of thematic

analysis which presents a systematic way of identifying patterns and themes in the response. Categories and codes are developed systematically to minimise researcher bias that can improve consistency in interpretation. For the quantitative phase the reliability was strengthened through the use of standardised financial indicators and operational measures. The variables utilised in the study are gross margin, net margin, contribution margin and break-even volume, which are used to gauge profitability in the chosen healthcare aggregator companies. These indicators are popular with both operational and financial management studies to enhance uniformity (Krome et al., 2025). All the chosen healthcare aggregators were measured using the same financial formulas and measurement procedures to ensure consistency of comparability across cases. Validity can be defined as the extent to which the research measures the right variable. This research looks at both internal validity and external validity. The qualitative and quantitative data utilised add internal validity. Triangulation of data is embraced through the employment of interviews, financial data, industry reports, and operational performances. The results obtained by data triangulation are more credible as they are not based on a single method of analysis and are collected using multiple sources (Atariata et al., 2026). As an example, operational inefficiency that is noted during the interviews can be confirmed by examining logistics costs or reduced margins in financial information. The financial indicators, interview questions, and operational variables are matched with the research objectives which ensures content validity. The degree to which results can be extrapolated to parallel situations is known as external validity. The selected participants represent the key stakeholders in Tier 1 and Tier 2 Indian cities within the diagnostic aggregation ecosystem. The study acknowledges that the operational conditions in rural or underserved areas may fluctuate from the urban markets. This helps to guarantee that the research results offer an authentic and significant assessment of the profitability improvement methods in the Indian healthcare aggregator pathology sector.

3.13 Ethical Consideration

` Ethical considerations are a relevant parameter of this research because the study involves human participation, financial information, and operational data related to healthcare aggregate platforms. Ethical research practices provide fairness, dignity, confidentiality and respect to the participants during the research process. This is to be done under ethical standards in order to ensure that both the participants and organisations are not abused by sensitive information. The research adheres to the accepted ethics of confidentiality, consent, anonymity, data protection, and responsible reporting of the results. All subjects were already informed about the aim, the aim and scope of the research. All respondents were informed about the research and gave informed consent to participate in the interviews (Scope et al., 2024). This will mean that participants will not feel pressured or influenced to participate in the study against their will. The research process is highly confidential, and the data being exchanged by healthcare aggregators may be sensitive to business. People, healthcare aggregators, diagnosis laboratories and radiology centres will not be disclosed in the research paper in order to protect the privacy of participants and the organisations. Pseudonyms used in order to mention the data obtained from interviews or financial analyses. Information that is collected is omitted from the transcript in order to minimise any possibility of revealing identities (Heaton, 2022). It is also in the study where the significance of guarding sensitive financial and operational information acquired by the healthcare aggregators is identified. Money data on gross, operating costs and pricing models are entered solely to be analysed academically. All the documents, recordings of the interviews and financial records are stored in a digital system with a password. The researchers and approved academic supervisors are the only ones who can access the data collected. These measures help to ensure compliance with the data protection principles and decrease the possibility of unauthorised access or misuse of information. The data analysis does not entail any type of deception, manipulation or misrepresentation of data by the researchers. The participants are not deceived about the purpose of the study or the usage of the information they give. Participants also have the authority to refuse to answer any question they consider sensitive or inappropriate. Another important ethical consideration is related to objectivity and researcher bias. Consequently, it is essential for the researcher to make sure that his/her personal beliefs or anticipations do not affect the results and interpretations. This can be achieved by using triangulation whereby qualitative interviews need

to be combined with financial analyses and industry data. This is enhanced by applying systematic thematic analysis and financial modelling methods. Lastly, the research ensures that all findings are presented honestly and accurately without selective reporting of data. The conclusions and recommendations of the study are based entirely on the evidence collected during the research process. This study ensures credibility, academic integrity, and responsible research practice while investing in profitability strategies in the Indian Healthcare aggregator pathology sector.

3.14 Research Limitations

Although the study is designed to provide a comprehensive analysis of profitability improvement strategies in the Indian healthcare aggregator pathology sector. The scope, generalisability and interpretation of the findings can also be limited in a variety of ways. These are operational, geographical, and data-related restrictions related to carrying out research (Chandran & Roy, 2024). It is essential to be aware of these limitations as it assists in giving transparency to the limits that the research falls within which the results are supposed to be understood. One of the major limitations of this study is the relatively small sample size. The sample size can be considered to be suitable in qualitative exploratory research and might not be representative of the entire picture of the operations of the whole Indian healthcare aggregator pathology industry. Various organisations can employ various pricing systems, technology systems and business models which can affect profitability performance in different ways. Nevertheless, the conclusions made based on the sampled respondents might not necessarily apply across the entire population of healthcare aggregators in India. The other limitation is that the study is based on Tier 1 and Tier 2 whereby the diagnostic aggregation services are on a relatively advanced level. Other disadvantages that rural healthcare markets expose them to include poor infrastructure, poor digital literacy, poor accessibility to laboratories, and logistical limitations (Bazi et al., 2025). The proposed hybrid operational model may require further adaptation before being implemented effectively in rural healthcare ecosystems. The research also relies on financial and functioning data retrieved by using particular healthcare aggregators and the secondary industry reporting. The healthcare industry is usually closed to access to fine-grained financial data due to the sensitivity of profitability data, pricing patterns, commission rates, and operational expenses to the business. Other organisations might have reservations regarding making full

financial records public since it is confidential information. As such, the analysis can be based on operational estimates which are available partly and published industry reports on the analysis as well as rough approximations of the cost structure of some parts of the financial analysis. Such a limitation can influence the accuracy and comparability of profitability estimates of various healthcare aggregators. The other constraint is associated with the assumption made when carrying out the financial modelling. The paper uses the contribution margin analysis, break-even analysis, scenario analysis and sensitivity analysis to test the viability of the proposed hybrid operational model. Such methods, however, make certain assumptions about the diagnostic test volumes, customer needs, outsourcing risk, pricing stability, logistics costs, and scalability. Practically, the variables are liable to variations brought about by competing forces, changes in policies, inflation, technological changes, and shifting consumer tastes. As such, the reality performance can have variance with what the study prescribed.

3.15 Chapter Summary

This chapter provides an understanding of the methodological approach applied in exploring profitability improvement strategies in the Indian healthcare aggregator pathology industry. The methodology was designed to investigate the problem of operational inefficiencies, pricing asymmetries, and structural constraints to the operation of healthcare aggregator platforms alongside testing the possibility of a hybrid form of operation. The chapter covered the research philosophy, research strategy, research design, sampling strategy, data gathering methods, data analysis methodology, reliability and validity processes, ethical considerations, and the research limitations in connection with the research. The research philosophy in the study was pragmatist since the research objectives are to solve a practical business issue for profitability and operational sustainability in healthcare aggregation services. Pragmatism has been deemed to be suitable because it advocates the combination of qualitative and quantitative research approaches and is aimed at producing practical and evidence-based solutions. The chapter has also addressed the abductive research methodology used in the research. The abductive method is a mixture of inductive and deductive thought, which enables the study to bring the theory and practical observations in the industry. The chosen approach was appropriate as the Indian healthcare aggregator pathology sector is a developing and comparatively untapped field of digital healthcare

research. The study was chosen to be exploratory based on a mixed-method research design. The qualitative part entailed semi-structured interviews with the founders of healthcare aggregators, diagnostic labs, radiology administrators, and operational personnel including phlebotomists. The aim of these interviews was to determine operational inefficiencies, pricing issues, reliance on diagnostic centres, and profitability limitations in the diagnostic aggregation ecosystem. The quantitative aspect was aimed at financial and operational analysis with the help of chosen healthcare aggregators. The profitability of the proposed hybrid operational model and its scalability were assessed using financial modelling methods but not limited to contribution margin analysis, break-even analysis, scenario analysis, and sensitivity analysis. The chapter also described the population of the study, sample size and purposive sampling method in selecting the sample that had the experience and knowledge of the industry in its operations. Methods of data collection were semi-structured interviews, financial documentation, data on operational performance and secondary industry reports. Qualitative data were analysed using thematic analysis to identify common operational and strategic themes in the interviews with stakeholders. The quantitative analysis quantified profitability dimensions of gross margin, net margin, cost of operation and break-even volume. Triangulation of the data, standardised interview formats, and the uniformity of measurement of the financial instruments enhanced reliability and validity. Ethical issues like informed consent, confidentiality, anonymity, voluntary participation, and safe management of financial data were also mentioned to ascertain responsible research practice. The chapter also recognised the constraints of access to financial data, assumptions in financial modelling and the dynamism of the Indian healthcare sector. The methodology represents a systematic and practical approach to assessing the restructuring of operations and profit maximisation of the Indian healthcare aggregator pathology industry. The results and discussion based on qualitative and quantitative data gathered through the research process will be given in the next chapter.

CHAPTER 4: PRESENTATION OF RESEARCH (RESULTS)

4.1 Introduction

The chapter reports the results and discussion of the study carried out on profitability-increasing techniques in the Indian healthcare aggregator pathology industry. This chapter seeks to examine operational, financial and strategic drivers of profitability and sustainability of healthcare aggregation platforms in the diagnostic ecosystem. These results are informed by both qualitative and quantitative sources of information gathered using semi-structured interviews, financial sources, operational measures, and secondary sources in the industry. The combination of qualitative and quantitative results enables the research to present a holistic perspective on the operational inefficiency, price asymmetry, dependency risk, and financial issues of healthcare aggregations in India. The main task of this chapter is to assess the efficiency of the suggested hybrid operational model aimed at enhancing profitability, operational and value capture in the pathology aggregation ecosystem. The paper narrowly focuses on the role of selective vertical integration with the help of in-house phlebotomy, outsourced laboratory processing, radiology coordination, and digital platform management in cost optimisation and financial sustainability. The chapter also looks at the existing operational frameworks of healthcare aggregators and what are the biggest sources of margin leakages, as well as operational inefficiencies that restrain profitability within the traditional models of aggregation. The chapter is subdivided into two main parts: quantitative data analysis and qualitative data analysis. The quantitative analysis section aims at measuring the performance of the financial and operating positions of the chosen healthcare aggregator companies. The financial indicators that are examined to evaluate the profitability of the existing operational models include package pricing, the cost of pathology processes, the cost of radiology processes, the cost of logistics, the cost of digital platform, gross margins, net margins and break-even volumes. The financial viability and scalability of the proposed hybrid operational framework are evaluated using contribution margin analysis, break-even analysis, scenario analysis and sensitivity analysis. The quantitative results also give comparative data on the variation between the traditional models of aggregators and the hybrid model proposed. The qualitative analysis section reports the results of semi-structured interviews with the founders of healthcare aggregators, the managers of diagnostic laboratories, the managers of radiology, as well

as operational employees such as phlebotomists. Thematic analysis is adopted to analyse the interview findings and identify the recurrent themes that are connected to pricing control, operational inefficiencies, reliance on diagnostic centres, problems in service coordination, customer management, and scalability issues. These qualitative data give context-driven and practical insights into the realities of operations of the Indian healthcare aggregator pathology industry. Triangulation of evidence through a combination of qualitative and quantitative results allows for enhancing the reliability and validity of the final results of the research. The results in this chapter have been consistent with the research objectives and conceptual framework in the previous chapters. The chapter thus presents an evidence-based assessment of the suggested hybrid operational model and how this can enhance profitability and operational sustainability in the Indian healthcare aggregator pathology industry.

4.2 Quantitative Data Analysis

4.2.1 Introduction to Quantitative Analysis

A quantitative analysis was done to evaluate the operational profitability, sustainability and scalability of different healthcare aggregations in the diagnostic healthcare space in India. The key issue of this section is to assess the system costs, the returns to the healthcare service and its scalability in healthcare aggregation systems under various operational configurations. The quantitative results are used to address the research questions to understand the potential benefits of improving profitability and operational sustainability of the proposed hybrid operational model in the current healthcare aggregation models in the Indian diagnostics industry (Lee & Kim, 2024; Jain, 2023). The quantitative part of the study is done with a comparative operational-financial modelling methodology. The present study is different from the accounting-based financial analysis as it attempts to analyse the operational economics using cost structure decomposition, contribution margin analysis, break-even modelling, and scalability assessment. The analysis is thus not only financial but also operational and sustainable viability of healthcare aggregation structures in the long term. This way, it is easier to understand the relationship between the three factors, operational ownership, outsourcing dependency, and infrastructural intensity, and the retention of profits and scalability of the healthcare diagnostics ecosystem. The analysis of the

study is focused on 5 main operational dimensions. These include contribution margins, cost structures, operational profitability, break-even feasibility and scalability characteristics of healthcare aggregation models. Cost structure analysis compares the contribution of pathology, radiology, collection, logistics and operational overheads to the different models. Contribution Margin Analysis compares package revenues to operational variable costs to determine the profit left. A break-even analysis is used to assess the minimum required volume of operations for sustainability, and a scalability analysis is used to investigate the scalability of profitability and infrastructure intensity with operational expansion. The study compares the five operational archetypes of diagnostics observed in India for comparative analyses. These are the PharmEasy-model of aggregator, the Healthians-model of hybrid home collection, the centralized pathology model of Thyrocare, the vertically integrated model of Dr Lal PathLabs, and the proposed hybrid operational model in the present study. These operational models include varying degrees of operational ownership and dependency on infrastructure, and diagnostic integration, allowing for the comparative assessment of their financial and operational characteristics (Fleming et al., 2021; Spooner et al., 2025). Primary data for the quantitative datasets was obtained from the Indian diagnostic healthcare market and operational data from the various companies available in the market. Package pricing data was pulled from publicly available diagnostic platforms and company websites and operational costs were calculated based on industry operational assumptions, diagnostic sector benchmarks and the proposed hybrid operational framework. The standard costing and contribution-margin formulas were used to arrive at break-even values and contribution margins in a mathematical way. As a result, the generated data sets offer a structured operational-financial model of the healthcare aggregation models in the diagnostic healthcare landscape of India.

4.2.2 Descriptive Statistical Analysis

To offer a general picture of the operational and financial features of the health care aggregation models studied in this paper, the descriptive statistical analysis was performed. The analysis is conducted to identify the patterns of operational costs, distribution of profits and variations in margins between various healthcare aggregation models in the Indian Diagnostics Sector (Alcantara et al., 2022). Descriptive statistics for various major operational variables such

as package MRP, pathology cost, radiology cost, total operational cost, gross profit, and gross margin percentage were determined. Central tendency, operational variability, and distribution of profitability of the selected models were assessed using statistical indicators such as the mean, minimum, maximum, and standard deviation. The operational economics of the selected healthcare aggregation structures is shown to be quite different through the descriptive analysis. There was a notable difference in the price of packages, distribution of costs across the path, operating expenses, and profits, suggesting that the structure of operations is a key factor in the financial sustainability of healthcare aggregation systems.

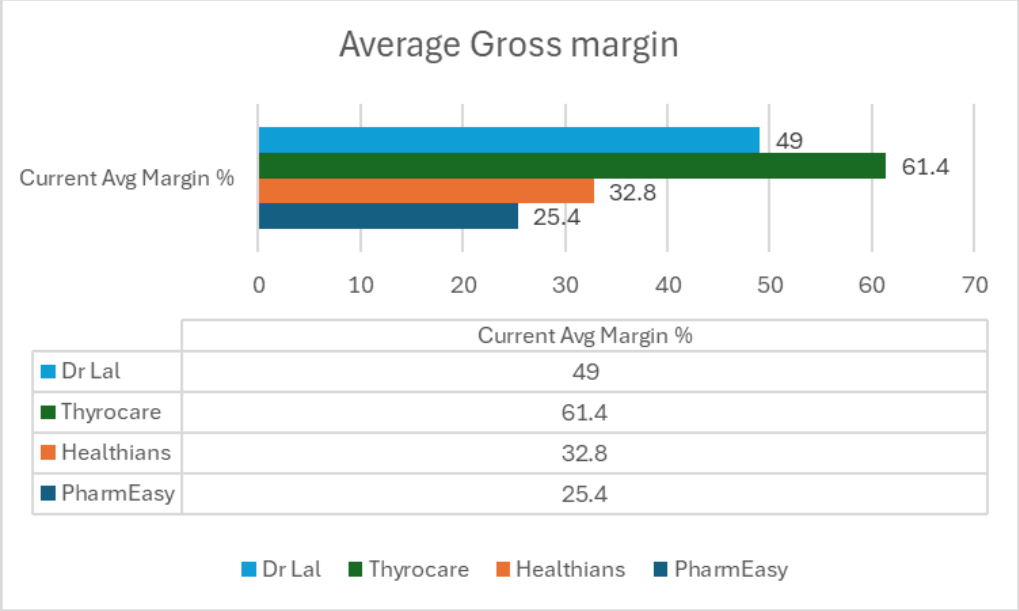


Figure 4.2.2.1: Average Gross Margin

(*Source*: Author's work)

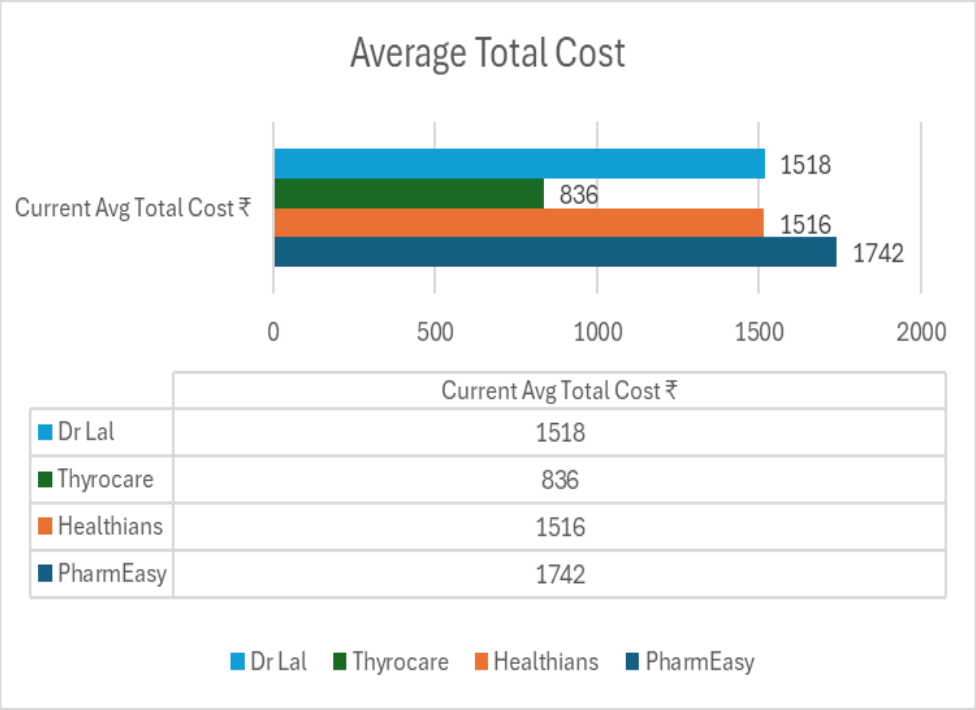


Figure 4.2.2.2: Average Total Cost

(*Source*: Author's work)

A. Overview of Package Pricing

There is clear variation among the selected healthcare aggregation models in the package pricing analysis. The PharmEasy model of aggregator on average reported an MRP of ₹2360 package and the Healthians model of hybrid aggregator reported an average MRP of ₹2260 packages. Thyrocare-type centralized model, on one hand, recorded an average package price of ₹2100 while the vertically integrated model by Dr Lal PathLabs, on the other, had the highest average package MRP of ₹2900. The higher package pricing within the vertically integrated model suggests that there is a premium diagnostic positioning and greater package infrastructure integration. Dr Lal model was able to provide the highest price for the maximum package with a price of ₹4500, indicating a more robust capacity to provide high-quality diagnostic packages that include high-end diagnostic services like pathology and radiology. The centralized model (Thyrocare) on the other hand exhibited comparatively lower prices that also reflect the centralized

nature of mass-processing associated with high-volume pathology services (Nordin et al., 2024). The standard deviations also show that there is a significant difference in the prices of the operational models. The pricing variation for Dr Lal's vertically integrated structure was the highest, having a standard deviation of 1093.16 with a wide range of basic and premium diagnostic packages. Thyrocare, on the other hand, showed relatively lesser price variations in their centralized pathology structure as they have more standardization in their operation and centralized pricing efficiency.

B. Pathology Cost Analysis

Pathology cost was the largest operational cost centre across all of the healthcare aggregation models. Aggregator structure, similar to PharmEasy, had the highest average pathology cost of ₹1370, which shows that there is a high dependency on outsourcing these diagnostic partners. Likewise, the hybrid model has been adapted to the Healthians and the average cost of the pathology work is ₹1190, which is a moderate dependency on operation, even as there has been improvement in the ownership of the collections and decentralized operation. The centralized pathology model in the case of Thyrocare, on the other hand, showed significantly lower levels of pathology costs, with an average pathology cost of just ₹540. This is a measure of the efficiency of central automated pathology processing systems. The fairly low standard deviation of 155.72 also indicates the high operational consistency and process standardisation in a centralized pathology laboratory. The vertically integrated model by Dr Lal showed an average pathology cost of ₹960 which was still lower than the outsourced aggregator model, but was higher than the centralized model by Thyrocare. This represents the cost considerations of having vertically integrated infrastructure ownership, premium diagnostic positioning and operational integration in general.

C. Radiology Cost Analysis

Radiology cost analysis confirms that radiology costs are a substantial part of the operational costs in all healthcare aggregation facilities. On the other hand, PharmEasy-type aggregator model had reported an average radiology expense of ₹180, and Healthians-type hybrid

model posted an average expense of ₹170. The average cost of radiology in the Thyrocare centralized pathology model was slightly lower at ₹160, with lesser integration of radiology operations into the centralized pathology model. The average radiology cost of the Dr Lal model was the highest at ₹300 and the maximum cost of radiology was the highest at ₹1500. This is representative of the high levels of vertical integration in radiology, in terms of infrastructure and equipment. Second, the high standard deviation (670.82) suggests that there is substantial variation across the different diagnostic packages used (pathology only vs. radiology).

D. Gross Profit and Margin Overview

Other significant differences were found in gross profitability and the percentage of gross profitability retained in the operational models. The PharmEasy model, which is an aggregator model, had the lowest profitability performance as they had an average gross profit of only ₹618 and an average gross margin of 25.4%. This shows high dependency on outsourcing-related operational leakage and lack of operational coordination. The hybrid model (the Healthians) achieved better profitability results, with an average gross profit of ₹744 and a gross margin of 32.8%. These results indicate that the operational benefits of home collection ownership and decentralized management of the collections slightly increase retained profitability. Thyrocare centralized pathology model had the best gross margin performance with average gross profit of ₹1264 and average gross margin of 61.4%. This is an expression of what operational efficiency has gained in a centralized automation, high volume processing and economies of scale. Likewise, the Dr Lal vertically integrated model had good profitability retention with an average gross profit of ₹1382 and an average gross margin of 49%. The results indicate that although the infrastructure costs are higher, high retained profitability significantly still results from the vertically integrated operational ownership.

E. Variability Analysis

The average of the standard deviation (SD) values shows that there is a high level of variability in the operation of the selected healthcare aggregation model. The higher the standard deviation values for package pricing, total cost and profitability, the more inconsistent/varies the operations between the categories for diagnostic packages. The vertically integrated Dr Lal model was found to have the highest level of variation for a few variables, which indicated a higher level of diversification of the services and premium positioning of the diagnostics. On the other hand, the Thyrocare centralized pathology model showed relatively less variation in pathology cost and operational cost, which suggests that the process is relatively more standardized and efficient when it's centralized. The margin stability of the PharmEasy model for aggregators was relatively low and moderate, likely because they rely more on external diagnostic fulfilment.

The overall discussion of these statistics suggests that the profitability of the Indian diagnostics aggregation industry is more dependent on the ability of retaining value within the operational system than package pricing. The findings indicate that ownership of infrastructure does not automatically translate into maximum efficiency, although premium pricing strategies, observed in the Dr Lal model, do increase gross profit. In the similar way, asset-light aggregator models do not turn revenue into retained profitability due to a high portion of revenue going to external fulfilment partners. The suggested hybrid model seeks to alleviate this structural deficit by combining operational ownership with efficiency of infrastructure. The hybrid approach does not involve the complete integration of the system, but the selection of a few high-value activities to be integrated in-house alongside the optimisation of the processing of the pathology activities by negotiated processing. This helps to establish a more efficient cost-to-revenue relationship and gives them a firm basis for continued profitable growth.

4.2.3 Cost Structure Analysis of Current Aggregator Models

The cost structure analysis was performed to analyse the operational expenditure pattern, dependency pattern and profitability characteristics of the selected healthcare aggregation models in the Indian diagnostics sector. The aim of this section is to identify the key operational cost centres to the aggregation of health services, and to evaluate the impact of various operational structures on retained profitability and operational efficiency. This analysis focuses on the relative proportions of the cost of pathology, cost of radiology, collection expenditure, logistics expenditure, platform overheads, total operational expenditure and gross margin retention for the various models of healthcare aggregation selected (Lingervelder et al., 2022). The results suggest significant differences among the operational efficiency and keeping profits of the selected operational structures. Structures with high outsourcing dependency had significantly higher operational leakage and lower retained margins while structures with high operational ownership had better profitability performance and better cost efficiency. Overall, the findings indicate that operating structure has a significant impact on the sustainability of profitability in healthcare aggregation systems (Schuurman et al., 2025).

Table 4.2.3.1: Cost Structure Analysis of Current Aggregator Models

Aggregator	Avg Pathology Cost ₹	Avg Radiology Cost ₹	Avg Collection Cost ₹	Avg Logistics Cost ₹	Avg Platform/Admin Cost ₹	Avg Total Cost ₹	Avg Gross Profit ₹	Avg Gross Margin %
PharmEasy	1370	180	98	50	44	1742	618	25.4
Healthians	1190	170	78	41	37	1516	744	32.8
Thyrocare	540	160	68	35	33	836	1264	61.4
Dr Lal PathLabs	960	300	116	66	76	1518	1382	49.0

(*Source*: Author's work)

A. PharmEasy-style Aggregator Analysis

The PharmEasy type aggregator model had the least advantageous operating profitability structure of the healthcare aggregation systems analysed. The average of the pathology cost reported by the model was ₹1370, the highest pathology cost among all the operational models studied in the study. Likewise, the radiology cost of the model was an average of ₹180, and the total operational cost was an average of ₹1742. Although gross margin was relatively low at 25.4%, in the model, the high level of operating leakage and low level of contribution retention suggested there was a significant problem. The results show the strong outsourcing of the operational

structure inherent in traditional healthcare aggregator systems. The PharmEasy model is mainly a coordination-based online aggregation platform that relies largely on third-party diagnostic centres to perform pathology and radiology fulfilments. Therefore, much of the package revenue is taken up by external diagnostic partners, instead of being kept in the aggregation system. The relatively high pathology cost indicates the degree of reliance on outsourcing pathology services. As the processing of the pathology is carried out by the external party, the aggregator has little control over pricing, processing efficiency, and diagnostic throughput (Fatima et al., 2024). Likewise, there is not sufficient internal ownership of the radiology infrastructure, which is why coordination is needed with diagnostic centres and imaging facilities and renders the expenditure a little high.

While the model features relatively low collection, logistics, and administrative costs because of the asset-light nature, contribution margins are relatively low, and outsourcing reliance is high, meaning the model does not generate enough savings on infrastructure ownership to offset weak contribution margins and outsourcing dependency. The lack of coordination is also evident in the operational structure, which raises intermediary leakage, and translates to lower retained profitability, even though the level of infrastructure intensity is lower.

B. Healthians-style Hybrid Analysis

The moderate profitability improvement in the Healthians style hybrid operational model was noted compared to PharmEasy style aggregator structure. The model reported a mean pathology cost of ₹1190 which was still significant, but lower than the PharmEasy-style model. In the same way, the model showed reduced collection expenses of ₹78 and logistics expenses of ₹41, while the average gross margin was 32.8%. The researchers' results indicate that partial operational ownership can be a means of achieving cost efficiency and retained profitability in healthcare aggregation systems. The Healthians type of model introduces owned home collecting systems and decentralized phlebotomy systems to the conventional aggregator model. By employing their own collection staff, the company avoids the inefficiencies in coordinating operations with third-party collection partners and does not overly rely on them (Hanna & Ardon, 2023). The cost savings achieved on collection and logistics reflects the benefits of ownership to phlebotomy infrastructure. The model allows for better control over home collection operations,

which improves the routing process, minimises coordination leakage, and gives flexibility in operations. As a result, this semi-integrated solution enables the operational value to be better maintained than with fully outsourced aggregation solutions. Even with increased collection efficiency, however, pathology costs are still relatively high, as they continue to rely on external diagnostic processing. The model still depends on outsourcing for diagnostics for large volumes, as such limiting the margin one can achieve by restructuring operations. The results thus show that part-ownership does not completely remove the dependence on outsourcing in healthcare aggregation systems, but on the contrary leads to increased retained profitability. The hybrid model, with the Healthians approach, shows that, while the ability to own collection infrastructure will lead to more efficient operations, the profitability performance will also be moderate, but with a significant reliance on external pathology providers that will limit the long-term margin expansion.

C. Thyrocare-style Centralized Pathology Analysis

Thyrocare-style centralized pathology model was the most cost-effective among the various health-care aggregation models selected. The model reported an average cost of pathology of only ₹540, which was much lower than all of the other operational models which were studied. Likewise, the model recorded the lowest total operational cost of ₹836 while the highest gross margin was recorded at 61.4%. The results suggest that centralized pathology processing can greatly enhance operational efficiency and lead to greater retention of profits in diagnostics systems within the healthcare sector. The Thyrocare style model has inbuilt automated pathology infrastructure with a centralized system, which can process huge volumes of diagnostics with the standardized system. This centralized automation significantly cuts down the expenses of pathology processing and boosts working productivity. The low pathology expenditure shows the operational benefits of economies of scale and centralisation and automation. High volume processing allows for reduced average operational expense per test due to cost distribution across a larger volume of tests. In addition, the process is more standardized and the efficiency in the diagnosis is enhanced. The collection, logistics and administrative expenses were also relatively less in the Thyrocare-style model. The operational setup is centralized, enabling efficient sample routing and optimized logistics management and coordination, which reduces fragmentation of the

operations. The relatively lower radiology cost is because the primary focus of the model is to keep the imaging segment centralized and not on building a large imaging infrastructure. The high gross margin performance in the Thyrocare-type business model suggests that the aggregate system with centralized operational control clearly enhances the retained profitability of health care businesses. Centralized pathology systems can maintain larger contribution margins than traditional aggregator models, by reducing middlemen and increasing efficiency. The results hence indicate that centralized pathology processing is one of the most operationally efficient healthcare diagnostic models in the diagnostics segment of India. The model achieves a good balance between infrastructure ownership and scale efficiency of operations, leading to a significant increase in the profitability retained.

D. Dr Lal PathLabs-style Vertical Integration Analysis

The vertically integrated model that replicates the Dr Lal PathLabs had lower infrastructure intensity and a strong profitability retention. The model reported an average cost of the pathology service of ₹960 and the highest average cost of the radiology service of ₹300. Also, the model had the highest collection cost of ₹116, logistics cost of ₹66 and platform/administrative cost of ₹76. However, the average gross margin was strong, at 49%, with these additional operating costs. The results provide an indication of the operational nature of vertically integrated healthcare diagnostic systems. In a vertically integrated approach, rather than relying on an aggregator, the hospital keeps control of both pathology processing and radiology facilities as well as collection systems and administration. The large number of operational ownerships significantly decreases the dependency on intermediaries and the operational profitability can be retained. Pathology and radiology costs are relatively high, which is consistent with the high infrastructure costs of vertically integrated healthcare. The investment needed in operations of ownership of diagnostic laboratories and imaging facilities, collection centres, and technical equipment is significant. Therefore, the costs of collecting, transporting, and administration are more expensive than those of less integrated operational structures. Even though the vertically integrated model is costlier to run, it still has significantly better profitability than outsourced models that are aggregators. In-house fulfilment of diagnosis reduces intermediary leakage and enhances retained contribution margins. Moreover, the integration of operational co-ordination improves the quality of services,

operational control and price flexibility. Thus, the findings indicate that the vertical integration seems to significantly increase the retention of the profit margins and increase significantly the infrastructure investment and operational complexity. The model has good operational sustainability and profitability but the scalability is limited to capital availability and expansion of infrastructure.

E. Cross-model Cost Structure Comparison

The cross-model comparison illustrates that the profitability retention and operational efficiency of a healthcare aggregation system is strongly dependent on the operational ownership and infrastructure configuration. Pathology cost was found to be the biggest operational expenditure in all models and it is a known fact that pathology fulfilment is the main operational cost centre in healthcare diagnostics aggregation. The PharmEasy aggregator model was most dependent on the pathology sector and had the lowest retained profitability, given the high level of outsourcing and lack of coordination across the operations. The centralized pathology structure with Thyrocare automation (i.e., centralized pathology) showed the lowest pathology expenditure and the best gross margin because of the economies of scale and the centralized automation. All models had some level of radiology expenditure, especially in the vertically integrated Dr Lal model. The results indicate that radiology remains a very infrastructure driven operational aspect in healthcare aggregation systems. Operational models that had more collection ownership and good routing optimization were also found to have lower collection and logistics costs. The hybrid model (Healthians) had higher collection efficiency, reflecting the benefits of having owned phlebotomy infrastructure, which helps coordinate operations and reduces leakage of intermediaries.

The cost structure comparison illustrates that the main issue for a healthcare aggregator is revenue generation but the excessive operational leakage. In the traditional model, a significant proportion of revenue to third-party diagnostic providers in transferred, which limits profitability than customer acquisition access. While retained margins can be enhanced in a vertically integrated and centralised manner, this may lead to infrastructure intensity and capital costs. This proposed hybrid model is strategically superior, targeting the highest-cost activities in the business

rather than trying duplicate complete infrastructure-intensive models. The hybrid model also retains ownership of collection networks and customer-oriented business aspects while leveraging negotiated pathology partnerships, which effectively captures value retention benefits by avoiding major capital investment. It suggests that the hybrid approach is more cost-effective and flexible, which is suitable for diagnostic aggregators aiming to enhance profitability through strategic operational management rather than full ownership.

4.2.4 Comparative Analysis of Current and Proposed Hybrid Models

A comparative study of the existing and proposed hybrid healthcare aggregation models was performed to assess the efficiency of operating restructure in enhancing profitability, reducing operational leakage and sustainability in long terms in the Indian diagnostics industry. This section is the heart of the quantitative analysis of this study as it directly assesses the financial and operational implications of the suggested hybrid operational framework versus the current healthcare aggregation frameworks. This analysis compares the overall performance of the different operational models in terms of their total operational costs, retained gross margin, and overall profitability, with the overall operational performance of the different hybrid operational models. Results highlight that the suggested hybrid operational structure significantly increases retained profitability in all the healthcare aggregation structures analysed in this research. Very large savings were realized in the operational costs and very large gains in gross margin retention were realized across all operational archetypes. The findings hence suggest that operational ownership, decentralized collection optimization, less dependency on intermediaries, and better coordination of the pathology function all contribute to better system-level profitability and operations' sustainability.

Table 4.2.4.1: Comparative Analysis of Current and Proposed Hybrid Models

Aggregator	Current Avg Total Cost ₹	Hybrid Avg Total Cost ₹	Current Avg Margin %	Hybrid Avg Margin %	Margin Improvement %
PharmEasy	1742	764	25.4	69.0	43.6
Healthians	1516	707.6	32.8	69.8	37.0
Thyrocare	836	629.4	61.4	71.2	9.8
Dr Lal	1518	1097	49.0	63.0	14.0

(*Source*: Author's work)

A. PharmEasy-style Aggregator versus Proposed Hybrid Model

The PharmEasy model of aggregator showed the highest appreciable improvement in profitability after restructuring the operations along the proposed hybrid model. The operational model reported an average total operational cost of ₹1742 while an average gross margin of just 25.4% was reported. Average operating cost reduced substantially to ₹764 after operational restructuring into hybrid, and average gross margin jumped dramatically to 69% after the restructuring, which is an improvement of 43.6%. The results show that there is significant leakage of operations in traditional healthcare aggregation systems, with strong reliance on outside

pathology and radiology services. Under the existing PharmEasy-like business model, a large percentage of package income goes to third-party diagnostic completion partners. Therefore, despite (comparatively) low infrastructure ownership, the aggregator has limited profitability. The proposed hybrid operational framework significantly reduced dependency on operations with better operational ownership and negotiated pathology processing. One of the largest drivers of margin improvement in the hybrid model is the cost savings from the reduction in pathology processing. The hybrid approach significantly decreases the share of funds spent on external diagnostic providers, and enhances direct coordination of the operations. Likewise, collection and logistics costs were also reduced by optimizing home collection management and coordinating routing. The operational efficiency was improved and coordination leakage was reduced by semi-owned collection networks and decentralised operational management. Less integration in workflows and persistent operational fragmentation also lowered the costs of the platform and administration (Chaudhary et al., 2025).

B. Healthians-style Hybrid versus Proposed Hybrid Model

The operational hybrid model, which was Healthians-style, also exhibited significant profitability pre- and post-transition to the proposed operational hybridization. The current operational model is Healthians style and reported an average total operational cost of ₹1516 and an average gross margin of 32.8%. The proposed hybrid operational framework resulted in a significant reduction of the average total cost to ₹707.6 and the average gross margin to 69.8%, an increase of 37%. In comparison to the PharmEasy-style aggregator model, the Healthians-style structure already had moderate operational integration – the ownership of home collection infrastructure, as well as the decentralisation of phlebotomy operations. As a result, the model under study was shown to have relatively low collection and co-ordination inefficiencies as compared to fully-aggregated aggregation systems. Despite collection improvements, the current system of operation was still tightly coupled with external pathology collection. This continued dependence hindered ability to retain profits and prevented operational leakage from the healthcare aggregation system. The proposed hybrid structure thus aimed to further deepen the operational integration and minimize reliance on external pathology processing infrastructure. This cost saving of the total operation cost under the hybrid arrangement highlights the need for integrated

ownership of the operation and optimized decentralized care approaches. Integrated collection effort reduced duplicate routing expense, and efficient logistics resulted from negotiated pathology processing, which lowered diagnostic fulfilment expense.

C. Thyrocare-style Centralized Pathology versus Proposed Hybrid Model

Thyrocare-type centralized pathology showed relatively lower but substantial profitability gains after hybrid optimization of operations. The average total operational cost reported by the current centralized pathology structure was ₹836 and the average gross margin was 61.4%. The proposed hybrid operational framework also saw reduction in average total operational cost to ₹629.4, coupled with a corresponding improvement in average gross margin to 71.2%, up 9.8%. The centralized model like Thyrocare, when compared to the traditional health care aggregation system, has already proven to be very efficient and cost-effective with a high profit margin. Centralized automated pathology processing had a substantial impact on the cost of pathology processing and on the throughput of operations. As a result, the model already had lower operational leakage and better margin retention at the start of the hybrid restructuring process. The planned hybrid approach, however, provides for more flexibility and decentralization in operational optimization. Centralised pathology processing is very effective, but over centralisation can increase dependency on logistics and lack of adaptability in the operations of geographically spread healthcare ecosystems. The hybrid framework was thus able to introduce more operational flexibility, and maintain centralized pathology efficiency. There were also reductions in overall operational expenditure due to improvements in collection coordination, decentralized routing optimization and a reduction in the fragmentation of logistics. Even the very efficient centralized system can generate further profitability through hybrid operational refinement, the findings indicate. Importantly, the results suggest that operational efficiency and operational flexibility are not mutually exclusive, as they can be achieved simultaneously in a centralized manner. The idea of the hybrid model shows the possibility of centralized diagnostic processing and decentralized operational optimization, in order to improve the overall sustainability and retain the profitability. The margin improvement which has been observed in the Thyrocare type model is relatively less because the original central structure had already a good operational efficiency. These results confirm, however, that even in the case of a highly

optimized central diagnostic system, restructuring can lead to increased scalability and operational flexibility using a hybrid approach (Smedemark et al., 2024).

D. Dr Lal-style Vertical Integration versus Proposed Hybrid Model

The Dr Lal type vertically integrated model yielded high profitability with both present and hybrid operation models. In the current vertically integrated business, the average total operating cost is ₹1518 along with an average gross margin of 49%. In the proposed hybrid operational scheme, the average operational cost came down to ₹1097 and gross margin came up to 63% which is a margin gain of 14%. The results show that health systems with vertically integrated diagnostic operations already have strong profitability as they have direct control of pathology processing, collection and diagnostic operations. Compared to an outsourced aggregation system, operational ownership significantly reduces the amount of leakage that can happen between the various hands, and contributes to higher contribution margins. But, even with good profitability, vertically integrated business models are still high on capital cost. Laboratories, imaging systems, collection centres, logistics systems and administrative systems create significant operating costs and capital costs. In summary, vertical integration with existing systems may be highly reliant on the capability to invest in the systems infrastructure. The proposed hybrid framework greatly eased the burden of operations, but retained a relatively high level of profitability retention. The hybrid model achieved profitability similar to vertically integrated systems, with reduced infrastructure intensity (Wale et al., 2024) by optimizing the coordination of collections, minimizing the duplication of effort and improving the management of decentralized operations.

E. Overall Margin Improvement Analysis

However, the comparative results have been found throughout the study to show that hybrid restructuring in operations can significantly increase retained profits for each of the healthcare aggregation structures studied. Total operational cost was reduced significantly in all operational archetypes and gross margin retention was increased in those same operational archetypes. The PharmEasy style aggregator showed the highest margin uplift as it greatly reduced the reliance on outsourcing and intermediary leakages. Likewise, the Healthians hybrid structure

proved to be very effective at improving profitability through increased operational integration and optimized centralization of collection management. The centralized model (Thyrocare) showed relatively low margin improvement as the existing structure had a high level of operational efficiency. However, hybrid refinement enhanced the flexibility of operation and minimized logistical inefficiencies. The same is true with the Dr Lal vertically integrated structure, which provided moderate margin improvement by optimizing operations and also minimizing the infrastructure load. Pathology processing cost was the main contributor to operational leakage in all models. For models with high levels of pathology outsourcing, retained profitability was clearly lower than for those with higher levels of diagnostic ownership and processing integration. Likewise, the logistics and collection cost showed significant operational implications. Having collection infrastructure and optimized routing systems helped to strengthen operational coordination and minimise leakage through intermediaries. The results thus suggest that the operating ownership of OPs has a significant impact on the retained value of the system in the healthcare domain.

The comparative results suggest that market expansion is not sufficient to achieve profitability in the Indian diagnostics market, whereas operational redesign becomes a better option. Even though the initial infrastructure and operating model varied by archetype, the hybrid model delivered significant margin enhancements in all four operational types. The consistency indicates that the inefficiencies are not isolated to a particular firm but are a common problem in the industry. Notably, dependency on outsourcing fulfilment has been the biggest hurdle to retained profitability, with the greatest improvement seen in the sub-sets of outsourcing-dependent models. The hybrid model directly tackles this challenge as it lessens the dependency of intermediaries and offers flexibility in the functioning. Comprehensively, the hybrid model offers the same profitability advantages as vertically integrated systems, but with reduced financial risk and lower time engagement. Therefore, the proposed model proposes a scalable framework that could help to boost margins, decrease operational fragmentation and enhance long-term competitiveness in various healthcare aggregation contexts.

4.2.5 Break-even Analysis of Operational Models

A break-even analysis was performed to assess the financial sustainability, operability and long-term viability of the different healthcare aggregation models analysed in the current study. The Break-even analysis is one of the most important operational-financial indicators for the healthcare diagnostics system, as it sets the floor for necessary operational volume for covering the fixed operational expenditure. Lower break-even thresholds signify increased operational sustainability, decreased financial risk, and quicker realization of profitability (Gaffney & Mirza, 2025), in the context of healthcare aggregation. The analysis is based on the relationship between the fixed operational expenditure, contribution margin per test and operational scalability in various healthcare aggregation structures. Contribution margin is the money that remains after variable costs of diagnostic fulfilment, collection, logistics and related diagnostic operation are subtracted from the revenue. The higher the contribution margin, the more sustainable the operation is as it increases the efficiency of the addition of each diagnostic package.

Table 4.2.5.1: Break-even Analysis of Operational Models

Model Type	**Fixed Monthly Cost ₹**	**Contribution Margin/Test ₹**	**Break-even Volume**
PharmEasy-style Aggregator	15,00,000	400	3750
Healthians-style Hybrid	10,00,000	1100	909
Thyrocare-style Centralized Pathology	25,00,000	700	3571
Dr Lal-style Vertical Integration	40,00,000	1300	3077
Proposed Hybrid Model	10,00,000	1400	714

(*Source*: Author's work)

A. PharmEasy-style Aggregator

The PharmEasy aggregator model was found to be the least break-even among the healthcare aggregation structures evaluated. The model yielded a contribution margin of just ₹400 per test and required 3750 tests per month to break even. The results show that conventional health care aggregation systems have significant operational sustainability issues, because of low retained profitability and large intermediary leakage. The low contribution margin is due to the traditional

operational configuration of healthcare aggregation systems, which are very outsourced. Pathology and radiology are externalised to coordinate fulfilment, meaning that a significant portion of package revenue goes to third party diagnostic providers. The aggregator then only has the residual value of the operation after meeting the variable operational costs.

The break-even realization is severely postponed because the contribution margin is weak, though infrastructure intensity is not high in the model as in vertical systems. A need to complete 3750 tests per month by covering their operational expenditure suggests poor operational sustainability and lower rate of profitability realization.

B. Healthians-style Hybrid

The Healthians model (hybrid) showed significantly better break-even performance than the PharmEasy model (aggregator). The model indicated that contribution margin is ₹1100 per test, while the break-even point is just 909 tests per month. The results show that there is a substantial improvement in operational sustainability and financial viability in the case of partial operational ownership in healthcare aggregation systems. The better contribution margin is due to operational benefits of decentralized ownership and partially integrated operational coordination. The Healthians-style model brings with it some owned home collection infrastructure and a decentralized phlebotomy approach to reduce coordination inefficiencies and minimize operational leakage due to reliance on third parties for collection services. The lower break-even threshold shows that the operational structure is able to reach sustainability significantly earlier than conventional outsourced aggregation structures. The model has significantly reduced the number of diagnostic packages to pay for the monthly fixed operational costs because a larger proportion of revenues is left over after deducting variable operational costs.

C. Thyrocare-style Centralized Model

The Thyrocare-style centralised pathology model was relatively efficient due to its automated centralised lab model and high-volume processing. The average cost of operation was ₹1300 per test equipped on a monthly basis, whereas the fixed monthly cost of the machine was

₹25,00,000, and the contribution margin was ₹700 per test. Nevertheless, although the cost has decreased due to higher turnaround efficiency, the break-even point was still high at 3571 tests per month. It suggests that a significant volume should be reported in a centralised system to make it economically viable. A scalability score of 9/15 was calculated, indicating that the model was conditionally scalable. Centralisation allows for economies of scale, automated pathology and bulk testing processes, which further decrease pathology processing costs (Isa et al., 2023). However, the high capital intensity of central labs, advanced equipment, logistics routing, and maintenance of operations for in-house operations are essential factors. As a result, scalability is heavily dependent on maintaining consistently high testing volumes. The results indicate that a centralised pathology system is highly effective for optimising operational inefficiencies and enhancing laboratory productivity. However, its scalability is limited due to heavy reliance on the infrastructure and high operating costs of the system. Thus, centralised models offer operational efficiency benefits but are also susceptible to demand fluctuations and require some considerable market penetration to ensure long-term profitability.

D. Dr Lal-style Vertical Integration

One of the strongest contribution margin performances was achieved by the vertically integrated model proposed by Dr Lal. The model recorded an average revenue per test of ₹3500 and a contribution margin of ₹1300 per test. The model costing also had the highest fixed monthly operational cost of ₹40,00,000, which reflects the heavy investment in infrastructure, such as laboratories, diagnostic centres, radiology equipment, and centrally integrated operational networks. It also indicated that break-even remained fairly high at 3077 tests per month. The 9/15 scalability score categorised the model as conditionally scalable. Vertical integration would enable better control over the operations, give minimal dependence on intermediaries, and assure better profitability retention and coordination of services (Ekaireb et al., 2024). The model is based on an integrated diagnostic infrastructure, brand positioning, and increased operational reliability. However, the significant amount of investment in infrastructure, equipment upkeep, staffing, and regulatory monitoring increases financial strain on the organisation. Findings suggest that vertically integrated diagnostic systems have high profit potential once operational scale is achieved, but expansion necessitates a high flow of capital and long-term investment in

infrastructure. Therefore, the model has good profitability potential as an infrastructure-intensive model, while the capital expenditure is high and does not allow for rapid operations as compared to other flexible operational hybrid models.

E. Proposed Hybrid Model

The proposed hybrid operational model outperformed all reviewed operational models in terms of financial and scalability performance. The fixed monthly operational cost calculated by the model was relatively low, at ₹10,00,000, and the contribution margin was the highest, at ₹1400 per test. This resulted in a substantially lower break-even threshold (only 714 tests per month), lower financial risk, and rapid operational sustainability. Thus, this model achieved the highest scalability score of 14/15 and was categorised as highly scalable. Operational leakage reduction, logistics control, in-house phlebotomy, and negotiated pathology processing were the key factors contributing to the superior performance of the proposed hybrid model. The hybrid model reduced reliance on outsourced diagnostics services while avoiding the heavy infrastructure associated with the vertically integrated solution. This allowed for higher retained profitability with reduced ownership of a large laboratory. The findings suggest that the proposed hybrid model is able to achieve the desired equilibrium between profitability, operational flexibility, and infrastructure efficiency. The model combines the scalability benefits of centralisation with the cost savings of decentralised healthcare aggregation. Therefore, it can be concluded that the suggested hybrid model has a high sustainability potential in the long-run and provides a financially viable operational option to increase revenue for the Indian healthcare aggregator pathology industry.

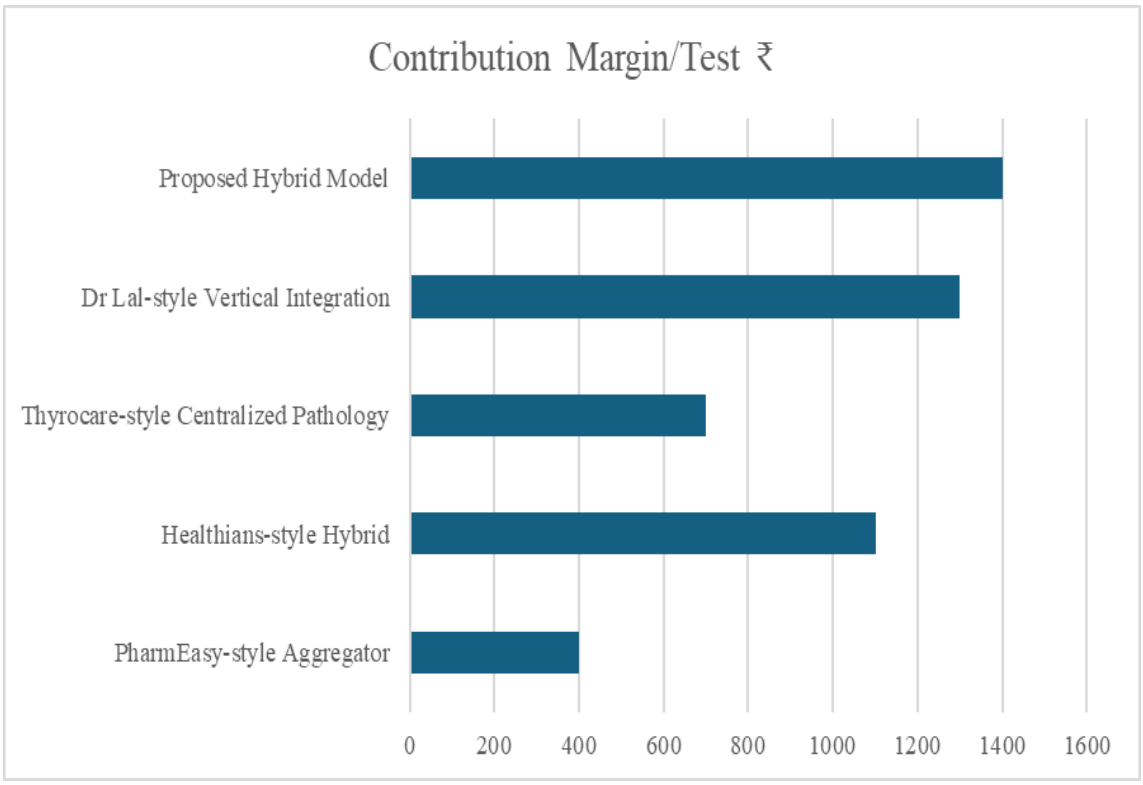


Figure 4.2.5.1: Contribution Margin Per Test Comparison

(*Source*: Author's work)

The quantitative results show that the proposed hybrid operational model can provide fast profitability with a lower breakeven level and higher contribution margin. Decreasing system leakage and increasing collection rates are needed to drive improved financial sustainability, and restructuring of the operational models within the systems significantly enhances scalability and feasibility over the conventional healthcare aggregation and infrastructure-based diagnostic approach.

Based on the findings, the break-even results show that revenue generation is not the only determinant for financial sustainability in healthcare diagnostics but also the efficiency in converting the revenue into contribution margin. Models with extensive outsourcing demands a higher testing volume to be profitable, resulting in exposure to demand risks and market vulnerabilities. On the other hand, the hybrid model is capable of generating profiting at a lower

operating level. It reduces financial risks during slower growth and provides for earlier re-investment in expansion activities. In addition, the hybrid model demands minimal break-even scenario than centralised and vertically integrated structures while maintaining profitability. Overall, it demonstrates that operational sustainability can be achieved by strategic cost optimisation, not simply by expanding infrastructure. Thus, the hybrid model offers a more sustainable and stable operating structure that can sustain profitability across various market conditions and demand fluctuations.

4.2.6 Scalability Analysis of Operational Models

A. Infrastructure Intensity Comparison

Infrastructure intensity is identified as one of the key factors determining the scalability of operation among the healthcare aggregation models. The PharmEasy-style aggregator model had the lowest infrastructure intensity, with high reliance on outsourcing diagnostic fulfilment and partner diagnostic labs. Although it aims to decrease overall investment, it holds limited operational control and limited scalability in the long run. In contrast, the Healthians-style hybrid model operated with moderate infrastructure intensity with owned phlebotomy networks and decentralised collection operations, further allowing increased operational flexibility as well as decreased dependency leakage. The high infrastructure intensity in the Thyrocare-style model of centralised pathology is due to its high-volume processing capacities, centralised laboratory automation systems, and supply of logistics systems. The Dr Lal model of vertical integration also had a high intensity of infrastructure, which was evident from the facility ownership of laboratories, radiology equipment, diagnostic centres, and workforce infrastructure. Such facilities enhanced the operation and profitability but raised capital dependence and the operational load. The results showed that infrastructure-heavy models can provide higher levels of operational control but require massive investments for growth. On the other hand, moderate models of infrastructure are more scalable and flexible. Thus, infrastructure efficiency became one of the major factors affecting the sustainable growth within the Indian healthcare aggregator pathology sector.

B. Contribution Margin and Scalability

Contribution margin holds a prominent influence in assessing the scalability potential of the operational models analysed in the study. Increased contribution margin led to better scalability as each additional test holds a greater impact on covering the fixed operating expenses and achieving retained profitability benefits. The PharmEasy-type aggregator model had the lowest contribution margin at ₹400 per test, as it was mostly dependent on outsourcing its order fulfilment to the pathology and radiology lab. As a result, the model has limited operational value while demonstrating weaker scalability. The Healthians-style hybrid model generated a stronger contribution margin of ₹1100 per test through owned collection networks and improved operational coordination. Thyrocare-style centralised pathology model offered benefits regarding operational efficiency with automated pathology processing, thus contributing to moderate contribution margins and having scalability for processing. The vertically integrated structure with Dr Lal was one of the highest contribution margins with no dependence on intermediaries and complete operational control.

C. Break-even and Scalability Relationship

The study revealed a directly proportional relationship between break-even thresholds and the scalability in the various healthcare aggregation models. A lower break-even volume indicates a positive impact on the scalability, stating that financial sustainability is achieved earlier and less operational risk when expanding (Padulles et al., 2025). Considering the low contribution margin and high dependency leakage, the PharmEasy-type aggregator model had the highest break-even threshold mean of 3750 tests per month. This restricted scalability, as substantial testing volumes were required before sustainable profitability could be achieved. Healthians-style hybrid model showed a significantly lower contribution margin (909 tests per month) and higher operational efficiency. While the Thyrocare model of centralised pathology was operationally economical of scale, the break-even point was still comparatively high, as centralised laboratory standard practices involve high investment in infrastructure. Similarly, the Dr Lal-style vertically integrated approach showcased good profitability but needed a high level of operational throughput to justify significant capital expenditure.

The proposed hybrid model showed the lowest break-even point (714 tests per month), which suggests the highest scalability potential among all the operational models. The results indicate that reduced break-even ratios significantly increase flexibility in markets and financial risk analysis in market expansion. Thus, break-even efficiency became a key factor for sustainability and scalable growth for the long run within the Indian healthcare aggregator diagnostics sector.

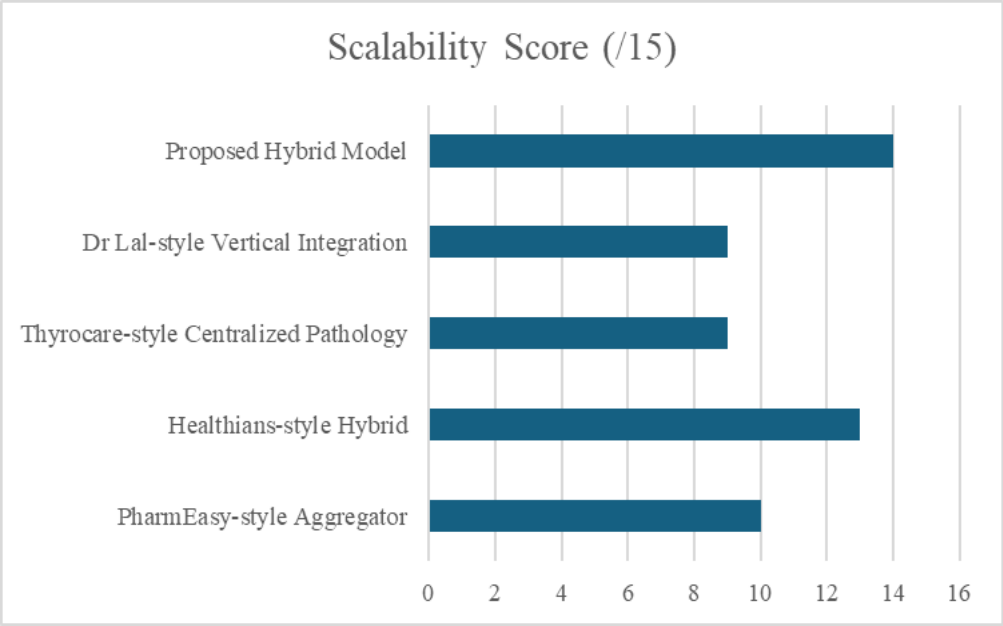


Figure 4.2.6.1: Scalability Test Comparison

(*Source*: Author's work)

D. Scalability Score Interpretation

The break-even efficiency, contribution margin strength, and infrastructure intensity were integrated within the scalability scoring framework to provide an overall assessment of operational scalability. The PharmEasy aggregator model got a scalability score of 10/15 by categorising it as moderately scalable. The model achieved good infrastructure burden but had low contribution margins and outsourcing dependency, which negatively impacted operational sustainability and profitability retention. The Healthians-style hybrid was rated highly scalable with a score of 13/15.

The model examined how it increased the operational control of phlebotomy and network optimisation, secured better contribution margins, and reduced the break-even points. However, both the Thyrocare-style centralized pathology system and the Dr Lal-style vertically integrated model received a scalability score of 9/15 and were considered conditionally scalable. Operational efficiency and profits were the core benefits in both models, yet infrastructure intensity and the dependency on capital restrained rapid scalability. The hybrid model proposed had the best score of scalabilities (14/15 points) and it was designed as the strongest overall operational structure. The model achieved a good combination of strong contribution margins, moderate contributions of the infrastructure, and moderate break-even levels. The findings show that profitability is not the only factor contributing to scalability, but rather a multifaceted interaction of operational efficiency, retained margins, infrastructure intensity, and financial sustainability.

E. Proposed Hybrid Model Analysis

The hybrid operational combination had the best scalability results among all the assessed healthcare aggregation models. The model provided moderate infrastructure intensity, the largest contribution margin, and the lowest break-even, thus establishing a high potential for scalability and financial sustainability. Compared to other traditional aggregator models, it aimed to minimise dependence on external diagnostic delivery units by retaining in-house phlebotomy staff and managing logistics, and still process pathology based on negotiated rates (Ozlugedik et al., 2026). The model resulted in significant gains of operational efficiency due to the reduction of the loss of tangible intermediate and enhanced retained profitability. The proposed structure alleviated unnecessary overlying infrastructure burdens with tight operational control of customer services and experience, in comparison with the centralised and vertically integrated models. This led to the possibility of scalability without any need for significant laboratory and radiology investments. The results suggest a novel architecture being an aggregation of both decentralised and centralised systems, which combines scalability benefits of decentralised healthcare aggregation and profitability benefits from ownership of the operations. The model proved to be more financially flexible, more quickly operational, sustainable, and less capital dependent than traditional healthcare aggregations. As a result, the hybrid model was identified as the most balanced

operating model to ensure the enhanced long-term benefits of profitability, sustainability, and scalable growth in the Indian healthcare aggregator pathology value chain.

Through the scalability analysis, it was found that scaled hybrid operational structures possess the maximum profit, infrastructure efficiency, and operational sustainability in the Indian healthcare aggregator diagnostics sector. However, hybrid models benefited from stronger contribution margins, necessitated moderate set-up investments, and a lower break-even level. Conversely, vertically integrated diagnostic systems continued to generate higher revenue, but remained highly capital-intensive due to extensive infrastructure ownership and operational maintenance requirements.

The scalability analysis identifies a basic trade-off between controlling operations and relying on infrastructure in healthcare aggregation systems. Infrastructure ownership is a valuable differentiator for traditional aggregators, especially known for their quick growth, but may not be profitable, while the centralised and vertically integrated model can provide better margin retention at the cost of flexibility and capital efficiency. In this regard, the proposed hybrid framework effectively meets this trade-off, incorporate decentralised services delivery and selective operational ownership. These strategies make it more scalable without restraining on infrastructure. Strategically, this is especially crucial in the Indian healthcare market where geographical diversity, unequal access to healthcare, and the cost-sensitivity demand flexible expansion strategies. The hybrid model enables companies to gain access to new markets faster and maintain control over key business processes. Therefore, this model is more scalable supported by operational efficiency and coordination, without requiring consistent investment in diagnostic infrastructure and expensive laboratory.

4.2.7 Synthesis of Quantitative Findings

A. Cost Structure Findings

The quantitative analysis showed that the dependence on external diagnosis centres is high in the outsourced system of the healthcare aggregator, reflecting a significant amount of operational leakage. The largest components of operational costs were the fulfilment for pathology and radiology, across all current aggregation structures. PharmEasy-type aggregators had the lowest dependency burden, resulting in the lowest retained margins and operational efficiency. On the other hand, centralised and vertically integrated systems minimise leakage from the intermediaries through operational ownership and processing efficiencies. The proposed hybrid concept had a great reduction in pathology, collection, and logistics costs due to in-house phlebotomy and negotiated processing. The results demonstrated that operational restructuring has a direct impact on the cost optimisation and maintenance of profit in healthcare aggregation systems.

B. Profitability Findings

The profitability analysis reflected the differences between the retained margins of the operational models observed in the study. There were weak margins in current aggregator structures due to a high proportion of package revenue offset by outsourced diagnostic fulfilment costs. Healthians-style hybrid operations recorded moderate profitability gains using owned collection systems and through better coordination of operations. Centralised pathology and vertically integrated systems showed higher profits as these systems are operationally owned and have lower dependency leakage. However, higher profitability was observed across the proposed hybrid model by combining lower levels of operations and moderated levels of infrastructural intensity. In this regard, the results have shown that retained profitability is significantly enhanced in healthcare aggregation structures through controlled collection, logistics optimization, and by minimising the need for intermediaries. Overall, the evidence of profitability indicates that the ability of healthcare aggregators to reduce intermediary leakage is the primary factor impacting financial performance, but operational flexibility should also be maintained. Platform-based

aggregators are focused on increasing platform size, but do not focus on gaining sufficient value from the diagnostic fulfilment activities. On the other hand, fully integrated models are more profitable, but have high infrastructure expenses that can limit growth. Combining these two approaches in a hybrid model becomes crucial to bridge the gap between them, followed by maximised retained contribution margin and limited capital intensity. It also indicates that increased future profit in the diagnostics business will rely on optimising operational flows, rather than on price hikes in packages. Thus, the hybrid approach is a viable way to ensure long-term profitability and maintain financial agility and flexibility.

C. Break-even Findings

The break-even analysis showed that contribution margin and infrastructure intensity have a significant influence on operational sustainability. The weak margins maintained by current aggregators and their heavy reliance on outsourcing resulted in the highest break-evens. Centralised pathology and vertically integrated systems had a higher contribution margin but required substantial operational throughput to recover the fixed costs involved in infrastructure. However, the proposed hybrid model has shown the smallest break-even requirement, meaning that it has a higher speed in achieving profitability and a lower operational risk. The results indicate that increasing contribution margin and lowering operational leakage can accelerate the financial sustainability process. This also provides improved operational flexibility and a more robust long-term feasibility for scalable healthcare aggregation systems.

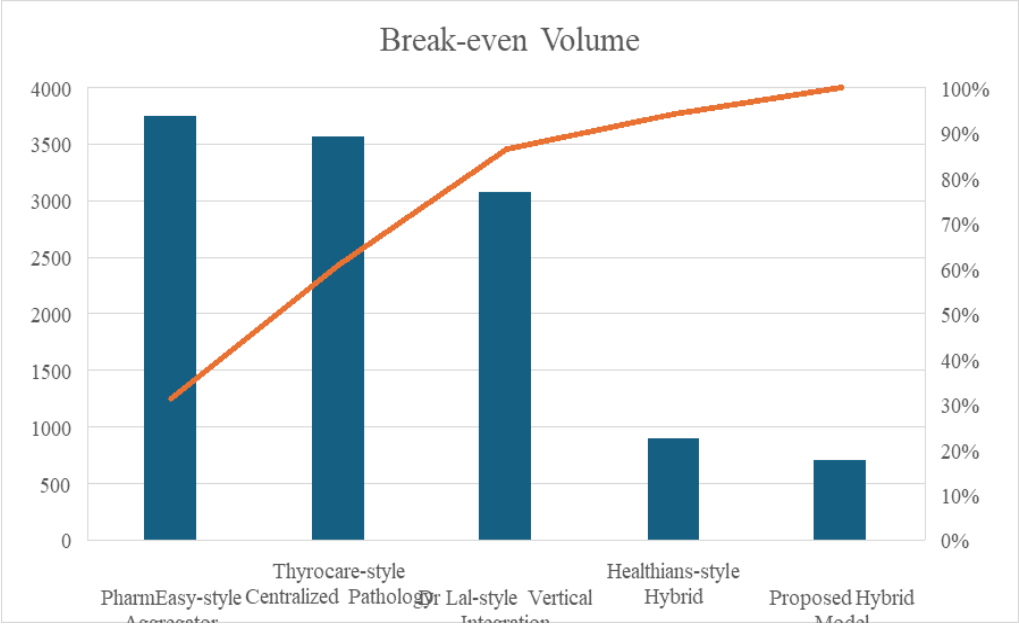


Figure 4.2.7.1: Break-even Volume Comparison

(*Source*: Author's work)

D. Scalability Findings

The issues of operational ownership and infrastructure efficiency were identified through the scalability analysis as key factors contributing to sustainability in healthcare aggregation systems. The vertically integrated and centralised systems exhibited good efficiency of operation but remained constrained by high capital demands and infrastructure intensity. With the absence of dependency leakage with conventional aggregator models and lower retentions of profitability, these models were weakly scalable. This proposed hybrid operational model achieved the strongest scalability by having moderate infrastructure needs, high contribution margins, and lower break points. Therefore, this hybrid approach makes a sustainable and profitable pathway for expanding healthcare aggregation. Combining the findings of the synthesis provides further evidence for the need for infrastructure efficiency and operational ownership to realise sustainable growth. Models mainly positioned at extreme conditions like heavily integrated diagnostic systems and fully outsourced aggregators encounters limited profitability retention and expansion. In this regard, the suggested hybrid structure becomes strategically advantageous in leveraging both approaches. It

maintains key operational capabilities holding significant impact on the customer experience and margin generation without the massive investment in diagnostic infrastructure with large-scale investments. This balance can give a huge boost to long-term growth potential and also lower the financial risk in expansion. The results indicate that competitive edge for the Indian Health Aggregator Pathology industry is likely to be derived from hybrid operational ecosystems which offers profitability, flexibility and scalability rather than traditional aggregation or complete vertical integration.

4.3 Qualitative Data Analysis

4.3.1 Introduction to Qualitative Analysis

The qualitative analysis of this study was carried out using the thematic analysis method, which was used to analyze the themes of the operational and strategic issues that affect profitability in Indian healthcare aggregator platforms in the pathology sector. Ten stakeholders, who were purposefully selected for their role in the industry such as aggregator founders, laboratory managers, phlebotomists, logistics coordinators and healthcare technology professionals were interviewed using an interview guide with a semi-structured format. Patterns, perceptions and concerns from the stakeholders and the operational issues with regards to cost, inefficiencies, digital transformation, hybrid operational models and scalability in aggregator–diagnostic partnerships were identified through thematic analysis.

4.3.2 Theme 1: Existing Cost Structure in Aggregator–Diagnostic Partnerships

Subtheme 1.1: Revenue Allocation and Dependency on Diagnostic Providers

The qualitative results showed that current cost structure in the healthcare aggregator-diagnostic service provider relationship is extremely dependent on third-party diagnostic service providers. Healthcare aggregators primarily are concerned with customer acquisition, digital, appointment scheduling, logistics coordination, home sample collection services whereas diagnostic laboratories and radiology centres are engaged in testing, reporting and technical operations. This working model establishes a revenue-sharing model where diagnostic centres

keep a bigger share of the generated revenue because these centres have ownership of the infrastructure, the equipment and the specialized skills. Participant 1, founder of a healthcare aggregator platform said that the aggregators are facing financial pressure every day as the majority of diagnostic revenues are earmarked for partner laboratories. While aggregators are responsible for the customer-facing operations and logistics, their revenue share is relatively low as they bear the responsibility of covering all the expenses required for running the operational activities including digital marketing, technology maintenance, transportation and workforce management. Participant 10 echoed similar sentiments, acknowledging that the existing partnership model is inequitable in terms of value sharing in the healthcare aggregation landscape.

Subtheme 1.2: Customer Acquisition, Logistics and Technology Cost Burden

One of the top financial pressures on healthcare aggregators was the cost of customer acquisition. All participants emphasized that health care markets are highly competitive and the consumers are often enticed to purchase through price reduction and promotional offers. Participant 5 described how aggregators spend heavily on the online advertising, mobile application, digital platform and promotional campaign to keep customers engaged and visible in the market. However, the costs of these have a significant impact on profitability and demands sustainability on the operation. Other important factors identified in the current structure of the cost were also logistics and transportation. The effective route planning, transportation management, scheduling coordination and work supervision are required in home sample collection services (Rekabi et al., 2024). The participant 3 who is a phlebotomist working in home sample collection services, explained that traffic congestion, inefficiencies in route allocation, repeated visits and other scheduling issues contribute to higher operational costs of aggregators. Fuel prices and transportation delays also help to reduce margins. The interviews also identified that pathology and radiology are very capital intensive. Participant 2, diagnostic laboratory manager described the significant cost involved in purchasing diagnostic laboratories. These infrastructure costs are placed on diagnostic centres and as a consequence, they can afford to keep a higher percentage of their payments (Malik, 2022). This weakens the power of the aggregators and lessens their scope of maximising profit margins.

Subtheme 1.3: Pricing Control, Operational Fragmentation and Profitability Constraints

Participants also stressed that the pricing will be beyond the direct influence of healthcare aggregators as the diagnostic laboratories and radiology centres are the ones who are responsible for the main testing infrastructure. A healthcare consultant (participant 6) commented that aggregators are still reliant on third parties for diagnostic processing and reporting services. This is a limitation as they cannot ensure that the prices for their services are negotiated in a favourable way and that the quality of the services is uniform throughout several facilities. Consequently, profitability is very sensitive to the external diagnostic partners' operational choices. One of the other key findings was that operational responsibilities were spaced across the partnering between aggregators and diagnostics. The main job of aggregators is engaged in customer-facing stuff and for laboratories, it is about the clinical operations in the backend. This configuration may reduce the investment required for the infrastructure but may also lead to difficulties in coordinating the operation and duplication. Participant 9 explained that repeated communication processes, scheduling conflicts and transportation problems result in inefficiencies and higher operating costs.

Operating costs associated with technology were also a significant component of costs. Participant 7, a digital health technology manager, described how aggregators are always seeking to invest in their mobile applications, appointment scheduling, customer management platforms and digital tracking technologies. These systems are crucial for ensuring smooth operations and customer satisfaction. However, maintenance of digital infrastructure needs continuous investment of money which further decreases the overall profitability. The results also indicated that there are differences, though a similar complexity in radiology services and finances. Participant 4 (Radiology centre administrator) described that the radiology services need high capital investment in the imaging technologies such as MRI, CT scan, ultrasound and x-ray equipment. Because of these capital costs, healthcare aggregators tend not to open their own radiology practice, but rely on outside radiology centres. This lowers direct capital spending, but also leads to reliance on third-party providers and reduces operational control.

Some of the participants also stated that smaller healthcare aggregators struggle to be profitable because of their high marketing costs, workforce management expenses, technology

investments and discounted pricing strategies. New healthcare websites do not generally have the scope and bargaining strength to foster beneficial interactions with diagnostic providers. The results from the qualitative components of the study suggest that the current setup of cost structure in aggregator–diagnostic partnerships is high in operational dependency, unequal revenue sharing, high customer acquisition costs and increasing logistics costs (Xu et al., 2022). Existing models allow aggregators to do their business without investing heavily in the diagnostic infrastructure, but at the same time they restrict control over operations and the profitability potential. One of the significant challenges that are at play in the Indian pathology diagnostic market is reliance on third-party diagnostic providers, which will pose a strategic threat to the long-term sustainability of healthcare aggregator platforms.

Based on the findings, a critical interpretation highlighted that the current aggregator-diagnostic partnership model is built on a fundamental mismatch between a value creation and a value capturing strategy. The healthcare aggregator plays an essential role in the healthcare market, such as customer acquisition, digital engagement, appointment coordination, home sampling, logistics, and others, but absorbs only a small percentage of the economic value that occurs within the diagnostic service chain. On the other hand, diagnostic laboratories and radiology centres holds relatively stronger bargaining power due to their specialised infrastructure, technical skills and regulatory capacity. This leads to an operational dependency, in which aggregators absorb huge marketing, technology and coordination costs, without obtaining corresponding financial benefits. The results further indicate that the asset-light business model of traditional aggregators not only decreases capital investment but also restrict operational control and the influence on pricing. Strategically, the current model focuses on expanding the market rapidly and acquiring customers rather than optimising profitability in the long term. In this increasingly competitive environment, with customer acquisition costs increases consistently, this reliance on outsourced diagnostic partners may not be sustainable. Therefore, the evidence confirmed that greater operational integration, enhanced control over customer-facing activities, and the ability to capture value chain share in the healthcare diagnostics industry will be fundamental in achieving future profitability improvements in the Indian pathology aggregation sector.

4.3.3 Theme 2: Operational Inefficiencies and Margin Leakages

Subtheme 2.1: Coordination Failures and Operational Fragmentation

The qualitative results presented that operational inefficiencies and margin leakages are a significant problem for the healthcare aggregator platforms in the Indian pathology sector affecting its profitability and sustainability. Fragmented coordination systems, logistics problems, communication issues, delays and reliance on third party providers were frequently cited as factors which add to high operating expenses and slim profit margins (SysGenPro, 2026). These inefficiencies were more evident in the home sample collection services, transportation of samples and coordination between aggregators and diagnostic centres. Inefficient coordination among Healthcare Aggregators and laboratories posed as one of the most critical issues pointed out by participants. As part of this service model, several groups work independently of each other, such as the aggregators, laboratories, phlebotomists, logistics coordinators and radiology centres, said participant 5, operations manager at a healthcare aggregator platform. Such a disjointed structure results in communication delays, scheduling problems and administrative problems. This makes it difficult to get appointments confirmed, take samples and generate reports etc. making operational processes inefficient and time-consuming.

Participant 1 went on to explain how a lack of integrated operational systems makes it difficult to be dependent on external diagnostic providers and also makes it difficult for aggregators to maintain consistent service standards. The aggregators have limited operational control of timeliness of service delivery due to the testing and reporting activities done in laboratories and radiology centres (Gupta & Sunil, 2023). This reliance makes it more likely to experience service interruptions and can have a harmful impact on customer satisfaction and profitability. Another significant opportunity for margin leakage and inefficiency was in logistics management. Timely delivery of diagnostic samples, workforce scheduling, route planning and transportation management are all important aspects of home sample collection. Participant 3, a home collection phlebotomist, reported that traffic, scheduling problems, incorrect patient address information and transportation delays frequently impact home collection activities. Missed appointments or communication issues often require repeat visits, resulting in extra fuel expenses and loss of manpower productivity.

Subtheme 2.2: Logistics, Sample Collection and Scheduling Inefficiencies

A healthcare logistics coordination (participant 9) also noted poor route management and transportation coordination can be a key contributor to high operational costs. People have reported that aggregators have difficulty with requests for geographically distributed sample collection in short time horizons. The delays not only raise transportation costs but can also make a difference in the quality of temperature-sensitive samples and report timeliness. Another common problem encountered was scheduling inefficiencies. Participant 8, a senior pathologist lab technician described the many times that samples are collected in different teams and labs, and the time it takes to get the samples tested and reported. Sometimes laboratory workload imbalances cause further inefficiency in operations and delays in services. These operating incidents have a negative impact on customer experiences and decrease the reliability of the platform. Major contributors to operational inefficiencies included lack of communication between aggregators, lack of communication between laboratory and field staff. When it comes to communicating patient information, the requirements for tests and the timing for collecting them, participants said it often leads to confusion and duplication of efforts. Participant 3 reported that sometimes phlebotomists are not given full diagnostic orders or have to come back to the patient or call the laboratory several times to request clarification. This inefficiency puts a strain on employees and can result in a decrease in productivity.

Subtheme 2.3: Customer Acquisition Costs and Process Duplication

The results also showed that customer acquisition activities make a significant contribution to the margin leakages in healthcare aggregation platforms. Healthcare aggregators often rely on discounting and promotional pricing tactics to compete in the digital healthcare landscape, the participants explained. Participant 10 reported that if they charge more for an item that is on discount, the customer will be more likely to become a customer, but it will significantly erode profits as they are already operating with slim margins. Online advertising, promotional campaigns and digital marketing are thus costly and inevitably put a strain on the finances. There were also more cuts in operational processes that were repeated which were also linked to higher operational costs. According to participant 5, there are a number of activities that are scheduled, communicated

with customers, organised with logistics and are often duplicated across the various operational teams. These inefficiencies are further exacerbated by the lack of digital systems integrated into the system as a result of different stakeholders having different coordination systems and communication methods.

Subtheme 2.4: Lack of Standardisation, Technology Integration and Workforce Management

Lack of operational standardization of diagnostic partners was also determined as an important issue in the interviews. Participant 6, a healthcare consultant, gave the example of healthcare aggregators often needing to work with multiple labs and radiology centres that have varying pricing structure, turnaround times and service processes. This is a source of problems with uniformity of the services provided and the customer service experience in different regions. There are also differences in the ways that customers are reported and the operational procedures used. It contributes to customer disenchantment and poor platform reliability. Technological constraints were also found to be a factor contributing towards the operational inefficiencies. Another participant, the digital health technology manager, explained that many healthcare aggregators and diagnostic providers are still using disconnected digital systems. Poor integration between scheduling platforms, lab reporting systems and logistics tracking technologies leads to a delay in schedule coordination and information sharing. The participant believes that an integration of digital systems in real time is key to efficiency and less leakages in operation.

Another operational issue that participants pointed out was workforce management which has a negative impact on profitability. There is a great deal of coordination and supervision needed in multi-city scenarios to manage phlebotomists, logistics and customer service teams. A lack of staff, fluctuating training practices and staff turnover further contribute to this instability. Workforce coordination is especially challenging when there are periods of high demand, delays or conflicts. The qualitative results suggest a strong linkage between the two dimensions of operational inefficiencies and margin leakages as these two dimensions are interdependent across healthcare aggregator platforms.

According to the findings, the critical examination reveals that operational inefficiencies and margin leakages are not merely operational but structural issues effecting overall healthcare aggregation system. The evidence indicates that profitability erosion is caused as aggregators are responsible for coordinating customer-facing activities, yet they have minimal influence over the diagnostic procedures to determine service outcomes. This leads to a fragmented operating environment with different stakeholders having different priorities, systems and performance standards. As a result, inefficiencies created at one point in the service chain often led to increased costs at another point, causing an overall loss of operational efficiency or leakage. As per this findings, logistics inefficiencies, failed communications, manpower coordination and technology fragmentations are effectively linked together. For instance, poor digital integration can lead to scheduling mistakes, increasing transportation expenses, staff usage inefficiencies and dissatisfied customers. Similarly, relying on discounts in order to acquire customers drives lowers profit margins and does not solve any operational failings. Strategically, the findings indicate that the current aggregator model focuses more on market access and service coordination, but it is not sufficiently integrated into the system for long-term efficiency. Such inefficiencies may be exacerbated as healthcare aggregators keep growing in geographically dispersed markets. To increase profitability, cost-reduction programs should be backed by restructure business processes, adopt new technologies, and implement new mechanisms of coordination of services to reduce leakage along the diagnostic value chain.

4.3.4 Theme 3: Technology Adoption and Digital Transformation

Technology adoption and digital transformation have emerged as one of the most significant themes in qualitative analysis. The participants have consistently highlighted that the digital technologies play a pivotal role to optimise the operations of the healthcare aggregators within the Indian pathology sector. The aggregators highly depend on the technology driven systems for the scheduling of appointments, customer communication, logistics coordination, home sample collection and delivery of reports. The participants explained the challenges faced during integration of technology, fragmentation of digital systems and concerns related to cybersecurity and infrastructure which hamper operational efficiency and profitability. Simultaneously, the respondents also emphasize the effective use of technology to improve

coordination, customer satisfaction, operational control and long-term scalability. Based on the responses of the interviews, three major sub-themes have been identified for technology adoption and digital transformation.

Sub theme 3.1: Role of Digital Platforms in Operational Coordination

Most participants stated that the healthcare aggregators highly depend on the use of digital platforms for the management of operational activities across the pathology service chain. Participant 1 stated that the aggregators focus primarily on the digital booking systems, customer acquisition, logistics coordination and home sample collection while the laboratories conduct technical testing procedures. On the same note, Participant 7 remarked that the aggregators invest huge amounts in mobile applications, digital coordination systems and customer communication to enhance healthcare operations. The answers suggest that digital transformation has already been a part of the business model of healthcare aggregators in India. Multiple respondents pointed out that technology can facilitate the coordination of multiple operational activities. Participant 5 shared insights on the critical role that the digital coordination systems play in route planning, workforce scheduling, customer service, and logistics management. Furthermore, Participant 9 reported that logistics management and transportation scheduling involves real-time operational coordination of and, for timely sample collection and reporting, transportation. This indicates that digital systems can play a crucial part in home diagnostic services ensuring operational efficiency. These responses align with another study which states that the technology mediated business operations not only improve operational efficiency but also enhances coordination between the employees (Malik et al., 2023).

However, there are various challenges which are faced by the healthcare professionals for technology integration and digital adoption. Participant 7 states that the poor integration between appointment and reporting systems cause delayed feedback among aggregators and laboratories. This was due to the lack of communication between the aggregators and the laboratories. Moreover, Participant 4 mentioned that radiology centres also face scheduling conflicts and reporting mismatches owing to the lack of integrated coordination systems. The findings indicate that though the healthcare aggregators have adopted digital technologies, operational integration

between the service providers needs to be strengthened. Participant 3 highlighted that sometimes the instructions for tests and handling of specimens are not clear due to the lack of communication between the phlebotomists, aggregators and laboratories. Likewise, it was pointed out by Participant 8 that delays in processing and processing problems resulted from sub-optimal coordination of phlebotomists and laboratory teams. The results show that the Indian path lab sector is still undergoing digital transformation and needs to improve the interoperability of all the stakeholders involved in the pathology sector. Naik et al., (2022), states that the healthcare sector has started to adopt the various technologies such as Artificial intelligence, cloud data solutions, telemedicine and real time tracking to enhance business operations. Hence it is understood that the proper integration of technologies and mitigation of challenges can facilitate the operations of the healthcare aggregators in the Indian pathology sector.

Sub theme 3.2: Technological and Digital Infrastructure Limitations

While digital transformation is seen as a key asset to enhance the operational landscape, the participants repeatedly raised some of the technological and infrastructure aspects that have an impact on the healthcare aggregators. One of the issues which was discussed frequently by the participants was the lack of integrated digital systems between aggregators and diagnostic service providers. Participant 2 remarked that the maintenance of communication between the aggregators and laboratories through secure digital systems is quite difficult since the providers use separate operational platforms. This results in sub-optimal scheduling of appointments, sample tracking, and sharing reports. A key point highlighted by Participant 6 was the need for robust digital infrastructure and secure healthcare data management systems necessary to support the hybrid operational model. Likewise, Participant 7 noted that aggregators must invest in and deploy cybersecurity infrastructure, integrated technology platforms and operational management infrastructure that would help increase coordination and gain customer trust. Such answers imply data protection and digital security are necessary operational demands in the digital health world. Furthermore, Participant 10 shared that the adoption of the integrated communication systems or logistic management solutions would further raise the operating cost of aggregators in the short term. The responses of the participants are consistent with the findings of the existing literature. In the low- and middle-income countries such as India, infrastructure of the healthcare organisation

must be developed accompanied by technological integration and digital transformation (Patel et al., 2021). The responses of the participants and the existing literature indicate that the healthcare companies must heavily invest on the infrastructure to enhance business operations and increase profitability.

Sub Theme 3.3: Technology as a Driver of Profitability and Service Improvement

Participants widely agree upon the fact that effective adoption of technology can significantly contribute towards the improvement of profitability, operational efficiency and customer satisfaction in healthcare aggregator platforms. A majority of the respondents gave explanations of how digital technologies can contribute to decreasing operational fragmentation, increased coordination and better customer retention. Participant 7 agreed that better digital coordination would have the advantage of fewer service delays, more customer satisfaction and more rebooking. This could lead to a better return on the investment in the long run. Likewise, Participant 6 stated that technology integration can enhance the operational reliability and customer trust that positively impact towards financial sustainability. The interviews also uncovered that technology may facilitate improved logistics management and operational optimisation. Participant 9 noted that digital logistics systems have potential to help coordinate transportation, reduce operational wastage and reduce delays in sample collection services. Similarly, Participant 5 felt that the digital approach for the workforce management and operational tracking systems would assist in better route planning and optimisation of services. These results suggest that integration of technology offers essential benefits to reduce operational inefficiencies and increase margin retention for healthcare aggregators. In the Indian pathology sector, the healthcare aggregator firms must invest in information and communication technology such that enhanced operational and cost efficiency can be achieved (Ansari & Gupta, 2025). It is thus quite evident that technology can act as a driver of profitability and service improvement for the healthcare aggregator firms within the Indian pathology sector.

A critical evaluation of the findings indicates that the implementation of technology is not sufficient to transform healthcare services, and it must also be integrated into the healthcare service system. While large investments were made by healthcare aggregators for digital booking systems,

customer management platforms, logistics technology and communication tools, many operational inefficiencies exist due to fragmented technological infrastructures. The results show that the main challenge does not include lack of technology but also the interoperability between aggregators, laboratories, radiology centres and field employees. Consequently, information delays, scheduling conflicts, duplicated processes, and communication gaps continue to generate operational inefficiencies and margin leakages despite ongoing digital transformation efforts. Moreover, the findings underpin a strategic dilemma between short-term investment in technology and long-term benefits for operational efficacy. Smaller aggregators can also face issues in justifying significant advantages in integrated digital infrastructure, cybersecurity systems, and mechanisms for managing their workforce, despite their ability to afford significant investments in these areas. The findings indicate that healthcare aggregators have the potential to establish digital ecosystems, providing them a better chance in delivering sustainable profitability, enhancing customer experience, and eliminating operational fragmentation. Thus, digital transformation is not just a technology upgrade in the Indian pathology aggregation industry, but a key driver of competitive advantage.

4.3.5 Theme 4: Stakeholder Perception of the Proposed Hybrid Operational Model

The participants across different stakeholder groups perceived the model positively and believed that it could address the major operational inefficiencies and profitability challenges faced in the Indian healthcare aggregator pathology sector. The proposed model will comprise three components including in-house phlebotomy management by aggregators, outsourced laboratory processing for pathology testing, and radiology services conducted at specialized diagnostic centres. Most of the participants have elaborated how such an operational structure will help enhance coordination, operational control, customer satisfaction and profitability, while minimizing over-investment in infrastructure. Some financial, technological and management problems are also identified as the challenges to putting the model into practice on a scale. Based on the findings of the interview, four major sub themes were identified for stakeholder perceptions of the proposed hybrid operational model.

Sub theme 4.1: Improved Operational Control through In-House Phlebotomy

One of the major findings across the interviews was that the participants considered the in-house phlebotomy management as a beneficial factor of the proposed hybrid operational model. Participant 1 noted that in-house phlebotomy would enable aggregators to show enhanced control over operations, better coordination with customers. The other advantages noted by Participant 1 includes better quality of service, and less reliance on third parties for all sorts of service operations. Likewise, Participant 5 reported that aggregators could benefit from having a dedicated phlebotomist in-house to more effectively manage customer interactions like collecting samples and overseeing logistics. The findings indicate that the stakeholders have considered the management of collection operations quite essential for the minimisation of operational fragmentation. Some of the respondents also associated in-house phlebotomy with improved service reliability and customer satisfaction. Participant 3 stated that direct supervision of phlebotomy teams might be better trained, better organized and more efficiently coordinated. Similarly, Participant 8 said that aggregators may provide better coordination and efficiency in the segment of customer processes in sample collection, while leaving technical testing processes to the laboratories. The responses suggest stakeholders see in-house phlebotomy as a way to improve consistency in service delivery and reduce communication gaps. Moreover, the provision of in-house phlebotomy will also be beneficial for the patients suffering from chronic diseases (Lingervelder et al., 2022). This factor will also enhance the management of operations for the healthcare aggregator firms in the Indian pathology sector. Therefore, the findings suggest that in-house phlebotomy management could strengthen operational coordination, improve service consistency, and reduce dependency-related inefficiencies within the proposed hybrid operational model.

Sub theme 4.2: Outsourced Laboratory Processing and Radiology Service Efficiency

Most of the participants believed that the outsourcing of technical diagnostic operations such as pathology testing and radiology services remains operationally practical and financially efficient. The stakeholders explained that path labs and radiology centres have specific infrastructure, technical expertise and operational capacities that would not be easy and cheap for

aggregators to develop independently. Participant 2 explained that the laboratories bear all the expenses related to diagnostic infrastructure, equipment, reagents, staffing, and accreditation, and are also responsible for the core testing functions. Participant 4 explained that high-end diagnostic equipment such as MRI, CT scan, ultrasound and X-ray machines are expensive equipment that would be more efficient to outsource to the centres rather than keeping them in-house at the aggregator. These results confirm that pretty much all stakeholders understand the substantial capital requirement for investing in diagnostic infrastructure. The participants also emphasise on the fact that outsourced diagnostic processing allows aggregators to maintain operational flexibility while reducing the infrastructure costs. Participant 5 described how outsourcing certain laboratory processing and radiology functions would lighten both the investment load on infrastructure and provide operational flexibility and scalability. Participants also noted a lot of diagnostic testing capacities and radiology centres have special technical skills which are not yet accumulated by aggregators. Participant 6 said that it is crucial for laboratories to concentrate on technical services delivery when entrusting specialized diagnostic services to aggregators and coordinators will enhance customer management. Similarly, Participant 7 said that through outsourcing part of the technical processing function, diagnostic centres would not lose control over their specialised functions. At the same time, the aggregators would also have enhanced operational visibility on the customer-centred functions. The results show that stakeholders are favourable to an operational balance with all organizations having their means delegating to their core competency. The existing studies also find out that the workflow of healthcare organisations can improve through the outsourcing of the laboratory processing and radiology service along with implementation of clinical standards (Neto et al., 2025). Therefore, the findings suggest that outsourced laboratory processing and radiology services could help healthcare aggregators achieve operational flexibility, cost optimization, and improved service efficiency.

Sub theme 4.3: Profitability Improvement and Margin Retention Potential

Participants consistently explained that the proposed hybrid operational model can have significant contributions towards profitability improvement and margin retention for healthcare aggregators. A majority of stakeholders felt the current operational model causes unnecessary reliance on external service providers, margin leakages, duplication of operations and the loss of

leverage. Overall, the proposed hybrid scenario was considered to be an effective way of increasing value capture and minimizing operational inefficiencies. Participant 1 explained that if they were internally able to manage the phlebotomy, they would not have the operational leakages, improve customer experience and will be able to capture more revenue through cost management for aggregators. Likewise, Participant 6 said that minimizing operational fragmentation and customer turnover could have a positive impact on future financial sustainability. The results show that there is a correlation between profitability improvement and operational coordination and service optimisation, as well as revenue growth. Many participants also associated profitability improvement with better logistics management and reduced transportation inefficiencies. Participant 9 remarked that better control over logistics operations could minimise transportation delays, reduce repeated operational expenses and improve overall service efficiency. Participant 5 said a shift from reliance on third-party providers would enable aggregators to enhance their margin retention and operational control. Also, Participant 10 said that it sees greater ease of working together and less fragmentation creating the possibility to lower operating expenses and keep more margins on forward prices. The answers of the stakeholders suggest that the stakeholders see the hybrid model as a means to boost the strategic role of aggregators in the healthcare value chain. The other significant issue raised by participants was the link between customer satisfaction and the improvement of profitability. Participant 7 said increased repeat bookings and customer confidence through operating coordination and delivery efficiency reduction could positively contribute to profitability Similarly, Participant 8 noted that limiting operational mistakes and ensuring a better service could help cut down on service repeat costs and foster better customer connections. Therefore, participants consistently viewed the hybrid model as a strategy for improving both operational efficiency and customer experience simultaneously. The responses of the participants are consistent with the existing studies which state that the healthcare services must adhere to the use of developed models to enhance customer experience and gain increased profits (George, 2026). Overall, the findings indicate that the hybrid operational model could improve profitability, strengthen margin retention, and enhance operational efficiency through better coordination, customer satisfaction, and cost optimization.

Sub theme 4.4: Implementation Challenges and Scalability Concerns

Despite the positive perception of the proposed hybrid operational model, participants also identified various technological, financial and managerial challenges associated with implementation and scalability. Participant 1 said that there could be significant managerial issues with training, recruitment, and ensuring effective logistics and operation coordination in multiple cities during expansion. Likewise, Participant 5 stated that aggregators would need to invest in workforce management systems, logistics technologies and platforms for operating in the hybrid model effectively. These results suggest a model that will have long-term operational benefits but demands high implementation cost initially. Many participants also pointed out that integration of technology is a tremendous operational challenge. Participant 7 described this as requiring digital systems, cyber security infrastructure together with a real time operational management. Similarly, Participant 4 pointed out that the coordinated implementation of the systems of integrated scheduling, as well as digital reporting platforms, would be required for the development of effective coordination between aggregators and radiological centres. The above findings indicate that digital infrastructure development is a key element to the successful implementation of the hybrid operational model. Therefore, the findings suggest that successful implementation of the hybrid operational model largely depends on technological integration, workforce management, and strong digital infrastructure development.

The results indicate that the suggested hybrid operational model can overcome several structural shortcomings in the current health care aggregation model. Unlike traditional aggregator models that rely heavily on third-party providers for most operational activities, the hybrid structure selectively internalises customer-facing functions while continuing to outsource highly specialised diagnostic services. This provides more balanced distribution of operational control as well as use of the resources. The results show that stakeholders perceive the model to alleviate coordination problems, enhance service uniformity, and capture value without continuing to outsource highly specialised diagnostic services. Importantly, the model seems can compromise operational flexibility and profitability enhancement, leaving the aggregators with overall control on collection, logistics and customer interaction while utilising the technical skills of diagnostic laboratories and radiology centres. However, such findings also show that overcoming

technological integration issues, workforce management problems, and initial investment needs are critical to the successful implementation of the systems. Therefore, the hybrid model does not require complete eradication of outsourcing, but effective distribution of operational responsibilities. The hybrid approach offers a balance between control, flexibility, and infrastructure efficiency, making it a potential more scalable and sustainable option in the Indian healthcare aggregator pathology market.

4.3.6 Theme 5: Scalability and Implementation Feasibility

Sub Theme 5.1: Scalability Potential in Tier 1 and Tier 2 Cities

The interview findings demonstrated that most of the participants believed that the hybrid operational model was highly scalable especially in Tier 1 cities. Digital health care adoption, diagnostic infrastructure, and customer awareness were high in such locations. According to Participant 1, the proposed operational model was scalable in metropolitan cities since there was a steady rise in customer demand for preventive health care and home-based diagnostic services. The existing capacity of healthcare infrastructure and digital health services in the Tier 1 cities enabled scalability of the hybrid model of operation. As evidenced by Participant 7, improved internet connectivity and knowledge about digital healthcare in urban regions increased efficiency in coordinating the operations of healthcare aggregators. Scalability would be possible in the Tier 2 cities; however, there would be a need for well-established logistics systems and healthcare workers. Participant 6 indicated that the expansion into small cities depended on logistics networks and the availability of healthcare workers. Participant 9 agreed that proper transportation infrastructure and operational coordination networks were necessary to facilitate expansion into Tier 2 cities. These findings are consistent with the earlier works that revealed rapid digital healthcare growth in urban and semi-urban India. According to Sharma et al., (2023), The increase in smartphone penetration and the adoption of digital health care was supporting the growth of online healthcare portal expansion to Tier 2 and Tier 3 cities. This was mainly because there was more awareness about preventive health care and digital health care was being adopted.

Sub Theme 5.2: Operational Feasibility of In-House Phlebotomy

The second significant result to be mentioned here was that internal phlebotomy was seen both as a viable operation and a strategically smart solution for healthcare aggregators. Most of the interviewees agreed that internalizing sample collecting process might bring better coordination within operations, higher levels of customer service quality, and higher efficiency of work schedules. Training and controlling processes with regards to internal sample collectors might lead to minimizing delays and optimizing efficiency in sample collection process. In particular, participant 8 highlighted that internalization of processes might increase coordination of collection teams with laboratories because of direct overseeing of customer-related activities. Besides, many respondents indicated that internalization of processes could positively impact the reliability and effectiveness of healthcare services delivered to customers. Better route and workforce planning will eliminate transportation inefficiency as well as repetitive costs related to external logistics processes. Participant 9 emphasized that improved logistics control might help to minimize home sample collecting delays and ensure consistent operations. From these statements, it is clear that adopting internal phlebotomy services will enable increased process control as well as reducing reliance on outside agencies for logistical support. These findings have been confirmed by several studies related to healthcare decentralization and home-based diagnosis. According to Isakov et al., (2024), home-based services make it possible to improve convenience and flexibility of digital healthcare organisations. After the COVID-19 outbreak, there was an increasing tendency towards providing patients with decentralized and contactless healthcare services. Improved logistics control and coordination were identified as important aspects of ensuring high-quality healthcare services. Therefore, internal phlebotomy is feasible for healthcare aggregators and will provide operational advantages.

Sub Theme 5.3: Financial and Technological Challenges in Implementation

While the hybrid model was viewed positively by participants, some of them noted several financial and technological barriers to its implementation. Many participants pointed out the high cost of initial investment needed to recruit the workforce, introduce digital systems, and manage logistics. Participants 1 identified the need for an investment in hiring and training of phlebotomists. In addition, there was a need for investments in logistics systems according to participant 10. Participants also indicated technological integration as one of the barriers to the use

of a hybrid model. There is currently no technological integration, which creates inefficiencies in the process of testing and analysing samples. Participant 7 indicated that there is a need for digital integration, cybersecurity measures, and the use of real-time tracking systems to facilitate the implementation of a hybrid model. There is also the need to have integrated scheduling and reporting systems for facilitating coordination among aggregators and laboratories. This section indicates the relevance of technological integration in the operations of healthcare organisation. According to Kharat (2024), the use of IoT systems, digital platforms, and real-time coordination systems is crucial for improving the efficiency of healthcare operations. The use of digital infrastructure and data protection systems is essential for organisations that work with patients' personal health information.

Sub Theme 5.4: Workforce Management and Coordination Challenges

Another challenge related to scalability and feasibility was workforce management and operational coordination found from the interviews. Coordinating operations across various geographical locations may be challenging when scaling up the operations of the aggregator company. Participant 5 claimed that it would be difficult to maintain consistent performance across all sites. Participant 6 also pointed out that coordination of internal teams and diagnostic providers would need efficient operational management systems. The interviews also identified several other operational challenges for home healthcare services. Appointment clashes, delays in transport, and communication problems between collection teams and labs are the most common sources of inefficiencies. Participant 9 further noted that scheduling transport and rescheduling emergency appointments is a common operational challenge in the home sample collection service industry. The findings clearly indicate that scalability will require not only an investment in finance but also efficient management of large networks of operations. The findings are consistent with prior research on operational management challenges in healthcare logistics. It has been found by Mirza et al., (2024) that fragmentation of coordination process in the health care system results in inefficiency within the processes of delivering services. In like manner, according to Alasiri et al., (2024), operational integration and workforce coordination pose significant challenges for healthcare organizations adopting digital transformation approaches. Further, the use of advanced

workforce management systems and AI-driven coordination is becoming more necessary in healthcare organisations.

Based on the findings, the operational hybrid model is proposed and assessed for its scalability, which does not only depend on market demand, but also on the operational complexity of healthcare aggregators. As per the findings, participants consistently perceived the model as very scalable, particularly in Tier 1 cities, but this scaling process does need to be accompanied by the growth of logistics capabilities, systems for workforce management, as well as digital infrastructure. It has been found that the hybrid approach provides a competitive edge as it eliminates the significant infrastructure costs of vertically integrated diagnostic systems while enabling more efficient and flexible control of the diagnostic processes compared to the traditional aggregator approach. However, scalability is not automatic and may be constrained by workforce shortages, technological integration challenges, and coordination difficulties across geographically dispersed locations. Hence, the sustainability of the hybrid approach relies on the flexibility of the operations while maintaining a level of control over the organisation. The results indicate that the healthcare aggregators who are able to use technology, logistics, and coordinating the workforce effectively will have better chances of securing their sustainable growth and profitability in the Indian pathology market in the long term.

4.3.7 Comparative Discussion of Stakeholder Views

The findings of the study demonstrate that the various stakeholders in the Indian healthcare aggregator pathology sector have shared similarities and differences. This includes their perceptions of operating challenges, profitability issues, and hybrid healthcare models. Although these stakeholders belong to different sectors of operations, it is evident that there is an agreement between them regarding the issues of inefficiency and lack of financial sustainability in the existing healthcare aggregation process (Hazra & Bora, 2025). It was also found out that there are some interrelated issues like fragmentation of the healthcare system, coordination problems, pressure on prices, and integration of new technologies in the Indian digital healthcare platform industry. The healthcare aggregation stakeholders seem to concern themselves with the issues of operational management, customers, and improving profits. In addition, they all agree that their current

partnership suffers from the problem of being financially limiting, as they heavily rely on the diagnostic centres in terms of their tests and radiology services. Creation of value in digital healthcare enterprises faces difficulties due to issues like ownership of infrastructures and knowledge of how to use them by healthcare providers and diagnostic centres (Javanmardi, 2024). Additionally, diagnosis service providers and laboratory experts feel that operational and infrastructure costs associated with these services are quite high. The diagnostic services require investment in terms of infrastructure and equipment; hence it is justifiable to distribute revenues among them. While the logistics and operational stakeholders are more interested in aspects such as logistics efficiency, scheduling systems, and workforce management, those involved in the issue of technology concern themselves with the processes of digitalization, security issues, real-time coordination systems, and operational analytics. Logistics in the healthcare organization is important as far as its effective management leads to good operational performance. Healthcare organizations require health analytics and coordination systems for making decisions related to operational performance. Therefore, there is a need for integrated digital systems in such organizations.

All stakeholders agree that operational coordination and inefficiency in healthcare aggregation systems should be addressed. Most stakeholders appreciate the idea of selective operational control through hybrid healthcare models that can increase service quality and profitability in the long run. The existing literature suggests that a mixed structure is beneficial to companies since it helps them manage the cost aspect (Javanmardi, 2024). The rapid development of the digital healthcare sector in India facilitates the implementation of an expandable healthcare aggregation model. Moreover, greater internet access and the introduction of telemedicine are contributing to changes in the healthcare domain of India. Additionally, stakeholders also highlighted the growing importance of customer cantered healthcare services in improving competitiveness within the pathology aggregation sector. India’s private healthcare sector significantly remains fragmented with weak primary care, secondary service, and effective care (Mor, 2025). The absence of strong coordination between diagnostic centres, healthcare providers, hospitals, and logistic providers often results in delays in service delivery and increased operational costs. Also, the increasing demand for faster report delivery, home based healthcare services, digital accessibility, and transparent pricing has forced the healthcare aggregators to

adopt a more flexible and technology driven operational model. While stakeholders differ in their approaches to operational challenges, they acknowledge the need for improved operational coordination, technological integration, and new healthcare business model. The success of implementing the proposed operational model will depend on a coordinated approach towards financial management, technology adoption, logistic efficiency, and partnership with different diagnostic service providers.

4.3.8 Integration of Qualitative Findings with Theoretical Framework

4.3.8.1 Transaction Cost Economics (TCE) Theory

Transaction Cost Economics (TCE) theory is used to understand how organisations try to reduce the costs of transactions, coordination and inefficiencies (Patil et al., 2024). The interview results validate the significance of TCE for the understanding of profitability issues in the Indian health care aggregator pathology segment. The most cited inefficiencies were high coordination costs, delays for communications, fragmented logistics and reliance on third-party laboratories. Participants 1, 5, 6, and 10 gave examples of large investments in customer acquisition, transportation, scheduling, and coordination efforts among aggregators and their limited ability in the lab and pricing. Operational dependencies add to transaction costs and impact margin retention.

The findings also indicated that outsourcing all aspects of operational functions to external laboratories generates inefficiencies in monitoring, service quality inconsistencies and delays in communication. Participants 2, 4, 7 and 8 pointed out that the lack of connectivity between the electronic systems, scheduling issues and lack of coordination between collection teams and laboratories create operational complexity. TCE theory suggests that this kind of coordination failure leads to higher governance costs and lower organisational efficiency (Syed et al., 2023). The suggested hybrid operating model solves these issues of transaction costs by reallocating some operational activities, including phlebotomy and logistics management, to the laboratory department and keeping other, more capital-intensive, activities outsourced, such as radiology and other clinical areas.

The interviews also suggest that in-house phlebotomy can help to ensure smoother operational control, better communication and lower recurring operational costs. The participants repeatedly indicated that having direct control over the services that they deal with customers would make the scheduling more efficient, customer satisfaction greater and the operation more reliable. The rationale for this is based on TCE theory, which suggests that when it becomes costly and inefficient for the external market to coordinate activities, they will internalise. Thus, the qualitative results confirmed that the hybrid operational model would be beneficial for healthcare aggregators in reducing transaction costs, making the coordination more efficient and improving the profitability of the operation in the Indian patho sector.

4.3.8.2 Resource-Based View (RBV) Theory

The Resource-Based View (RBV) theory focuses on how organisations can get a competitive advantage by effectively using valuable, rare, inimitable, and well-organised resources and capabilities (Wartini et al., 2024). The interview results indicate that the present-day healthcare aggregators in the Indian pathology industry have a good grip over digital and customer management aspects, but are lacking in taking ownership of the crucial diagnostic equipment. Over and over, participants stated that laboratories and radiology centres are the ones who own testing equipment, technical knowledge and systems for reporting tests, and the aggregators are largely responsible for digital platforms, logistics, customer acquisition and appointment management. The results indicate that the reliance by aggregators on external diagnostic providers reduces the strategic value for aggregators and reduces profitability. Participants 1, 5, 6 and 10 highlighted that laboratories have a higher proportion of funds since they possess specialised diagnostic tools, including laboratory infrastructure, imaging tools, reagents and technical manpower. The RBV theory states that organisations with control of strategic resources have greater bargaining power and competitive advantage. Aggregators are finding it hard to control their prices, quality of services, and margins.

The suggested hybrid management system is similar to the RBV theory in terms of enhancing the capabilities of the organisations from within. In-house phlebotomy and logistics management could be great strategic assets for aggregators, participants said. Participants 3, 7 and

9 specifically identified that having direct control over customer-facing services would enhance the operational coordination, customer satisfaction and repeat bookings. By developing operational competencies through training programs, digital integration systems, and logistics management skills, aggregators can outpace their competitors in many areas. Thus, the qualitative results corroborate the claim that the hybrid operational model can help healthcare aggregators to improve their internal capacities, minimise dependence on operations, and ensure a sustainable competitive advantage in the Indian pathology market.

4.3.8.3 Theory of Reasoned Action (TRA)

Theory of Reasoned Action (TRA) is an explanation of the relationship between individual attitudes and subjective beliefs to behavioural intentions and decision-making processes (Sadeghi et al., 2024). The overall purpose of TRA in this study is to explore the relationship between customer perception, service experience, and operational reliability and the adoption and success of healthcare aggregator platforms in the Indian pathology sector. The results of the interviews indicated that satisfaction, trust, convenience, and service consistency are important factors in repeat bookings and profitability. Some participants highlighted that inaction in generating reports, lack of communication, inconsistent service quality or scheduling inefficiencies have a detrimental impact on customer trust. At the other end of the spectrum, participants 3, 5, 7 and 10 reported that delays due to external laboratories often leave customers feeling that the aggregator is responsible for this. TRA says customers' behavioural intentions are influenced by their attitudes towards service quality and perception of operational reliability. Bad service can decrease the likelihood that customers will return to healthcare aggregators.

The suggested operational model is a hybrid that could have a positive effect on customer behavioural intentions through improved operational coordination and service consistency. Consistent with this, participants repeatedly identified that in-house phlebotomy might enhance the scheduling of appointments, communication and interaction with patients. Improved coordination and quicker delivery of logistics could improve the positive attitudes of customers towards aggregator platforms. Improved logistics coordination and faster delivery services can boost positive customer attitudes towards aggregator platforms. Improved customer perceptions

can lead to higher behavioural intentions to use, customer loyalty, and positive word of mouth recommendations, according to TRA.

4.4 Chapter Summary

This chapter discussed the results of the quantitative and qualitative stages of the study. The analysis aims to set the profitability issues of healthcare aggregators that operate in the Indian pathology market and to test the viability of a suggested hybrid business model of in-house phlebotomy and outsourced laboratory that process the radiology solution. The quantitative analysis allowed the provision of a comprehensive evaluation of the financial and operational performance of the chosen healthcare aggregators. The results revealed that the existing aggregator model has a relatively low profit margin due to the high percentage that goes to partner diagnostic centres. The cost structure analysis demonstrated that pathology and radiology costs were the biggest cost elements in diagnostic packages. The idea of aggregators has led to a system where they only receive a small percentage of the entire package value even after delivering services. The analysis also revealed that the reliance on external diagnostic partners affects the pricing and reduces the capacity of aggregators to enhance profitability. The analytical analysis of the existing model and the hybrid model revealed a high level of financial benefits in regard to a high degree of control in the operations. The accounting estimates indicated greater gross and net margins with the hybrid model. Break-even analysis also revealed that the proposed model is able to break-even at a lower level of operation than the current model. The scalability analysis implied that the hybrid solution could enable long-term growth with efficient operations and quality of provided services.

The findings of the qualitative analysis corroborated the quantitative findings because the former offered more in-depth information about the experiences and perceptions of the stakeholders. The interviews indicated that there is a general issue of concern with margin pressure, reliance on diagnostic centres, lack of control over pricing choices and an increase in operational costs. Radiology services were always rated by participants as one of the costliest and hardest to deal with in the diagnostic packages. Most of the respondents mentioned that existing partnership arrangements offer less in terms of profit expansion and are usually problematic in ensuring that they deliver uniform quality of services. The qualitative analysis also identified several operational

inefficiencies such as difficulties in coordination, logistics, and lack of communication between aggregators and diagnostic providers. Respondents also had a positive attitude towards technological developments and digital transformation projects, which were considered to be significant tools of enhancing efficiency and customer experience. The majority of the stakeholders found the hybrid operational model suggested to be sensible and economically profitable. Most of them were of the view that in-house phlebotomy would improve control of the service, help improve customer relationships and also help increase profitability. Issues arise about costs of implementation, managing workforce, regulatory compliance, and the necessity of efficient operational planning in the expansion process. Both quantitative and qualitative results of the studies have proven the thesis that the existing healthcare aggregator model has severe constraints on profitability as it dominates heavily on external diagnostic centres. The evidence indicates that a hybrid operational approach will be a feasible solution to help boost margins, control operations and facilitate sustainable growth.

CHAPTER 5: SUMMARY, IMPLICATIONS, CONCLUSIONS (DISCUSSION)

5.1 Summary of Findings

This study focused on the Indian healthcare aggregator pathology industry's profitability issues and operational inefficiencies and highlighted the imbalance between the healthcare aggregators and third-party diagnostic service providers. The main purpose of the research was to examine the feasibility of implementing a hybrid operational restructuring approach that can enhance profitability, operational efficiency, scalability and lower infrastructure costs compared to a fully-integrated approach. The study was undertaken due to the surge in digital healthcare platforms in India and the challenges of running a sustainable business among the pathology aggregators. The study used a mixed-methods approach that involved quantitative and qualitative analyses to accomplish the research goals. The quantitative results were obtained by modelling and comparing the financial parameters of various healthcare aggregation business models, retained margin analysis, break-even analysis, cost structure evaluation and scalability assessment. Qualitative data was collected via thematic analysis of the perspectives of stakeholders such as healthcare providers, operational managers, logistics coordinators and diagnostic service providers. The combined approach allowed for a holistic view of both the economic and business landscape of healthcare pathology aggregators.

The findings showed that traditional aggregator models have significant operational inefficiencies with multiple parties having to coordinate, high dependency on third parties and unequal value added by the aggregators and diagnostic laboratories. Old platforms may carry the expense of acquiring customers, scheduling, logistics and customer operation and they only keep a small percentage of the diagnostic revenue. This makes it difficult for many aggregators to keep their profitability when they make inroads into their customer base at large scale and expand their digital footprint. The study also showed that the proposed hybrid model where phlebotomy is in-house and operational coordination is also in-house but pathologist processing and radiology infrastructure is outsourced, offers a more balanced and financially viable model. While doing comparative financial analysis, the hybrid model was found to generate better retained margins,

lower operational leakages, better unit economics and scalability benefits. The overall findings support the hypothesis that the operational ownership of select companies can greatly improve the profitability and sustainability of the healthcare pathology aggregation industry. Based on the results of the study, it was concluded that there were some structural and operational inefficiencies in the existing healthcare aggregator pathology model that would cause a decrease in profitability and sustainability of the model. Healthcare aggregators have made customer experience easier with digital booking systems and home sample collection but heavy reliance on third party diagnostic laboratories and lack of integration within the business models make them very financially at risk.

One of its key results was the disparity of value and revenue between aggregators and diagnostic centres. Aggregators carry out such operation intensive tasks as customer acquisition, digital marketing, customer support, home sample collection, logistics management and coordination of schedules. These activities can require a great amount of overhead and ongoing human resource management. Nevertheless, aggregators only have a small share of the total diagnostic revenues as the majority of services are captured by the diagnostic centres and pathology laboratories. Such imbalance significantly lowers the retained margins and affects profitability. It also found that reliance on third party laboratories is restrictive for operational control of aggregators. The role of the aggregator in the diagnostic testing process is to an extent passive, where they are not involved in the coordination, quality, turnaround time or pricing of the diagnostic testing. This dependency can lead to communication issues, missed reporting, time conflicts and varying customer experiences. The study also revealed that logistics issues pose significant operational challenges, especially for home sample collection and logistics monitoring. Inadequate coordination among the phlebotomist, logistics team and lab often adds to the cost of operations and delays in services.

Acquisition cost for customers of digital healthcare competition also came in as a major issue point. In urban healthcare markets, aggregators are keen to keep pace with their competitors by spending significant amounts on promotional incentives, digital advertising and customer engagement. The results, however, showed that the costs of these products are not adequately balanced by the revenue retained due to low margins on retained products and aggressive pricing

competition. In summary, the results identified the inefficiency in the traditional aggregator model which is scalable and available digitally, as a consequence of the dispersed operations, leakage in operations, limited negotiating power, and high degree of dependency on third parties. These inefficiencies, taken as a whole, decrease profitability and hinder the long-term sustainability of healthcare pathology aggregation businesses. The findings indicate that ‘operational challenge' is one of the major factors impacting the efficiency and profitability of healthcare aggregator pathology firms in India. The analysis revealed that there are significant inefficiencies in the service delivery process due to the lack of coordination among the different parts of the system consisting of aggregators, diagnostic laboratories, logistics and phlebotomists. The inefficiencies add to the cost of operations and can impact customer satisfaction and service reliability.

A major streamlining problem was noted was the lack of effective coordination of home samples. The study revealed that poor scheduling systems, delayed communication, and lack of consistent availability of phlebotomists often led to delays in appointments, multiple home visits, and inefficient route planning. These challenges made transportation more expensive and more affected the productivity of the workforce. In a few instances, delays also impacted samples, quality and turnaround time, which negatively impacted customer satisfaction and trust in aggregation platforms in the healthcare sector. Another challenge that was found was the logistics and transportation management as a significant burden in the operations. Pathology services are highly reliant on proper sample collection and timely delivery to a pathologist for diagnosis and this logistics pathway slowdown would have a major impact on the services provided. The study found that these challenges made transportation more expensive and more affected the productivity of the workforce. In a few instances, delays also impacted samples, quality and turnaround time which negatively impacted customer satisfaction and trust in aggregation platforms in the healthcare sector. The overall results showed that operational inefficiencies significantly result in cost leakage, weaken coordination and decrease the sustainability of the traditional models of healthcare aggregation in the long term.

One of the most important findings of this study is the proposed hybrid operational model that offers a sustainable and practical solution to the profitability challenges in the Indian pathology sector. The model includes the in-house phlebotomy and sample collection, the

outsourced processing of the pathology laboratory, and the outsourced radiology services. This model enables the aggregators to retain control over customer facing operations without having a large amount of money on the capital investment. The results demonstrate that the hybrid model enhances operational management, profitability, coordination, customer management, and scalability. Operating phlebotomy in-house, the aggregators obtain first-hand control over the scheduling of appointments, quality of sample collection, logistics, and dealings with customers. This saves reliance on the outside diagnostic centres and assists in the enhancement of service uniformity. Home sample collection service may positively affect customer convenience and efficiency of operations and enhance patient engagement (Gupta, 2024). Selective vertical integration established a balance between ownership and outsourcing. Aggregators can also concentrate on the high value operations activities rather than investing large amounts of money in pathology laboratories and radiology equipment. The approach is consistent with both the Theory of Transaction Cost Economies and the Resource Based View, which emphasise that organisations are better with integrating activities that add strategic value. The qualitative evidence revealed that the proposed model had a high level of support among stakeholders. The majority of the participants of the interviews were of the opinion that in-house phlebotomy would enhance coordination among service providers, operational inefficiency, customer relationship, as well as profit margin. The model was also perceived as more scalable by the participants since the expansion would not require significant investment of the laboratory infrastructure. The results show that the hybrid model offers a sustainable balanced approach between complete outsourcing and complete vertical integration. It enables healthcare aggregators to enhance profitability and operational performance and remain flexible.

The quantitative results of the research prove that the suggested hybrid functioning model can significantly enhance the financial results of healthcare aggregators of the Indian pathology industry. It was observed that the current model of aggregators is not profitable as a large percentage of the package revenues are given to partner diagnostic centres. This causes lots of margin leakage and restricts the capacity of aggregators to store values in their services. The same issues with being dependent on outside healthcare specialists and less value creation have been observed in recent studies of healthcare business. It was suggested in the financial modelling that incorporating the hybrid model can lead to improved Gross Margin and Net Margin as a result of

better cost management and optimisation of operation. Aggregators can decrease the reliance on middlemen and keep a bigger portion of the revenues by implementing in-house phlebotomy and sample collection. Such results reflect that the best cost of pathology could be realised while staying on with the laboratory and keeping the client facing activities. This minimises operational leakage and enhances economic performance of the unit. It is suggested that selective vertical integration has the potential to raise the level of profitability through lowering the cost of transactions and more effective use of resources (Kosiol et al., 2023). The break-even analysis also revealed that the hybrid model will be financially stable at a lower service volume than the traditional aggregator model. This gives a valuable business expansion benefit since aggregators are able to attain profitability much more quickly and increase financial risk is minimised. The model is more efficient in terms of capital as a huge sum of money is not needed to locate pathology laboratories and radiology infrastructure. The resources may rather be invested in customer acquisition, logistics, and in improving service quality.

The results of this paper demonstrate that the proposed hybrid model of operation has a high scalability and sustainability prospects in the Indian healthcare pathology market. The quantitative and qualitative findings indicate that the model could be used to make the business grow without necessarily having to invest huge sums of money on pathology laboratories and radiology facilities. The aggregators are able to operate at a reduced financial risk and with ease by outsourcing the pathology processing and radiology services and retaining the in-house phlebotomy. The model is appropriate to be extended to Tier-1 cities, where the demand on preventive healthcare, sample collection at home, and digital health services is still growing. Since the model does not entail complete ownership of diagnostic infrastructure, healthcare aggregators may access new markets much more rapidly and cheaply. Changes in the same direction have emphasised that healthcare business models offer enhanced flexibility and scalability in the fast-developing healthcare markets. The results also confirm the significance of growth supported with logistics. The successful alignment of phlebotomy teams and transportation networks with the laboratories of the patterns makes it possible to provide a greater number of customers with the service without compromising the quality. Digital integration is also essential in integrating scalability as technologies such as mobile applications, cloud-based systems, AI, data analytics, and automated scheduling improve operational coordination, customer management, and decision-

making processes. The qualitative results indicated that the majority of stakeholders considered technology-enabled operations as a key to the future growth and sustainability.

The results of this research are directly related to the low profitability and operational issues of the Indian healthcare aggregator pathology sector. The findings affirmed that over reliance on diagnostic centres decreases margins, diminishes operational control and generates inefficiencies in service delivery. The analysis of cost structures, operational challenges, perceptions of stakeholders, and the analysis of the proposed hybrid operational model all managed to reach all objectives of the research. The results also confirm that the hybrid model of in-house phlebotomy and outsourced pathology processing and radiology services can greatly enhance the financial and operational performance. The hybrid model increases the profitability, minimises operational inefficiencies, improves the scalability, and offers a more sustainable healthcare aggregation model to the Indian pathology market industry.

5.2 Discussion with Literature

5.2.1 Current Aggregator Model Analysis

The findings of this study showed that the prevailing healthcare aggregator pathology model was low retained margin, fragmented operations and high reliance on third party diagnostic labs. While healthcare aggregators have enhanced the accessibility of healthcare services and the convenience of patients, the findings revealed that these benefits in terms of operation have not been reflected in long-term profitability. The customer-facing operational expenses are high for aggregators such as logistics coordination, customer acquisition, scheduling management and platform maintenance and diagnostic labs still account for a large portion of the service revenue. The results are quite consistent with recent literature about digital health platforms and the health care operational ecosystem. There have been recent studies that have argued that healthcare platform models often suffer from inefficient operations due to a lack of central coordination among stakeholders and control on the essential healthcare infrastructure. The study of the complexity of digital healthcare platforms by Alt (2021), revealed that systems with multiple independent actors can be complex and experience coordination problems, administrative

difficulties and higher operating expenses, as a result of the fragmented service delivery structure. This aligns with the current study results which found that the aggregators are not profitable due to the high number of operational segments between the laboratories, logistics providers, phlebotomists and the platform operators.

Likewise, the results of third-party dependency are similar with the recent Indian healthcare management literature. A study by Shetty et al.,(2022), discovered that operational control, service coordination and the ability to keep performance efficient across different service stakeholders are often weak at healthcare intermediaries and third-party administration systems. In the current study, this is done specifically in the pathology aggregation sector as it is found that reliance on external diagnostic centres decreases the bargaining power of aggregators and constrains their ability to control turnaround time, service quality and price. The study also revealed that logistics inefficiencies and coordination deficiencies contribute to a higher amount of leakage and customer dissatisfaction. Research on eHealth and digital health in India by Das & Sengar (2022), also has supported that operation coordination issues, a lack of coordination among communication systems, and challenges related to technology integration are significant barriers for the efficient functioning of healthcare services. Moreover, Akhtar et al., (2022), identified the need for strong integration with the operational systems to ensure quality consistency and reliability of services. The observations are very similar to this one in the current study about the inconsistent service coordination and inefficient logistics management in aggregator pathology services.

The theoretical implications of the results are very strong in favour of Transaction Cost Economics (TCE), which states that over-reliance on outside service providers adds to the cost of coordination, uncertainty in operation and inefficiency in transactions. The existing aggregator model relies heavily on external diagnostic laboratories, which adds complexity to the operation and loss of managerial control. The findings also corroborate the Resource Based View (RBV) theory since it is difficult for aggregators to develop sustainable competitive advantage and long-term profit, if they have no control over the important resources of the operation.

The results of this research revealed that the existing healthcare aggregator model has worked out to be effective in enhancing access to diagnostic service, enhancing convenience, and

facilitating the delivery of digital healthcare. Using online systems, aggregators can link patients to a variety of pathology and radiology providers and help them easily book appointments, compare prices, collect samples at home and get access to the report. The model has been used to expand preventive healthcare and consumer involvement within the Indian diagnostic industry (Sharma, 2023). The results also indicate that the existing model is mostly reliant on third-party diagnostic centres to deliver services. Aggregators are more of an intermediary and they own limited core diagnostic infrastructure with comparison to traditional healthcare providers. The study established that the platform provides a disbalance in value capture with diagnostic centres that captures a large portion of the service revenue. The same issues have been raised in the businesses of digital platforms where the middlemen experience challenges in keeping enough value even with the creation of customer demand. The results also show that the rise in competition among aggregators has increased the price-based strategies and differentiation is hard and stricter on profitability.

5.2.2 Operational Challenges Identified

Based on the findings of this study, this research identified that there are a number of issues that are a hindrance to the current healthcare aggregator model for the Indian pathology industry in terms of its impact on profitability and long-term sustainability. One of the most important problems found was the reliance on external diagnostic laboratories for test processing. The quantitative analyses identified that the revenue mainly comes from the diagnostic partners, with the aggregators having a small contribution margin. The finding is consistent with the literature of Healthcare Aggregation which indicates that diagnostic institutions have a relatively huge bargaining power because they hold a hold over the core diagnostic infrastructure and testing capabilities (Panwar, 2021; Chen & Miraldo, 2022). As a result, aggregators continue to struggle to derive any value, even while they acquire customers, manage bookings and coordinate service. A further operational issue that was found was the high cost of home sample collection and logistics management. The main challenges for respondents were transportation costs, inefficiency in the routes, problems related to the phlebotomist's working schedule and sample handling risks. This is consistent with Lutfi (2024) which said that logistics management remains one of the most complex cost centres in pathology aggregation service. On the same note, AlSahly et al., (2024),

pointed out that delays in the transportation of goods, as well as improper sample packaging and management, can impact the quality of diagnostics, customer satisfaction, and the financial bottom line. Based on the results of the current research, it can be concluded that fragmented logistics systems play a major role in margin leakage and impact on the overall efficiency of operation. The study also revealed that acquisition costs put on the customer are still very high. Digital marketing campaigns, discounts and promotional offers remain critical tools for aggregators in the healthcare sector to compete in a many-faceted industry. These practices drive up sales, but compromise profit margins. Similarly, King et al., (2022) recommended that more attention be paid to the customer retention of healthcare industry platforms to enhance profitability.

Another operational challenge was complex technology adoption. While digital transformation is good for efficiency, the costs of investing in technologies like artificial intelligence, predictive analytics and integrated healthcare platforms represent difficulties for many aggregators. Kulkov et al., (2023) indicated that small health care organizations tend to be resource restricted for implementing high-level digital technologies. Moreover, Jain (2023) pointed out that FMCSA must dedicate significant resources to meet cybersecurity and data privacy regulations, which add to the cost of operation. Qualitative results also indicated the need to invest in technology to meet the financial pressures in the short term. The results also highlighted issues pertaining service standardisation and quality measures to be addressed by different diagnostic partners. It will involve many laboratories with different level of operation and providing consistent services to them will be a great challenge. According to Yadav et al., (2022), there are cases where regulatory gaps and quality variations continue to be prominent issues within Digital Healthcare Ecosystems. These challenges support the Transaction Cost Economics perspective that high levels of external dependence will lead to higher coordination costs and a decrease in value capture opportunities for healthcare aggregators.

This study found that there are still several operational issues that have a bearing on efficiency and sustainability of healthcare aggregators in the Indian pathology segment. Aggregators have to align patients, phlebotomists, logistics providers, pathology labs and radiology centres, which adds to the possibility of delays in communication and service inconsistency. Fragmented healthcare systems usually experience challenges in ensuring achieved

continuity and smooth interaction of care among various service providers (Mirza et al., 2024). Another problem is the increased reliance on digital technologies in daily operations. The digital medium makes things more convenient and accessible, and it demands ongoing cybersecurity investments, software upgrades, data management, and system integration. The risk of data privacy and information security is becoming a significant issue in healthcare organisations, complicating and expensive the operational management. The results also indicate that it is hard to keep the quality of the services uniform in several partner laboratories. The variations can be created through differences in the operational processes, turnaround time and quality standards among other factors of customer experiences. This can impact customer trust and long-term loyalty, which are significant in terms of building sustainable business growth.

5.2.3 Proposed Hybrid Model Analysis

The results show that the proposed hybrid operational model is a valid model to get rid of the profit limitations found in traditional healthcare aggregator model. The model integrates in-house phlebotomy by the company, outsourced laboratory processing and keeps radiology services at external diagnostic centres. This facilitates aggregators to maintain control over customer facing operations without the heavy investment needed to set up full labs for diagnostics. The findings showed that the profitability, operational efficiency and scalability had improved when compared to this conventional aggregator model. The proposed model has several advantages, including enhanced value capture. In the traditional model, large chunks of the revenue go to diagnostic partners. Aggregators can be able to take in the sample collection and phlebotomy activities which will enable them to be able to capture more of the value of the service. The result backs up the theory put forward by Åhlin et al., (2026), whereby selective vertical integration may lead to a more profitable outcome because of the decrease in intermediary costs. Similarly, Transaction Cost Economics suggests that organisations can reduce dependency related inefficiencies, when they have more control of activities that matter for their operations (Chen & Miraldo, 2022). The study results point to greater margin retention with selective internalisation without becoming the owner of diagnostic equipment.

The usage of the new model is based on the imperfections of the existing system pertaining to logistics. In-house phlebotomy teams enable aggregators to better manage transport coordination, sample collection quality, and scheduling. Lutfi (2024) suggested that internal logistics management has the potential to enhance operational control and minimize delay in providing services. Likewise, Mirza et al., (2024), highlighted the need for ecosystem coordination of healthcare systems to improve healthcare efficiency and continuity. The conclusions drawn from the results of this study clearly show that there is a significant reduction in leakages and customer satisfaction is enhanced with the introduction of in-house sample collection. Besides, it is possible to preserve customers by the better-quality control of services in the model. The sample collection process is at the aggregator's discretion, allowing for a consistent experience for customers and developing brand trust. This finding aligns with the results from Villalobos-Quesada et al., (2023), who found that adopting a customer-centric focus in health care service delivery has a positive impact on customer repeat purchase and long-term customer loyalty. Moreover, Nurjanti (2025) said customer retention positively affect the profit more sustainably than constantly acquiring customers. The proposed hybrid operational structure is overall effective to meet the above-mentioned operational weaknesses of the traditional aggregator structure. The findings reflect the research hypothesis as, through the use of the business model framework they have shown that selective vertical integration enables value capturing, logistics control, technological coordination and scaling of operations that result in increased profits and sustainable growth in the Indian healthcare aggregator pathology sector.

The results of this research indicate that the proposed hybrid model tries to mitigate several structural weaknesses in the current healthcare aggregator system. The hybrid model establishes a more balanced structure of operation by integrating both the internal capability and specialist outsourcing. The balance allows the aggregators to concentrate on the activities that have a direct impact on the customers' experience and still enjoy the technical competence of the external diagnostic partners. The findings discussion emphasised the integration of the Resource-Based View (RBV) that states that organisations may attain sustainable competitive advantage based on the creation of valuable internal capabilities. In-house phlebotomy and customer coordination as strategic resources will be hard to rival as proposed in the model. These abilities enhance brand recognition, better service quality and develop better customer connections. The results also show

that the hybrid model improves the flexibility in the organisation as the aggregators can use resources to the development and training of employees and innovation of services. This is the method through which organisations are able to be more responsive to changes in the market and expectations of customers.

The benefits of the proposed hybrid operational model can be understood by the ability of the model to combine operational ownership with strategic outsourcing. In contrast to the standard aggregator model that heavily relies on external labs and diagnostic centres for service delivery, the hybrid model incorporates certain key and lucrative services. This enables resources to be optimally allocated, and healthcare aggregators to capture a greater value from the value chain of the diagnostic services. The results show that aggregators who own customer activities such as phlebotomy, logistics coordination and service scheduling have more visibility and control of their operations. This helps them to enhance the quality of services, minimise delays and enhance optimisation of customer interactions while improving profitability. The results further show that a role for in-house phlebotomy services is more strategic than just collecting specimens. Having a strong relationship with the customer is essential for phlebotomists, as they ensure that each customer's experience is consistently satisfying. However, there is a limited understanding of mid-level health workers, such as phlebotomists, who form a key component of health care service systems (Gupta et al., 2024). Better control of collection operations enables aggregators to increase the reliability of appointments, decrease collection errors and lower transportation inefficiencies. This operational control has a positive impact on customers' trust (Shie et al., 2022). This stimulates the use of diagnostic services to speed up the development of customer numbers and reduce acquisition costs. The hybrid approach, therefore, helps not only to enhance the financial advantages, but also to boost customer retention and potential for long-term revenue generation. The other major benefit of the proposed model is that it minimises risk for dependency with third party diagnostic providers. In the current market model, a large part of the overall revenue of services is being collected by the diagnostic laboratory, and margin leakages are common in that case. The hybrid approach facilitates access to specialized diagnostic infrastructure in an outsourcing arrangement, whilst enhancing value capture by introducing partial ownership. As a result, this model offers numerous advantages of vertical integration without the massive investment cost often attributed to integrated diagnostic networks.

The results also reinforce the concepts of the Theory of Transaction Cost. The theory is that any activity undertaken by an organization would be better carried out in-house when the cost of coordinating, supervising and relying on external providers gets too expensive. These challenges are highlighted in the current healthcare aggregation model, which suffers from issues with coordination, quality of services, price flexibility and efficiency. Findings show that the internal transaction costs arising from the internal contracting process result in medical staff retention costs and in costs of control of the contract itself (Victor et al., 2023). Therefore, the proposed hybrid approach involves increased ownership of key operational functions and minimises these transaction costs. Likewise, the Resource-Based View theory emphasises that it is the rare organisational skills that give a firm a sustainable competitive advantage. In-house collection network, logistics management, and customer relationship building build valuable organizational resources which it is hard for competitors to duplicate. These capabilities further bolster the competitiveness of health care aggregators and actively support long-term profitability.

5.2.4 Financial Projections and Unit Economics

The financial results of the present research show that the hybrid model of operation offered can produce more positive financial results in comparison with the traditional model of the healthcare aggregator. The quantitative analysis proved that the existing model has the disadvantage of low profitability due to a significant amount of package revenue, which is paid to diagnostic laboratories and radiology centres. Healthcare aggregators are intermediaries, and they get a little portion of the total revenue after paying customer acquisition, logistics, marketing, and operational costs. This puts a strain on margins and reduces financial sustainability over the long term. The suggested hybrid model emphasises this financial structure to enable the aggregators to directly control the selected functions of operation, especially the phlebotomy and customer-facing functions. With these functions in-house, the aggregators will be able to keep a larger share of the service revenues and lessen the reliance on third-party services. The financial forecasts prepared in this study shows that the gross and net margin will improve because of the enhanced allocation of costs and operational effectiveness. The same results have been indicated in research on the topic of healthcare vertical integration, where the increased influence on the choice of operational

processes facilitates better performance in the financial domain and value retention (Amado, 2022).

The hybrid model also has considerable economic benefits in terms of not only cutting down on the waste of running services but also the ability to better coordinate between service providers. Healthcare aggregators can use limited resources optimally and still deliver quality service by eliminating redundant administrative tasks and improving service integration. Pathology processing and radiology infrastructure is still out-sourced, thus bypassing the significant capital expenditure needed when establishing and maintaining diagnostic facilities. The study by Mor (2025), also shows that the asset-light healthcare systems are more flexible financially and less risky in operations when compared to fully integrated healthcare systems. The results also show that digital technologies can bolster the financial results in the hybrid operating model. Use of automated scheduling, routing optimization software, customer relationship management (CRM) systems and data analytics can help to boost operational productivity and minimize wastage. Ali Mohamad et al., (2023), have demonstrated that the successful adoption of technology in healthcare organizations along with restructuring of operations tends to give better financial results and better resource utilization. Hence, it is concluded that the hybrid model is a viable option in the Indian healthcare aggregator pathology market on the financial front.

The unit economies also reflect the success of the suggested model. The results showed that a significant amount of diagnostic revenue is lost to third-party laboratories, resulting in a significant margin leakage in traditional aggregators systems. As a result, aggregators generally do not get high contribution margins even when they have a lot of customers. The hybrid approach will enhance revenue retention capabilities by bringing internalisation of the phlebotomy and customer coordination. This enables aggregators to bring in extra value from the diagnostic services and also opens the avenue for cross-selling preventive healthcare packages along with providing customised healthcare services. The results of these findings are aligned with the Resource Based Theory which depicts that organisations can achieve better performance by building their internal resources and capabilities. The other significant result is that there is a cost benefit in improved operational coordination because of lower service delivery costs. In the field

of healthcare service management, Huang et al., (2024), indicates that coordination in service delivery leads to better cost efficiency and customer satisfaction.

A second important factor of unit economies was customer retention. Operational control, service quality and communication are enhanced which also allows for strengthening customer relationships within the hybrid solution. This higher retention helps lower customer acquisition costs and boosts long-term customer value, gaining greater profitability. Abid et al., (2024), also identified that person-based health services models succeed in being financially sustainable via repeat use and longer engagement. The financial projections and the unit economics analysis shows that the proposed hybrid model will provide a balanced and sustainable financial plan that will help to achieve a better profit margin, lower operating costs, improved customer relationships and a strong competitive position in the Indian healthcare diagnostics industry in the long-term. Many of the healthcare aggregators engage in aggressive expansion programs, offering discounts and promotions. However, even though these strategies can help achieve increased sales figures, they may contribute to reduced margins and even increased financial burdens. The conclusions suggest that higher levels of operational control and value capture, alongside higher revenues, result in higher chances of profitability in the long run. That finding is supported by previous research on the health care platforms, in which the researchers state that ownership of the key elements of the process helps ensure long-term profitability and value capture (Lee & Kim, 2024). Client acquisition cost (CAC) is also an important measure of client acquisition in terms of the unit economic model. With an ever-evolving Indian healthcare diagnostics industry, the aggregators are spending considerable efforts and resources on digital advertising, promotion campaigns, and customer incentives. However, due to the low contribution margin, a considerable share of the costs of customer acquisition cannot be recovered. The proposed hybrid model helps solve this problem to some extent thanks to the increased profitability, optimization of customer lifetime value (CLTV), and retention in addition to increased efficiency and operational consistency. Such results demonstrate that profitability can be enhanced not only through the decrease in costs but also by increasing customers' satisfaction and engagement, which is achieved by improving retention (Nurjanti, 2025). In addition, the lack of need for the massive installation of diagnostic equipment makes this model sustainable because it incorporates unit economics. The model shows that the financial benefits of operational ownership of functions that engage

customers include reduced transaction costs, better coordination and increased value capture. This idea aligns well with the Transaction Cost Economics theory's principle of the fact that coordinating activities outside of the organization is more expensive than creating a centralized supply chain inside of the organization (Hennart & Verbeke, 2022). Thus, the implementation of the proposed hybrid model seems to be a viable option that can help healthcare aggregators enhance their profitability while ensuring flexibility.

5.2.5 Break-Even and Scalability Analysis

Break-even Analysis of Proposed Hybrid Model

The results in the study will be useful in providing evidence on the financial feasibility of the proposed hybrid operation model. A break-even analysis can help to determine how many services are needed to break even and begin to generate some profits. The results suggest that the conventional healthcare aggregator model needs a relatively large number of diagnostic tests to be profitable due to the large share of revenue handed over to an external panel of pathologists and radiologists. This has caused aggregators to have difficulties in sustaining the profits at the level they are looking for despite the increased number of customers. The hybrid model is proposed to improve the break-even performance through increased retained margin and reduced the inefficiencies in the operations. When phlebotomy is performed in-house, it adds more value to the organization as aggregators are in control of an important aspect of the service delivery process. This will help to improve contribution margins, and reduce the number of transactions required to offset the fixed costs. In a study by Kakani (2025), carried out on the same topic, it has been proposed that selective vertical integration can improve the efficiency of the operations, reduce transaction costs, thereby improving financial sustainability.

The results also suggest that the hybrid model will reduce the capital-intensive investments' exposure to risk. Aggregators do not need to set up their pathology labs and radiology centres but instead, keep outsourcing such special services and concentrate on the core business operations which create more value to them. The strategy reduces the overheads of a fixed cost and also the timeframe to break-even performance. Healthcare organizations are likely to manage

financial risks more effectively and sustain themselves over time with a flexible and technology-driven operating model, as highlighted by Kanaan et al., (2025). Also, incorporation of technology has a positive impact on break-even results. The use of digital scheduling software, route optimization and customer relationship management platforms helps to reduce administrative costs and improve the productivity of the staff. These efficiencies in operation lead to an increase in operating cost efficiency and profitability per transaction. Hence, the results indicate that the suggested hybrid model is able to reach financial sustainability sooner as compared to traditional aggregator model without compromising service quality and operational flexibility.

Scalability Analysis and Long-term Growth potential

The scalability analysis reveals that the proposed hybrid model can provide a solid foundation to develop in the long term in the Indian healthcare aggregator pathology industry. Scalability also involves the capacity to scale up an organization's operations without the costs. Based on the results, the hybrid model is more scalable as it is managed by the operation with relatively light asset-based business structure. An important benefit cited in the many testimonials to date from customers is the opportunity to reach new customers, across the globe, without the need for a significant capital investment in diagnostics. The purchase of diagnostic and radiology processing services by the healthcare aggregators has enabled them to enter new markets, by establishing phlebotomy and customer service networks as opposed to building expensive diagnostic laboratories. This makes the process of expanding into new Tier 2 and Tier 3 cities, where there is increasing demand for diagnostic services, much more efficient and cost-effective. According to Faizan et al., (2025), implementing decentralised health service delivery models and leveraging a digital environment provides increased access to health services and improved availability of health care and can also support the establishment of effective enterprise development.

The results of the break-even analysis reveal that the operational structure is a key factor in deciding the financial sustainability and scalability of healthcare aggregation models. The hybrid model proposed had the least break-even of 714 tests per month and the highest contribution of 1400 rupees per test, implying that it is more efficient in operations and the break-even will be

realised in the shortest time possible than any current models. Lower break-even volume lowers financial risk and allows organisations to attain operational sustainability at a quicker rate by covering their fixed costs at a higher rate. It is also shown that the contribution margin of the aggregator-based models, such as the PharmEasy-style model, is less since it is much reliant on the third-party diagnostic providers. This reliance results in increased operational leakage, loss of profitability, and an increased break-even point. Conversely, the Healthians-style hybrid model exhibited better financial performance by means of partial ownership of the operations, as it increased revenue retention and decreased the reliance on external service providers.

The Thyrocare-style centralised model and Dr Lal-style vertically integrated model were found to be highly efficient in terms of operations and had the potential to be highly profitable, but both had to achieve very large volumes of testing to meet their large infrastructure and operating expenses. These results show that though infrastructure-intensive models may be able to make profits in the long term, they tend to be very sensitive to the persistence of demand and the entry of large markets. On the whole, the suggested hybrid model is the most balanced as it will include the flexibility of operation, reduced infrastructure needs, and increased profitability retention. This balance will boost scalability, lessen financial strain, and facilitate sustainable long-term development in the field of healthcare diagnostics aggregation. The result shows that the break-even point is an important factor in organisational sustainability and maintenance of financial stability. The hybrid model reached the break-even point with about 714 tests per month, as compared to the aggregator model, such as PharmEasy, which required about 3750 tests per month. This significant difference proves that the suggested model can attain operational sustainability with a much lower level of demand. In real terms, a lower break-even point decreases the risk of market volatility, seasonal demand swings and competitive prices. Therefore, healthcare aggregators are more empowered to survive the slowdown in growth at least for a while, better prepared to get through the unpredictable times of the markets. The scalability analysis also highlights the strategic benefits of the proposed model. The hybrid model keeps the slim and flexible footprint, and enables a company to keep its business light-on-assets but still have oversight over customer-facing functions. An organisation has the capability of expanding in its geographical reach without high capital expenditure. This flexibility is crucial in the Indian healthcare market given the leverage that Tier-2 and Tier-3 cities possess, and the continued

presence in metros. Another important implication is the reduction of capital risk. While vertically integrated diagnostic chains can be profitable, they have the disadvantage of underusing the assets if demand growth slows down. The hybrid is the better choice when it comes to spreading operational risks. And it outsources capital-intensive work and keeps operations that drive customer experience and value capture under its own management. The scalability score of the proposed model is also high (14/15), indicating that the model is suitable for long-term growth. The results indicate that the proposed model effectively integrates operational strategies, financial viability, and service quality, providing a robust framework for future growth and expansion in the healthcare diagnostics sector of India.

5.3 Managerial Implications

The results of this study offer some significant managerial implications to the healthcare aggregators, diagnostic services providers, healthcare entrepreneurs and operational managers of the healthcare pathology aggregation industry in India. The study showed that the current healthcare aggregation system is the one with high problems of profitability and operational sustainability as a consequence of the fragmentation of operations, too much reliance on third-party diagnostic laboratories, low co-ordination mechanisms and retained margins. The Indian diagnostics sector is expected to grow further with a rise in digital healthcare and home-based diagnostics services and managers need to re-imagine their working models to ensure sustainable long-term profitability, efficiency and competitiveness (Shah, 2025). An important management takeaway from this research is the need for the operational ownership to be selective in the healthcare aggregation. The results showed that those aggregators who have no control over the laboratory that they use have low revenue retention, low control of their operations and high operational leakage. Managers should therefore re-think fully outsourced operational systems and wisely internalise those activities that have an impact on customer experience and in turn, on operational efficiency.

The proposed hybrid operational model shows that it is possible to optimize operational transparency and minimize labour inefficiencies, even with an in-house phlebotomy service, customer coordination systems, scheduling management and logistics without having to be totally

responsible for the acquisition of expensive laboratory infrastructure. With this strategy of selective vertical integration, a healthcare aggregator can have the best of both worlds of financial flexibility and control over performance. The results also highlight the importance of logistics optimisation and staff coordination in terms of enhancing the profitability of the organisations. Healthcare pathology services run in a very time-critical environment where sample collection, transportation and reporting time is critical for service quality and customer satisfaction. Poor route planning, irregular schedules of phlebotomists, multiple home visits and communication breakdowns have significant impacts on transportation, costs and operational inefficiency found in the study. Hence, managers should focus on investing in technologies for route optimisation, central scheduling software and monitoring systems for operations in real-time to enhance coordination between laboratories, logistics and field workers. A well-managed logistics system can help minimise leakage, increase the reliability of service and boost productivity of employees (Sebata, 2024).

One of the other key implications for managers is how to acquire and retain customers in a highly competitive healthcare environment online. It showed that a lot of healthcare aggregators are competing with one another on a discount basis and by aggressively marketing their digital products. While this can help to boost sales in short-term, it can cause serious issues due to the continued high customer acquisition costs relative to retained margins in the long-term. The key takeaway for managers is that they should shift from a price competition strategy to a value-based or differentiation strategy. Better turnaround time, better systems to support patients, reliability of service, the provision of preventive healthcare packages and the incorporation of digital healthcare services can make it easier to keep customers and lessen the reliance on unsustainable pricing models. An increased emphasis on customer trust and service quality may help to establish more sustainable long-term revenue streams (Shie et al., 2022). The study also emphasizes the important role of technology in healthcare aggregation management. The results showed that technology is not just a digital convenience tool, but something that can also become an integral part of operational management that can enhance coordination, efficiency and profitability.

Managers should put such focus on the investment in integrated healthcare technologies such as AI-powered scheduling systems, digital logistics management platforms, predictive

workforce allocation systems, centralized operational dashboards and automatic customer communication systems. These technologies can be used to help mitigate communications barriers among stakeholders and provide greater transparency and coordination of services (Shoaib et al., 2026). In highly competitive healthcare ecosystems, technology-based operational integration may be a key differentiator and sustainable competitive advantage. The findings also put light on the various aspects of stakeholder management and strategic partnership. Pathology aggregation companies need to work with a number of different stakeholders and players and effective coordination is crucial for successful operation. The research revealed that not very often there were weak collaboration mechanisms, with inconsistent quality of services, delayed delivery of services and inefficiency in the operation. Managers should thus develop more robust service contracts with diagnostic centres, performance-based agreements, quality monitoring systems and communication systems that are integrated across the diagnostic centres and hospital (Kebede et al., 2026). Enhanced inter-organisational coordination can help the digital healthcare ecosystem become more consistent and build customers' trust.

Furthermore, the study emphasises the significance of workforce management in the home healthcare and pathology services operations. Phlebotomists and field service workers help to ensure the quality of service and reliability of the operation. The results showed that workforce scheduling inefficiencies, lack of coordination and uneven training are significant factors in affecting work operational disruptions. Therefore, managers should target the strategies for workplace development such as professional training, digital monitoring systems of the workforce, performance evaluation systems and incentive-based systems for operation. Better workforce management can help increase service efficiency, minimise service delays and have a positive impact on customer satisfaction. The findings showcase that healthcare aggregators must be mindful of not building without building when it comes to strategic growth. Rapid expansion and rollout across geographies can lead to increased logistical inefficiencies and service coordination issues, especially as services become increasingly fragmented. Managers need to take a cautious approach in expansion and adopt a phased approach, however, with support from their operations, especially when entering Tier-2 and semi-urban healthcare markets. The research suggests that before going for a vigorous expansion in other markets, there is a need for having operational

standardization, having workforce available, technology integration and effective logistics system in place for scalable growth.

The proposed hybrid model illustrates how scalability and profitability can be achieved at the same time by having control over the operational aspects of greater importance and outsourcing the capital-intensive diagnostic infrastructure. Integrated operational coordination systems, selective vertical integration strategies, technology-driven management strategies and customer-focused service models are shown to be positively related to realizing sustainable competitive advantage in the changing healthcare diagnostics industry in India. The results further have key strategic relevance for various stakeholder groups in the healthcare diagnostics industry. While the desire for quick growth is a key objective for many digital healthcare platforms, the study shows that being the operational owner of selected functions can achieve higher financial benefits than growth. Therefore, Managers should examine their operating structures in order to determine the activities that can be carried out with a higher level of ownership, which leads to higher profit and higher customer satisfaction. The results indicate that diagnostic chains or laboratory partners need to become more partners with aggregators. Traditional revenue share negotiation leads to value capture imbalances and may constrain the sustainability of both parties. Performance-based partnerships, integration of operational systems and shared digital platforms can be used to enhance coordination and facilitate mutually beneficial growth opportunities. Given the ongoing transformation of healthcare ecosystems towards integrated service delivery models, such collaboration could be more critical in the future (Hermes et al., 2020).

The study can also serve as an important guide to those making a career move as a healthcare entrepreneur. The results indicate that a strategy of total vertical integration at an early stage can involve significant capital expense in building laboratory space, resulting in a high financial risk for the organisation. A business model with a hybrid character allows firms to enjoy greater financial flexibility, stay in control of the organization, and possess a sustainable growth strategy. Such a strategy may be useful specifically in cases when people have great ambitions for investment in the healthcare sector, yet the lack of infrastructure prevents them from pursuing it in such a way. From the perspective of an investor, it would be wise to focus more on operational

efficiency and unit economics than client growth. There is also a number of important measures related to the CLTV and operational metrics in particular.

5.4 Policy and Industry Implications

The results of this research give significant policy and industry implications for the Indian healthcare ecosystem for healthcare regulators, digital healthcare platforms, diagnostic service providers, investors, and policy makers. A significant shift towards digital aggregation of healthcare services in India has enhanced healthcare access, especially with online diagnostic booking and home-based pathology services. The present model of aggregation was shown to have significant profitability, coordination and operational sustainability problems. In general, the policy and industry actors need to create more comprehensive, technology-ready and operationally viable healthcare systems to facilitate the future development of the digital diagnostics industry. The study also revealed that there is a need for more robust regulatory frameworks to control digital healthcare aggregators which is one of the key policy recommendations. The findings showed that there are inconsistencies in service quality, turnaround time and customer experience due to poor coordination between aggregators, the diagnostic laboratories, logistics service providers and the healthcare professionals. Therefore, the policymakers should set the uniform rules of operation for home-based diagnostic services, sample collection, transportation and digital healthcare coordination systems (Gronvall et al., 2023). Standardisation across the regulatory landscape can enhance accountability in the healthcare aggregation space, increase reliability of services and eliminate inefficiencies across the business.

Furthermore, the results indicate that more technology integration should be promoted within the network of healthcare services. The study highlighted that poor communication networks, poor coordination of logistics and a lack of digital infrastructure are major causes of inefficiencies in operations. Interoperable health data systems, Central Digital health Platforms and AI tools for healthcare coordination enabled by the Government can bring great improvements in diagnostics operational efficiency (Abbas et al., 2026). In India, efforts towards digital healthcare transformation can also support the development of technology-driven pathology aggregation systems and enhance accessibility and service delivery efficiency. The other policy

implication is that of the regulation and monitoring of the activities of the home healthcare and diagnostics workforce. The results showed that phlebotomists and field-level health workers are key to ensuring quality of service and reliability of operations. But there are service delays and customer dissatisfaction due to inconsistent training and the lack of workforce coordination. Thus, it is recommended that the policy makers establish a certification process, sources of operation and training requirements of home diagnostics and quality standards of service for home diagnostics. Enhanced regulation of the workforce can lead to more efficient service operations, better patient safety and a greater degree of trust in the digital services provided in health care.

Industry-wise, the research reveals the increasing significance of operational sustainability in the wake of the increasing marketization. The focus for many healthcare aggregators is on pushing out customers and competition on the back of discounts. However, the results showed that overemphasizing short-term growth can lead to lower profits due to the continued high cost of operations and the high costs of customer acquisition. Hence, the industry representatives should move towards an operational model that is more sustainable, with a focus on efficiency, quality of service, retention and the distribution of the revenue in a more balanced way, beyond just focusing on price. The results also highlight the need for a more hybrid approach to operations in the healthcare diagnostics sector, to increase the mix of operational ownership and strategic outsourcing. The proposed hybrid model showed that profitability and scalability can be increased by outsourcing the capital-intensive laboratory infrastructure and keeping customer coordination and phlebotomist and logistics services in house. Traditional aggregation models may, therefore, need to be restructured by industry participants to ensure that they gain control over their operations without facing undue burden of infrastructure investments. This hybrid model may gain even greater significance in the coming years in the urban and semi-urban market of India as demand for healthcare grows.

The study also offers suggestions for healthcare investors and venture capitalists. In India, these platforms that provide healthcare services by leveraging technology have been able to lure a lot of investments, owing to the perception of the scalability of healthcare services through technology. However, it suggests that scalability does not necessarily provide for long-term profitability. Investors should consider the factors such as operational efficiency, unit economies,

retained margins, logistics and sustainable economies to understand healthcare aggregation companies beyond the customer growth numbers. According to Nandy (2025), investing in a single area of growth can expose healthcare technology platforms to financial instability in the future if there is not a proper level of innovation to resolve operational inefficiencies. Collaboration between healthcare aggregators, diagnostic laboratories, insurance providers, and public health systems is also emphasised within the findings, as enhanced relationships amongst industry participants can provide greater access to healthcare, improve operational coordination, and assist in supporting preventive healthcare initiatives. Public-Private Partnerships (PPP) can help expand access to diagnostic services and alleviate infrastructure constraints by integrating digital pathology aggregate systems into existing healthcare delivery systems in modernising India's healthcare system.

Overall, future research will need to place greater emphasis on developing patient-centric, ecosystem-based healthcare delivery systems versus creating a multitude of independent digital service delivery systems. It is crucial to integrate operation efficiency, technological integration, workforce coordination and service reliability into sustainable healthcare aggregation models to guarantee long-term stability and sustainability in the healthcare sector. Thus, policymakers and industry players need to cooperate to develop regulatory, technological and operational conditions to enable efficient and scalable healthcare diagnostics services that are financially viable and sustainable in India.

5.5 Limitations of the Study

Despite the fact that the study has offered significant information on profitability enhancement in the Indian healthcare aggregator pathology industry, it is still necessary to recognise that there are some limitations that can be applied in interpreting the study. The drawbacks are mainly associated with sample size, data availability, geographical area, methodological constraints and the practical application of the proposed hybrid operational model. The comparatively small sample size of the qualitative investigation is one of the main limitations of the research. The study included the perspective of only ten industry stakeholders, such as healthcare aggregator founders, diagnostic laboratory managers, radiology administrators and

phlebotomists. These respondents have extensive experience in the industry and offered specific information about operational and profitability issues. However, the sample might not be completely reflective to various experiences and views of all stakeholders involved in the Indian healthcare diagnostics ecosystem. Accordingly, the results can be conditioned by the individual experience of the sampled participants. The other limitation is associated with the quantitative analysis, which was carried out with the help of four healthcare aggregator companies based on financial and operational data. These organisations were chosen due to their relevance to the pathology aggregation services. Though the fact that there are only a few firms limits the generalisability of the financial results to the whole healthcare aggregation sector. Various organisations might have different business models, pricing strategies, market conditions and operational structures which could not be fully encompassed in the scope of this study.

The limitation also focused on the geographical aspects of the research. The data has been collected mainly in the selected Tier 1 and Tier 2 cities in India, where digital healthcare services and diagnostic aggregation platforms are quite developed. Therefore, these results might not be representative of the operational reality, profitability limitations, and infrastructure issues of the healthcare aggregators in rural and underserved nations. The overall applicability of the proposed model towards the other settings might be affected by differences in healthcare accessibility, logistic networks, customer behaviour, and diagnostic demands. The research is also based on self-reporting data gathered in the form of interviews and organisational data sources. Data triangulation efforts were undertaken to validate findings. However, some responses might have been affected by participant bias, less disclosure, or subjective interpretation of operational challenges. Similarly, inconsistency in reporting practices and cost assignment processes in the financial data reported by organisations can occur. Moreover, the suggested hybrid operating model was tested with the help of financial modelling and using scenarios instead of the actual implementation. Although the findings show a good profitability and scalability potential, the real operational performance may vary because of unpredictable market factors, regulatory and policy fluctuations, labour issues, technological constraints and competitive forces. The analysis is thus a review of the estimated performance and not actual operation outcomes.

5.6 Practical and theoretical recommendations

The results of this research give some applicable and theoretical suggestions on how to enhance profitability in the Indian healthcare aggregator pathology industry. Practically speaking, healthcare aggregators must consider implementing a hybrid business model that integrates in-house phlebotomy, outsourced pathology processing and coordinated radiology management. This would eliminate the errors in operations, increase the contribution margin and reduce the break-even point without incurring the expensive infrastructure costs of a full integrated diagnostic system. Aggregators also need to improve logistics coordination, agree on more favourable prices with diagnostic partners and leverage digital technologies in order to promote operational effectiveness, customer experience and service delivery. Moreover, organisations should constantly review the operational costs and profitability indicators to support effective strategic decisions and long-term business growth. Theoretically, the research adds to the scarce literature on profitability maximisation in healthcare aggregation solutions by combining the operational efficiency concepts with the analysis of financial sustainability. The paper stresses that the choice of the operational ownership must go hand in hand with the strategic outsourcing to achieve the best out of the value capture. The future scientist should consider extrapolating the study concerning hybrid healthcare aggregation models to other parts of the healthcare industry and geography.

Pathology aggregator firms should source digital integration and lab process automation technologies to optimise the functioning and minimise costs. Many pathology aggregators operate through a vast network of partner laboratories, collection centres and diagnostics which can lead to disconnected workflows and administration challenges. Adopting integrated laboratory information management systems (LIMS), automated reporting solutions, artificial intelligence-driven diagnostics, and digital scheduling facilities can improve operations and reduce risk of human error (Venkatesh et al., 2024). Streamlined sample tracking and reporting may help cut down on the lead time, which can enhance customer happiness and retention. The digital integration allows real-time tracking of laboratory performance, assisting management to detect inefficiency and guide in optimising resource utilisation. While the initial setup cost can be substantial, the benefits of these reduced operating costs, increased productivity and the better

patient experience can make a significant impact on profitability. Moreover, digital capabilities enable scalability, enabling aggregators to expand their network without increasing their administrative and operational costs.

Pathology aggregators must also diversify their revenue streams by increasing preventive services and implement a subscription-neutral-based diagnostic plan. The Indian healthcare market is becoming more aware, especially about preventive health management particularly in urban markets and patients suffering from chronicity. This trend can be leveraged by the aggregators through annual health packages, wellness monitoring programmes, corporate health screening contracts and subscription-based diagnostic contracts. These services accelerate recurring revenue and minimise the need for one-time diagnostic tests. Long-term customer engagement can be fostered through digitised health consultations, regular health assessment, and discounted testing services under a subscription-based model (Sun, 2025). Non-EU partnerships can also be used to expand market reach and customer acquisition, such as employers, insurance providers and wellness platforms. This transition of the business model from transactional to recurring revenue pattern has the potential to improve the revenue predictability, boost the customer lifetime value, enhance the profitability for pathology aggregators and enable them to support preventive healthcare outcomes.

In order to achieve asset-light growth, pathology companies should consider strategic partnerships and capital-heavy laboratory expansion. Partnerships with independent diagnostic Labs, hospitals, clinics, pharmacies, and healthcare technology vendors help to optimise infrastructure costs and extended geographical reach (Olaniyan et al., 2021). This collaboration can help organisations maximise existing diagnostic capability, enhance provision reach in poorly-served areas and enhance the quality of services. A quality assurance process should standardise and applied to partner facilities to provide uniformity of service. Also, aggregators can enter into volume-based deals which benefit from economies of scale, minimising testing expenses and boosting their profit margins. Cross-referral programs within strategic partnerships can also boost brand awareness in local healthcare environments. Optimising networks instead of extensive capital expenditures can help pathology aggregators rapidly penetrate the market, streamline

operations, and grow their sustainability by delivering significant profitability gains across a highly competitive healthcare environment.

This study's results have several theoretical implications for comprehending profitability and sustainable operation of digital healthcare aggregation systems. Healthcare platform performance is captured by existing theories, including the Transaction Cost Economics (TCE), the Resource-Based View (RBV), and the Theory of Reasoned Action (TRA), but the findings indicate that there is a need for developing the theories when they are used to predict the performance of pathology aggregation firms in emerging healthcare markets.

The results show that the traditional health care aggregator model has significant profitability leakage due to over-reliance on third party diagnostic providers. Although the TCE literature suggests that firms choose the governance structure that will reduce transaction costs, the current study finds that the cost of coordination, the power imbalance, and the margin erosion are ongoing challenges faced by healthcare aggregators that are not involved in production. To this end, future theory-building efforts in this field should be more nuanced and consider hybrid forms of governance as a new category of organisational forms in healthcare service ecosystems. It is proposed that a hybrid model of operation can achieve a combination of the flexibility benefits of outsourcing and the cost benefits of in-sourcing strategic activities, such as phlebotomy and customer-facing activities, to reduce transaction costs. Therefore, future research on TCE needs to focus on understanding the balance between organizational internal control and external partnerships. This theoretical development will enhance the understanding of governance decisions in digitally enabled healthcare markets where it is often not economically feasible to achieve full vertical integration.

The traditional thinking of the Resource Based View is that organisations have a competitive advantage because they possess valuable, rare, inimitable and non-substitutable resources. But the results indicated that the difference in profitability of healthcare aggregation firms may be attributed to something other than ownership of resources. The analysis identified that profitability gains are mostly related to its operational skills, not ownership of diagnostic infrastructure. The suggested hybrid model yielded better financial results, even though it lacked

as much physical resource as some of its competitors by being a vertically integrated company. This discovery indicates that future research on RBV should focus more on role capability orchestration and resource coordination instead of only resource ownership. Digital coordination systems, logistical optimisation features, home collection systems and operational integration mechanisms could be strategic resources that are more important to profitability than physical diagnostic resources. Based on these considerations, theoretical models of RBV should take dynamic operational capabilities as a fundamental dimension to the creation of competitive advantage in a platform-based healthcare ecosystem.

The Theory of Reasoned Action is a model that describes behavioural intentions using attitudinal and subjective norms. However, in the context of healthcare aggregators, there seems to be some other drivers affecting patient decisions that align with issues such as platform trust, diagnostic quality, and service clarity. According to the study, trust in diagnostic quality, turnaround time and operational reliability in addition to convenience and pricing is a driver of customer adoption of healthcare aggregation services. In light of this, future theoretical work should include platform trust, perceived service reliability and healthcare data security as other constructs that can affect behavioural intentions in digital health. This extension would enable an explanation of the TRA to be applied to technology adoption in healthcare and digital diagnostic services.

Among the most important results of the study, there is value capture asymmetry between aggregators and diagnostic service providers. The diagnostic centres that own diagnostic infrastructure capture a significant share of revenues, despite the healthcare aggregators building the customer demand and providing coordination for service delivery. Existing platform theories only consider the network effects and user growth, and only partially explain how value is shared among ecosystem actors. Theoretically, future studies should thus seek to integrate the two value capturing formulations to understand how value creation and value appropriation can be achieved in healthcare platforms. A framework to this end could incorporate elements from platform economics, TCE and RBV to provide an explanation of why some health care aggregation models are able to produce superior profitability, albeit under similar market conditions.

The quantitative results indicated that contribution margins, operational ownership and break-even thresholds have strong relationships with scalability. Theories of healthcare platforms that are in existence tend to focus on growth and adoption of the platform, but they do not offer much theoretical insight into financial scalability. Among all the operational structures analysed the proposed hybrid showed the lowest break-even volume and the best scalability performance. Scalability should not only be considered as the ability to grow and expand the market but also as the possibility to maintain profit and efficiency. Theories of the future should thus take into account financial scalability as an additional construct besides operational efficiency and competitive advantage. This way, one could offer a more complete picture of sustainable growth in the healthcare platform ecosystems. To conclude, the study proposes the continuation of some of the theories already presented in organisations and platforms to incorporate aspects of the actual healthcare aggregation systems. The results align with the creation of a theoretical framework that incorporates hybrid governance, capability integration, platform trust, value creation mechanisms and financial scalability as key factors to sustain the successful implementation of a healthcare platform in the long term.

5.7 Scope for Future Research

The present study aims to contribute significant insights into improving the profitability in India's pathology segment of the healthcare aggregator industry by proposing an operational model that combines two approaches. There are still several avenues to further research that can build upon and further clarify the results.

First, future studies can undertake large scale empirical studies with a larger sample size of healthcare aggregators, diagnostic laboratories, and healthcare service providers from several regions in India. Future research will be useful to validate the proposed framework with real-world financial and operational data from a larger sample of healthcare organisations whose primary focus is not on representative operational models.

Second, future studies might focus on long-term implementation issues of hybrid operational structures. In the present study, the methods of financial modelling and operational

projection are used to assess the profitability gains. Pre- and post-studies of organisations before and after implementation would give more solid evidence to the benefits and issues of working in the hybrid model and the sustainability results.

Thirdly, artificial intelligence, machine learning, and predictive analytics could be explored in future research for their impact on healthcare aggregation systems. As these technologies become more prevalent, there is a chance to explore how technological advancements affect the efficiency of operations, cost savings, and profitability. This study could help to clarify the relationship between the digital transformation and the performance of healthcare business.

Fourthly, future studies could go beyond pathology-based services to radiology, telemedicine, pharmaceutical aggregation and integrated healthcare ecosystems. The Indian healthcare landscape is becoming more and more digital, with multi-service interconnected platforms. There might be areas of common profitability drivers and areas of best practice in terms of operations across these sectors identified as a result of the comparative studies.

Finally, future research could explore customer behavioural factors related to the adoption of healthcare aggregators. However, the present research concentrates on operational and financial performance, other factors such as patient trust, service quality perceptions, digital literacy, pricing sensitivity, and privacy concerns can have a larger impact on the platform's sustainability in the long run. Combining a behavioural and operational approach would give a more complete picture of how successful the aggregation of health data is.

Sixth, future studies could be done to perform cross-country comparative analyses of healthcare aggregation models in other emerging economies like China, India, Brazil and markets in Southeast Asia. Such studies would help to identify whether the financial difficulties faced by Indian Pathologists are limited to India or are indicative of the general financial difficulty of emerging healthcare ecosystems.

Last but not least, future theoretical studies could lead to the creation of integrated frameworks that integrate the concepts and theories of both TCE and RBV, Platform Economics,

and Healthcare Ecosystem Theory. The results of the present study indicate a lack of a single theory that can fully explain the phenomenon of profitability dynamics in the healthcare aggregation business. This may lead to more robust explanations of value creation, value capture, scalability of operation and sustainability of digital healthcare platforms through the development of multidimensional theoretical models.

In general, further studies on new operational configurations, technologies and institutional arrangements that enhance profitability without compromising accessibility, affordability and quality of health services should be continued. These activities will help to build academic knowledge and education of sustainable aggregation models in emerging economies.

References

Abbas, S. R., Abbas, Z., Rehman, M. U., & Lee, S. W. (2026). Blockchain for smart healthcare: A systematic review of security, interoperability, and AI–IoT integration. *Digital Health*, *12*, 20552076261420985. https://doi.org/10.1177/20552076261420985

Abernethy, A., Adams, L., Barrett, M., Bechtel, C., Brennan, P., Butte, A., Faulkner, J., Fontaine, E., Friedhoff, S., Halamka, J. & Howell, M. (2022). The promise of digital health: then, now, and the future. NAM perspectives, 2022, pp.10-31478.https://doi.org/10.31478/202206e

Abid, M. H., Kumah, A., Newera, A., & Hafez, P. (2024). Patient-Centered Healthcare: From Patient Experience to Human Experience. *Global Journal on Quality and Safety in Healthcare*, *7*(4). https://doi.org/10.36401/jqsh-24-x2

Adekoya, A., Okezue, M. A., & Menon, K. (2025). Medical laboratories in healthcare delivery: A systematic review of their roles and impact. Laboratories, 2(1), 8. https://doi.org/10.3390/laboratories2010008

Agudelo, R., Pereañez, J.A., Muñoz, S.M.C., Granados, J. & Ceballos, M. (2025). e-Health applications for outpatient professional pharmaceutical care services: A scoping review. *Exploratory research in clinical and social pharmacy*, *17*, p.100567. https://doi.org/10.1016/j.rcsop.2025.100567

Aguirre-Duarte, N. (2025). Connecting the Dots: Digital Ecosystems and Interoperability's Essential Role in Achieving Integrated care and Person-Centred care [online].https://www.researchgate.net/profile/Nelson-Aguirre-Duarte/publication/385137700_Connecting_the_Dots_Digital_Ecosystems_and_Interoperability's_Essential_Role_in_Achieving_Integrated_care_and_Person-Centred_care_An_influential_analysis_of_applied_research_in_practice/links/671822de68ac304149ab9232/Connecting-the-Dots-Digital-Ecosystems-and-Interoperabilitys-Essential-Role-in-Achieving-Integrated-care-and-Person-Centred-care-An-influential-analysis-of-applied-research-in-practice.pdf

Åhlin, P., Almström, P., & Wänström, C. (2026). Decision-making in hospital-wide patient flow: a multiple-case study of leading academic hospitals. *Production Planning & Control*, 1-19. https://doi.org/10.1080/09537287.2026.2655748

Ahmad, M., & Wilkins, S. (2025). Purposive sampling in qualitative research: A framework for the entire journey. Quality & Quantity, 59(2), 1461-1479. https://doi.org/10.1007/s11135-024-02022-5

Ahmad, N., Alias, F. A., Hamat, M., & Mohamed, S. A. (2024). Reliability analysis: application of cronbach's alpha in research instruments. Pioneering the Future: Delving Into E-Learning's Landscape, 114-119. https://appspenang.uitm.edu.my/sigcs/2024-2/Articles/e-Book_SIGCSe-LearningVol8_2024.pdf#page=121

Ahmadi, S., Aqeel, U. & Gera, S. (2024). Healthcare Laboratories: a venture to ramp up health of rural India. Emerald Emerging Markets Case Studies, pp.1-20.https://doi.org/10.1108/EEMCS-04-2023-0126

Ahmed, S. K. (2025). Sample size for saturation in qualitative research: Debates, definitions, and strategies. Journal of Medicine, Surgery, and Public Health, 5, 100171. https://doi.org/10.1016/j.glmedi.2024.100171

Ajayi-Kaffi, O., Emmanuel, I., Azonuche, T. I., & Ijiga, O. M. (2025). Agile-Driven Digital Transformation Frameworks for Optimizing Cloud-Based Healthcare Supply Chain Management Systems. International Journal of Scientific Research and Modern Technology, 4(5), 138-156.https://doi.org/10.38124/ijsrmt.v4i5.1002

Akase, S., & Kpera, T. (2024). Ensuring Accuracy, Ensuring Life; a Crucial Role of Quality Management Systems in Medical Laboratories. *ScienceOpen Preprints*. https://doi.org/10.14293/PR2199.001258.v1

Akhtar, N., Khan, N., Qayyum, S., Qureshi, M.I. & Hishan, S.S. (2022). Efficacy and pitfalls of digital technologies in healthcare services: A systematic review of two decades. *Frontiers in Public Health*, [online] 10. doi:https://doi.org/10.3389/fpubh.2022.869793.

Al Hammad, Z. J., Al Mulhim, S. M., Al Raheb, Z. A. H., Al Dossary, F. A., Al Bahrani, E. A. A., Al Dossary, W. A. L., ... & Al Yasin, Z. A. (2025). Effectiveness Of Quality Indicators (EG, TAT, Error Rates) As Tools For Continuous Improvement In Clinical Laboratories: A Systematic Review Of The Evidence. *The Review of Diabetic Studies*, 254-271. https://doi.org/10.70082/8qr1mw26

Al Harith, A. A. M., Alsaed, Y., Al-Yami, A. M. A., al-Yami, H. H. M., Almansour, s., Al Mansour, a. H. R., ... & Alwadii, o. (2024). A comprehensive Review of Interdepartmental

Collaboration for Enhanced Patient Care. *JOURNAL OF ECOHUMANISM Учредители: Transnational Press London*, *3*(8), 1782-1791. https://doi.org/10.62754/joe.v3i8.4870

Alasiri, A. K., Atiq, A. A. ., Abdullah M, A., Edah, A. , M. ., Ibrahim A, A., Omar, T. H., Majed K, A. ., Alasiri, A. K. ., Alharbi, A. S., & Sofi, S. S. . (2024). Critical Analysis of Healthcare Policies, Technological Integration, And Economic Sustainability. Journal of Ecohumanism, 3(8), 5399. https://doi.org/10.62754/joe.v3i8.5185

Alasiri, M. A. Z., Alboqami, A. M. D., Alaslani, N. O. R., Almowalad, A. H., Al Samah, N. Y. F., Alghamdi, A. S., ... & Alsahafe, F. H. (2024). The Digital Transformation of Diagnostic Imaging: A Narrative Review on Cloud-Based Platforms, Artificial Intelligence Integration, and Global Networks in Modern Teleradiology. *The Review of Diabetic Studies*, 307-315. https://www.diabeticstudies.org/index.php/RDS/article/view/1432

Al-Assaf, K., Alzahmi, W., Alshaikh, R., Bahroun, Z., & Ahmed, V. (2024). The relative importance of key factors for integrating Enterprise Resource Planning (ERP) systems and performance management practices in the UAE Healthcare Sector. Big Data and Cognitive Computing, 8(9), 122.https://doi.org/10.3390/bdcc8090122

Alcantara, J. C., Alharbi, B., Almotairi, Y., Alam, M. J., Muddathir, A. R. M., & Alshaghdali, K. (2022). Analysis of preanalytical errors in a clinical chemistry laboratory: A 2-year study. Medicine, 101(27), e29853. https://doi.org/10.1097/md.0000000000029853

Ali Mohamad, T., Bastone, A., Bernhard, F., & Schiavone, F. (2023). How artificial intelligence impacts the competitive position of healthcare organizations. *Journal of Organizational Change Management*, *36*(8), 49-70. https://doi.org/10.1108/JOCM-03-2023-0057

Ali, A., Ali, H., Saeed, A., Ahmed Khan, A., Tin, T. T., Assam, M., ... & Mohamed, H. G. (2023). Blockchain-powered healthcare systems: enhancing scalability and security with hybrid deep learning. *Sensors*, *23*(18), 7740. https://doi.org/10.3390/s23187740

Almaiah, M. A., Hajjej, F., Ali, A., Pasha, M. F., & Almomani, O. (2022). A novel hybrid trustworthy decentralized authentication and data preservation model for digital healthcare IoT based CPS. *Sensors*, *22*(4), 1448. https://doi.org/10.3390/s22041448

AlSahly, S. N. S., Alothiqi, I. A. M., Alzahrani, N. A. S., Halawi, M. Y. M., Alharbi, Y. A. I., Hazazi, Y. A. A., ... & Dhafer, R. T. A. (2024). Evaluating Pre-analytical and Post-Analytical Errors in Laboratory Processes and Their Impact on Diagnostic Delay and

Patient Safety in Family Medicine Referrals. Vascular and Endovascular Review, 7(2), 293-298.http://verjournal.com/index.php/ver/article/download/978/821

Alt, R. (2021). Electronic Markets on platform complexity. *Electronic Markets*, 31(4), pp.737–742. doi:https://doi.org/10.1007/s12525-021-00517-9.

Alubaie, M. A., Sayed, M. Y., Alnakhli, R. E., Alshaia, F. I. N., Aldossary, S. B., Alsubaie, N. M., ... & Alahmary, M. D. A. (2024). The efficiency and accuracy gains of real-time health data integration in healthcare management: a comprehensive review of current practices and future directions. *Egyptian journal of chemistry*, *67*(13), 1725-1729. https://doi.org/10.21608/ejchem.2025.343595.10967

Amado, G. C., Ferreira, D. C., & Nunes, A. M. (2022). Vertical integration in healthcare: What does literature say about improvements on quality, access, efficiency, and costs containment? The International Journal of Health Planning and Management, 37(3), 1252-1298. https://doi.org/10.1002/hpm.3407

Ansari, G. G., & Gupta, R. S. (2025). Does ICT investment necessarily improve operational performance? An empirical analysis of health services firms in India. BMC Health Services Research, 25(1), 841. https://doi.org/10.1186/s12913-025-12984-3

AppsyOne (2026). Digital Transformation for Diagnostic Labs in India: Complete Guide. [online] AppsyOne. Available at: https://www.appsy.one/blog/diagnostic-lab-digital-transformation?utm [Accessed 12 May 2026].

Apte, A., Bright, H. R., Kadam, S., Sundarsanam, T. D., & Chandy, S. J. (2023). Implementation of e-pharmacy in India—facilitators, barriers, and its potential impact on cost, quality, and access to medicines: a scoping review. J Health Technol, 12(3), 45-57.https://doi.org/10.2196/preprints.51080

Aqeel, U., & Gera, S. (2023). Transformation in Indian health care: the Tata 1mg merger story. *Emerald Emerging Markets Case Studies*, 1-33. https://doi.org/10.1108/EEMCS-04-2023-0115

Asamoah, D. (2025). The role of health services regulation in healthcare delivery. Electr J Med Dent Stud, 14(1). https://doi.org/10.29333/ejmds/16003

Atariata, O., Asangansi, I., Adoghe, A., Alle, O., & Abdulsalam, U. (2026). Consolidation of health data to improve health data governance using the Multi-Source Data Analytics and

Triangulation platform. BMJ Health & Care Informatics, 33(1), e101837. doi:10.1136/bmjhci-2025-101837

Atmojo, A., & Wibisono, D. (2023). Proposed design of performance management framework for 3pl (third-party logistics) aggregator. International Journal of Current Science Research and Review, 6(06), 3121-3133.https://ijcsrr.org/wp-content/uploads/2023/06/05-03-2023.pdf

Avdasheva, S. B., & Geliskhanov, I. Z. (2025). Transaction cost economics: Lessons from past reforms and potential for the digital economy. Russian Journal of Economics, 11(3), 237-268.https://doi.org/10.32609/j.ruje.11.156897

Babatunde, S. O. (2024). Business model innovation in healthcare: A theoretical review of entrepreneurial strategies in the medical sector. *International Journal of Biological and Pharmaceutical Sciences Archive*, *7*(1), 148-157. https://doi.org/10.53771/ijbpsa.2024.7.1.0032

Bagga, G., Singh, H., & Hood, M. M. (2024). Revolutionizing Indian Healthcare: The Impact of Digital Health AI Telemedicine and Data Security. *IOSR Journal of Business and Management*, *26*(9), 30-34. DOI: https://doi.org/10.9790/487x-2609013034

Baron, R. & Haick, H. (2024). Mobile diagnostic clinics. *ACS sensors*, *9*(6), pp.2777-2792. https://doi.org/10.1021/acssensors.4c00636

Battista, F., Duregon, F., Vecchiato, M., Ermolao, A. & Neunhaeuserer, D. (2025). Sedentary lifestyle and physical inactivity: A mutual interplay with early and overt frailty. *Nutrition, Metabolism and Cardiovascular Diseases*, [online] 35(6), p.103971. doi:https://doi.org/10.1016/j.numecd.2025.103971.

Bazi, A., Emadi, V., Isfahani, P., Sarani, M., & Moghadam, M. P. (2025). A scoping review of virtual clinics in underserved regions: barriers and opportunities. BMC Health Services Research, 25(1), 1596. https://doi.org/10.1186/s12913-025-13710-9

Benda, A., Zerajic, L., Ankita, A., Cleary, E., Park, Y., & Pandey, S. (2021). COVID-19 testing and diagnostics: a review of commercialized technologies for cost, convenience and quality of tests. *Sensors*, *21*(19), 6581. https://doi.org/10.3390/s21196581

Bendowska, A., & Baum, E. (2023). The significance of cooperation in interdisciplinary health care teams as perceived by polish medical students. *International journal of environmental research and public health*, *20*(2), 954.https://doi.org/10.3390/ijerph20020954

Brady, A. P., Allen, B., Chong, J., Kotter, E., Kottler, N., Mongan, J., ... & Slavotinek, J. (2024). Developing, purchasing, implementing and monitoring AI tools in radiology: practical considerations. A multi-society statement from the ACR, CAR, ESR, RANZCR &RSNA. *Canadian Association of Radiologists Journal*, *75*(2), 226-244. https://doi.org/10.1177/08465371231222229

CAHL (2025). *The Hidden Cost of Inefficiency: How Poor Operational Efficiency Impacts Healthcare - California Association of Healthcare Leaders*. [online] California Association of Healthcare Leaders. Available at: https://ache-cahl.org/articles/the-hidden-cost-of-inefficiency-how-poor-operational-efficiency-impacts-healthcare/.

Caldecott, B., McCarten, M., Christiaen, C., & Hickey, C. (2022). Spatial finance: practical and theoretical contributions to financial analysis. Journal of Sustainable Finance & Investment, 1-17. https://doi.org/10.1080/20430795.2022.2153007

Carlos Ferreira, J., Elvas, L. B., Correia, R., & Mascarenhas, M. (2024). Enhancing EHR interoperability and security through distributed ledger technology: A review. In *Healthcare* (Vol. 12, No. 19, p. 1967). MDPI. https://doi.org/10.3390/healthcare12191967

Chakraborty, I., Ilavarasan, P. V., & Edirippulige, S. (2023). Critical success factors of startups in the e-health domain. Health Policy and Technology, 12(3), 100773. https://www.sciencedirect.com/science/article/pii/S2211883723000497

Chandra, M., Kumar, K., Thakur, P., Chattopadhyaya, S., Alam, F. & Kumar, S. (2022). Digital technologies, healthcare and Covid-19: insights from developing and emerging nations. Health and Technology, 12(2), pp.547-568.https://doi.org/10.1007/s12553-022-00650-1

Chandran, A., & Roy, P. (2024). Applications of geographical information system and spatial analysis in Indian health research: a systematic review. BMC Health Services Research, 24(1), 1448. https://doi.org/10.1186/s12913-024-11837-9

Chaudhary, S. R., Mathur, S., Chauhan, R., & Shah, S. (2025). Point of care devices in primary care setting in india: A scoping review. BMC Primary Care, 26(1). https://doi.org/10.1186/s12875-025-02984-x

Chen, J. & Miraldo, M., (2022). The impact of hospital price and quality transparency tools on healthcare spending: a systematic review. Health Economics Review, 12(1), 62. https://doi.org/10.1186/s13561-022-00409-4

Chen, Y., Lehmann, C. U., & Malin, B. (2024). Digital information ecosystems in modern care coordination and patient care pathways and the challenges and opportunities for AI solutions. *Journal of medical Internet research*, *26*, e60258. https://doi.org/10.2196/60258

Cheruku, V. R. (2025). Real-Time AI-Powered Predictive Analytics in Cloud-Based Healthcare Platforms: From Concept to Implementation. *Journal of Computer Science and Technology Studies*, *7*(4), 21-32. https://doi.org/10.32996/jcsts.2025.7.4.3

Chowdhury, R., & Sultana, R. (2023). The Role of ERP-Integrated Decision Support Systems In Enhancing Efficiency And Coordination In Healthcare Logistics: A Quantitative Study. International Journal of Scientific Interdisciplinary Research, 4(4), 265-285. https://doi.org/10.63125/c7srk144

Conley, J., Snyder, G. D., Whitehead, D., & Levine, D. M. (2022). Technology-enabled hospital at home: innovation for acute care at home. *NEJM Catalyst Innovations in Care Delivery*, *3*(3), CAT-21. https://doi.org/10.1056/CAT.21.0402

CRISIL, (2024). Assessment of the diagnostics industry in India [online]. [Accessed on: 27.02.2026. Available from: https://www.surakshanet.com/pdf/investor/CRISIL_Assessment%20of%20diagnostic%20industry_21.10.24_Final%20-%20Signed.pdf]

Cxooutlook.com (2021). Diagnostic Industry In India In 2021 - CXO Outlook. CXO Outlook. https://www.cxooutlook.com/diagnostic-industry-in-india-in-2021/

Daoutakou, M. & Kintzios, S. (2025). Point-of-care testing (POCT) for cancer and chronic disease management in the workplace: Opportunities and challenges in the era of digital health passports. Applied Sciences, 15(12), p.6906.https://doi.org/10.3390/app15126906

Darko, E. O., & Vlachos, I. (2022). Creating valuable relationships with third-party logistics (3PL) providers: a multiple-case study. Logistics, 6(2), 38. https://doi.org/10.3390/logistics6020038

Das, D. & Sengar, A. (2022). A fuzzy analytic hierarchy process-based analysis for prioritization of barriers to the adoption of eHealth in India. *International Journal of Medical Informatics*, 165, p.104830. doi:https://doi.org/10.1016/j.ijmedinf.2022.104830.

Dasaradharami Reddy, K., & Gadekallu, T. R. (2023). A comprehensive survey on federated learning techniques for healthcare informatics. *Computational Intelligence and Neuroscience*, *2023*(1), 8393990. https://doi.org/10.1155/2023/8393990

Dawadi, S., Shrestha, S., & Giri, R. A. (2021). Mixed-methods research: A discussion on its types, challenges, and criticisms. *Journal of Practical Studies in Education*, *2*(2), 25-36.https://oro.open.ac.uk/75449/1/Dawadi%2C%20Shreshta%20and%20Giri%202021.pdf

Delapedra-Silva, V., Ferreira, P., Cunha, J., & Kimura, H. (2022). Methods for financial assessment of renewable energy projects: A review. Processes, 10(2), 184. https://doi.org/10.3390/pr10020184

Digitalindia.gov.in, (2024). Ayushman Bharat Digital Mission - Digital India | Leading the transformation in India for ease of living and digital economy | MeitY, Government of India. Digital India | Leading the Transformation in India for Ease of Living and Digital Economy | MeitY, Government of India. https://www.digitalindia.gov.in/initiative/ayushman-bharat-digital-mission/

Dodson, P., Haase, A.M., Jeffreys, M. & Hales, C. (2024). Capturing patient experiences of care with digital technology to improve service delivery and quality of care: a scoping review. Digital Health, 10, p.20552076241282900.https://doi.org/10.1177/20552076241282900

Donaldson, C., Newbery, R., Mirabent, J.B. & Kallmuenzer, A. (2025). Decoding value exchange in entrepreneurial ecosystems through a service-dominant lens. *Small Business Economics*, *64*(3), pp.1057-1081. https://doi.org/10.1007/s11187-024-00935-x

Donkoh, S., & Mensah, J. (2023). Application of triangulation in qualitative research. Journal of Applied Biotechnology and Bioengineering, 10(1), 6-9. https://www.academia.edu/download/98007485/JABB_10_00319.pdf

Dube, B., Nkomo, D., & Apadile-Thokweng, M. (2024). Pragmatism: an essential philosophy for mixed methods research in education. *International Journal of Research and Innovation in Social Science*, *8*(3), 1001-1010. https://dx.doi.org/10.47772/IJRISS.2024.803073

Dudovskiy, J. (2023). *Research Approach - Research-Methodology*. [online] Research-Methodology. Available at: https://research-methodology.net/research-methodology/research-approach/.

Dutta, S. S. (2026). The lab report gamble: India's continued diagnostic quality crisis. India Today. https://www.indiatoday.in/health/story/india-diagnostic-labs-quality-crisis-accreditation-gap-patient-risks-2887998-2026-03-28

Eccher, A., Dei Tos, A.P., Scarpa, A., L'Imperio, V., Munari, E., Troncone, G., Naccarato, A.G., Seminati, D. & Pagni, F. (2023). Cost analysis of archives in the pathology laboratories: from safety to management. *Journal of Clinical Pathology*, *76*(10), pp.659-663. Doi: https://doi.org/10.1136/jcp-2023-209035

Ekaireb, R., Yap, A., & Kucejko, R. (2024). Vertical Integration and Market Consolidation in Healthcare: Policy Drivers and Impact on Physicians and Patient Care. *Seminars in Colon and Rectal Surgery*, *35*(3), 101038–101038. https://doi.org/10.1016/j.scrs.2024.101038

El Khatib, M., Al Mulla, A., & Al Ketbi, W. (2022). The role of blockchain in e-governance and decision-making in project and program management. Adv. Internet Things, 12(03), 88-109. https://doi.org/10.4236/ait.2022.123006

Elets News Network. (2026). AI in Healthcare Transforming India's Hospital Ecosystem. Retrieved May 30, 2026, from eHealth Magazine website: https://ehealth.eletsonline.com/2022/07/national-medical-commission-disapproves-of-medical-aggregators-encourages-use-of-independent-platforms/

Elgeddawy, M., & Abouraia, M. (2024, July). Pragmatism as a research paradigm. In *European Conference on Research Methodology for Business and Management Studies* (pp. 71-74). Academic Conferences International Limited. https://www.researchgate.net/profile/Mohamed-Elgeddawy/publication/381802464_Pragmatism_as_a_Research_Paradigm/links/6748cbf13d17281c7de6f617/Pragmatism-as-a-Research-Paradigm.pdf

Fahim, Y. A., Hasani, I. W., Kabba, S., & Ragab, W. M. (2025). Artificial intelligence in healthcare and medicine: clinical applications, therapeutic advances, and future perspectives. European Journal of Medical Research, 30(1), 848.https://doi.org/10.1186/s40001-025-03196-w

Faiyazuddin, M., Rahman, S. J. Q., Anand, G., Siddiqui, R. K., Mehta, R., Khatib, M. N., ... & Sah, R. (2025). The impact of artificial intelligence on healthcare: a comprehensive review of advancements in diagnostics, treatment, and operational efficiency. Health science

Faizan, M., Han, C., & Lee, S. W. (2025). Policy-driven digital health interventions for health promotion and disease prevention: a systematic review of clinical and environmental outcomes. In *Healthcare* (Vol. 13, No. 18, p. 2319). MDPI. https://doi.org/10.3390/healthcare13182319

Fatima, G., Alhmadi, H., Ali Mahdi, A., Hadi, N., Fedacko, J., Magomedova, A., Parvez, S., & Mehdi Raza, A. (2024). Transforming Diagnostics: A Comprehensive Review of Advances in Digital Pathology. Cureus. https://doi.org/10.7759/cureus.71890

Feulner, S., Guggenberger, T., Stoetzer, J. C., & Urbach, N. (2025). Beyond disintermediation: A multiple case study of emerging intermediary roles in blockchain applications. Electronic Markets, 35(1), 98.https://doi.org/10.1007/s12525-025-00832-5

Finance.yahoo.com. (2025). India Diagnostic Laboratories Market Report 2025-2030: Digital Innovation and Personalized Care Transform the Landscape. Yahoo Finance. https://finance.yahoo.com/news/india-diagnostic-laboratories-market-report-124500395.html

Financialexpress.com. (2022). The Financial Express. [online] Available at: https://www.financialexpress.com/life/helping-consumers-test-the-worth-of-diagnostic-offerings-2647540/?utm [Accessed 12 May 2026].

Fitzpatrick, P.J. (2023). Improving health literacy using the power of digital communications to achieve better health outcomes for patients and practitioners. Frontiers in digital health, 5, p.1264780.https://doi.org/10.3389/fdgth.2023.1264780

Fleming, K. A., Horton, S., Wilson, M. L., Atun, R., DeStigter, K., Flanigan, J., Sayed, S., Adam, P., Aguilar, B., Andronikou, S., Boehme, C., Cherniak, W., Cheung, A. N., Dahn, B., Donoso-Bach, L., Douglas, T., Garcia, P., Hussain, S., Iyer, H. S., & Walia, K. (2021). The Lancet Commission on diagnostics: transforming access to diagnostics. The Lancet, 398(10315), 1997–2050. https://doi.org/10.1016/s0140-6736(21)00673-5

Gaffney, H., & Mirza, K. M. (2025). Pathology in the artificial intelligence era: Guiding innovation and implementation to preserve human insight. Academic Pathology, 12(1), 100166. https://doi.org/10.1016/j.acpath.2025.100166

Geeks for geeks, (2025). Phlebotomist Salary in India [online]. Accessed on: 09.03.2026. <Available from: https://www.geeksforgeeks.org/gfg-academy/phlebotomist-salary-in-india/>

Geissdoerfer, M., Vladimirova, D. & Evans, S. (2018). Sustainable business model innovation: A review. *Journal of cleaner production*, *198*, pp.401-416. https://doi.org/10.1016/j.jclepro.2018.06.240

George, A. S. (2026). Healthcare Monopoly and Patient Welfare: Economic Analysis of Essential Dialysis Services in Underserved Markets.https://www.researchgate.net/profile/A-Shaji-George/publication/403026893_Healthcare_Monopoly_and_Patient_Welfare_Economic_Analysis_of_Essential_Dialysis_Services_in_Underserved_Markets/links/69c03c099f53d47411bf034c/Healthcare-Monopoly-and-Patient-Welfare-Economic-Analysis-of-Essential-Dialysis-Services-in-Underserved-Markets.pdf

Georgiou, A., Li, J., Hardie, R.-A., Wabe, N., Horvath, A. R., Post, J. J., & Pearce, C. (2021). Diagnostic Informatics-The Role of Digital Health in Diagnostic Stewardship and the Achievement of Excellence, Safety, and Value. Frontiers in Digital Health, 3. https://doi.org/10.3389/fdgth.2021.659652

Getachew, E., Adebeta, T., Muzazu, S.G., Charlie, L., Said, B., Tesfahunei, H.A., Wanjiru, C.L., Acam, J., Kajogoo, V.D., Solomon, S. & Atim, M.G. (2023). Digital health in the era of COVID-19: Reshaping the next generation of healthcare. Frontiers in public health, 11, p.942703.https://doi.org/10.3389/fpubh.2023.942703

Giansanti, D. (2025). April. The future of healthcare is digital: unlocking the potential of mobile health and e-Health solutions. In Healthcare (Vol. 13, No. 7, p. 802). MDPI.https://doi.org/10.3390/healthcare13070802

Gizaw, Z., Astale, T., & Kassie, G. M. (2022). What improves access to primary healthcare services in rural communities? A systematic review. *BMC Primary Care*, *23*(1), 313.https://doi.org/10.1186/s12875-022-01919-0

Goodair, B., & Reeves, A. (2022). Outsourcing health-care services to the private sector and treatable mortality rates in England, 2013–20: an observational study of NHS privatisation. The Lancet Public Health, 7(7), e638-e646.https://doi.org/10.1016/S2468-2667(22)00133-5

Grand View Research. (2025). Pathology Laboratories Market Size & Trends Report, 2030. [online] Available at: https://www.grandviewresearch.com/industry-analysis/pathology-laboratories-market-report.

Grand View Research. (2026). India Pathology Laboratories Market Size & Outlook, 2030. [online] Available at: https://www.grandviewresearch.com/horizon/outlook/pathology-laboratories-market/india.

Gronvall, G. K., Rao, S. B., Van Meter, S., Borden, A., & Inglesby, T. (2023). Proposal for a national diagnostics action plan for the United States. *Health Policy OPEN*, *5*, 100099. https://doi.org/10.1016/j.hpopen.2023.100099

Gruijters, S. L., & Peters, G. J. Y. (2022). Meaningful change definitions: Sample size planning for experimental intervention research. Psychology & Health, 37(1), 1-16. https://doi.org/10.1080/08870446.2020.1841762

Gu, G. Y. (2024). Technology and disintermediation in online marketplaces. Management Science, 70(11), 7868-7891.https://papers.ssrn.com/sol3/Delivery.cfm?abstractid=4150094

Gupta, A. (2025, December 29). *India diagnostic chains expanding labs as testing demand surges*. Medical Buyer. https://medicalbuyer.co.in/india-diagnostic-chains-expanding-labs-as-testing-demand-surges/

Gupta, M., Karnatak, N., & Jain, M. (2024). Understanding the Technology-Mediated Home Phlebotomy Ecosystem in India. *Proceedings of the ACM on Human-Computer Interaction*, *8*(CSCW1), 1-26.https://dl.acm.org/doi/pdf/10.1145/3637421

Gupta, P. & Nandraj, S. (2023). Challenges and gaps in regulating medical laboratories in India. Medical Law International, 23(4), 351-367. DOI: 10.1177/09685332231194199

Hanna, M. G., & Ardon, O. (2023). Digital pathology systems enabling quality patient care. Genes, Chromosomes and Cancer, 62(11), 685–697. https://doi.org/10.1002/gcc.23192

Hanna, M. G., Pantanowitz, L., Dash, R., Harrison, J. H., Deebajah, M., Pantanowitz, J., & Rashidi, H. H. (2025). Future of artificial intelligence—machine learning trends in pathology and medicine. Modern Pathology, 38(4), 100705. https://doi.org/10.1016/j.modpat.2025.100705

Hanna, M.G., Ardon, O., Reuter, V.E., Sirintrapun, S.J., England, C., Klimstra, D.S. & Hameed, M.R. (2022). Integrating digital pathology into clinical practice. *Modern Pathology*, *35*(2), pp.152-164. https://doi.org/10.1038/s41379-021-00929-0

Haripriya, R., Khare, N., Pandey, M. & Biswas, S., (2025). A privacy-enhanced framework for collaborative Big Data analysis in healthcare using adaptive federated learning aggregation. Journal of Big Data, 12(1), 113. https://doi.org/10.1186/s40537-025-01169-8

Hazra, S., & Bora, K. S. (2025). Capitalization of digital healthcare: The cornerstone of emerging medical practices. Intelligent Pharmacy. https://doi.org/10.1016/j.ipha.2024.12.002

HealthCareOnTime. (2025). How Long Does It Take to Get Results from an At-Home Blood Test in India? HealthcareOnTime. https://www.healthcareontime.com/health-tips/how-long-does-it-take-to-get-results-from-an-at-home-blood-test-in-india/?srsltid=AfmBOoq7SLx6TizBUpUbU_D4iA7TsHbnoGbTncxgAg93Va89QdH6G8df

Heaton, J. (2022). "Pseudonyms are used throughout": A footnote, unpacked. Qualitative Inquiry, 28(1), 123-132. https://doi.org/10.1177/10778004211048379

Heeringa, J., Mutti, A., Furukawa, M.F., Lechner, A., Maurer, K.A. & Rich, E. (2020). Horizontal and vertical integration of health care providers: a framework for understanding various provider organizational structures. *International journal of integrated care*, *20*(1), p.2. DOI: https://doi.org/10.5334/ijic.4635

Hermes, S., Riasanow, T., Clemons, E. K., Böhm, M., & Krcmar, H. (2020). The digital transformation of the healthcare industry: exploring the rise of emerging platform ecosystems and their influence on the role of patients. *Business Research*, *13*(3), 1033-1069. https://doi.org/10.1007/s40685-020-00125-x

Hickmann, E., Richter, P. & Schlieter, H. (2022). All together now–patient engagement, patient empowerment, and associated terms in personal healthcare. BMC health services research, 22(1), p.1116.https://doi.org/10.1186/s12913-022-08501-5

Hinzmann, R. (2023). Direct-to-consumer testing–benefits for consumers, people with disease and public health. *Clinical Chemistry and Laboratory Medicine (CCLM)*, *61*(4), 703-708. https://doi.org/10.1515/cclm-2023-0007

Hoffman, S., & Ganguli, I. (2025). Access to Primary Care and Health Care Fragmentation. *Case Legal Studies Research Paper*, (2025-4). https://papers.ssrn.com/sol3/Delivery.cfm?abstractid=5146577

Huang, S. W., Weng, S. J., Chiou, S. Y., Nguyen, T. D., Chen, C. H., Liu, S. C., & Tsai, Y. T. (2024). A study on decision-making for improving service efficiency in hospitals. In *Healthcare* (Vol. 12, No. 3, p. 405). MDPI. https://doi.org/10.3390/healthcare12030405

Hulter, P., Langendoen, W., Pluut, B., Schoonman, G.G., Luijten, R., van Wetten, F., Ahaus, K. & Weggelaar-Jansen, A.M. (2023). Patients' choices regarding online access to laboratory, radiology and pathology test results on a hospital patient portal. *PLoS One*, *18*(2), p.e0280768. https://doi.org/10.1371/journal.pone.0280768

Humphreys, D. P., Gavin, K. M., Olds, K. M., Bonaca, M. P., & Bauer, T. A. (2022). At-home sample collection is an effective strategy for diagnosis and management of symptomatic and asymptomatic SARS-CoV-2 carriers. *BMC Infectious Diseases*, *22*(1). https://doi.org/10.1186/s12879-022-07377-4

Hussain, S., Mubeen, I., Ullah, N., Shah, S. S. U. D., Khan, B. A., Zahoor, M., ... & Sultan, M. A. (2022). Modern diagnostic imaging technique applications and risk factors in the medical field: a review. *BioMed research international*, *2022*(1), 5164970. https://doi.org/10.1155/2022/5164970

Ibeh, A. I., Oso, O. B., Alli, O. I., & Babarinde, A. O. (2025). Scaling healthcare startups in emerging markets: A platform strategy for growth and impact'. International Journal of Advanced Multidisciplinary Research and Studies, 5(1), 838-854. https://www.multiresearchjournal.com/admin/uploads/archives/archive-1738924616.pdf

Imarcgroup.com. (2026). India Diagnostic Labs Market Size, Share, Forecast 2026-34. [online] Available at: https://www.imarcgroup.com/india-diagnostic-labs-market?utm [Accessed 12 May 2026].

IMRAC Group, (2026). India Pathology Lab Services Market to Reach USD 45.4 Billion by 2034, Growing at 9.37% CAGR - IMARC Group. OpenPR.com; openPR. https://www.openpr.com/news/4389275/india-pathology-lab-services-market-to-reach-usd-45-4-billion

Indian Health Fund. (2024). *Navigating the Roadmap for Diagnostic Testing|IHF - Indian Health Fund*. [online] Available at: https://www.indiahealthfund.org/navigating-the-maze-of-medical-sample-storage-and-transportation-in-india/ [Accessed 13 May 2026].

Investing.com. (2021). A Quick Overview of Indian Diagnostic Industry. Investing.com India; Investing.com. https://in.investing.com/analysis/a-quick-overview-of-indian-diagnostic-industry-200496906?utm

Iria, J. & Soares, F. (2023). An energy-as-a-service business model for aggregators of prosumers. Applied Energy, 347, p.121487.https://doi.org/10.1016/j.apenergy.2023.121487

Isa, S., Mat Salleh, M. J., & Mahsin, H. (2023). Steering Standardization of Pathology Services Through Centralisation and Consolidation of Laboratory Procurement. Malaysian Journal of Medicine & Health Sciences, 19. https://medic.upm.edu.my/upload/dokumen/2023011613400635_MJMHS_0341.pdf

Isakov, T. M., Härkönen, H., Atkova, I., Wang, F., Vesty, G., Hyvämäki, P., & Jansson, M. (2024). From challenges to opportunities: Digital transformation in hospital-at-home care. International Journal of Medical Informatics, 192, 105644. https://doi.org/10.1016/j.ijmedinf.2024.105644

Isibor, E. (2024). Regulation of healthcare data security: Legal obligations in a digital age. *Available at SSRN 4957244*. https://dx.doi.org/10.2139/ssrn.4957244

Jabarulla, M. Y., & Lee, H. N. (2021). A blockchain and artificial intelligence-based, patient-centric healthcare system for combating the COVID-19 pandemic: Opportunities and applications. In Healthcare (Vol. 9, No. 8, p. 1019). Mdpi.https://doi.org/10.3390/healthcare9081019

Jain, D. (2023). Regulation of Digital Healthcare in India: Ethical and Legal Challenges. Healthcare, 11(6), 911. https://doi.org/10.3390/healthcare11060911

Jameson, J., McDonnell, K., & Forristal, P. D. (2025). Comparing the profitability of first wheat crops grown with different crop establishment systems both on farms and in a replicated trial in Ireland. Irish Journal of Agricultural and Food Research, 64(1), 112-124. DOI: 10.15212/ijafr-2025-0004

Javanmardi, E., Maresova, P., Xie, N., & Mierzwiak, R. (2024). Exploring business models for managing uncertainty in healthcare, medical devices, and biotechnology industries. Heliyon, 10(4). https://doi.org/10.1016/j.heliyon.2024.e25962

Jones-Esan, L., Somasiri, N., & Lorne, K. (2024). Enhancing healthcare delivery through digital health interventions: a systematic review on telemedicine and mobile health applications in low and middle-income countries (LMICs). *Research Square*.https://doi.org/10.21203/rs.3.rs-5189203%2Fv1

Junaid, S.B., Imam, A.A., Balogun, A.O., De Silva, L.C., Surakat, Y.A., Kumar, G., Abdulkarim, M., Shuaibu, A.N., Garba, A., Sahalu, Y. & Mohammed, A. (2022), Recent advancements in emerging technologies for healthcare management systems: a survey. In Healthcare (Vol. 10, No. 10, p. 1940). MDPI.https://doi.org/10.3390/healthcare10101940

Kakani, P. (2025). The impact of vertical integration on health care delivery and costs: Evidence from physician–pharmacy integration. *Journal of Health Economics*, *104*, 103085–103085. https://doi.org/10.1016/j.jhealeco.2025.103085

Kanaan, A., Ahmad, A. H., Jaradat, Z., Alorfi, A., Alqudah, M., Alqudah, M., & Abualigah, L. (2025). Towards technology-driven business continuity management in the saudi healthcare sector through security and operational risk management. *Sustainable Futures*, *10*, 101389. https://doi.org/10.1016/j.sftr.2025.101389

Kar, E., Fakhimi, M., Turner, C., & Eldabi, T. (2025). Hybrid simulation in healthcare: a systematic exploration of models, applications, and emerging trends. Journal of Simulation, 19(2), 231-249. https://doi.org/10.1080/17477778.2024.2354250

Karatsareas, P. (2022). Semi-structured interviews. Research methods in language attitudes, 99. https://www.academia.edu/download/95302809/Karatsareas_2022_.pdfc

Karthiga, B., Praneeth, K. R., Saravanan, V., & Rao, T. R. K. (2025). Enhancing cancer detection in medical imaging through federated learning and explainable artificial intelligence: A hybrid approach for optimized diagnostics. *Egyptian Informatics Journal*, *31*, 100751. https://doi.org/10.1016/j.eij.2025.100751

Kebede, Y., Ndlovu, N., Nabadda, S., Sawadogo, C., Fuller, D., Pai, M., ... & Peter, T. (2026). The future of diagnostics in Africa. *Nature Medicine*, 1-11. https://doi.org/10.1038/s41591-026-04308-7

Kelly, J. T., Campbell, K. L., Gong, E., & Scuffham, P. (2020). The Internet of Things: Impact and implications for health care delivery. *Journal of medical Internet research*, *22*(11), e20135. http://dx.doi.org/10.2196/20135

Kelvin-Agwu, M. C., Adelodun, M. O., Igwama, G. T., & Anyanwu, E. C. (2024). The impact of regular maintenance on the longevity and performance of radiology equipment. Int J Eng Res Dev, 20(9), 171-177. https://www.researchgate.net/profile/Mojeed-Adelodun/publication/384638056_The_Impact_of_Regular_Maintenance_on_the_Longevity_and_Performance_of_Radiology_Equipment/links/6700ad91b753fa724d59657d/The-Impact-of-Regular-Maintenance-on-the-Longevity-and-Performance-of-Radiology-Equipment.pdf

Ken Research. (2023). India Diagnostics Services Market, Growth Opportunities & Future Outlook to 2030. [online] Available at: https://www.kenresearch.com/industry-reports/india-diagnostics-services-market

Kero, C. A., & Bogale, A. T. (2023). A Systematic Review of Resource-Based View and Dynamic Capabilities of Firms and Future Research Avenues. *International Journal of Sustainable Development & Planning*, *18*(10). https://doi.org/10.54518/rh.2.6.2022.85

Khamaksorn, A. (2022). A Study of Interstitial Space and Its Development Approach in the Context of Urbanization. Jurnal Kejuruteraan.https://doi.org/10.17576/jkukm-2022-si5(1)-01

Khan, H., Arslan, A., Haapanen, L., Rodgers, P. & Tarba, S.Y. (2023). Hybrid market offering in the medical technology sector and the role of network configuration: an exploratory assessment in both developed and emerging markets. International Marketing Review, 40(4), pp.612-635.https://doi.org/10.1108/IMR-10-2021-0303

Khan, J.A., Raman, A.M., Sambamoorthy, N. & Prashanth, K.C. (2023). *Research Methodology (Methods, Approaches And Techniques)*. [online] SAN International Scientific Publications. doi:https://doi.org/10.59646/rmmethods/040.

Kharat, A. P., & Gaikwad, S. Y. (2024). Third Party Data Aggregation for Data Storage with the IoT Healthcare Model. *Journal of Sensors, IoT & Health Sciences (JSIHS, ISSN: 2584-2560)*, *2*(2), 56-68. https://fringeglobal.com/wp-content/uploads/2024/07/httpsdoi.org10.69996-jsihs.2024010.pdf

King, J. S., Montague, A. D., Arnold, D. R., & Greaney, T. L. (2022). Antitrust's healthcare conundrum: cross-market mergers and the rise of system power. *Hastings LJ*, *74*, 1057. https://papers.ssrn.com/sol3/Delivery.cfm?abstractid=4037747

Kiran, N., Sapna, F. N. U., Kiran, F. N. U., Kumar, D., Raja, F. N. U., Shiwlani, S., ... & Raja, F. (2023). Digital pathology: transforming diagnosis in the digital age. Cureus, 15(9). https://www.cureus.com/articles/182616-digital-pathology-transforming-diagnosis-in-the-digital-age.pdf

Kitsios, F., Stefanakakis, S., Kamariotou, M., & Dermentzoglou, L. (2023). Digital service platform and innovation in healthcare: measuring users' satisfaction and implications. Electronics, 12(3), 662. https://doi.org/10.3390/electronics12030662

Konopik, J. (2023). The impact of digital platforms and ecosystems in healthcare on value creation—a integrative review and research agenda. IEEE access, 11, pp.135811-135819.Digital Object Identifier 10.1109/ACCESS.2023.3336983

Kosiol, J., Fraser, L., Fitzgerald, A., & Radford, K. (2023). Resource-based view: A new strategic perspective for public health service managers. Asia Pacific Journal of Health Management, 18(1), 8-19. doi: 10.24083/apjhm.v18i1.2053 https://journal.achsm.org.au/index.php/achsm/article/download/2053/983

Kotecha, D., Asselbergs, F.W., Achenbach, S., Anker, S.D., Atar, D., Baigent, C., Banerjee, A., Beger, B., Brobert, G., Casadei, B. & Ceccarelli, C. (2022). CODE-EHR best-practice framework for the use of structured electronic health-care records in clinical research. The Lancet Digital Health, 4(10), pp.e757-e764.https://doi.org/10.1016/S2589-7500(22)00151-0

Kovur, P., Kovur, K.M., Rayat, D.Y. & Wishart, D.S. (2025). POC sensor systems and artificial intelligence—where we are now and where we are going? Biosensors, 15(9), p.589.https://doi.org/10.3390/bios15090589

Krishna, A. (2020). Designing for Doctors: Medlife. [online] Medium. Available at: https://medium.com/abhinav-krishnas-portfolio/designing-for-doctors-medlife-308a66a395c3 [Accessed 9 Mar. 2026].

Krome, M. J., Pidun, U., & zu Knyphausen-Aufseß, D. (2025). Investigating the strategic choices of business ecosystem orchestrators: evidence from sports aggregation ecosystems. Review of Managerial Science, 19(11), 3457-3493. https://doi.org/10.1007/s11846-025-00857-2

KS, S., Barkur, G., & G, S. (2023). Assessment of healthcare service quality effect on patient satisfaction and care outcomes: A case study in India. Cogent Business & Management, 10(3), 2264579. https://doi.org/10.1080/23311975.2023.2264579

Kulkarni, V., Gawali, M., & Kharat, A. (2021). Key technology considerations in developing and deploying machine learning models in clinical radiology practice. JMIR medical informatics, 9(9), e28776. https://doi.org/10.2196/28776

Kulkov, I. (2023). Next-generation business models for artificial intelligence start-ups in the healthcare industry. International Journal of Entrepreneurial Behavior & Research, 29(4), pp.860-885.https://doi.org/10.1108/IJEBR-04-2021-0304

Kulkov, I., Ivanova-Gongne, M., Bertello, A., Makkonen, H., Kulkova, J., Rohrbeck, R., & Ferraris, A. (2023). Technology entrepreneurship in healthcare: Challenges and opportunities for value creation. Journal of Innovation & Knowledge, 8(2), 100365. https://doi.org/10.1016/j.jik.2023.100365

Kumar, P., Lionis, C., Andoko, D., Rahman, Z., Anastasaki, M., & Awankem, B. (2025). Evaluation of diagnostic services in rural and remote areas: bottlenecks, success stories, and solutions. *Journal of Surgical Specialties and Rural Practice*, *6*(1), 32-37. https://doi.org/10.4103/jssrp.jssrp_8_25

Kumar, S. & Ujire, D.K. (2024). Inductive and deductive approaches to qualitative research. *International Journal of Multidisciplinary Educational Research*, *13*(1), pp.58-63. http://ijmer.in.doi./2024/13.1.69

Kunzharikova, D., Kaliyeva, A. E., Baspakova, A., Kurmangaliyeva, S. S., & Alkaubayeva, A. (2025). Patient Satisfaction with Laboratory Services: Current Trends and Strategies for Quality Improvement. J Environ Treat Tech, 13, 52-61.DOI 10.18502/jett.v13i1.18699

Kuswari, M., Gantino, R. & Maratis, J. (2025). Maximizing healthcare service information system: Understanding the influence of integration on efficiency. *ADI Journal on Recent Innovation*, *6*(2), pp.108-117. DOI: https://doi.org/10.34306/ajri.v6i2.1145

Lee, N. K., & Kim, J. S. (2024). Status and Trends of the Digital Healthcare Industry. Healthcare Informatics Research, 30(3), 172–183. https://doi.org/10.4258/hir.2024.30.3.172

Li, J., Mao, Y., & Zhang, J. (2022). Maintenance and Quality Control of Medical Equipment Based on Information Fusion Technology. *Computational Intelligence and Neuroscience*, *2022*, 1–11. https://doi.org/10.1155/2022/9333328

Lin, G. S. S., Foong, C. C., Mohd Noor, M. N., & Cabatan, M. C. (2025). A practical guide to reporting appraisal and transparency in qualitative research in health professions education. Discover Education. https://doi.org/10.1007/s44217-025-01036-x

Lingervelder, D., Kip, M. M. A., Wiese, E. D., Koffijberg, H., Ijzerman, M. J., & Kusters, R. (2022). The societal impact of implementing an at-home blood sampling device for chronic care patients: patient preferences and cost impact. BMC Health Services Research, 22(1). https://doi.org/10.1186/s12913-022-08782-w

Lippi, G., & Ognibene, A. (2025). Perspectives on emerging challenges and training needs for the Laboratory Medicine specialist of the future. *Advances in Laboratory Medicine / Avances En Medicina de Laboratorio*. https://doi.org/10.1515/almed-2025-0146

Lobo, S., & Bhat, S. (2022). A systematic literature review and research agenda of share price movement of the Indian Pharmaceutical Industry. *International Journal of Management,*

Technology and Social Sciences (IJMTS), *7*(2), 1-27. DOI: https://doi.org/10.5281/zenodo.6823278

Lu, Y., Shi, L., & Wang, Z. (2025). Patient mobility in the digital era: how online service information from internet hospitals shapes patients' Cross-Regional healthcare choices. In Healthcare (Vol. 13, No. 5, p. 484). MDPI. https://doi.org/10.3390/healthcare13050484

Ludin, D., Duman, S., Kirchner, V., & Mikulec, M. (2025). Digital innovation in healthcare: impacts on patient behaviour, appointment scheduling and times in waiting rooms: an explorative empirical study in Germany. *Marketing i menedžment innovacij*, *16*. https://doi.org/10.21272/mmi.2025.2-06

Lyu, G. (2025). Data-driven decision making in patient management: a systematic review. *BMC medical informatics and decision making*, *25*(1), 239. https://doi.org/10.1186/s12911-025-03072-x

Ma, L., Tao, Z. & Wei, Q. (2024). On-demand ride service platform with differentiated services. PloS one, [online] 19(1), e0296732–e0296732. doi: https://doi.org/10.1371/journal.pone.0296732.

Mahesh, N., Devishamani, C. S., Raghu, K., Mahalingam, M., Bysani, P., Chakravarthy, A. V., & Raman, R. (2024). Advancing healthcare: the role and impact of AI and foundation models. *American journal of translational research*, *16*(6), 2166. https://doi.org/10.62347/WQWV9220

Makhmirzaeva, G. G., Golubkina, E. S., Airapetyan, A. D., Root, V. A., Uran-oolovich, O. K., Kuzhuget, A. A., & Aliyeva, K. M. (2025). The importance of early screening in preventing chronic diseases. *Revista Latinoamericana de Hipertension*, (1). http://doi.org/10.5281/zenodo.14868407

Malhotra, G., Dandotiya, G., Shaiwalini, S., Khan, A., & Homechaudhuri, S. (2025). Benchmarking for organisational competitiveness: a resource-based view perspective. *Benchmarking: An International Journal*, *32*(3), 943-964. https://doi.org/10.1108/BIJ-09-2023-0668

Malik, A., Kumar, S., Basu, S., & Bebenroth, R. (2023). Managing disruptive technologies for innovative healthcare solutions: the role of high-involvement work systems and technologically-mediated relational coordination. Journal of Business Research, 161, 113828 https://doi.org/10.1016/j.jbusres.2023.113828

Malik, D. V. (2022, April 17). *How to do Business Analysis of Diagnostic Labs*. Dr Vijay Malik. https://www.drvijaymalik.com/diagnostic-labs/ https://www.drvijaymalik.com/diagnostic-labs/

Maretha, C. (2023). Positivism in philosophical studies. *Journal of Innovation in Teaching and Instructional Media*, *3*(3), 124-138. https://pdfs.semanticscholar.org/9e89/639ea6052cf6fe7714717090868f0f2542c9.pdf

Mashmool, A., Delzanno, G., Saadatfar, H., Ahmad, A., Koschke, R., Alizadehsani, R., ... & D'Agostino, D. (2026). Edge Computing in Healthcare Using Machine Learning: A Systematic Literature Review. *Wiley Interdisciplinary Reviews: Data Mining and Knowledge Discovery*, *16*(1), e70069.https://doi.org/10.1002/widm.70069

Mathew, J., Gupta, N., & Jagose, J. (2023). Innovations in the Indian healthcare industry to brave the vuca times. *Asia Pacific Journal of Health Management*, *18*(1), 252-258. https://journal.achsm.org.au/index.php/achsm/article/download/1703/995

Mbanefo, C., & Grobbelaar, S. (2025). Evolutionary dynamics of digital platform ecosystems in healthcare: A case study of the discovery ecosystem in South Africa. *Electronic Markets, 35*(1). https://doi.org/10.1007/s12525-025-00820-9

Mbata, A. O., Soyege, O. S., Nwokedi, C. N., Tomoh, B. O., Mustapha, A. Y., Balogun, O. D., ... & Iguma, D. R. (2024). Preventative medicine and chronic disease management: reducing healthcare costs and improving long-term public health. International Journal of Multidisciplinary Research and Growth Evaluation, 5(06), 1584-1600. https://doi.org/10.54660/.IJMRGE.2024.5.6.1584-1600

Meijer, A., & Boon, W. (2024). Digital platforms for the co-creation of public value. In *Strategic Management of the Transition to Public Sector Co-Creation* (pp. 50-70). Policy Press. https://doi.org/10.1332/030557321X16115951032181

Minango, J., Carvajal Mora, H., Zambrano, M., Orozco Garzón, N., & Pérez, F. (2025). Distributed ledger technology in healthcare: enhancing governance and performance in a decentralized ecosystem. *Technologies*, *13*(2), 58. https://doi.org/10.3390/technologies13020058

Mirza, M., Verma, M., Aggarwal, A., Satpathy, S., Sahoo, S. S., & Kakkar, R. (2024). Indian Model of Integrated Healthcare (IMIH): a conceptual framework for a coordinated referral system in resource-constrained settings. *BMC health services research*, *24*(1), 42. https://doi.org/10.1186/s12913-023-10454-2

Mirzayev, N. (2025). Decentralized Decision-Making in Global Trade: Cybernetic Governance Through Logistic Informatics. International Journal of Advances in Business and Management Research (IJABMR), 3(1), pp.67-75.https://doi.org/10.62674/ijabmr.2025.v3i01.006

Mishra, P., & Singh, G. (2023). Internet of medical things healthcare for sustainable smart cities: current status and future prospects. *Applied Sciences*, *13*(15), 8869.https://doi.org/10.3390/app13158869

Mishra, U. S., Yadav, S., & Joe, W. (2024). The Ayushman Bharat digital mission of India: an assessment. *Health Systems & Reform*, *10*(2), 2392290. https://doi.org/10.1080/23288604.2024.2392290

Momeni, M., Afkanpour, M., Rakhshani, S., Mehrabian, A., & Tabesh, H. (2024). A prediction model based on artificial intelligence techniques for disintegration time and hardness of fast disintegrating tablets in pre-formulation tests. *BMC Medical Informatics and Decision Making*, *24*(1), 88.https://doi.org/10.1186/s12911-024-02485-4

Moorman, C., van Heerde, H. J., Moreau, C. P., & Palmatier, R. W. (2024). Marketing in the health care sector: disrupted exchanges and new research directions. Journal of Marketing, 88(1), 1-14. https://people.duke.edu/~moorman/Publications/Moorman-et-al-2023-marketing-in-the-health-care-sector-disrupted-exchanges-and-new-research-directions.pdf

Mor, N. (2025). Transforming the Indian Private Sector for Universal Health Coverage. In *Healthcare* (Vol. 13, No. 21, p. 2802). MDPI. https://doi.org/10.3390/healthcare13212802

Muzari, T., Shava, G. N., & Shonhiwa, S. (2022). Qualitative research paradigm, a key research design for educational researchers, processes and procedures: A theoretical overview. *Indiana Journal of Humanities and Social Sciences*, *3*(1), 14-20.

Mwogosi, A., & Mambile, C. (2025). Digital ecosystems for healthcare communication and collaboration: A scoping review. *Digital Health*, *11*, 20552076251377933.https://doi.org/10.1177/20552076251377933

NABH, (2025). NABH digital health standards for hospitals [online]. Accessed on : 09.03.2026. <Available from: https://portal.nabh.co/Announcement/Draft%20NABH%20DHS%202nd%20Edition.pdf >

Nagappan, A., Kalokairinou, L., & Wexler, A. (2024). Ethical issues in direct-to-consumer healthcare: a scoping review. *PLOS digital health*, *3*(2), e0000452. https://doi.org/10.1371/journal.pdig.0000452

Nagle, F., Seamans, R. & Tadelis, S. (2025). Transaction cost economics in the digital economy: A research agenda. *Strategic Organization*, *23*(2), pp.351-365. https://journals.sagepub.com/doi/abs/10.1177/14761270241228674

Naik, N., Hameed, B. Z., Sooriyaperakasam, N., Vinayahalingam, S., Patil, V., Smriti, K., ... & Somani, B. K. (2022). Transforming healthcare through a digital revolution: a review of digital healthcare technologies and solutions. Frontiers in digital health, 4, 919985. https://doi.org/10.3389/fdgth.2022.919985

Nair, M., Svedberg, P., Larsson, I., & Nygren, J. M. (2024). A comprehensive overview of barriers and strategies for AI implementation in healthcare: Mixed-method design. Plos one, 19(8), e0305949. https://doi.org/10.1371/journal.pone.0305949

Najjar, R. (2024). Clinical applications, safety profiles, and future developments of contrast agents in modern radiology: A comprehensive review. *Iradiology*, *2*(5), pp.430-468. https://doi.org/10.1002/ird3.95

Nandy, B. (2025). Hospital Investment Decisions and Prioritization of Clinical Programs. *Cureus*, *17*(3). https://doi.org/10.7759/cureus.79998

Neelakantan, M., & Kulkarni, A. (2023). Unifying India's healthcare markets. *Indian Public Policy Review*, *4*(4 (Jul-Aug)), 30-69. https://doi.org/10.55763/ippr.2023.04.04.002

Neto, C., Hak, F., Ferreira, D., Abelha, A., & Machado, J. (2025). Automation of hospital workflows using international standards: A case study with imaging exams. Computer Methods and Programs in Biomedicine, 266, 108777. https://doi.org/10.1016/j.cmpb.2025.108777

News, M. (2025). *Dr Lal PathLabs, Metropolis, others fall up to 2% as Amazon launches home diagnostics services*. Moneycontrol. https://www.moneycontrol.com/news/business/markets/dr-lal-pathlabs-metropolis-others-fall-up-to-2-as-amazon-launches-home-diagnostics-services-13162372.html

nexdigm. (2025). "India Healthcare Industry Outlook to 2030." Nexdigm, 2 Sept. 2025, www.nexdigm.com/market-research/report-store/india-healthcare-industry-report/.

Nexdigm. (2025). India Diagnostics Services Market Outlook to 2030. [online] Available at: https://www.nexdigm.com/market-research/report-store/india-diagnostics-services-market-report/.

Nguyen, A.D., White, S.J., Tse, T., Cartmill, J.A., Roger, P., Hatem, S. & Willcock, S.M. (2024). Communication during telemedicine consultations in general practice: perspectives from general practitioners and their patients. BMC Primary Care, 25(1), p.324. https://doi.org/10.1186/s12875-024-02576-1

Nickerson, C. (2023). Theory of reasoned action (Fishbein & Ajzen, 1975). *Simply Psychology*, 1-11. https://www.simplypsychology.org/theory-of-reasoned-action.html

Nordin, N., Ab Rahim, S. N., Wan Omar, W. F. A., Zulkarnain, S., Sinha, S., Kumar, S., & Haque, M. (2024). Preanalytical Errors in Clinical Laboratory Testing at a Glance: Source and Control Measures. Cureus. https://doi.org/10.7759/cureus.57243

Nunes, A. (2024). Vertical integration in healthcare and patient satisfaction: an exploratory analysis of Portuguese reforms. Sustainability, 16(3), 1078. https://doi.org/10.3390/su16031078

Nurjanti, L. (2025). Marketing Phenomena and Marketing Strategies in the Field of Healthcare Services and Their Impact to the Marketing Performance and Consumer Satisfaction. *J Bus Econo Stud*, *2*(2), 1-30. DOI: doi.org/10.61440/JBES.2025.v2.55

Nweke, O., & Owusu-Berko, L. (2025). Integrating AI-driven predictive and prescriptive analytics for enhancing strategic decision-making and operational efficiency across industries. *Int. Res. J. Mod. Eng. Technol. Sci*, *7*, 4013-4035. https://www.doi.org/10.56726/IRJMETS67921

Nyawira, L., Njuguna, R. G., Tsofa, B., Musiega, A., Munywoki, J., Hanson, K., ... & Barasa, E. (2023). Examining the influence of health sector coordination on the efficiency of county health systems in Kenya. BMC health services research, 23(1), 355.https://doi.org/10.1186/s12913-023-09344-4

Nygaard, A. (2022). From linear to circular economy: a transaction cost approach to the ecological transformation of the firm. Circular Economy and Sustainability, 2(3), 1127-1142.https://doi.org/10.1007/s43615-022-00158-w

Nyimbili, F., & Nyimbili, L. (2024). Types of purposive sampling techniques with their examples and application in qualitative research studies. https://doi.org/10.37745/bjmas.2022.0196

Obilor, E. I. (2023). Convenience and purposive sampling techniques: Are they the same. International Journal of Innovative Social & Science Education Research, 11(1), 1-7. https://www.researchgate.net/profile/Esezi-Obilor/publication/398681103_Convenience_and_Purposive_Sampling_Techniques_Are_they_the_Same/links/693fe9e8a1fd01798907e406/Convenience-and-Purposive-Sampling-Techniques-Are-they-the-Same.pdf

Ognibene, A., & Lippi, G. (2026). Global-of-care testing (GOCT): emerging challenges for laboratory medicine network. Diagnosis, 13(1), 40-45. https://doi.org/10.1515/dx-2025-0108

Ohakwe, C. R., & Wu, J. (2025). The impact of macroeconomic indicators on logistics performance: A comparative analysis using simulated scenarios. Sustainable Futures, 9, 100567. https://doi.org/10.1016/j.sftr.2025.100567

Olaniyan, O., Yusuf, A., Oluwakemi, A. K. H., & Igbin, L. A. (2021). Public-Private Partnerships in Healthcare: Leveraging Technology and Business Strategies to Improve Service Delivery. https://www.gajrc.com/media/articles/GAJEB_36_170-177.pdf

Olawale, S. R., Chinagozi, O. G., & Joe, O. N. (2023). Exploratory research design in management science: A review of literature on conduct and application. *International Journal of Research and Innovation in Social Science*, *7*(4), 1384-1395. https://doi.org/10.47772/IJRISS.2023.7515

Oluwagbade, E. (2025). Bridging the healthcare gap: the role of AI-driven telemedicine in emerging economies. *Int J Res Publ Rev*, 3732-43. DOI : https://doi.org/10.55248/gengpi.6.0125.0531

Onyeabor, U.S., Okenwa, W.O., Onwuasoigwe, O., Lasebikan, O.A., Schaaf, T., Pinkwart, N. & Balzer, F. (2024). Telemedicine in the age of the pandemics: The prospects of web-based remote patient monitoring systems for orthopaedic ambulatory care management in the developing economies. Digital health, 10, p.20552076241226964. https://doi.org/10.1177/20552076241226964

Open Medscience. (2025). *GPS for Healthcare: Enhancing Patient Safety and Quality of Life*. Open MedScience. https://openmedscience.com/gps-for-healthcare-enhancing-patient-safety-and-quality-of-life/

Oranga, J., (2025). Mixed methods research: Application, advantages and challenges. *Journal of Accounting Research, Utility Finance and Digital Assets*, *3*(4), pp.370-375. https://doi.org/10.54443/jaruda.v3i4.213

Orth, M., (2021). Direct to consumer laboratory testing (DTCT)–opportunities and concerns. EJIFCC, 32(2), p.209.https://pmc.ncbi.nlm.nih.gov/articles/PMC8343044/pdf/ejifcc-32-209.pdf

Otoo, J.A. & Schlappi, T.S. (2022). REASSURED multiplex diagnostics: a critical review and forecast. *Biosensors*, *12*(2), p.124. https://doi.org/10.3390/bios12020124

Ozlugedik, F. I., Dasdelen, M. F., Umer, R. M., & Marr, C. (2026). MoA: Mixture of Aggregators Improves Slide-Level Diagnosis in Computational Pathology. In Medical Imaging with Deep Learning. https://openreview.net/pdf?id=OEFIRrE6iT

Padole. S., (2021). A Quick Overview of Indian Diagnostic Industry. [Online]. Accessed on 8 May 2026. Available at https://in.investing.com/analysis/a-quick-overview-of-indian-diagnostic-industry-200496906

Padulles, R., Kountouris, I., Kanbur, B. B., Jensen, J. K., & Elmegaard, B. (2025). Break-even coefficient of performance: Scenario-based analysis of industrial heat electrification feasibility in Europe. Energy Conversion and Management, 326, 119488. https://doi.org/10.1016/j.enconman.2025.119488

Paliwal, D., & Puttanna, K. (2025). Digital Dispense: The Rise of E-Pharmacies and Their Impact on Traditional Pharmacies in India. https://www.researchgate.net/profile/Deepak-Paliwal-6/publication/396470883_Digital_Dispense_The_Rise_of_E_Pharmacies_and_Their_Impact_on_Traditional_Pharmacies_in_India/links/68ef6fc07d9a4d4e8709d8e6/Digital-Dispense-The-Rise-of-E-Pharmacies-and-Their-Impact-on-Traditional-Pharmacies-in-India.pdf

Panchal, D. H., & Trivedi, M. M. (2025). Advancing Oncology Trials Through Home Phlebotomy: A Comprehensive Review of Patient-Centered Outcomes. *International Journal for Research Trends and Innovation*, *10*(9), a46–a54. https://www.researchgate.net/publication/395349276_Advancing_Oncology_Trials_Through_Home_Phlebotomy_A_Comprehensive_Review_of_Patient-_Centered_Outcomes

Pandey, A.K. (2026). Prevalence and impact of referral fees in diagnostic radiology in India: Insights from an online survey of practicing radiologists. Current Problems in Diagnostic Radiology. doi: https://doi.org/10.1067/j.cpradiol.2026.01.002.

Panwar. V. (2021). India's Online Aggregator Platforms Are a New Way To Receive Healthcare [online]. [Accessed on: https://science.thewire.in/health/indias-online-aggregator-platforms-are-a-new-way-to-receive-healthcare/]

Parfrement, I. (2025). *New testing technologies reshaping decentralized healthcare*. Diagnostics; Roche Diagnostics International. https://diagnostics.roche.com/global/en/healthcare-transformers/article/decentralized-healthcare-new-technologies.html

Patel, N., & Singhal, S. (2026). *What to expect in US healthcare in 2026 and beyond*? McKinsey & Company. https://www.mckinsey.com/industries/healthcare/our-insights/what-to-expect-in-us-healthcare

Patel, S. A., Vashist, K., Jarhyan, P., Sharma, H., Gupta, P., Jindal, D., ... & Tandon, N. (2021). A model for national assessment of barriers for implementing digital technology interventions to improve hypertension management in the public health care system in India. BMC Health Services Research, 21(1), 1101. https://doi.org/10.1186/s12913-021-06999-9

Patel. S. (2025). Financial Planning For New Pathology Lab Setup in India [online]. Accessed on: 09.03.2026. <Available from: https://www.drlogy.com/plus/financial-planning-for-new-pathology-lab?srsltid=AfmBOooAllRyl8w9jO2THrWG8ZRpyr3-XS4hF1GYNe5yC-SM1VXa_QmS>

Patil, K., Garg, V., Gabaldon, J., Patil, H., Niranjan, S., & Hawkins, T. (2024). Firm performance in digitally integrated supply chains: a combined perspective of transaction cost economics and relational exchange theory. Journal of Enterprise Information Management, 37(2), 381-413.https://doi.org/10.1108/JEIM-09-2022-0335

Pib.gov.in. (2025). *From Data to Diagnosis*. [online] Available at: https://www.pib.gov.in/PressReleaseIframePage.aspx?PRID=2094604&reg=3&lang=2.

Pib.gov.in. (2026). Transforming Healthcare Delivery Through Artificial Intelligence. https://www.pib.gov.in/PressReleasePage.aspx?PRID=2227410&reg=3&lang=1

Pietronudo, M.C., Zhou, F., Caporuscio, A., La Ragione, G. and Risitano, M. (2022). New emerging capabilities for managing data-driven innovation in healthcare: the role of digital

platforms. European Journal of Innovation Management, 25(6), pp.867-891.https://doi.org/10.1108/EJIM-07-2021-0327

Pillai, S. P., & Fox, E. (2025). Laboratory quality management system fundamentals. Frontiers in Bioengineering and Biotechnology, 13, 1578654. https://doi.org/10.3389/fbioe.2025.1578654

Pillay, T. S., Khan, A. I., & Yenice, S. (2025). Artificial intelligence (AI) in point-of-care testing. Clinica Chimica Acta, 574, 120341.https://doi.org/10.1016/j.cca.2025.120341

Plebani, M. & Ciaccio, M. (2023). Combine data of all laboratory subspecialties and diagnostic imaging in the same report: Integrated diagnostics: a vision for the future of laboratory medicine. *Biochimica Clinica*, *47*. DOI: https://doi.org/10.19186/BC_2023.062

Poazi Deinmodei, W. (2023). The Significant Relationship Between Resource-Base View and Organizational Strategic Growth. *International Journal*, *7*(1). https://doi.org/10.48028/iiprds/ijedesr.v7.i1.16

Post, B., Hollenbeck, B.K., Norton, E.C. and Ryan, A.M. (2024). Hospital-physician integration and clinical volume in traditional Medicare. *Health Services Research*, *59*(1), pp 14172. DOI: https://doi.org/10.1111/1475-6773.14172

Pragya Kakani. (2025). The impact of vertical integration on health care delivery and costs: Evidence from physician–pharmacy integration. *Journal of Health Economics*, *104*, 103085–103085. https://doi.org/10.1016/j.jhealeco.2025.103085

PTI. (2021). *Home health care services on rise in India due to Covid-19 pandemic: Experts*. The Economic Times; Economic Times. https://economictimes.indiatimes.com/industry/healthcare/biotech/healthcare/home-health-care-services-on-rise-in-india-due-to-covid-19-pandemic-experts/articleshow/80444626.cms?from=mdr

Puri, V., Kataria, A. & Sharma, V. (2024). Artificial intelligence-powered decentralized framework for Internet of Things in Healthcare 4.0. Transactions on Emerging Telecommunications Technologies, 35(4), p.e4245.DOI: 10.1002/ett.4245

Purnomo, H. (2025). Legal Protection for Patients of Online Healthcare Service: Analysis of Risks and Challenges of Healthcare Services in Digital Era. Jurnal Ilmu Kepolisian, 19(3), 1-14. DOI: https://doi.org/10.35879/jik.v19i3.688

Rajamani, S. K., & Iyer, R. S. (2023). Networks in healthcare: a systematic review. *BioMedInformatics*, *3*(2), 391-404. https://doi.org/10.3390/biomedinformatics3020026

Rana, R. K., Kapoor, N., Kumar, D., Verma, M., & Taneja, G. (2024). Digital Health Revolution in India: Transforming Health and Medicine. Indian Journal of Community Medicine: Official Publication of Indian Association of Preventive & Social Medicine, 49(Suppl 2), S205. https://doi.org/10.4103/ijcm.ijcm_803_24

Reddy, K. V., Saketh, G., Priyanshu, S. S., Nitesh, M., Hussain, S. K., & Sharma, K. V. (2025). AI-driven healthcare management platform: enhancing accessibility, efficiency, and security in digital health systems. *Synthesis: A multidisciplinary research journal*, *3*(1), 1-14. https://www.macawpublications.com/Journals/index.php/SMRJ/article/download/115/502

Reegu, F. A., Abas, H., Gulzar, Y., Xin, Q., Alwan, A. A., Jabbari, A., ... & Dziyauddin, R. A. (2023). Blockchain-based framework for interoperable electronic health records for an improved healthcare system. *Sustainability*, *15*(8), 6337. https://doi.org/10.3390/su15086337

Rekabi, S., Moradi, B., Salamian, F., Fadavi, N., Zokaee, M., & Aghsami, A. (2024). A home healthcare routing-scheduling optimization model considering time-balancing and outsourcing. *Supply Chain Analytics*, *7*, 100077. https://doi.org/10.1016/j.sca.2024.100077

Reza, S., Sarfraz, L., & Reza, U. (2025). In-house versus outsourced laboratory testing: A comparative analysis in a small private laboratory. *Pakistan Journal of Pathology*, *36*(2), 88-96. https://doi.org/10.55629/pakjpathol.v36i2.892

Rounaghi, M. M., Jarrar, H., & Dana, L. P. (2021). Implementation of strategic cost management in manufacturing companies: overcoming costs stickiness and increasing corporate sustainability. Future Business Journal, 7(1), 31. https://doi.org/10.1186/s43093-021-00079-4

Russo. M., Lewis. S., Renner.S., & Lukich. M., (2024). The power of aggregators in healthcare. [online]. Accessed on: 08/04/2026. Available at https://marketbridge.com/article/aggregators-in-healthcare/

Sadeghi, D., Motlagh, M. K., Darvish, A., Daryaafzoon, M., Mohamadnejad, E., Molaei, A., ... & Hosseini, R. S. S. (2024). Comparative effect of physical health training and psychological

training of the theory of reasoned action (TRA) model on the life quality of patients with diabetes in Tehran, Iran: utilization of message texting. *BMC endocrine disorders*, *24*(1), 69. https://doi.org/10.1186/s12902-024-01598-1

Saghafian, S., Song, L., Newhouse, J., Landrum, M. B., & Hsu, J. (2023). The impact of vertical integration on physician behavior and healthcare delivery: Evidence from gastroenterology practices. Management Science, 69(12), 7158-7179.https://www.nber.org/system/files/working_papers/w30928/w30928.pdf

Saha, A., Andrewartha, K., Badman, S.G., Tangey, A., Smith, K.S., Sandler, S., Ramsay, S., Braund, W., Manoj-Margison, S., Matthews, S. and Shephard, M.D. (2023). Flexible and innovative connectivity solution to support national decentralized infectious diseases point-of-care testing programs in primary health services: descriptive evaluation study. Journal of Medical Internet Research, 25, p.e46701.https://doi.org/10.2196/46701

Sainatham, C., Yadav, D., Dilli Babu, A., Tallapalli, J. R., Kanagala, S. G., Filippov, E., ... & Lutfi, F. (2024). The current socioeconomic and regulatory landscape of immune effector cell therapies. *Frontiers in Medicine*, *11*, 1462307. https://doi.org/10.3389/fmed.2024.1462307

Saltkjel, T., Andreassen, T. A., & Minkman, M. (2023). Conceptualising service integration for inclusive activation: Exploring transferal and translation of models from health care. International Journal of Social Welfare, 32(2), 149-163.DOI: 10.1111/ijsw.12539

Santa-Ana-Tellez, Y., Lagerwaard, B., de Jong, A. J., Gardarsdottir, H., Grobbee, D. E., Hawkins, K., ... & Trials@ Home Consortium. (2023). Decentralised, patient-centric, site-less, virtual, and digital clinical trials? From confusion to consensus. *Drug Discovery Today*, *28*(4), 103520. https://doi.org/10.1016/j.drudis.2023.103520

Schuurman, G. S., Tiel Groenestege, W., Hirdes, M. M. C., Fidder, H. H., Oldenburg, B., de Roock, S., & van Schaik, F. D. M. (2025). Implementation of a Capillary Blood Self-Sampling Technique at Home for Monitoring of Patients With IBD. Inflammatory Bowel Diseases, 32(2), 282–289. https://doi.org/10.1093/ibd/izaf240

Scope, N., Rasin, A., Lenard, B., & Wagner, J. (2024). Statistical privacy and consent in data aggregation. In Proceedings of the 36th International Conference on Scientific and Statistical Database Management (pp. 1-12). https://doi.org/10.1145/3676288.3676298

Sebata, D. (2024). Investigating how logistics operations affect an organization's financial performance. In *Advances in Logistics Engineering*. IntechOpen. https://doi.org/10.5772/intechopen.1004304

Secundo, G., Shams, S. R., & Nucci, F. (2021). Digital technologies and collective intelligence for healthcare ecosystem: Optimizing Internet of Things adoption for pandemic management. *Journal of Business Research, 131*, 563-572. https://doi.org/10.1016/j.jbusres.2021.01.034

Shah, A., Arman, M., & Khan, S. A. (2025). Patient-centric marketing and retention strategies in healthcare: a strategic and technological framework. *Journal of Business and Management Studies*, *7*(2), 239-248. https://doi.org/10.32996/jbms.2025.7.2.17

Shah, D. S. (2025). The next big leap in Indian diagnostics: From regional labs to national giants. Retrieved May 29, 2026, from Express Healthcare website: https://www.expresshealthcare.in/news/the-next-big-leap-in-indian-diagnostics-from-regional-labs-to-national-giants/451533/

Shamim, M.M.R. (2022). Electrical and Mechanical Troubleshooting in Medical and Diagnostic Device Manufacturing: A Systematic Review Of Industry Safety And Performance Protocols. *American Journal of Scholarly Research and Innovation*, *1*(01), pp.295-318. Doi: 10.63125/d68y3590

Sharma, K. (2025). *Diagnostics beyond metros: Bridging the gap*. [online] Express Healthcare. Available at: https://www.expresshealthcare.in/news/diagnostics-beyond-metros-bridging-the-gap/447985/.

Sharma, L.R., Bidari, S., Bidari, D., Neupane, S. & Sapkota, R. (2023). Exploring the mixed methods research design: types, purposes, strengths, challenges, and criticisms. *Global Academic Journal of Linguistics and Literature*, *5*(1), 3-12. DOI: https://doi.org/10.36348/gajll.2023.v05i01.002

Sharma, R. S., Rohatgi, A., Jain, S., & Singh, D. (2023). The Ayushman Bharat Digital Mission (ABDM): making of India's digital health story. CSI transactions on ICT, 11(1), 3-9. https://doi.org/10.1007/s40012-023-00375-0

Shashiashvili, N. (2025). The impact of monopoly on the pharmaceutical market. *SOCIOPOLITOLOGOS*, *3*, pp.298-311. DOI: https://doi.org/10.52340/splogos.2025.03.24

Shen, Y., Yu, J., Zhou, J. & Hu, G. (2025). Twenty-five years of evolution and hurdles in electronic health records and interoperability in medical research: comprehensive review. Journal of Medical Internet Research, 27, p.e59024. https://doi.org/10.2196/59024

Shetty, A. & Minal, J., 2023. Chronicle of getting the diagnostic laboratory NABL accredited in a teaching medical institute: An overview of our experience. *Biomedicine*, *43*(6), pp.1899-1903. DOI: https://doi.org/10.51248/.v43i6.2521

Shetty, S.R., Chatterjee, D. & Pai, Y.P. (2022). Performance of Third Party Administrators in Indian Healthcare. *Journal of Health Management*, 24(4), pp.652–661. doi:https://doi.org/10.1177/09720634221128385.

Shie, A. J., Huang, Y. F., Li, G. Y., Lyu, W. Y., Yang, M., Dai, Y. Y., ... & Wu, Y. J. (2022). Exploring the relationship between hospital service quality, patient trust, and loyalty from a service encounter perspective in elderly with chronic diseases. *Frontiers in public health*, *10*, 876266. https://doi.org/10.3389/fpubh.2022.876266

Shilpa, Kaur, T., & Rajiv Kumar Garg. (2023). Digital healthcare: A topical and futuristic review of technological and robotic revolution. *Paladyn*, *14*(1). https://doi.org/10.1515/pjbr-2022-0108

Shinde, R., Patil, S., Kotecha, K., Potdar, V., Selvachandran, G. & Abraham, A. (2024). Securing AI-based healthcare systems using blockchain technology: A state-of-the-art systematic literature review and future research directions. Transactions on Emerging Telecommunications Technologies, 35(1), p.e4884.DOI: 10.1002/ett.4884

Shoaib, M., Mohmand, M. I., Sayed, N., Khan, I., Jan, S., & Lee, I. E. (2026). AI-Powered Human Resource Management System for Hospitals: Enhancing Workforce Planning, Scheduling, and Performance Evaluation. *IEEE Access*. https://doi.org/10.1109/ACCESS.2026.3688762

Siddiqui, C. B. Y., Abid Supto, M. A., Jit, T. H., Sultana, A., Rahman, F., & Shidujaman, M. (2024). Connecting patients with healthcare providers: a web-based e-health platform. In International Conference on Artificial Intelligence and Communication Technology (pp. 353-367). Singapore: Springer Nature Singapore.https://link.springer.com/chapter/10.1007/978-981-96-0092-2_26

Singh, G., Vinson, K. A., Jones, K., Gunsolus, B., Keever, J., & Keel, B. A. (2024). Long-term alliance for pathology equipment and technology acquisition: a paradigm shift for

improved quality and efficiency. *Laboratory Medicine*, *55*(2), 117-126. https://doi.org/10.1093/labmed/lmad071

Singh, M., Jauhar, S. K., Pant, M., & Paul, S. K. (2025). Modelling third-party reverse logistics for healthcare waste recycling in the post-pandemic era. International journal of production research, 63(2), 651-686. https://doi.org/10.1080/00207543.2023.2269584

Singh, V., Sharma, M. P., Jayapriya, K., Kumar, B. K., Chander, M. A. R. N., & Kumar, B. R. (2023). Service quality, customer satisfaction and customer loyalty: A comprehensive literature review. Journal of Survey in Fisheries Sciences, 10(4S), 3457-3464. https://www.researchgate.net/profile/Vikas-Singh-49/publication/371809524_Service_Quality_Customer_Satisfaction_And_Customer_Loyalty_A_Comprehensive_Literature_Review/links/64965cd18de7ed28ba5231c4/Service-Quality-Customer-Satisfaction-And-Customer-Loyalty-A-Comprehensive-Literature-Review.pdf

Singh, Y., Reddy, M., Papanicolas, I. & Scheffler, R. (2026). Private equity investments in health care in OECD countries: an exploratory analysis. *Health Economics, Policy and Law*, 1-28. doi:10.1017/S1744133125100352

Smedemark, S. A., Jepsen, D. B., Andersen-Ranberg, K., & Nybo, M. (2024). Validation of point-of-care tests used at in-home assessments among older adults in primary care. Scandinavian Journal of Primary Health Care, 43(2), 260–269. https://doi.org/10.1080/02813432.2024.2426162

Spooner, N., Baker, D., Carling, R. S., Collier, B. B., Gong, P., Maroto-García, J., Rayburn, E., Rospo, C., Ström, M., & Theodoridis, G. (2025). Patient centric blood sampling and analysis for diagnostics and laboratory medicine. Bioanalysis, 17(20), 1283–1293. https://doi.org/10.1080/17576180.2025.2572289

Srinivas, S., & Kale, D. (2023). New approaches to learning and regulation in medical devices and diagnostics: insights from Indian cancer care. Innovation and Development, 13(2), 361-384. https://doi.org/10.1080/2157930X.2021.2000145

Stoumpos, A. I., Kitsios, F., & Talias, M. A. (2023). Digital transformation in healthcare: technology acceptance and its applications. *International journal of environmental research and public health*, *20*(4), 3407. https://doi.org/10.3390/ijerph20043407

Sugiarno, Y., & Novita, D. (2022). Resources-Based View (RBV) as a strategy of company competitive advantage: A literature review. In International conference on economics business management and accounting (ICOEMA) (Vol. 1, pp. 656-666). https://www.researchgate.net/profile/Dina-Novita-6/publication/370765611_

Sun, Y. (2025). User-Profile-Driven Optimization of Marketing Services for Biohealth Products and B2B Customer Relationship Management Strategies. Economics and Management Innovation, 2(6), 63-70. https://doi.org/10.71222/vdt4a695

Surakshanet.com., (2024). Assessment of the diagnostics industry in India. Available at: https://www.surakshanet.com/pdf/investor/CRISIL_Assessment%20of%20diagnostic%20industry_21.10.24_Final%20-%20Signed.pdf [Accessed 12 May 2026].

Syed, T. A., Mehmood, F., & Qaiser, T. (2023). Brand–SMI collaboration in influencer marketing campaigns: A transaction cost economics perspective. Technological Forecasting and Social Change, 192, 122580.https://doi.org/10.1016/j.techfore.2023.122580

SysGenPro. (2026). *Healthcare ERP Systems for Fragmented Operations and Supply Workflow Delays*. SysGenPro. https://sysgenpro.com/industries/healthcare-erp-systems-that-reduce-fragmented-operations-and-supply-workflow-delays

Tabim, V. M., Ayala, N. F., & Frank, A. G. (2024). Implementing vertical integration in the industry 4.0 journey: which factors influence the process of information systems adoption?. Information Systems Frontiers, 26(5), 1615-1632. https://doi.org/10.1007/s10796-021-10220-x

Taherdoost, H. (2022). What are different research approaches? Comprehensive review of qualitative, quantitative, and mixed method research, their applications, types, and limitations. Journal of management science & engineering research, 5(1), 53-63. https://hal.science/hal-03741840/document

Team Bitscale (2025). medical practice | Company Directory. [online] Bitscale. Available at: https://bitscale.ai/directory/thyrocare-technologies-ltd [Accessed 9 Mar. 2026].

Team, A.E. (2025). *What Is Value-Based Care? A Comprehensive Guide to Better Outcomes and Lower Costs*. [online] Analytix Healthcare. Available at: https://www.analytixhealthcaresolutions.com/2025/07/03/what-is-value-based-care/.

Telukdarie, A., Makoni, L., Sarma, R. R., Munsamy, M., & Kumar, S. (2025). System models for synchronous strategies in operational healthcare forecasting. International journal of

environmental research and public health, 22(2), 265. https://doi.org/10.3390/ijerph22020265

Testing.com. (2021). *Where Lab Tests Are Performed*. [online] Available at: https://www.testing.com/articles/where-lab-tests-are-performed/.

The print, (2025). Indian diagnostics industry set for 14% growth; organised players to lead: PhillipCapital [online]. [Accessed on: 27.02.2026. Available from: https://theprint.in/economy/indian-diagnostics-industry-set-for-14-growth-organised-players-to-lead-phillipcapital/2595133/]

The Wire, (2021). India's Online Aggregator Platforms Are a New Way To Receive Healthcare. [online]. Accessed on: 08/04/2026. Available at https://science.thewire.in/health/indias-online-aggregator-platforms-are-a-new-way-to-receive-healthcare/

Timesofindia.indiatimes.com (2021). Sharp increase in home-based sample collection for regular ailments' tests. [online] The Times of India. Available at: https://timesofindia.indiatimes.com/city/pune/sharp-increase-in-home-based-sample-collection-for-regular-ailments-tests/articleshow/83048208.cms?utm [Accessed 12 May 2026].

Tvaliashvili, M., Sulaberidze, L., Goodman, C., Hanson, K. & Gotsadze, G. (2024). Exploring the risks of fragmentation in health care markets–An analysis of inpatient care in Georgia. Social Science & Medicine, 362, p.117428. https://doi.org/10.1016/j.socscimed.2024.117428

Tvaliashvili, M., Sulaberidze, L., Goodman, C., Hanson, K. & Gotsadze, G. (2024). Exploring the risks of fragmentation in health care markets–An analysis of inpatient care in Georgia. Social Science & Medicine, 362, p.117428.https://doi.org/10.1016/j.socscimed.2024.117428

Veen, M. (2021). Creative leaps in theory: the might of abduction. *Advances in Health Sciences Education*, 26(3), pp.1173–1183. doi:https://doi.org/10.1007/s10459-021-10057-8.

Vega-Crespo, B., Neira, V.A., Maldonado-Rengel, R., López, D., Delgado-López, D., Guerra Astudillo, G. and Verhoeven, V. (2024). Barriers and advantages of self-sampling tests, for HPV diagnosis: a qualitative field experience before implementation in a rural community in Ecuador. International Journal of Women's Health, pp.947-960. https://doi.org/10.2147/IJWH.S455118

Venkataraman, A., Ramamohan, V., & Edirippulige, S. (2025). Clinician Preferences for Telemedicine in Hybrid Outpatient Care: A Mixed-Methods Study. *Available at SSRN 5568278*. https://doi.org/10.1177/11786329211043301

Venkatesh, D. P., Ramalingam, K., Ramani, P., & Nallaswamy, D. (2024). Laboratory information management systems in oral pathology: a comprehensive review. Cureus, 16(5). https://assets.cureus.com/uploads/review_article/pdf/257896/20240620-14580-fvbgwc.pdf

Victor, J., & Paulo, A. (2023). Transaction costs in healthcare: empirical evidence from Portuguese hospitals. Cogent Business & Management, 10(2), 2220479. https://doi.org/10.1080/23311975.2023.2220479

Villalobos-Quesada, M., Ho, K., Chavannes, N.H. & Talboom-Kamp, E.P. (2023). Direct-to-patient digital diagnostics in primary care: Opportunities, challenges, and conditions necessary for responsible digital diagnostics. *European Journal of General Practice*, *29*(1), p.2273615. https://doi.org/10.1080/13814788.2023.2273615

Viswanadham, N. (2021). Ecosystem model for healthcare platform. *Sādhanā, 46*(4), 188.https://doi.org/10.1007/s12046-021-01708-y

Waheed, S., Tahir, M.J., Ullah, I., Alwalid, O., Irshad, S.G., Asghar, M.S. & Yousaf, Z. (2022). The impact of dependence on advanced imaging techniques on the current radiology practice. *Annals of Medicine and Surgery, 78*. https://doi.org/10.1016/j.amsu.2022.103708

Wale, A., Okolie, C., Everitt, J., Hookway, A., Shaw, H., Little, K., Lewis, R., Cooper, A., & Edwards, A. (2024). The Effectiveness and Cost-Effectiveness of Community Diagnostic Centres: A Rapid Review. International Journal of Public Health, 69. https://doi.org/10.3389/ijph.2024.1606243

Wartini, S., Prananta, W., Febriatmoko, B., & Putri, P. I. (2024). Theory of resource-based view (RBV): integrated framework of distinctive capability in university performance. Media Ekonomi dan Manajemen, 39(2), 334-349.https://pdfs.semanticscholar.org/91c8/fce055dd5364aacaff48851c5ff0c380bebb.pdf

Wasswa, J. H., Oundo, H., Oteba, M. O., Komakech, H., Ochola, I., Mwebaze, S., ... & Lugada, E. (2023). Leveraging electronic logistics management information systems to enhance and optimize supply chain response during public health emergencies: lessons from COVID-

19 response in Uganda. Journal of Pharmaceutical Policy and Practice, 16(1), 6.https://doi.org/10.1186/s40545-023-00517-4

Wasti, S. P., Simkhada, P., van Teijlingen, E. R., Sathian, B., & Banerjee, I. (2022). The growing importance of mixed-methods research in health. *Nepal journal of epidemiology*, *12*(1), 1175. https://doi.org/10.3126/nje.v12i1.43633

Willie, M.M. (2025). Exploring the Impact of Marketing Strategies and Promotional Tactics on Consumer Behaviour in the Healthcare Sector, South Africa. [online] 1(1), pp.90–101. doi:https://doi.org/10.55578/jift.2506.006.

Winasti, W., Berden, H., & van Merode, F. (2023). Hospital organizational structure and information processing: An entropy perspective. Entropy, 25(3), 420. https://doi.org/10.3390/e25030420

World Health Organization. (2024). Health Promotion and Disease Prevention through population-based interventions, Including Action to Address Social Determinants and Health Inequity. World Health Organization. https://www.emro.who.int/about-who/public-health-functions/health-promotion-disease-prevention.html

Xu, W., Lin, G.-H., & Zhu, X. (2022). Bundling Strategies for Ride-Hailing Platforms Based on Price and Service Level. *Journal of Theoretical and Applied Electronic Commerce Research*, *17*(2), 851–874. https://doi.org/10.3390/jtaer17020044

Yadav, M., Bansal, M.K. & Gupta, M. (2022). Need for Regulation of Online Health Service Aggregators Including Medical Practice and Diagnostic Services in India: Delhi High Court. *Indian Internet Journal of Forensic Medicine and Toxicology*, 29. https://www.researchgate.net/profile/Mukesh-Yadav-17/publication/362945859_Indian_Internet_Journal_of_Forensic_Medicine_and_Toxicology/links/6308a3c861e4553b953d36b0/Indian-Internet-Journal-of-Forensic-Medicine-and-Toxicology.pdf#page=32

Yang, S.M., Lv, S., Zhang, W. & Cui, Y. (2022). Microfluidic point-of-care (POC) devices in early diagnosis: A review of opportunities and challenges. Sensors, 22(4), p.1620.https://doi.org/10.3390/s22041620

Zhang, F., Kreuter, D., Chen, Y., Dittmer, S., Tull, S., Shadbahr, T., Schut, M., Asselbergs, F., Kar, S., Sivapalaratnam, S. & Williams, S. (2024). Recent methodological advances in

federated learning for healthcare. *Patterns*, *5*(6). https://doi.org/10.1016/j.patter.2024.101006

Zhang, X., Chu, J. & Manchanda, P. (2026). Bargaining and network effects in two-sided platforms: Evidence from online healthcare. Marketing Science, 45(2), 359-385.https://doi.org/10.1287/mksc.2024.0922

Zoričić, D., Knežević, G., Miletić, M., Dolinar, D., & Sprčić, D. M. (2022). Integrated risk analysis of aggregators: Policy implications for the development of the competitive aggregator industry. Energies, 15(14), 5076. https://doi.org/10.3390/en15145076

Zychlinski, N. (2024). Managing queues with reentrant customers in support of hybrid healthcare. *Stochastic Systems*, *14*(2), 167-190. https://doi.org/10.1287/stsy.2022.0105

Appendix

Participant 1 (Founder of Healthcare Aggregator Platform)

Interview Question	Response
1. How is the current cost structure designed between healthcare aggregators and diagnostic service providers in the Indian pathology sector?	The present cost structure is highly dependent on third-party diagnostic laboratories. Aggregators mainly focus on customer acquisition, digital booking systems, logistics coordination, and home sample collection, while laboratories conduct the testing process. Most of the package revenue goes to laboratories because they own the diagnostic infrastructure, leaving aggregators with smaller margins after operational expenses.
2. What are the major operational inefficiencies and margin leakages experienced in the existing aggregator–diagnostic partnership model?	Major inefficiencies include delays in appointment scheduling, communication gaps between aggregators and laboratories, and issues in logistics coordination. Margin leakages occur because of high customer acquisition costs, transportation expenses, discounts offered to customers, and dependency on external laboratories that control pricing.

3. How does dependence on third-party laboratories and radiology centres influence pricing control, service quality, and profitability of healthcare aggregators?	Dependence on third-party providers limits the control aggregators have over pricing and service quality. Diagnostic centres usually decide testing prices, while service quality differs across providers. This creates inconsistencies in customer experience and reduces profitability because aggregators cannot fully optimize operational costs.
4. What operational challenges are faced in home sample collection services, including phlebotomy management, logistics, and coordination with outsourced laboratories?	Home sample collection involves challenges such as route planning, traffic delays, scheduling conflicts, and maintaining sample quality during transportation. Managing phlebotomists effectively is difficult during peak demand periods. Communication gaps between collection teams and laboratories may also delay report generation and reduce customer satisfaction.
5. How effective would a hybrid operational model involving in-house phlebotomy, outsourced laboratory processing, and radiology services conducted at diagnostic centres be in improving operational efficiency?	The hybrid model could significantly improve efficiency. In-house phlebotomy would improve operational control, customer coordination, and service quality. Outsourced laboratory processing would reduce infrastructure costs, while radiology services could continue at diagnostic centres because of their requirement for expensive equipment and technical expertise.

6. In your opinion, how could the proposed hybrid model contribute to improving profitability and margin retention for healthcare aggregator platforms?	The hybrid model could improve profitability by reducing dependence on external providers for every operational activity. Managing phlebotomy internally would reduce operational leakages, improve customer experiences, and help aggregators retain a larger share of revenues through better cost management.
7. What technological, financial, and managerial challenges may arise during the implementation of the proposed hybrid operational model?	The major challenges include initial financial investment for hiring staff, training phlebotomists, and developing logistics systems. Technology integration between aggregators and laboratories also requires secure digital infrastructure. Managing workforce consistency and operational coordination across multiple cities could become difficult during expansion.
8. How feasible and scalable is the proposed hybrid operational model for healthcare aggregators operating in Tier 1 and Tier 2 cities in India?	The model is highly feasible in Tier 1 cities due to higher customer demand and digital healthcare adoption. In Tier 2 cities, scalability is possible but requires stronger logistics networks and greater healthcare awareness among customers. Overall, the model has good long-term scalability potential with proper operational planning and technological support.

Participant 2 (Diagnostic Laboratory Manager)

Interview Question	Response
1. How is the current cost structure designed between healthcare aggregators and diagnostic service providers in the Indian pathology sector?	The cost structure is mostly commission-based. Aggregators bring customers through their digital platforms, while diagnostic laboratories perform the testing services. Laboratories bear the expenses related to equipment, reagents, quality control, staffing, and accreditation, which is why they receive the major share of the revenue generated from diagnostic packages.
2. What are the major operational inefficiencies and margin leakages experienced in the existing aggregator–diagnostic partnership model?	One major inefficiency is the lack of proper coordination between aggregators and laboratories. There are delays in sample collection, communication issues regarding test requirements, and operational duplication in some cases. Margin leakages also occur due to discounted pricing strategies imposed by aggregators to attract customers.
3. How does dependence on third-party laboratories and radiology centres influence pricing control, service quality, and profitability of healthcare aggregators?	Aggregators rely heavily on laboratories because diagnostic centres own the testing infrastructure and technical expertise. Since laboratories manage the actual testing process, aggregators have limited control over pricing and service quality. This

	dependence reduces their bargaining power and affects profitability.
4. What operational challenges are faced in home sample collection services, including phlebotomy management, logistics, and coordination with outsourced laboratories?	Home sample collection services require proper scheduling, transportation management, and temperature-controlled handling of samples. Delays in transportation or improper handling can affect sample quality and testing accuracy. Coordination between collection staff and laboratories is also sometimes inefficient.
5. How effective would a hybrid operational model involving in-house phlebotomy, outsourced laboratory processing, and radiology services conducted at diagnostic centres be in improving operational efficiency?	The hybrid model may improve operational efficiency because aggregators can directly manage customer-facing services such as phlebotomy and logistics. Laboratories can continue focusing on technical diagnostic services. This separation of responsibilities may reduce coordination issues and improve service quality.
6. In your opinion, how could the proposed hybrid model contribute to improving profitability and margin retention for healthcare aggregator platforms?	The proposed model may improve profitability by reducing operational inefficiencies and giving aggregators more control over logistics and customer service. Better coordination and reduced dependency on external providers for some services could improve margin retention.

7. What technological, financial, and managerial challenges may arise during the implementation of the proposed hybrid operational model?	The implementation would require investment in digital integration systems, workforce training, and logistics management. Maintaining communication between aggregators and laboratories through secure digital systems could also be challenging. Financially, smaller aggregators may struggle with initial investment costs.
8. How feasible and scalable is the proposed hybrid operational model for healthcare aggregators operating in Tier 1 and Tier 2 cities in India?	The model is more feasible in Tier 1 cities where healthcare infrastructure and customer awareness are stronger. In Tier 2 cities, scalability may depend on logistics availability, trained workforce, and healthcare adoption levels. However, with proper planning, the model could gradually expand into smaller markets.

Participant 3: Phlebotomist – Home Sample Collection Staff

Interview Question	Response
1. How is the current cost structure designed between healthcare aggregators and diagnostic service providers in the Indian pathology sector?	From my experience, aggregators mainly handle bookings and customer communication, while laboratories perform the diagnostic testing. Most operational spending for aggregators goes into logistics, transportation, staff payments, and customer service activities.
2. What are the major operational inefficiencies and margin leakages experienced in the existing aggregator–diagnostic partnership model?	Operational inefficiencies mostly happen because of poor scheduling, delayed communication, and travel-related issues. Sometimes appointments are assigned too close together, making it difficult to collect samples on time. Fuel costs, travel delays, and repeated visits also increase operational expenses.
3. How does dependence on third-party laboratories and radiology centres influence pricing control, service quality, and profitability of healthcare aggregators?	Since laboratories control testing and report generation, aggregators have limited control over turnaround times and service quality. If reports are delayed or errors occur, customers usually blame the aggregator platform, which affects customer trust and repeat bookings.

4. What operational challenges are faced in home sample collection services, including phlebotomy management, logistics, and coordination with outsourced laboratories?	The biggest challenges include traffic congestion, difficulty locating customer addresses, delays in transportation, and maintaining sample quality during travel. There are also communication gaps between phlebotomists, aggregators, and laboratories, which sometimes create confusion regarding test instructions or sample handling.
5. How effective would a hybrid operational model involving in-house phlebotomy, outsourced laboratory processing, and radiology services conducted at diagnostic centres be in improving operational efficiency?	I think the hybrid model would improve efficiency because in-house phlebotomy teams could receive better training, direct supervision, and more organized scheduling support from aggregators. This could improve coordination and reduce delays in sample collection.
6. In your opinion, how could the proposed hybrid model contribute to improving profitability and margin retention for healthcare aggregator platforms?	Better management of sample collection and logistics could reduce operational wastage and improve customer satisfaction. Faster and more reliable service may also increase repeat customers, which can improve profitability over time.
7. What technological, financial, and managerial challenges may arise during the implementation of the proposed hybrid operational model?	The main challenges would include hiring and training enough phlebotomists, managing staff schedules, and investing in proper tracking systems for appointments and transportation. Smaller aggregators may

	face difficulties managing these additional operational responsibilities.
8. How feasible and scalable is the proposed hybrid operational model for healthcare aggregators operating in Tier 1 and Tier 2 cities in India?	The model is more practical in Tier 1 cities where digital healthcare services and customer demand are already high. In Tier 2 cities, scalability may depend on transportation facilities, workforce availability, and awareness of home diagnostic services. However, demand is growing in smaller cities as well.

Participant 4 (Radiology Centre Administrator)

Interview Question	Response
1. How is the current cost structure designed between healthcare aggregators and diagnostic service providers in the Indian pathology sector?	In radiology services, diagnostic centres usually bear high operational costs because imaging equipment such as MRI, CT scan, ultrasound, and X-ray machines require major investments and regular maintenance. Aggregators mainly manage appointment bookings and customer acquisition, while radiology centres handle the technical operations and reporting processes.
2. What are the major operational inefficiencies and margin leakages experienced in the existing aggregator–diagnostic partnership model?	One major inefficiency is the lack of integrated coordination between aggregators and radiology centres. There are frequent scheduling conflicts, communication delays, and reporting mismatches. Margin leakages also occur because aggregators often provide discounted pricing, which reduces profitability for both parties.
3. How does dependence on third-party laboratories and radiology centres influence pricing control, service quality, and profitability of healthcare aggregators?	Aggregators depend heavily on radiology centres because they do not own imaging infrastructure. This limits their control over pricing, appointment availability, and reporting timelines. Service quality also varies between centres, which can affect

	customer satisfaction and profitability of aggregator platforms.
4. What operational challenges are faced in home sample collection services, including phlebotomy management, logistics, and coordination with outsourced laboratories?	Although radiology services are different from pathology collection services, coordination challenges still exist. Patients often face appointment delays, communication issues, and rescheduling problems. In integrated healthcare packages involving pathology and radiology together, poor coordination between different service providers creates operational inefficiencies.
5. How effective would a hybrid operational model involving in-house phlebotomy, outsourced laboratory processing, and radiology services conducted at diagnostic centres be in improving operational efficiency?	The hybrid model appears practical because radiology services require expensive infrastructure and specialized staff, making outsourcing more efficient. At the same time, aggregators can improve operational control through in-house management of customer-facing services such as phlebotomy and logistics coordination.
6. In your opinion, how could the proposed hybrid model contribute to improving profitability and margin retention for healthcare aggregator platforms?	The model may improve profitability by reducing operational duplication and improving service coordination. Aggregators could focus resources on customer management and logistics while diagnostic centres continue handling specialized radiology operations. This could create better

	operational efficiency and cost optimization.
7. What technological, financial, and managerial challenges may arise during the implementation of the proposed hybrid operational model?	The implementation would require integrated scheduling systems, digital reporting platforms, and better communication systems between aggregators and radiology centres. Financial challenges may include technology investment and workforce training. Managing coordination between multiple service providers could also become complex.
8. How feasible and scalable is the proposed hybrid operational model for healthcare aggregators operating in Tier 1 and Tier 2 cities in India?	The model is highly feasible in Tier 1 cities because advanced radiology infrastructure and digital healthcare adoption are already established. In Tier 2 cities, scalability may depend on the availability of radiology facilities and skilled healthcare professionals. However, growing healthcare demand creates strong future potential for expansion.

Participant 5 (Operations Manager of Healthcare Aggregator Platform)

Interview Question	Response
1. How is the current cost structure designed between healthcare aggregators and diagnostic service providers in the Indian pathology sector?	The cost structure is primarily based on commission-sharing arrangements between aggregators and diagnostic centres. Aggregators spend significantly on digital marketing, customer acquisition, logistics management, and customer support, while diagnostic centres handle laboratory infrastructure and testing services. The majority of testing revenue generally remains with the laboratories.
2. What are the major operational inefficiencies and margin leakages experienced in the existing aggregator–diagnostic partnership model?	Operational inefficiencies mainly arise from fragmented coordination systems, repeated communication processes, scheduling delays, and inefficient logistics planning. Margin leakages are strongly linked to high customer acquisition costs, promotional discounts, transportation expenses, and dependency on external providers for operational activities.
3. How does dependence on third-party laboratories and radiology centres influence pricing control, service quality, and profitability of healthcare aggregators?	Dependence on third-party providers limits the ability of aggregators to standardize pricing and maintain consistent service quality across locations. Laboratories usually determine test pricing and turnaround times, while aggregators have limited

	operational control. This affects customer satisfaction and reduces profit margins for aggregators.
4. What operational challenges are faced in home sample collection services, including phlebotomy management, logistics, and coordination with outsourced laboratories?	Home sample collection services require effective route planning, workforce scheduling, transportation management, and real-time communication. Delays in sample transportation, staff shortages, and coordination gaps with laboratories can impact service efficiency and report delivery timelines.
5. How effective would a hybrid operational model involving in-house phlebotomy, outsourced laboratory processing, and radiology services conducted at diagnostic centres be in improving operational efficiency?	The hybrid model could improve operational efficiency because aggregators would gain better control over customer-facing services such as phlebotomy and logistics. Outsourcing laboratory processing and radiology services would also reduce infrastructure investment burdens while maintaining operational flexibility.
6. In your opinion, how could the proposed hybrid model contribute to improving profitability and margin retention for healthcare aggregator platforms?	By managing sample collection and logistics internally, aggregators can reduce operational inefficiencies and improve customer retention. Better service coordination and reduced dependency on external providers for every operational

	stage may help improve margin retention and long-term profitability.
7. What technological, financial, and managerial challenges may arise during the implementation of the proposed hybrid operational model?	The key challenges include investment in workforce management systems, logistics technologies, and digital integration platforms. Financially, aggregators would require capital for recruitment, training, and operational expansion. Managing staff performance and maintaining service consistency across multiple cities would also be challenging.
8. How feasible and scalable is the proposed hybrid operational model for healthcare aggregators operating in Tier 1 and Tier 2 cities in India?	The model is highly scalable in Tier 1 cities due to stronger healthcare infrastructure and digital adoption. In Tier 2 cities, scalability may require improvements in transportation systems, workforce training, and healthcare awareness. However, the increasing demand for digital diagnostic services supports long-term expansion opportunities.

Participant 6: (Healthcare Consultant)

Interview Question	Response
1. How is the current cost structure designed between healthcare aggregators and diagnostic service providers in the Indian pathology sector?	The current cost structure is largely platform-driven, where aggregators focus on digital operations, customer acquisition, and coordination services, while diagnostic centres manage testing infrastructure and technical operations. Due to the capital-intensive nature of pathology and radiology services, laboratories generally retain a larger share of the service revenue.
2. What are the major operational inefficiencies and margin leakages experienced in the existing aggregator–diagnostic partnership model?	Major inefficiencies arise from fragmented healthcare coordination, inconsistent service quality across laboratories, delays in communication, and overlapping operational responsibilities. Margin leakages mainly occur because aggregators spend heavily on marketing, discounts, and logistics while maintaining limited control over pricing and service execution.
3. How does dependence on third-party laboratories and radiology centres influence pricing control, service quality, and profitability of healthcare aggregators?	Heavy reliance on third-party providers weakens the strategic position of aggregators. Diagnostic centres control the testing process, pricing decisions, and operational standards, which reduces the bargaining power of aggregators. Variations in service quality and turnaround times also affect customer trust and profitability.

4. What operational challenges are faced in home sample collection services, including phlebotomy management, logistics, and coordination with outsourced laboratories?	The major operational challenges include managing geographically dispersed sample collection networks, maintaining sample integrity during transportation, handling scheduling conflicts, and ensuring proper communication between phlebotomists and laboratories. These operational inefficiencies can increase costs and reduce service reliability.
5. How effective would a hybrid operational model involving in-house phlebotomy, outsourced laboratory processing, and radiology services conducted at diagnostic centres be in improving operational efficiency?	The proposed hybrid model appears operationally effective because it balances control and cost optimization. Aggregators can improve customer service and operational coordination through in-house phlebotomy, while outsourced laboratory processing and radiology services reduce the burden of infrastructure investment and specialized workforce management.
6. In your opinion, how could the proposed hybrid model contribute to improving profitability and margin retention for healthcare aggregator platforms?	The model could improve profitability by reducing operational fragmentation and increasing value capture for aggregators. Better control over logistics and customer interaction may improve customer retention, operational efficiency, and service reliability, which can contribute positively to long-term financial sustainability.

7. What technological, financial, and managerial challenges may arise during the implementation of the proposed hybrid operational model?	The implementation would require strong digital integration systems, workforce training, and secure healthcare data management infrastructure. Financial challenges include investment in technology platforms and logistics systems, while managerial challenges involve maintaining coordination between internal teams and external diagnostic providers.
8. How feasible and scalable is the proposed hybrid operational model for healthcare aggregators operating in Tier 1 and Tier 2 cities in India?	The model is highly feasible in metropolitan areas where digital healthcare infrastructure and consumer adoption are already strong. In Tier 2 cities, scalability will depend on logistics development, trained workforce availability, and healthcare awareness levels. However, increasing digital healthcare penetration creates strong growth potential for expansion into smaller markets.

Participant 7 (Digital Health Technology Manager)

Interview Question	Response
1. How is the current cost structure designed between healthcare aggregators and diagnostic service providers in the Indian pathology sector?	The cost structure is mainly divided between digital operations handled by aggregators and diagnostic testing managed by laboratories. Aggregators invest heavily in mobile applications, digital platforms, customer acquisition, and coordination systems, while laboratories spend more on diagnostic infrastructure, equipment, and technical manpower.
2. What are the major operational inefficiencies and margin leakages experienced in the existing aggregator–diagnostic partnership model?	Operational inefficiencies are mainly caused by disconnected digital systems, delayed communication between aggregators and laboratories, and poor integration of appointment scheduling and reporting systems. Margin leakages occur because aggregators invest significantly in technology, marketing, and customer support while depending on third-party providers for core testing services.
3. How does dependence on third-party laboratories and radiology centres influence pricing control, service quality, and profitability of healthcare aggregators?	Dependence on external providers limits aggregators' ability to standardize service quality and pricing. Since laboratories control the testing process and reporting systems, aggregators face difficulties in maintaining uniform customer experiences

	across multiple partner centres. This reduces profitability and operational control.
4. What operational challenges are faced in home sample collection services, including phlebotomy management, logistics, and coordination with outsourced laboratories?	The major challenges include real-time tracking of phlebotomists, coordinating appointment schedules, maintaining communication between laboratories and collection teams, and ensuring timely report generation. Technology gaps between aggregators and laboratories also create coordination delays and inefficiencies.
5. How effective would a hybrid operational model involving in-house phlebotomy, outsourced laboratory processing, and radiology services conducted at diagnostic centres be in improving operational efficiency?	The hybrid model could improve efficiency because aggregators would gain better operational visibility and control over customer-facing services through in-house phlebotomy. At the same time, outsourcing technical diagnostic processing would allow laboratories to continue handling specialized functions efficiently.
6. In your opinion, how could the proposed hybrid model contribute to improving profitability and margin retention for healthcare aggregator platforms?	Improved digital coordination and operational control could reduce service delays, improve customer satisfaction, and increase repeat bookings. Better logistics management and fewer operational inefficiencies would help aggregators retain higher margins and improve long-term profitability.

7. What technological, financial, and managerial challenges may arise during the implementation of the proposed hybrid operational model?	The implementation would require investment in integrated digital systems, cybersecurity infrastructure, workforce training, and real-time operational management tools. Financially, maintaining advanced technology systems may be expensive for smaller aggregators. Managing operational consistency across different cities could also become challenging.
8. How feasible and scalable is the proposed hybrid operational model for healthcare aggregators operating in Tier 1 and Tier 2 cities in India?	The model is very feasible in Tier 1 cities because digital healthcare adoption and technology infrastructure are already well developed. In Tier 2 cities, scalability would depend on internet connectivity, logistics systems, and customer awareness of digital healthcare services. However, increasing smartphone penetration supports future expansion opportunities.

Participant 8 (Senior Pathology Laboratory Technician)

Interview Question	Response
1. How is the current cost structure designed between healthcare aggregators and diagnostic service providers in the Indian pathology sector?	In most partnerships, aggregators mainly handle patient bookings, customer communication, and logistics coordination, while pathology laboratories manage testing operations and laboratory infrastructure. Since laboratories bear the costs of equipment, reagents, technical staff, and quality control systems, they usually receive the larger portion of the service revenue.
2. What are the major operational inefficiencies and margin leakages experienced in the existing aggregator–diagnostic partnership model?	Operational inefficiencies are often caused by delays in sample transportation, poor communication regarding test requirements, and inconsistent coordination between collection teams and laboratories. Margin leakages also occur because aggregators frequently offer discounts to attract customers, which affects profitability across the partnership chain.
3. How does dependence on third-party laboratories and radiology centres influence pricing control, service quality, and profitability of healthcare aggregators?	Aggregators have limited control because laboratories determine many operational processes, including testing procedures, turnaround times, and pricing structures. Differences in service quality among partner laboratories can create inconsistent patient experiences, which may reduce

	customer trust and impact aggregator profitability.
4. What operational challenges are faced in home sample collection services, including phlebotomy management, logistics, and coordination with outsourced laboratories?	The major challenges include maintaining sample quality during transportation, avoiding delays in sample delivery, and ensuring accurate labeling and documentation. Poor coordination between phlebotomists and laboratory teams can sometimes result in delayed processing or testing errors.
5. How effective would a hybrid operational model involving in-house phlebotomy, outsourced laboratory processing, and radiology services conducted at diagnostic centres be in improving operational efficiency?	The hybrid model could improve efficiency because aggregators would have better control over sample collection and customer coordination through in-house phlebotomy teams. Laboratories could continue focusing on specialized testing processes, which would maintain technical quality while improving operational coordination.
6. In your opinion, how could the proposed hybrid model contribute to improving profitability and margin retention for healthcare aggregator platforms?	Better management of sample collection and transportation could reduce delays, improve customer satisfaction, and minimize operational wastage. Improved coordination between aggregators and laboratories may also help reduce repeated operational costs and improve profitability.

7. What technological, financial, and managerial challenges may arise during the implementation of the proposed hybrid operational model?	The implementation would require digital systems for tracking samples, coordinating appointments, and managing communication between different teams. Financial investment would also be needed for workforce recruitment, training, and logistics management. Maintaining consistent operational standards across locations could become a managerial challenge.
8. How feasible and scalable is the proposed hybrid operational model for healthcare aggregators operating in Tier 1 and Tier 2 cities in India?	The model is more feasible in Tier 1 cities where healthcare infrastructure and demand for diagnostic services are stronger. In Tier 2 cities, scalability may depend on logistics availability, laboratory partnerships, and workforce training. However, increasing demand for home healthcare services supports future expansion opportunities.

Participant 9 (Healthcare Operations and Logistics Coordinator)

Interview Question	Response
1. How is the current cost structure designed between healthcare aggregators and diagnostic service providers in the Indian pathology sector?	The cost structure mainly depends on the division of operational responsibilities. Aggregators manage customer bookings, logistics coordination, and digital services, while diagnostic centres handle laboratory testing and reporting. Logistics and transportation costs are a significant expense for aggregators, especially in home sample collection services.
2. What are the major operational inefficiencies and margin leakages experienced in the existing aggregator–diagnostic partnership model?	Major inefficiencies occur due to poor route planning, delays in communication, repeated sample pickups, and scheduling mismatches between patients and collection staff. Margin leakages are also caused by high fuel costs, transportation delays, customer cancellations, and inefficient coordination between aggregators and laboratories.
3. How does dependence on third-party laboratories and radiology centres influence pricing control, service quality, and profitability of healthcare aggregators?	Since laboratories and radiology centres control the technical testing process, aggregators have limited influence over service pricing and turnaround times. Variations in service quality across different partner centres also affect customer experiences and profitability for aggregators.

4. What operational challenges are faced in home sample collection services, including phlebotomy management, logistics, and coordination with outsourced laboratories?	The biggest challenges include managing transportation schedules, handling traffic-related delays, ensuring timely sample delivery, and coordinating between multiple teams. Maintaining sample quality during transit and managing emergency rescheduling requests are also common operational issues.
5. How effective would a hybrid operational model involving in-house phlebotomy, outsourced laboratory processing, and radiology services conducted at diagnostic centres be in improving operational efficiency?	The hybrid model could improve efficiency because aggregators would gain better control over logistics and home collection services through in-house phlebotomy teams. Outsourcing laboratory processing and radiology services would reduce the need for major infrastructure investments while allowing specialized centres to continue handling technical operations.
6. In your opinion, how could the proposed hybrid model contribute to improving profitability and margin retention for healthcare aggregator platforms?	Better logistics control and improved coordination could reduce operational wastage, transportation inefficiencies, and service delays. This may help aggregators improve customer satisfaction, reduce repeated operational costs, and retain a larger share of revenues.

7. What technological, financial, and managerial challenges may arise during the implementation of the proposed hybrid operational model?	The implementation would require investment in logistics tracking systems, workforce scheduling software, and communication platforms. Financially, hiring and training in-house phlebotomy teams would increase short-term operational costs. Managing staff performance and maintaining service consistency across different cities would also be challenging.
8. How feasible and scalable is the proposed hybrid operational model for healthcare aggregators operating in Tier 1 and Tier 2 cities in India?	The model is highly feasible in Tier 1 cities because transportation networks and healthcare demand are already strong. In Tier 2 cities, scalability may depend on logistics infrastructure, availability of trained staff, and operational coordination systems. However, increasing demand for home healthcare services creates strong opportunities for future growth.

Participant 10 (Founder of Regional Diagnostic Aggregator Startup)

Interview Question	Response
1. How is the current cost structure designed between healthcare aggregators and diagnostic service providers in the Indian pathology sector?	The current cost structure is heavily influenced by customer acquisition and operational coordination expenses. Aggregators mainly spend on marketing, technology platforms, home collection logistics, and customer support, while laboratories invest in testing infrastructure, machines, reagents, and technical manpower. Revenue sharing is generally uneven because laboratories control the core testing services.
2. What are the major operational inefficiencies and margin leakages experienced in the existing aggregator–diagnostic partnership model?	Operational inefficiencies mainly arise from fragmented coordination systems, inconsistent communication, delayed report generation, and repeated operational processes. Margin leakages are caused by heavy discounting strategies, rising logistics costs, and the inability of aggregators to control laboratory pricing and operational workflows effectively.
3. How does dependence on third-party laboratories and radiology centres influence pricing control, service quality, and profitability of healthcare aggregators?	Dependence on external diagnostic providers significantly reduces the operational control of aggregators. Since laboratories and radiology centres determine testing costs, report turnaround times, and service processes, aggregators struggle to maintain

	consistent service quality and stable profit margins.
4. What operational challenges are faced in home sample collection services, including phlebotomy management, logistics, and coordination with outsourced laboratories?	The major operational challenges include managing geographically dispersed collection requests, handling scheduling conflicts, maintaining timely transportation of samples, and ensuring communication between collection staff and laboratories. Workforce management and maintaining service consistency during peak demand periods are also difficult.
5. How effective would a hybrid operational model involving in-house phlebotomy, outsourced laboratory processing, and radiology services conducted at diagnostic centres be in improving operational efficiency?	The hybrid model could improve operational efficiency because aggregators would gain better control over customer-facing operations such as sample collection and logistics. Outsourcing laboratory processing and radiology services would also allow aggregators to avoid large infrastructure investments while still maintaining service partnerships with specialized diagnostic centres.
6. In your opinion, how could the proposed hybrid model contribute to improving profitability and margin	By reducing operational fragmentation and improving coordination, the hybrid model may help aggregators lower logistics inefficiencies and improve customer retention. Better operational control over

retention for healthcare aggregator platforms?	phlebotomy and scheduling may also reduce dependency-related costs and improve margin retention over time.
7. What technological, financial, and managerial challenges may arise during the implementation of the proposed hybrid operational model?	The implementation would require investment in integrated technology platforms, workforce training systems, logistics management tools, and digital communication systems. Financially, hiring and managing in-house teams would increase initial operational costs. Maintaining coordination across multiple cities and service providers could also become a managerial challenge.
8. How feasible and scalable is the proposed hybrid operational model for healthcare aggregators operating in Tier 1 and Tier 2 cities in India?	The model is highly feasible in Tier 1 cities because customer demand, digital adoption, and healthcare infrastructure are already well established. In Tier 2 cities, scalability would depend on logistics development, local laboratory partnerships, and customer awareness of digital healthcare services. However, the market potential for expansion remains strong due to increasing healthcare digitization across India.