
The Mediating Role of Internet of Things on the Relationship between Artificial Intelligence and Service Delivery of General Hospitals in Katsina State

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Abstract

This study examined the effect of artificial intelligence and service delivery of general hospitals with mediating effect of internet of things (IoT). On the ground of Technology Acceptance Model (TAM), cross-sectional survey was used to collect data from the respondents. The study population was 469 medical personnel and the sample size consists of 216 medical personnel from four general hospitals in Katsina state, Nigeria. A PLS-SEM approach was used with aid of Smart PLS 4.1 to analyse the data. The result showed that artificial intelligence dimensions (computer vision and robotic process automation) were significantly and positively related to service delivery of general hospitals in Katsina state. For the indirect relationship the result indicated that the Internet of Thing mediate the effect of computer vision and service delivery which the result of the mediating effect revealed that IoT significantly mediate the relationship between robotic process automation and service delivery in a negative way. The negative t-statistic suggests that as Robotic Process Automation increases, IoT decreases by 0.736. This study recommends that government should invest on Artificial Intelligence technologies like Computer Vision and Robotic Process Automation in the generals. This will improve more efficient, responsive, and customer-oriented service delivery in the general hospitals in the areas patient monitoring, diagnosis, and administrative processes.

Keywords: Artificial Intelligence, Robotic Process Automation, Computer Vision, Internet of Thing, Katsina State, Nigeria

1. Introduction

As important as human life is health systems worldwide grapple with a multitude of challenges, such as the increasing prevalence of non-communicable diseases (NCDs), aging populations, rising healthcare expenses, low productivity, and increased healthcare needs (Adeola, 2021). These obstacles prevent health systems from achieving their main goals, which are stable finances and fair access to healthcare. Thus, in order to solve these restrictions, it is imperative that healthcare systems need digital solutions to address the challenges of patient flows as well as the organization and delivery of all services related to disease diagnosis and treatment, as well as health promotion, maintenance, and restoration (Khaled et al., 2019). This is why Artificial Intelligence (AI) is required, since

it has the ability to greatly impact health service delivery in a variety of ways, including improved efficiency, accessibility, and outcomes.

According to a survey conducted by the World Health Organization (WHO, 2021), some wealthy European nations, including Germany, Switzerland, Norway, Ireland, the United States, and the United Kingdom, are adopting artificial intelligence to support a variety of public health interventions, including disease surveillance, outbreak response, and health system management. Approximately 53% to 58% of automated classifications of medical images were approved in 2020 for radiological examination and which exceed the performance of human experts in image-based diagnoses from several medical specialties including pneumonia in radiology.

According to another survey by Bajwa et al. (2021), 25% of the United State healthcare system has adopted AI, which has improved efficiency and streamlined operations with 61.4%, and has a greater efficacy in breast cancer screening than radiologists. This has reduced waste in the healthcare is estimated which has cost around \$850 billion or 25% of healthcare spending.

AI is the simulation of human intelligence in computer systems and machines (Zhang et al., 2023). It includes the creation of algorithms and software that allow machines to execute tasks that would normally need human intelligence, such as problem solving, learning from experience, comprehending natural language, identifying patterns, and making judgments (Reddy et al., 2019). AI is used in a variety of industries and sectors, including healthcare, finance, manufacturing, entertainment, transportation, and others, and its ability to automate tasks, provide insights from data, and improve decision-making processes continues to drive innovation and reshape how businesses and organizations operate in the modern world. In the healthcare industry, AI revolutionizing the way healthcare is delivered, improving patient outcomes, and enhancing operational efficiency (Jiang et al., 2023). AI algorithms can analyse medical images such as X-rays, Magnetic Resonance Imaging (MRIs), and Computed Tomography (CT) scans to assist radiologists in detecting and diagnosing diseases like cancer, fractures, and neurological disorders with high accuracy. It is capable of helping pathologists analyse tissue samples, improving the accuracy of cancer diagnosis and identifying abnormalities while analysing genetic, clinical, and lifestyle data to tailor treatments to individual patients, increasing the effectiveness of therapies and reducing side effects (Zhang et al., 2023). The objective of this study is to provide more light on how AI influences health care delivery and how the Internet of Things, which connects AI tools, mediates this relationship.

AI has made significant advancements in the healthcare sector worldwide, with a multitude of important benefits. It improves patient's experience of care, enhance caregiver experience and reduce the rising cost of care. However, despite the enormous benefits of using these AI and IoT powered technologies, the Nigerian hospitals particularly General Hospitals in Katsina cannot boast of these technologies (Bajwa et al., (2021). This has led highly placed individual and high political office holders travelled abroad to seek medical treatment. This could be attributed to poor or inadequate funding of the hospital infrastructures, lack of properly trained and compensated staff, inadequate manpower such as doctors, nurses and pharmacies laboratory technicians and brain drainage and inadequately remuneration for medical workers (Oleribe et al., 2019). Therefore, this study seek is to explore how AI affects service delivery in general hospitals and how Internet of Things connects the AI tools mediates this relationship.

Rozarioet et al. (2021) found that technology has enhanced accuracy; computational speed and maintained compliance with the legal, ethical consideration, quality, and data privacy/security have improved the healthcare sector. Jawaid (2023) revealed that AI has improved healthcare efficiency and patient outcomes but cannot fully replace human

healthcare professionals. AI can assist healthcare professionals in their work, leading to better resource utilization and improved patient care. However, there is still a need for human healthcare professionals to oversee AI systems and provide empathy and personalized care to patients.

Rajhi et al. (2020) revealed that machine-based practices such as mobile applications, computers, internet, and robotic devices enhance public health, personal care and medical clinical practices. Khaled et al. (2019) revealed that artificial intelligence has positively influence the healthcare delivery in terms of quality of care, efficiency and accuracy. On the other hand, AI showed negative implications in terms of ethical, data privacy and de-humanization of care (Boyd & Holton, 2018). To the best of author's knowledge, no study has empirically investigated computer vision and robotic process automation and have used the to carry out analysis which created a variable gap that study seeks to fill by addressing AI on service delivery, mediating role of internet of things in general hospitals of Katsina State

Similarly, based on the review of existing literatures, such as Rozario et al. (2021; Jawaid 2023; and Rajhi et al. 2020), the findings show significant and positive relationship between AI and service delivery in the health sector, while Khaled et al. (2019) found a negative relationship between AI and Service delivery. These findings are inconsistent which created a theoretical gap the study aim to fill.

The broad question of this research is to determine the extent does computer vision influence service delivery of General Hospitals in Katsina State, to examine the extent of influence of robotic process automation on service delivery of general hospital. The extent of internet of things mediates the relationship between computer vision and service delivery of general Hospitals in Katsina State. Does internet of thing mediate the relationship between robotic process automation and service delivery of general Hospitals in Katsina State?

This research aims to contribute to the study by shedding light on how AI technologies, represented by robotic process automation and computer vision, are being integrated into healthcare systems. Therefore, understanding this integration process is crucial for hospitals aiming to adopt these technologies effectively. This research has theoretical and practical implications. From a theoretical standpoint, this study contributes to the innovation management literature by investigating AI from a service delivery perspective. From a managerial perspective, the empirical evidence underscores the necessity for healthcare administrators to invest in digital technologies that optimize resource allocation and quality of care. Finally, this study provides useful information for policymakers. AI's service delivery highlights the critical role of institutional intervention in promoting the introduction of digital technologies in healthcare companies, boosting overall performance.

2. Literature Review

2.1 The concepts of Artificial Intelligence

Artificial intelligence (AI) is a broad field of computer science concerned with creating intelligent machines capable of performing activities that normally require human intelligence. It encompasses a wide range of technologies and approaches, including machine learning, natural language processing, computer vision, robotics, and expert systems (Wang et. al., (2021). Wang et. al. (2021) defined AI as simulation of human intelligence in machines or computer systems. This involves developing algorithms and models that enable machines to execute tasks that would normally need human intelligence. The systems are intended to perceive their surroundings, reason about them, make decisions, and conduct actions in order to attain certain goals. In each sector, AI

operates through various techniques, including machine learning, deep learning, neural networks, and natural language processing (Zhang et al., 2023). These strategies use large datasets and complex algorithms to spot patterns, anticipate outcomes, and automate decision-making, ultimately enhancing productivity, efficiency, and decision accuracy across a wide range of businesses. AI has the potential to greatly increase service delivery in the healthcare sector, notably among healthcare professionals and support workers in hospitals, clinics, and other healthcare facilities. It automates administrative tasks such as data entry, appointment scheduling, and billing, freeing up healthcare professionals to spend more time with patients while helped driven predictive analytics healthcare organizations forecast patient admission rates, allocate resources efficiently, and identify trends and areas that require attention (Jiang et al., 2023). Nevertheless, there are some challenges that need to be considered as AI usage increases in healthcare, such as ethical, social and technical challenges (Poalelungi et al., 2023). Jiang et al. (2023) cited some example that AI processes may lack transparency, making accountability problematic, or may be biased, leading to unfair, discriminatory behaviour or mistaken decisions.

Moreover, AI algorithms are unable to perform a holistic approach to clinical scenarios and are not fully able to take into consideration the psychological and social aspects of human nature, which are often considered by a skilled healthcare professional. Addressing those challenges requires collaboration between healthcare professionals, researchers, policymakers and technology developers to ensure that AI tools are implemented responsibly, ethically and safely in the healthcare sector (Poalelungi et al., 2023).

2.1.1 Computer vision

Computer vision is the technology that allows machines to recognize images automatically and provide precise and effective descriptions of them (Aggarwal et al, 2021). Medical practitioners are increasingly using AI and computer vision (CV) technologies to track their patients' fitness and overall health. Even in emergency situations, these analyses help physicians and surgeons make better judgments faster. When a patient reaches a critical point of the procedure, CV models can measure the volume of blood lost. The AI-enabled platform Triton efficiently tracks and approximates blood loss during surgery. It assists surgeons in estimating the volume of blood that the patient will require either during or following surgery (Richens et al, 2020). The worldwide healthcare system is facing a significant challenge due of the COVID-19 epidemic. CV has made a substantial contribution to addressing the challenge of the disease, which is being faced by nations all over the world (Kolikipogu et al., 2023). Rapid technological improvements have made CV applications useful for COVID-19 diagnosis, control, treatment, and prevention. Patients can have their disease easily detected when digital chest X-ray radiography images are used in conjunction with CV apps such as COVID-Net. The Canadian company Darwin AI built the prototype application, which has demonstrated results with an accuracy rate of about 92.4% for COVID diagnosis. Masked-face detection, which is frequently used to enforce and track tactics preventing the transmission of pandemic diseases, is performed using computer vision (Kolikipogu et al., 2023).

2.1.2 Robotic Process Automation

Robotic process automation (RPA) tools that are AI-powered leverage machine learning and artificial intelligence to extend the capabilities of RPA bots (Haahr et al., 2020). According to the International Federation of Robotics, a service robot is one that "operates semi- or fully autonomously to perform services useful to the well-being of humans and equipment, excluding manufacturing operations (Holland et al., 2021). This definition places a strong focus on the autonomy of the robot. The meaning of "service robot" has become more ambiguous as the terms have become more and more interchangeable

between the industry and service sectors. For example, service robots in unfamiliar settings like hospitals and mobile robots or automated guided vehicles (AGV) are employed in industrial automation applications. Service robots in a clinical setting can be used for many different purposes such as disinfection, surgery, logistics, monitoring, rehabilitation, and endoscopy (Holland et al., 2021). They have an important place in healthcare as they can provide precise control of instruments, increase safety, monitor patients, and perform some diagnostics. Although service robotics has long been a central topic of study in computer science and associated engineering disciplines, information systems (IS) researchers have not shown much interest in it thus far.

The study contend that, given the paucity of a comprehensive analysis of socio-technical issues and contextual influencing variables in current research, service robots is an intriguing field of inquiry, particularly for the healthcare industry (Jain & Bhatnagar., 2019). These systems can do cognitive tasks like image recognition and natural language processing, handle unstructured data, and make quick decisions. The field of robotic process automation (RPA) uses software "bots" to automate repetitive, rule-based tasks in commercial processes (Jia et al., 2021). RPA can be used for a variety of administrative and operational activities in the context of health service delivery in a general hospital to improve productivity, accuracy, and overall service quality. Robotic process automated assists accelerate billing processes by automating the generation of invoices, claims processing, and verification of billing information, improving accuracy and reducing delays (Kanyumba, 2018). Additionally, it improves the process of verifying patient insurance information, guaranteeing current and correct coverage facts. Automating data entry chores, including inputting lab results, updating patient records, and keeping accurate and current information in many hospital databases, is made possible by RPA bots. Reminders for appointments, follow-up emails, and patient surveys may all be sent automatically using RPA, which will improve engagement and contact with patients. By automating processes linked to tracking equipment, medications, and medical supplies, RPA can help manage inventories and help keep appropriate stock levels (Stephen & Bula, 2017).

2.2 Healthcare Service Delivery

Service delivery processes strive to provide enhanced value to the client by establishing standards, policies, principles, and limitations to guide all parts of their business and customer interactions. Service delivery in the health sector refers to the processes and methods by which healthcare services are provided to individuals and communities (Kumaraswamy, 2021). It also involves the two parties' constant engagement at the time when the provider provides the service and the client purchases it (Daft et al., 2010). Service delivery quality has been shown to be an important element in the medical sector. Health care service delivery forms the most visible function of the health system, both to patients and the general public. Health care service delivery quality is giving patients what they want (patient quality) and what they need (professional quality), and doing so using fewest resources, without error, delays and waste, and within higher level regulations (Kumaraswamy, 2021). The health care deals with different services such as hospital services, diagnosis services, physician consultancies and some other emerging fields. It also involves a range of activities, from prevention and promotion to diagnosis, treatment, and rehabilitation. Effective service delivery in the health sector is crucial for promoting health, preventing diseases, and ensuring timely and appropriate care. That is why it has to be ensured that healthcare services are geographically and financially accessible to all members of the population is a fundamental aspect of service delivery. This includes the availability of healthcare facilities, transportation, and financial support mechanisms to

help individuals access needed services. Providing high-quality healthcare services delivery involves maintaining standards of care, adhering to evidence-based practices, and employing qualified and skilled healthcare professionals. Quality assurance measures, such as accreditation and certification, help ensure that healthcare providers meet established standards (Atiq et al., 2019).

2.3 Internet of Thing

The Internet of Things (IoT) is an ecosystem that integrates physical objects, software and hardware to interact with each other (Ahmadi et al., 2019). Aging of population, shortage of healthcare resources, and rising medical costs make IoT-based technologies necessary to be tailored to address these challenges in healthcare. It is also to a number of topics pertaining to the expansion of the Internet and the Web into the physical world as a result of the development of Internet connectivity to objects. In the actual world, public health is crucial for both citizens and governments. Social health can be enhanced by managing and organizing personal data (Suraki & Jahansahi, 2018). The ideal method for obtaining information on a personal and public level is through the Internet of Things. In actuality, the Internet of Things can serve as the foundation for a healthy society. IoT devices can collect real-time data from various medical instruments, wearable devices, and patient monitoring systems. This real-time data is crucial for AI algorithms to make timely and accurate predictions, aiding in proactive and preventive healthcare service delivery (Satpathy et al., 2018). This is why combined IoT and AI technologies in the hospitals create a connected healthcare ecosystem that improves the quality of service delivery, enhances patient outcomes, and promotes operational efficiency. However, it's crucial to address challenges related to data security, interoperability, and ethical considerations to fully realize the potential benefits of this integration (Ahmadi et al., 2019).

2.3 Review of Empirical Studies

2.3.1 AI and Service Delivery of General Hospitals

Considerable studies have been conducted on the relationship between artificial intelligence and service delivery. Chew and Achananuparp (2022) Investigated perceptions and need of artificial intelligence in health care service delivery with a sample size 2780 from some selected hospitals in Singapore. The study revealed that use of AI was perceived to be positive because of its availability, ease of use, and potential to improve efficiency and reduce the cost of health care service delivery. However, concerns were raised regarding the lack of trust in data privacy, patient safety, technological maturity, and the possibility of full automation. The study recommended for improving the adoption of AI in health care was highlighted: enhancing personalization and customizability; enhancing empathy and personification of AI-enabled chat-bots and avatars; enhancing user experience, design, and interconnectedness with other devices; and educating the public on AI capabilities. Khaled et al. (2019) studied implications of artificial intelligence in healthcare delivery in the hospital settings in Malaysia. The study findings revealed that artificial intelligence has positively influence the health care delivery in terms of quality of care, efficiency and accuracy. While ethical, privacy and security have negative relationship with health care delivery.

Rani et al. (2023) explored the potential application of artificial intelligence in healthcare and hospitals in Hubei, China. The results demonstrate that AI has a significant potential to deliver enhanced outcomes in various aspects of healthcare and hospitals, including diagnosis, treatment, and management. However, the successful integration of AI requires overcoming numerous challenges such as regulatory standardization, privacy protection, and data availability. Li et al, (2020) evaluated using artificial intelligence to improve medical services in China. The study found that AI technologies, such as virtual

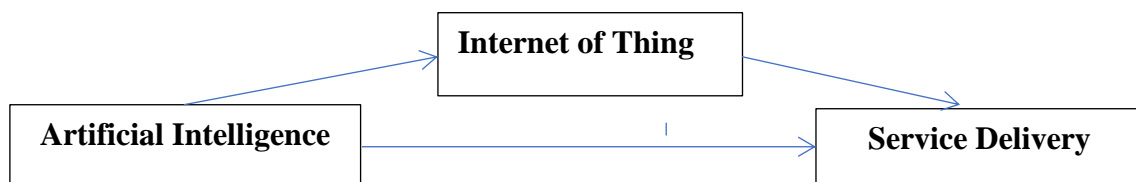
AI and tele-medical technology, diagnosis therapy and robotic surgery have significant and positive relationship with high-quality health care. From the above findings, it is clear that balancing technological advancements are essential for the evolution and improvement of healthcare delivery.

Al-Jbour (2020) in his study modelling the relationship between “Internet of Things”, value co-creation and innovation performance in some selected healthcare facilities in United Kingdom. The study’s findings confirm the influence of IoT monitoring and collaboration capabilities on the service innovation performance and support the proposition of IoT monitoring, optimisation and collaboration impact on value co-creation practices. However, IoT control capability shows no support to innovation performance. Findings also show that monitoring is an essential capability of IoT in healthcare, suggesting that successful value co-creation heavily depends on how hospitals access, observe, contact, interact and apply their technological knowledge processes. Islam et al. (2019) assessed the internet of things for health care. Findings revealed that architectures/platforms, applications, and industrial trends, security and privacy features, including security requirements, threat models, and attack taxonomies, big data, ambient intelligence, and wearable’s can be leveraged in a health care sector in Chicago, USA.

2.4 Conceptual Framework

Below is the conceptual framework illustrating the connection between the study's independent and dependent variables is presented.

Figure 2.4: Conceptual Framework



(Source: Developed by Researcher February, 2024)

Figure 2.4 depicts the conceptual framework for this investigation. The independent variable is artificial intelligence, which is proxied by computer vision and robotic process automation. The dependent variable is healthcare service delivery, and the mediating variable is the internet of things.

2.5 Theoretical Framework

The study employs Technology Acceptance Model (TAM). Technology Acceptance Model was developed by Fred Davis in the late (1980s) to understand and predict users' acceptance and adoption of information technology (IT) and systems. TAM posits that users' attitudes and behaviours towards using a technology are influenced by two primary factors: perceived usefulness (PU) and perceived ease of use (PEOU). 1. Perceived his usefulness is degree to which a user feels that a particular technology or system will improve their job performance or productivity. Users who believe a technology will help them achieve their objectives or meet their needs are more likely to accept and utilize it (Al-Rahmi et al., 2019). 2. Perceived Ease of Use (PEOU): This is the degree to which a user believes that using a technology or system will be effortless and free from mental or physical strain. Users are more likely to accept and adopt a technology if they perceive it as easy to use and learn.

Critics have argued that TAM's findings may not generalize well across different technologies, user populations, or cultural contexts. The model's applicability and effectiveness may vary depending on the specific technology under study and the characteristics of the user population. TAM assumes that users' perceptions of usefulness

and ease of use remain stable over time, overlooking the dynamic nature of technology adoption. Users' perceptions may change as they gain experience with the technology, encounter new features or updates, or face evolving organizational or environmental factors (Yuen et al, 2021).

However, TAM theory is related to independent, dependent and mediating variables such as artificial intelligence, service delivery internet of thing where the healthcare sector can apply to improve health care services in general hospitals. Applying the Technology Acceptance Model (TAM) to the integration of Artificial Intelligence (AI) into service delivery at general hospitals healthcare professionals may perceive AI technologies as useful tools for improving diagnosis accuracy, treatment planning, and patient outcomes. Patients may perceive AI-enabled services such as telemedicine, AI-assisted diagnostics, and personalized treatment recommendations as valuable for enhancing access to healthcare and improving overall quality of care. Healthcare professionals may evaluate the ease of using AI systems based on factors such as user interface design, integration with existing workflows, and the level of technical support provided. Patients may assess the ease of using AI-driven services based on factors such as user-friendly interfaces, accessibility through various devices, and the simplicity of interacting with AI-powered virtual assistants or decision support tools (Al-Rahmi et al, 2019).

3. Research Methodology

This study used descriptive cross-sectional survey. The descriptive research approach is best because it enable researcher approach respondents and explaining some aspects of the subject under study (Mugenda & Mugenda, 2003). The target population comprises 469 medical staff includes doctors, nurses, pharmacists, physiotherapists and amongst others from four hospitals. They are general hospital Katsina, Turai Yar adua maternity and child care hospital, general hospital Dutsin-ma and Ingawa general hospital. The decision to choose medical staff in the hospitals is because they are the only ones who can determine whether hospital is using current AI technologies in service delivery in the healthcare sectors. The study obtained a sample size of 216 employees of the hospital in Katsina state by the researcher. Using the Yamane (1967) statistical formula, an adequate sample size from the study population is given below:

$$n = N/(1+N(e)^2)$$

Where:

n= Signifies the sample size

N= Signifies the population under study

e= Signifies the margin error (=0.05)

Therefore

$$n = 469 / (1 + 469 (0.05)^2)$$

$$n = 469 / (1 + 469 (0.0025))$$

$$n = 469 / (1 + 1.1725)$$

$$n = 469 / 2.1725$$

$$n = 215.8803222094$$

$$n = 216$$

The proportionate stratum allocation approach and simple random sample technique was used to select participants for this study. The proportional stratum allocation approach is utilized because it ensures a representative sample, whereas the simple random technique is employed since each stratum has a mutually exclusive finite number of participants who are homogeneous.

The study used closed-ended questionnaire statements based on a 5-point Likert scale with numerical ratings of 5 (strongly agree), 4 (agree), 3 (neutral), 2 (disagree), and 1 (strongly

disagree). The collected data was analysed using descriptive statistic that is simple percentage for demographic data while regression analysis will be used to test the hypothesis of the study using Smart PLS software.

3.1 Model specification

Based on the dependent and independent variables, the independent variable Artificial Intelligence (AI) is measured by proxies' computer vision (CV) and robotic process automation (RPA). Dependent variable is Service delivery (SD) and Internet of Thing (IoT) serves as a mediator. Hence, the model is expressed using the standard multiple regression model below:

$$SD = \beta_0 + \beta_1 CV + \beta_2 RPA + \beta_3 IoT + \beta_4 CV * IoT + \beta_5 RPA * IoT + \mu \square$$

Where:

SD = Service Delivery

CV = Computer Vision

RPA = Robotic process Automation

IoT = Internet of Thing

$\beta_1 - \beta_5$ = Coefficient

β_0 = Intercept

$\mu \square$ = Error of Term

Therefore, IoT measurements act as a bridge between Artificial Intelligence and service delivery. In statistical jargon, an interaction occurs when the mediating variable influences the direction of the relationship between the dependent and independent variables. In regression analysis, a mediating effect is defined as the interaction between a targeted independent variable and another factor that determines the conditions in which it can be effective (Baron & Kenny, 1986). In this work, the IoT mediator was found by using interaction (product) terms in regression, such as AI and interaction term. IoT*AI was created by multiplying IoT and Artificial intelligence observations. According to the study, the statistics of the interaction term, such as the slope coefficient and p-value, are utilized to evaluate the mediating effect. The beta coefficient "beta" indicates how much mediator is present in the interaction term, and the p-value allows researchers to generalize their findings.

4. Results and Discussion

The structural model analysis, which was created, using Smart PLS 4, is presented below to provide an overview of the findings and evaluate the various study hypotheses, which range from H0:1 to H0:4. As a result, the size of the route coefficients and the effects of independent variables on the dependent variables were analysed using the PLS-SEM algorithm. Additionally, the significance of the effects was determined using a bootstrapping approach at 5000 cases Hair et al. (2020). Therefore, the investigation of the direct impacts of independent variables on the dependent variable was the main emphasis of model 4.1.

Table 4.1 Measurement Model Assessment

Table 4.1 Testing convergent validity and composite reliability

Vari ables	Cronbach's Alpha	Composite (rho-a)	Reliability	Composite (rho-c)	Average Extracted (AVE)	Variance
CV	0.886	0.888		0.914	0.640	
RPA	0.914	0.915		0.932	0.662	
SD	0.890	0.893		0.916	0.646	
IoT	0.851	0.856		0.893	0.627	

Note: AI, Service delivery; Computer Vision, Robotic Process Automation, and Internet of Thing.

Determining the quality of the study's construct depends critically on the assessment of the measurement model. This process involves assessing factor loading, reliability, and validity of the study constructs as it outlined in table 4.1 and figure 4.1.

Based on the study data in Table 4.1, Stevens' (1973) factor loadings criterion of 0.40 is regarded acceptable in confirmatory factor analysis (CFA). Hair et al. (2020) advised a value greater than 0.708. This means that the constructions account for more than half of the variance in the indicator, indicating a satisfactory level of item reliability.

Cronbach's alpha is a measure of internal consistency reliability, with values typically ranging from 0 to 1. For all constructs (CV, RPA, SD, IoT), the Cronbach's alpha values range from 0.851 to 0.914. These values are generally considered acceptable, as they exceed the commonly recommended threshold of 0.70, indicating good internal consistency reliability.

Composite Reliability (rho-a and rho-c) is another measure of internal consistency reliability. It assesses the extent to which items within a construct are interrelated. From table 4.1 the values of composite reliability (rho-a and rho-c) range from 0.856 to 0.915 for all constructs. These values are also above the threshold of 0.70, indicating good internal consistency reliability.

The Average Variance Extracted (AVE) which measures the variance captured by the construct relative to the variance due to measurement error. Higher values indicate greater convergent validity. The AVE values range from 0.627 to 0.662 for all constructs. While these values are slightly below the commonly recommended threshold of 0.70, they still indicate acceptable convergent validity.

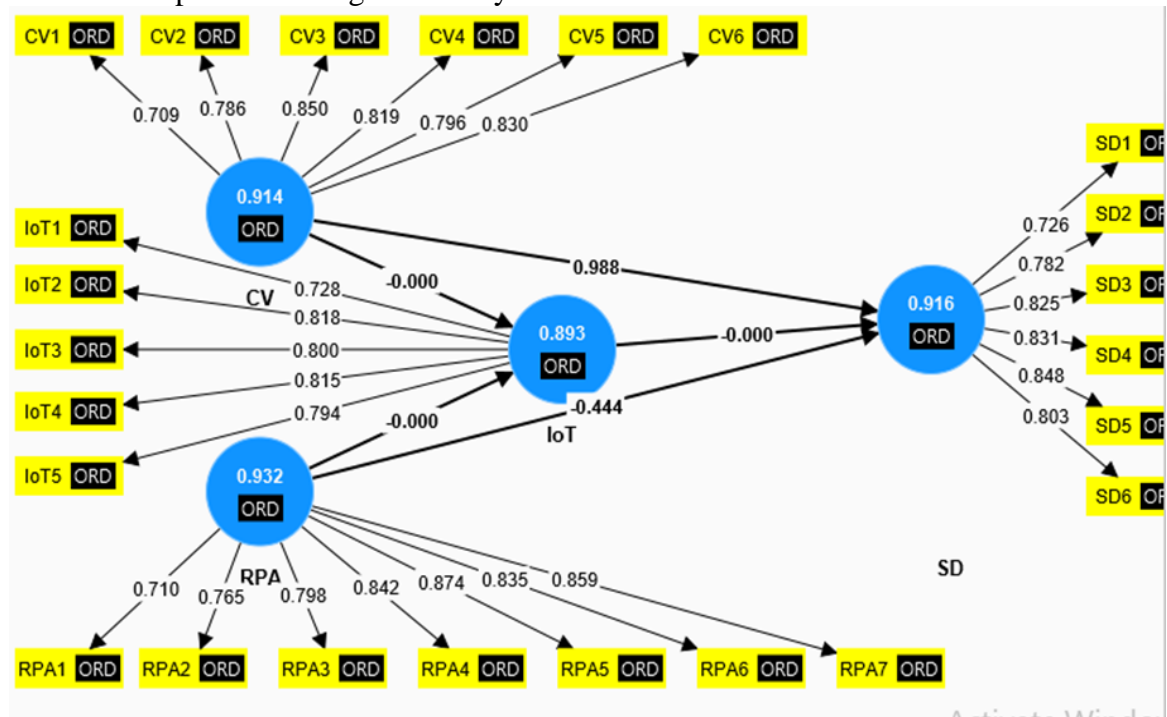


Figure 4.1 Measurement Model

4.1 Structural Assessment Model

After evaluating the measurement model and examining the structural path, it is critical to evaluate the relationships between the study constructs and their statistical significance. The structural model is evaluated using several key indicators, such as coefficient determination (R²), predictive relevance (Q²), path coefficient size and importance, and effect sizes f² and q², as reported by Hair et al. (2020).

The study empirically investigates the influence of the direct association between the independent factors (CV and RPA) and the dependent variable (Service delivery); also, the mediating effect of IoT is established on the link between the independent variables and the dependent variable.

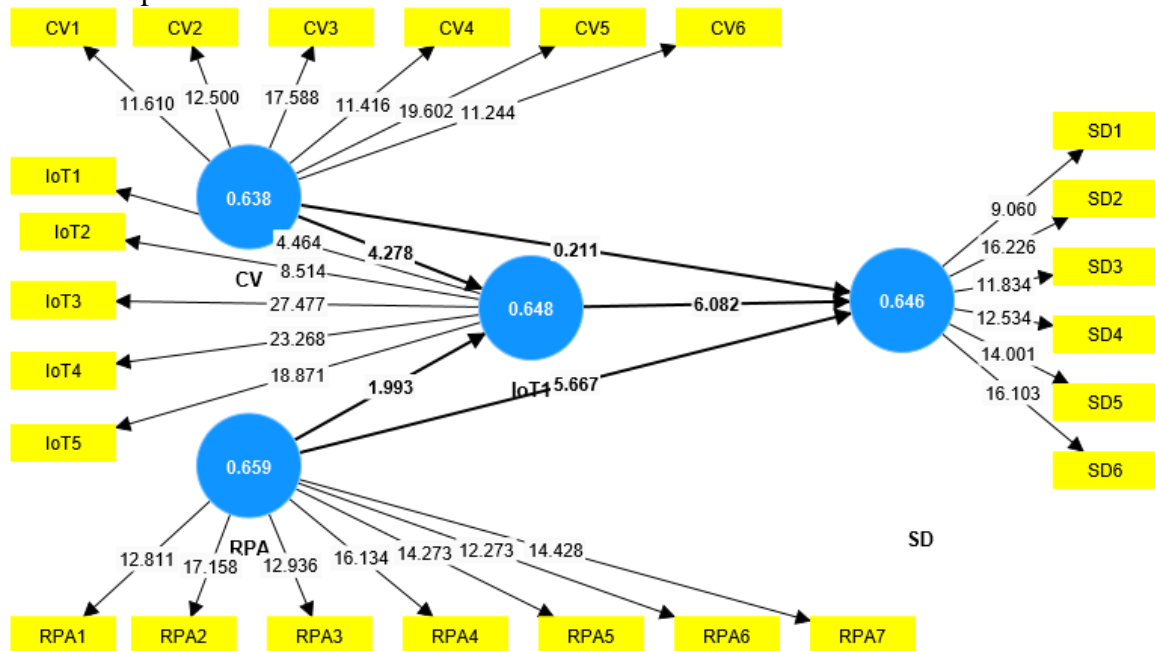


Figure 4.2 indicates the results of the structural model of the direct and indirect relationship of the dependent, mediating and independent variables..

4.2 Coefficient of Determination (R²)

	R-square	R-square adjusted
IoT	0.947	0.946
SD	0.966	0.965

4.3 Path coefficients, Mean, STDEV, T values, P value

	Original Sample (O)	Sample Mean (M)	Standard Deviation (STD VE)	T Statistics (IO/ STDVEI)	P Values	Decision
CV—IoT1	1.567	1.640	0.366	4.278	0.000	Rejected
CV—SD	0.391	.0402	0.145	2.696	0.007	Rejected
IoT1—SD	0.239	0.273	0.044	6.082	0.000	Rejected
RPA—IoT1	-0.736	-0.808	0.369	1.993	0.046	Rejected
RPA—SD	0.590	0.579	0.145	4.074	0.000	Rejected

4.4 Discussion of the Findings

The findings of this study are mostly concerned with developed research questions in chapter one and also, the discussion of the findings is in line with previous researches results and underpinning theories that anchor this study.

Direct Relationship between Artificial Intelligence Dimensions and Service Delivery

The researcher believes computer vision and robotic process automation will not have significant effect on service delivery before conducting the study. It was also not anticipated that Internet of thing would mediate the relationship between computer vision,

robotic process automation and service delivery. Some of the earlier expectations proved to be false after data analysis.

4.4.1 Hypothesis 1

H01: There is no significant relationship between computer vision and service delivery of General Hospitals in Katsina State.

The first hypothesis for the direct relationship H01, computer vision has no relationship on service delivery. The results of the data analysis show that computer vision has a positive significant effect on service delivery. Based on the descriptive statistics ($\beta= 0.391$, $t= 2.696$, $p\text{-value}= 0.007 < 0.05$). This indicates that the relationship between CV and Service Delivery (SD) is positive and statistically significant. The positive t-statistic suggests that as CV increases, SD also increases by 0.391. This supports the hypothesis that AI technologies like CV can positively impact service delivery in the health sector. The current study is consistent with previous researchers (Chew & Achananuparp 2022; Rani et al. 2023; Khaled et al. 2019) who find out that artificial intelligence has positively and significant influence on service delivery in the health sector in area of quality of care, efficiency and accuracy.

4.4.2 Hypothesis 2

H02: Robotic process automation has no significant relationship with service delivery of General Hospitals in Katsina State.

Similarly, the second hypothesis H02 Robotic process automation has no significant effect on the service delivery. The result revealed that Robotic process automation has a positive and significant effect ($\beta= 0.590$, $t= 4.074$, $p\text{-value} 0.000 < 0.05$) on the service delivery of general hospitals in Katsina State. This indicates that the relationship between RPA and SD is statistically significant. The positive t-statistic suggests that as RPA increases, SD also increases by 0.590. This supports the hypothesis that RPA technologies can positively impact service delivery in the health sector.

Indirect Relationship between Artificial Intelligence Dimensions and Service Delivery

Mediating effect of Internet of Thing in the relationship between computer vision and service delivery in general hospitals in Katsina State.

This section discusses the mediating results of the study. There are two (2) hypotheses (HO3 and HO4 that were tested).

4.4.3 Hypothesis 3

H03 Internet of thing does not significantly mediate between computer vision and service delivery of General Hospitals in Katsina State.

The third objective of this study is to examine the mediating effect of IoT in the relationship between computer vision and Service delivery. Specifically, the objective was to determine whether IoT mediate the effect of computer vision on service delivery. The result indicate that the mediating role is significant on computer vision and service delivery ($\beta= 1.567$, $t= 4.278$, $p\text{-value} 0.000 > 0.05$). This indicates that the relationship between Computer Vision (CV) and the Internet of Things (IoT) is statistically significant. The positive t-statistic suggests that as CV increases, IoT also increases by 1.567. This is consistent with the idea that AI technologies like CV can be integrated with IoT devices to improve service delivery in the health sector. This study is consistent with previous researchers (Al-Jbour 2020; Islam et al. 2019) who found out that internet of Thing control capability shows no support to service delivery in the health care sector.

4.4.4 Hypotheses 4

H0:4 Internet of thing does not significantly mediate between robotic process automation and service delivery of general Hospitals in Katsina State.

The fourth objective of this study is to examine the mediating effect of IoT in the relationship between Robotic process automation and service delivery. The objective was to determine whether IoT mediate the effect of Robotic process automation on service delivery. The result of the mediating effect revealed that IoT significantly mediate the relationship between robotic Process automation and service delivery in a negative way ($\beta = -0.736$, $t = -1.993$, $p \text{ value } 0.046 < 0.05$). This indicates that the relationship between Robotic Process Automation (RPA) and IoT is statistically significant but negative. The negative t-statistic suggests that as RPA increases, IoT decreases by 0.736. This is an interesting finding and may suggest that RPA and IoT are not always complementary in the context of service delivery in the health sector.

This study submitted that the results suggest that both CV and IoT have a positive impact on service delivery in the health sector, while RPA has a mixed impact on IoT. These findings provide valuable insights into the potential of AI technologies to improve service delivery in the health sector, with implications for policy and practice

5. Conclusion

Given the outcome of this study it is concluded that service delivery is predicted by computer vision and robotic process automation. The study also concludes that Internet of Thing mediate the relationship between service delivery and computer vision and robotic process automation. However, the negative t-statistic suggests that as RPA increases, IoT decreases. This suggests that RPA and IoT are not always complementary in the context of service delivery in the health sector.

6. Recommendations

Based on the findings and conclusion, the following recommendations are put forward for consideration

Given the positive impact of AI technologies like CV and RPA on service delivery in general hospitals, it's recommended that hospitals government and management of the hospitals invest in these technologies. This could involve implementing AI-powered systems for tasks such as patient monitoring, diagnosis, and administrative processes.

The study found that IoT has a mediating effect on the relationship between AI and service delivery. Therefore, it's recommended that hospitals integrate AI technologies with IoT devices. This could involve using IoT sensors to collect data that can be analyzed by AI algorithms to improve patient care and operational efficiency.

To fully leverage the benefits of AI and IoT in general hospitals, it's important to ensure that staff are trained on how to use these technologies effectively. This could involve providing training programs on AI and IoT for healthcare professionals, as well as IT staff that will be responsible for managing and maintaining these systems.

Given the complexity of AI and IoT technologies, it's recommended that hospitals collaborate with experts in these fields. This could involve partnering with technology companies, research institutions, or consulting firms that specialize in AI and IoT. By leveraging external expertise, hospitals can ensure that they are implementing these technologies in the most effective and responsible way possible.

References

Adeola, O. S. (2021). Medical imaging system and the health care delivery system in Nigeria: An overview. *International Journal of Medical Imaging*, 9(1) 45-56.

- Aggarwal, R., Sounderajah, V., Martin, G., Ting, D. S., Karthikesalingam, A., King, D., & Darzi, A. (2021). Diagnostic accuracy of deep learning in medical imaging: a systematic review and meta-analysis. *NPJ Digital Medicine*, 4(1), 65-57.
- Ahmadi, H., Arji, G., Shahmoradi, L., Safdari, R., Nilashi, M., & Alizadeh, M. (2019). The application of internet of things in healthcare: a systematic literature review and classification. *Universal Access in the Information Society*, 18, 837-869.
- Al-Jbour, R. S. (2020). Modelling the relationship between “Internet of Things”, value co-creation and innovation performance in healthcare (Doctoral dissertation, The British University in Dubai (BUiD)).
- Al-Rahmi, W. M., Yahaya, N., Aldraiweesh, A. A., Alamri, M. M., Aljarboa, N. A., Alturki, U., & Aljeraiwi, A. A. (2019). Integrating technology acceptance model with innovation diffusion theory: An empirical investigation on students’ intention to use E-learning systems. 7(9), 26797-26809.
- Atiq, A., & Mehmood, A. (2019). Service Delivery Innovation in Health Sector–Micro-Hospital.
- Bajwa, J., Munir, U., Nori, A., & Williams, B. (2021). Artificial intelligence in healthcare: transforming the practice of medicine. *Future Healthcare Journal*, 8(2), e188–e194.
- Bajwa, J., Munir, U., Nori, A., & Williams, B. (2021). Artificial intelligence in healthcare: transforming the practice of medicine. *Future healthcare journal*, 8(2), e188.
- Boyd, R., & Holton, R. J. (2018). Technology, innovation, employment and power: Does robotics and artificial intelligence really mean social transformation?. *Journal of Sociology*, 54(3), 331-345.
- Chew, H. S. J., & Achananuparp, P. (2022). Perceptions and needs of artificial intelligence in health care to increase adoption: scoping review. *Journal of medical Internet research*, 24(1), 732-939.
- Haahr, A., Norlyk, A., Martinsen, B., & Dreyer, P. (2020). Nurses experiences of ethical dilemmas: A review. *Nursing ethics*, 27(1), 258-272.
- Hair, J. F., Howarda, M.C., & Nitzl, C. (2020). Assessing measurement model quality in PLSSEM, using confirmatory composite analysis. *Journal of Business Research*, 109, 101-110
- Holland, J., Kingston, L., McCarthy, C., Armstrong, E., O’Dwyer, P., Merz, F., & McConnell, M. (2021). Service robots in the healthcare sector. *Robotics*, 10(1), 47.
- Islam, S. R., Kwak, D., Kabir, M. H., Hossain, M., & Kwak, K. S. (2019). The internet of things for health care: A Comprehensive Survey. 3(5) 678-708.
- Jain, R., & Bhatnagar, R. (2019). Robotic process automation in healthcare-a review. *International Robotics & Automation Journal*, 5(1), 12-14.
- Jawaid, S. A. (2023). Artificial intelligence (ai) and its application on human health. *Journal of Advances in Artificial Intelligence*, 1(1) 57-66.
- Jia, Y., Chen, O., Xiao, Z., Xiao, J., Bian, J., & Jia, H. (2021). Nurses’ ethical challenges caring for people with COVID-19: a qualitative study. *Nursing ethics*, 28(1), 33-45.
- Jiang, Y., Li, X., Luo, H., Yin, S., & Kaynak, O. (2022). Quo vadis artificial intelligence?. *Discover Artificial Intelligence*, 2(1), 324-325.
- Kanyumba, B. (2018). The importance of employee training and retention strategies of healthcare professionals for effective service delivery: a case study of Manama Mission Hospital in Zimbabwe (Doctoral dissertation).
- Khaled, N., Turki, A., & Aidalina, M. (2019). Implications of artificial intelligence in healthcare delivery in the hospital settings. *International Journal of Public Health and Clinical Sciences*, 6(5), 22-38.

- Kolikipogu, R., Ramya, D., Siddiqui, M., Siddiqui, A., & Prakash, C. O. (2024). Introduction to Computer Vision Aided Data Analytics in Healthcare Industry 4.0. In *Healthcare Industry 4.0* (pp. 1-18). CRC Press.
- Kumar, R., Kumari, L., & Kumar, V. (2016). Ethical considerations in medical practice and research. *Journal of Evolution of Medical and Dental Sciences*, 5(7), 343-346.
- Kumaraswamy, S. (2021). Service quality in health care centres: An empirical study. *International Journal of Business and Social Science*, 3(16) 242-342.
- Li, R., Yang, Y., Wu, S., Huang, K., Chen, W., Liu, Y., & Lin, H. (2020). Using artificial intelligence to improve medical services in China. *Annals of Translational Medicine*, 8(11) 231-324.
- Oleribe, O. O., Momoh, J., Uzochukwu, B. S., Mbofana, F., Adebisi, A., Barbera, T., & Taylor-Robinson, S. D. (2019). Identifying key challenges facing healthcare systems in Africa and potential solutions. *International journal of general medicine*, 2(4)395-403.
- Poalelungi, D. G., Musat, C. L., Fulga, A., Neagu, M., Neagu, A. I., Piraianu, A. I., & Fulga, I. (2023). Advancing patient care: How artificial intelligence is transforming healthcare. *Journal of Personalized Medicine*, 13(8), 1308-1214.
- Puaschunder, J. M. (2020). The future of artificial intelligence in international healthcare: An index. In *Proceedings of the 17th International RAIS Conference on Social Sciences and Humanities. Scientia Moralitas Research Institute* 1(8) 19-36.
- Rajhi, F. A., Tohary, M. M. N., Mahzari, A. M. A., Shayani, A. Y., Kariri, K. M., Rajhi, M. A., ... & Kriri, M. M. (2020). Artificial intelligence; as an innovative effective instrument in healthcare; telemedicine, public health, and pharmacy-A Systematic Review. *Artificial Intelligence*, 4(1) 122-322.
- Rani, S., Jining, D., Shah, D., Xaba, S., & Singh, P. R. (2023). The potential application of artificial intelligence in healthcare and hospitals. In *ITM Web of Conferences*, 5(3) 324-843
- Reddy, S., Fox, J., & Purohit, M. P. (2019). Artificial intelligence-enabled healthcare delivery. *Journal of the Royal Society of Medicine*, 112(1), 22-28.
- Richens, J. G., Lee, C. M., & Johri, S. (2020). Improving the accuracy of medical diagnosis with causal machine learning. *Nature Communications*, 11(1), 3923.
- Rozario, M., Zainuddin, A. A., & Gamage, S. A. (2021). Artificial intelligence and machine learning in the healthcare sector: A review. *Malaysian Journal of Science and Advanced Technology*, 12(9) 89-96.
- Satpathy, S., Sahoo, B., & Turuk, A. K. (2018). Sensing and actuation as a service delivery model in cloud edge centric internet of things. *Future Generation Computer Systems*, 8(6), 281-296.
- Stephen, S. O., & Bula, H. (2017). Human resource management practices and quality of health care service delivery at Jaramogi Oginga Odinga teaching and referral hospital, Kenya. *Human Resource Management*, 10(10), 126-140.
- Stevens, R. J. (1973). A cholinergic inhibitory system in the frog optic tectum: its role in visual electrical responses and feeding behaviour. *Brain Research*, 49(2), 309-321.
- Suraki, M. Y., & Jahanshahi, M. (2018). Internet of things and its benefits to improve service delivery in public health approach. In *2013 7th International Conference on Application of Information and Communication Technologies* 1-4).
- Wang, W., Chen, L., Xiong, M., & Wang, Y. (2021). Accelerating AI adoption with responsible AI signals and employee engagement mechanisms in health care. *Information Systems Frontiers*, 1(18), 2110-1544.
- WHO (2021). Health care system survey

- Yuen, K. F., Cai, L., Qi, G., & Wang, X. (2021). Factors influencing autonomous vehicle adoption: An application of the technology acceptance model and innovation diffusion theory. *Technology Analysis & Strategic Management*, 33(5), 505-519.
- Zhang, B., Zhu, J., & Su, H. (2023). Toward the third generation artificial intelligence. *Science China Information Sciences*, 66(2), 121101.