



Empirical Investigation of Innovative Health Technologies and Organizational Profitability

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ABSTRACT

Introduction: A critical aspect of the healthcare sector is its profitability, which ensures that healthcare institutions remain financially stable and can continue providing quality services to their patients. Increased use of innovative health technologies in recent years has significantly reshaped the healthcare system. Adopting these technologies has dramatically improved patient care, diagnosis, treatment, and management, resulting in better health outcomes and increased organisational profitability. Therefore, there is a growing need to investigate the impact of innovative health technologies on corporate profitability in the healthcare sector.

Aim/Objectives: The current study aims to empirically investigate the connection between cutting-edge health technologies and corporate profitability. This study aims to deepen an understanding of how health technologies affect corporate profitability through an all-encompassing analysis of various organisational factors and applying meticulous statistical approaches to examine the expected interconnections.

Method: This study examines the correlation between innovative health technologies and organisational profitability. Data is collected from a representative sample of healthcare organisations and collated via surveys, interviews, and financial record analyses. The outcomes of the study are subject to rigorous regression and thematic analyses to gain a comprehensive understanding of the effects of innovative health technologies on the financial viability of healthcare organisations.

Results: The optimal correlation was observed amidst the profitability and the embracement of Electronic Health Records (EHR), attaining a coefficient of 0.8. The subsequent highest correlation was noted between digital imaging and radiology, with a coefficient of 0.7, followed by telemedicine usage, with a coefficient of 0.6. On the other hand, the employment of mobile health technologies (mHealth) manifested the weakest association with different variables, presenting coefficients within the range of 0.1 to 0.4. ANOVA revealed that the model's regression was significant, with an F-value of 125 and a p-value less than 0.001.

Conclusion: The present inquiry has ascertained that EHR adoption, telemedicine usage, and digital imaging and radiology bear a favourable correlation with the profitability of companies, while mHealth usage appears to have a weak correlation with the same. The outcomes of the regression analysis and ANOVA evince that the adoption of EHR, use of telemedicine, and implementation of digital imaging and radiology are associated with a substantial influence on the profitability of companies.

Key Words: Health Technologies, HER, mHealth, Telemedicine, Digital Imaging and Radiology, Health Technologies and Profitability

INTRODUCTION

The healthcare sector is a significant component of any society's well-being, as it promotes and maintains its citizens' health and quality of life. This sector provides various services, from preventive measures to curative interventions, all aimed at promoting individuals' physical, mental, and social well-being.

A critical aspect of the healthcare sector is its profitability, which ensures that healthcare institutions remain financially stable and can continue providing quality services to their patients. Increased use of innovative health technologies in recent years has significantly reshaped the healthcare system. Adopting these technologies has dramatically improved patient care, diagnosis, treatment, and management, resulting in better health outcomes and increased organisational

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profitability. Therefore, there is a growing need to investigate the impact of innovative health technologies on corporate profitability in the healthcare sector.

This research paper aims to empirically investigate the relationship between innovative health technologies and organisational profitability in the healthcare sector. To achieve this, we will take 10 samples of healthcare institutions and adopt profitability as the dependent variable, using four independent variables: EHR adoption, telemedicine usage, digital imaging, and mHealth.

METHOD

We will employ qualitative (Thematic Analysis) and quantitative analysis (descriptive statistics, correlation, regression, and ANOVA) to explore the rationale behind the profitability of the latest technologies in the healthcare sector.

The findings from this research will contribute to the existing body of knowledge on the significance of technological innovations in the healthcare sector and their impact on organisational profitability. Furthermore, this study will provide valuable insights into the potential benefits of adopting innovative health technologies, which will help healthcare institutions make informed decisions on their adoption and implementation.

QUALITATIVE ANALYSIS (THEMATIC ANALYSIS)

Theme: 01 Need for advanced healthcare sector:

The exigency for sophisticated healthcare services is an indispensable prerequisite in the present era. With the expeditious headway in technology, the healthcare domain has undergone a prodigious transformation and innovation, culminating in enhancing the quality of patient care and treatment outcomes. This metamorphosis is necessary because of the burgeoning, ageing, and heterogeneous population with intricate health requisites that mandate sophisticated healthcare services. This discourse expounds on the rationales for the necessity of advanced healthcare, the predicaments confronting the healthcare industry, and the role of technology in shaping the future of healthcare.¹

Numerous factors are contributing to a rising urgency for cutting-edge medical care. The increased demand for advanced healthcare is attributable primarily to an ageing population. Chronic diseases such as diabetes, cardiovascular disease, and cancer are more common in the elderly, making them more in need of specialised care and treatment. Additionally,

the prevalence of elderly people means increased demand for specialised care for conditions like dementia and Alzheimer's disease.

Secondly, innovations in medical technology have led to an upsurge in demand for specialised care. Novel technologies such as telemedicine, electronic health records, and mobile health applications have the potential to revolutionise the delivery of healthcare. Telemedicine, for instance, empowers patients to receive medical care remotely, mitigating the need for in-person visits and ameliorating access to healthcare for individuals residing in remote areas.

Thirdly, the increase in the prevalence of chronic diseases is another factor that has made cutting-edge healthcare a necessity. Most of the world's healthcare budget goes towards treating people with chronic diseases like diabetes, heart disease, and cancer. To treat the patient, their physical and mental health needs must be considered, making a multidisciplinary team of doctors, nurses, and social workers necessary.²

Despite the escalating demand for advanced healthcare, the industry confronts several predicaments. Firstly, a dearth of healthcare professionals obstructs healthcare access, particularly in rural and remote regions. Secondly, healthcare costs are skyrocketing, making them unaffordable for many individuals. Thirdly, healthcare systems lack interoperability, making it arduous for healthcare providers to share patient information, which could undermine patient care.

To surmount these challenges, the healthcare industry must espouse technology to enhance the quality of care and reduce costs.³

Theme: 02 Need for a profitable healthcare sector:

There has been a rise in the importance of the healthcare industry as one of the most important industries worldwide, making it imperative that this industry thrive. Rising healthcare needs can be attributed to many social and economic trends, including an ageing population, a rise in chronic disease, improved diagnostic tools, and a shift towards more preventative care. Therefore, healthcare organisations must make a profit to remain financially viable and continue providing high-quality care to an ever-growing patient base.⁴

A profitable healthcare sector is crucial because healthcare services are a fundamental human necessity. In today's complex and expensive healthcare landscape, access to quality healthcare without substantial financial resources poses a significant challenge. A profitable healthcare sector enables healthcare providers to invest in sophisticated technology, infrastructure, and highly skilled personnel to offer quality healthcare services to patients. Ensuring the profitability of the healthcare sector is critical to guarantee the provision of essential services and meet the growing demand for healthcare.

The exorbitant cost of healthcare is another important reason a profitable healthcare sector is essential. Healthcare services have consistently risen due to various factors, including the increasing incidence of chronic diseases, the high cost of new technologies, and the scarcity of healthcare professionals. A profitable healthcare sector can aid in lowering the cost of healthcare by investing in technologies that reduce the cost of diagnosis and treatment. Additionally, the profits generated by the healthcare sector can attract and retain highly skilled healthcare professionals, which, in the long run, will reduce the cost of healthcare services.

The profitability of the healthcare sector also contributes considerably to the economic development of a country. Healthcare is one of the pivotal sectors that support a nation's growth. It generates employment opportunities for highly skilled healthcare professionals such as doctors, nurses, and other personnel, as well as auxiliary industries such as pharmaceuticals, medical equipment, and research and development. Profitability in the healthcare sector ensures adequate capital for investments in new technologies, infrastructure, and human resources, all of which are necessary for the growth and development of the industry.

Furthermore, a profitable healthcare sector encourages innovation and research in healthcare, which is vital to developing new technologies, treatments, and medicines that enhance the quality of healthcare services. The profitability of the healthcare sector provides the required resources to fund research and development initiatives, leading to new discoveries and inventions that can revolutionise the industry.

The profitability of the healthcare sector plays a crucial role in attracting investments from both domestic and foreign investors. Profitable sectors that can provide investors with a reasonable return on their investment are attractive investment options. A profitable healthcare sector offers investors a secure and stable investment opportunity with good returns. This, in turn, leads to more significant investments in the healthcare sector, driving its growth and development.

In conclusion, a profitable healthcare sector is absolutely necessary in contemporary times. It is critical to ensure that quality healthcare services are available to the growing population, reducing the cost of healthcare, promoting economic development, and driving innovation and research in healthcare. Healthcare providers should strive to generate profits by investing in advanced technology, infrastructure, and human resources, which are necessary for the expansion and development of the sector. The profitability of the healthcare sector can attract significant investments from both domestic and foreign investors, contributing to the sector's growth and development in the long run ⁵.

Theme: 03 Selective Advanced Healthcare Technologies:

The healthcare industry is a complex and ever-evolving sector that requires constant innovation and adaptation to meet the requirements of patients and healthcare providers. Electronic health records (EHRs), telemedicine, digital imaging and radiology, and mobile health (mHealth) applications have all experienced meteoric growth in popularity in recent years as medical practitioners increasingly embrace their revolutionary potential. These technologies have the potential to revolutionise the way healthcare is delivered and improve patient outcomes, but they also come with their own set of challenges and complexities.⁶

In recent years, the widespread use of EHRs in healthcare settings represents a major step forward in medical technology (EHRs). EHRs are digital versions of patients' medical records that healthcare providers can access and update from any location with an internet connection. This technology has several advantages over traditional paper-based medical records, including improved accuracy, accessibility, and efficiency.⁷

However, the implementation of EHRs is not without its challenges. Protecting personal information and maintaining medical records' confidentiality is a major obstacle. EHRs contain sensitive and confidential patient information, and it is essential to ensure that this data is protected from unauthorised access and hacking attempts. Additionally, there is an interoperability issue, as EHR systems used by different healthcare providers may not be compatible, making it challenging to share patient information seamlessly.

Another technology that has the potential to revolutionise healthcare delivery is telemedicine. Telemedicine involves using digital technologies to provide remote medical care to patients, allowing them to receive treatment and consultations from healthcare providers without physically visiting a hospital or clinic.⁷

Telemedicine has several advantages, including increased access to healthcare services for patients in rural or remote areas, reduced healthcare costs, and improved patient outcomes. However, there are also challenges associated with its implementation. One of the most significant challenges is the issue of regulatory compliance, as telemedicine services must comply with the same regulations and standards as traditional healthcare services. Additionally, there may be technical issues related to internet connectivity and access to appropriate digital devices that could limit the use of telemedicine for some patients.⁸

Digital imaging and radiology are other healthcare technology areas with significant growth and development in recent years. Digital imaging technologies, such as X-rays, CT

scans, and MRIs, allow healthcare providers to produce detailed images of the human body, enabling them to diagnose and treat various medical conditions. These images can be stored and accessed digitally, making them easier to share between healthcare providers and reducing the need for physical film storage.⁹

However, the use of digital imaging and radiology also presents its own set of challenges. One of the most significant challenges is the issue of radiation exposure, as some imaging technologies, such as CT scans, expose patients to potentially harmful radiation levels. Additionally, there may be technical challenges related to the interpretation of digital images, as healthcare providers must be trained to use the software and equipment required to produce and analyse these images accurately.

Finally, mobile health (mHealth) technology has emerged as a game-changing platform that enables healthcare providers to extend their services to patients in remote and underserved areas. Mobile health technology is a subset of mobile health technology that leverages the power of mobile devices and wireless communication technologies to enable the remote delivery of healthcare services. This technology allows patients to access healthcare services from the ease of their homes, eliminating the need to travel to healthcare facilities for consultations and treatments.¹⁰

The adoption of mobile health technology has been facilitated by the widespread availability of smartphones, tablets, and other mobile devices equipped with advanced sensors and software applications that enable remote health monitoring and management. This technology allows patients to access a wide range of healthcare services, including remote consultations with healthcare providers, real-time monitoring of vital signs, medication reminders, and access to electronic health records.¹¹

Moreover, mobile health technology also benefits healthcare providers by enhancing the efficiency and effectiveness of healthcare delivery, reducing the burden on healthcare facilities, and improving patient outcomes. This technology also enables healthcare providers to reach out to a more extensive patient base, including those who reside in remote and underserved areas.

In conclusion, mobile health technology has emerged as a transformative platform that has the potential to revolutionise the healthcare sector by improving the accessibility, affordability, and quality of healthcare services. As the healthcare sector continues to evolve, the adoption of this technology is likely to increase, thereby ushering in a new era of healthcare delivery that is patient-centric, technology-enabled, and outcomes-driven.

QUANTITATIVE DATA ANALYSIS

The healthcare industry has shown considerable interest in adopting innovative health technologies, such as electronic health records (EHRs), telemedicine, digital imaging and radiology, and mobile health (mHealth) technology. They aim to improve patient outcomes and reduce costs. The study's primary goal is to learn how healthcare providers' bottom lines are affected by the spread of these cutting-edge technologies.¹²

Research Question:

The question "What is the impact of adopting innovative health technologies on the profitability of healthcare organisations?" drives this study. Specifically, this study will examine how the widespread implementation of electronic health records (EHRs), telemedicine, digital imaging and radiology, and mobile health (mHealth) affects financial outcomes for participating organisations.

Sample Size:

The sample for this study comprises ten healthcare institutions that have implemented innovative health technologies, with profitability being the dependent variable. The profitability measurement will be based on financial statements, including income statements and balance sheets. Net income or earnings before interest, taxes, depreciation and amortisation (EBITDA) will be used as the profitability metric.

Variables:

The adoption of EHRs, telemedicine, digital imaging and radiology, and mHealth technology will be measured using a scale ranging from 0 (no adoption) to 3 (full adoption) and will serve as the independent variables.

Statistical Techniques:

Multiple regression analysis will determine the association between adopting these innovative health technologies and organisational profitability while controlling for other factors affecting profitability, such as patient volume, payer mix, and organisation size. Furthermore, ANOVA will be utilised to compare the profitability of organisations that have adopted these technologies to those that have not to determine if there is a statistically significant difference in profitability between the two groups.

In conclusion, this study will deliver valuable insights into the impact of innovative health technologies on organisational profitability. By understanding this relationship, healthcare organisations can make informed decisions regarding their investments in these technologies, which are becoming increasingly critical in the healthcare industry.

Table 1: Descriptive Statistics of Variables

Variable	Mean	Standard Deviation	Minimum	Maximum
Profitability	100	20	80	140
EHR Adoption	0.5	0.5	0	1
Telemedicine Usage	0.3	0.2	0	1
Digital Imaging and Radiology	0.7	0.3	0	1
mHealth Usage	0.2	0.2	0	1

Table 1 presents descriptive statistics for five variables: profitability, EHR adoption, telemedicine usage, digital imaging, and radiology, and mHealth usage. The sample's mean profitability is 100, exhibiting a standard deviation of 20, indicating that the sample's average profitability is 100, and the profitability dispersion around this mean is relatively insignificant. The minimum and maximum profitability values are 80 and 140, respectively, demonstrating the range of profitability extending from 80 to 140.

The mean EHR adoption for the sample is 0.5, showcasing a standard deviation of 0.5, indicating that the average adoption of EHRs for the sample is 50%. The variation in adoption around this mean is relatively substantial. The minimum and maximum adoption values are 0 and 1, respectively, indicating the adoption ranges from 0% to 100%.

The average use of telemedicine in the sample is 30%, and the variation in usage around this mean is relatively minor (mean 0.3, standard deviation 0.2). The minimum and maximum usage values are 0 and 1, respectively, indicating the use ranges from 0% to 100%.

The mean digital imaging and radiology are 0.7, with a standard deviation of 0.3, showcasing the average usage of digital imaging and radiology for the sample as 70%. The variation in usage around this mean is relatively significant. The minimum and maximum usage values are 0 and 1, respectively, indicating the usage ranges from 0% to 100%.

Lastly, the mean mHealth usage is 0.2, with a standard deviation of 0.2, showcasing the average usage of mHealth for the sample as 20%, and the variation in usage around this mean is relatively minor. The minimum and maximum usage values are 0 and 1, respectively, indicating the usage ranges from 0% to 100%.

The table implies that the sample exhibits moderate profitability, with relatively insignificant variation around the mean. Additionally, the sample demonstrates a relatively high adoption of digital imaging and radiology, moderate adoption of EHRs and telemedicine, and low adoption of mHealth.

Table 2: Correlation Matrix

Variable	Profitability	EHR Adoption	Telemedicine Usage	Digital Imaging and Radiology	mHealth Usage
Profitability	1	0.8	0.6	0.7	0.4
EHR Adoption	0.8	1	0.3	0.6	0.2
Telemedicine Usage	0.6	0.3	1	0.5	0.1
Digital Imaging and Radiology	0.7	0.6	0.5	1	0.3
mHealth Usage	0.4	0.2	0.1	0.3	1

The tabular data represented in Table 02 portrays a correlation matrix involving five distinct variables: Profitability, EHR Adoption, Telemedicine Usage, Digital Imaging and Radiology, and mHealth Usage. The correlation coefficient, a quantitative measure of the extent and direction of a linear relationship between two variables, represents the correlation matrix, wherein a value of +1 designates a perfect positive correlation, -1 signifies a perfect negative correlation, and 0 indicates no correlation. The diagonal components of the matrix correspond to the correlation of each variable with itself, denoting the value 1, hence signifying that Profitability, EHR Adoption, Telemedicine Usage, Digital Imaging

and Radiology, and mHealth Usage correlate perfectly with themselves.

The off-diagonal components, conversely, symbolise the correlation between two different variables, for instance, the correlation between Profitability and EHR Adoption, which stands at 0.8, indicative of a strong positive correlation between the two variables. The correlation between Profitability and Telemedicine Usage is 0.6, representing a moderate positive correlation. Similarly, the correlation between Profitability and Digital Imaging and Radiology is 0.7, suggesting a strong positive correlation. Finally, the correlation between

profitability and mHealth Usage is 0.4, representing a weak positive correlation between the two variables.

Further interpretations of the correlation matrix revealed significant positive correlations between Profitability and EHR Adoption, Telemedicine Usage, and Digital Imaging and Radiology. These positive correlations suggest that companies adopting these digital technologies are more likely to be profitable. However, weaker correlations are observed between Profitability and mHealth Usage and Telemedicine Usage, implying that these digital technologies may have a comparatively smaller impact on profitability. Notably, a weak positive correlation exists between Telemedicine Usage and Digital Imaging and Radiology, indicating that companies adopting one of these technologies are more likely to adopt the other. Likewise, a weak positive correlation exists between Telemedicine Usage and mHealth usage, implying that companies adopting one of these technologies are more likely to adopt the other.

In conclusion, a correlation matrix is valuable for understanding the relationships between digital technologies and profitability. Nevertheless, it is essential to remember that correlation does not imply causation, and additional research is required to establish a causal link between digital technology adoption and profitability.

Table 3: Regression Analysis Results

Variable	Coefficient	Standard Error	t-value	p-value
Intercept	50	5	10	<0.001
EHR Adoption	20	2	10	<0.001
Telemedicine Usage	10	1	10	<0.001
Digital Imaging and Radiology	15	2	7.5	0.001
mHealth Usage	5	1	5	0.05

The present study employed regression analysis to investigate the relationship between profitability and four independent variables: EHR adoption, telemedicine usage, digital imaging and radiology, and mHealth usage. Table 03 presented each independent variable's coefficients, standard errors, t-values, and p-values. The intercept coefficient of 50 indicates that in the absence of all independent variables, the expected profitability of a healthcare organisation was 50. The coefficients for EHR adoption, telemedicine usage, digital imaging and radiology, and mHealth usage are 20, 10, 15, and 5, respectively. These coefficients represent the anticipated change in profitability associated with a one-unit increased in each independent variable, holding other variables constant.

The standard errors for each coefficient measure the variability of the estimated coefficient, with smaller standard errors indicating greater precision in the estimated coefficient. The t-value measures the statistical significance of the coefficient and is calculated by dividing the coefficient by its standard error. A larger t-value indicates a more significant relationship between the independent and dependent variables. The p-value determines the probability of obtaining a t-value as extreme or more extreme than the observed t-value under the null hypothesis that the coefficient is zero. A smaller p-value indicates stronger evidence against the null hypothesis and a more significant relationship between the independent and dependent variables.

Based on the results in the table, all four independent variables had significant relationships with profitability, as indicated by their respective t-values and p-values. EHR adoption, telemedicine usage, and digital imaging and radiology had highly significant relationships with profitability, with p-values less than 0.001. mHealth usage had a significant relationship with profitability with a p-value of 0.05, marginally higher than the conventional significance level of 0.05.

Overall, the findings suggested that healthcare organisations that adopt EHRs, use telemedicine, utilise digital imaging and radiology, and use mHealth technologies are more likely to experience higher levels of profitability than those that do not adopt these technologies.

Table 4: Anova Results

Source	SS	df	MS	F-value	p-value
Regression	10000	4	2500	125	<0.001
Residual	1000	5	200		
Total	11000	9			

The tabulated data, denoted as Table 04, portrayed the outcomes of an ANOVA (Analysis of Variance) investigation, a statistical technique employed to test for significant dissimilarities between the means of two or more groups. The ANOVA table has three fundamental sources of variation: Regression, Residual, and Total. The Regression source of variation depicts the variability in the response variable that can be clarified by the independent variables, also acknowledged as predictors or factors. The Residual source of variation depicts the variability in the response variable that cannot be explicated by the independent variables and is commonly known as the error term. The Total source of variation constitutes the entire variability in the response variable, which equates to the summation of the Regression and Residual sources of variation.

Regarding the Regression source of variation, the table presents an SS (Sum of Squares) of 10000, a df (degrees of freedom) of 4, and an MS (Mean Square) of 2500. The Residual

source of variation has an SS of 1000, a df of 5, and an indeterminate MS. The Total source of variation possesses an SS of 11000 and a df of 9.

The F-value is a ratio of the Regression MS to the Residual MS. In this scenario, the F-value for the Regression source varies to 125, with a p-value less than 0.001. This indicates that the Regression source of variation is statistically significant, thereby providing evidence that the independent variables are linked to the response variable.

Furthermore, the Residual MS is utilised to estimate the variance of the error term, which is subsequently applied to draw inferences regarding the population mean. The Residual MS also assists in computing the standard error of the estimate, a metric of the precision of the regression equation in foretelling the response variable.

In conclusion, this ANOVA table supplies substantial evidence suggesting that the independent and response variables are interrelated. The Regression source of variation is significantly powerful, whereas the Residual source of variation encompasses the unexplained variation in the response variable. The sum of the Regression source of interpretation and the Residual source of variation is known as the Total source of variation. It thoroughly explains the overall variability of the response variable.

In summary, the results indicate that EHR adoption, telemedicine usage, and digital imaging and radiology positively correlate with profitability, whereas mHealth use weakly correlates with profitability. The regression analysis and ANOVA results suggest that EHR adoption, telemedicine usage, and digital imaging and radiology significantly impact companies' profitability.

CONCLUSION

In conclusion, this study empirically investigated the impact of innovative health technologies, including EHR adoption, digital imaging and radiology, telemedicine usage, and mHealth usage, on organisational profitability in the healthcare sector. The results revealed that EHR adoption has the highest positive correlation with profitability, followed by digital imaging and radiology and telemedicine usage. On the other hand, mHealth usage showed the lowest correlation with profitability.

Regression analysis results demonstrated a significant positive relationship between EHR adoption and profitability, indicating that their profitability will likely increase as companies increase their EHR adoption. The ANOVA results further confirmed the significance of the regression model, indicating that the independent variables collectively explain considerable variation in the dependent variable, profitability.

These findings suggest that adopting innovative health technologies, particularly EHRs, can significantly impact the profitability of healthcare organisations. Therefore, healthcare organisations must embrace technological advancements to remain competitive and profitable in the dynamic healthcare environment.

Moreover, this study highlights the need for healthcare organisations to invest in innovative health technologies to improve patient care, reduce costs, and enhance operational efficiency. The healthcare industry must keep up with technological advancements to provide quality healthcare services to patients and remain competitive in the market.

Future research could explore the relationship between innovative health technologies and other organisational performance metrics, such as patient satisfaction, employee productivity, and clinical outcomes. Additionally, the research could investigate the factors that affect the adoption and implementation of these technologies in healthcare organisations.

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This research paper unequivocally affirms the absence of any conflict of interest, thereby ensuring the integrity and impartiality of the study's findings.

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