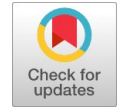


# Impact of IoT Adoption on Agility and Flexibility of Healthcare Organization

Samyadip Chakraborty, Vaidik Bhatt, Tulika Chakravorty



**Abstract:** *This study addresses one of the most critical advents and highly sought after the technological breakthrough of today's service sector. Internet of things has been finding relevance in today's service sector as a significant impetus to superior service delivery and advanced service proposition to customers. Healthcare sector is also no exception. This study taking data from the Indian healthcare sector attempts to check the relationship between IoT adoption and proposed service delivery gains experienced by healthcare organizations (if any). The study based on the theoretical premises of cybernetic control theory and technology adoption model by Davis, Hypothesized that IoT adoption must positively influence flexibility and agility and in turn, flexibility positively influence readiness. The empirical evidence supports these hypotheses, and all the findings validate the propositions that healthcare organizations and the players and actors involved in healthcare consider IoT adoption as pivotal. Because the survey outcomes establish path analysis linkages through Structural equation modeling (SEM). SEM results highlight the significant positive impact of IoT adoption on flexibility and agility and in turn, even stronger association and effects of flexibility on readiness in the services offered by healthcare organizations. This study outcomes are very vital for hospital managers and upcoming healthcare practitioners as it establishes empirical evidence supporting IoT adoption as a helpful step and prominent success factor for better flexible patient care delivery and agility.*

**Key Words:** *IoT, Healthcare, Agility in Healthcare, Flexibility in healthcare, Technology adoption*

## I. INTRODUCTION

In the era of information technology and connected world, IoT is a stepping stone. It is a foundation stone in the industry 4.0 where all the things are wirelessly connected and coordinated, due to its capability. IoT has the potential to change its existing business and bring effectiveness in data collection and decision making because of the superior quality of data collection. The technology is used in too many organizations; be it production or services. Mc Kinsey & Company also reported the bright future for IoT and its use.

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According to the Mc Kinsey & Company report IoT will host the economy with manifolds increase in its investments. Today, many companies are investing in IoT based operations as it is easy to administer with the integrated devices, which will seamlessly and swiftly communicate and share the data. Wearable devices can have a plethora of opportunities which can be served for a business, which can be worn directly or can have loose contact with the human or operator (1) as operators can always see how devices are communicating with each other through mobile of computer application. All the transaction data are stored on the cloud. Due to IoT's capabilities of effectiveness, security, efficiency, and decision making using free communications between conventional devices, it is recognized as a paradigm-shifting idea. With the help of IoT devices are seamlessly united, interconnected, and communicated across the environments and physical objects (2). With the pervasive interaction, things work simultaneously and reach a common goal with advanced services. (2 & 3). As per (4) Things and network both became more valuable when connected and interacted with each other.

IoT can provide enhanced product and services with the opportunity to create new businesses with its usefulness. On the other side, IoT has many more challenges yet to be addressed such as for reliability, standardization, network alignment, cost issues, etc. (5; 6; 7). Especially in a country like India, where companies and consumers both facing primary network and connectivity issues, adoption of IoT has a most significant challenge to increase the connectivity in the last mile. No matter how the incredible technology is if it fails to be assimilated into the market due to any reason, including consumer education (8). For implementation in India, educating a consumer is also a hurdle.

IoT can be used in service as well as production sectors; in fact, almost all the business can find the opportunities to use IoT (9). IoT is connectable to the digital communication platform, which facilitates a large amount of data to be stored (10). For each company, real-time data can be provided, which can be used for real-time analytics, and operational efficiency can be enhanced or increased (11).

This study broadly gives the idea and check the relationship between the IoT adoption and flexibility of healthcare organization because of IoT adoption and agility of healthcare organization because of IoT adoption. On the other end, the study also checks and confirms the established relationship between flexibility and agility in the context of healthcare organizations and hospitals. Our research explores the following objectives:



Objective 1: To check and establish a relationship of IoT adoption with the flexibility and agility of a healthcare organization

Objective 2: To check the established relationship between flexibility and agility in the context of the healthcare organization, in the presence of IoT adoption

## II. LITERATURE REVIEW

### A. Theoretical Underpinnings

#### *Cybernetic Control Theory*

As IoT is a kind of a self-regulatory system, (12), Cybernetic control theory offers a theoretical understanding that, how IoT system provides a means by which a manager (hospital administrator) can effectively develop the different kinds of strategy and organizational capabilities. (13) In his Cybernetic control theory and (14) highlights the importance of getting timely data, analyzing the deviations and differences between the expectations and reality, and making a decision to match the expectations and reality for an organization. On the other end, IoT adoption offers a way by which real-time, high quality and accurate data can be obtained by the medical staff, administrator and other critical personnel in the hospital environment and make a quick decision on the nature of treatment, instruments, equipment, and medicine to be used in the procedure.

### B. Internet of Things

IoT – Internet of things is a new paradigm through which computational objects are connected and communicate with each other. The universal definition of IoT is still not available, as IoT is a term which is broadly used (15). Although the universal definition is not available for IoT, the definition for the understanding can be made as “a network of devices such as vehicles, home appliances, electronics, software, sensors, actuators connect, interact and exchange the data with each other” (16). (17) Has defined IoT as “set of the interconnected things over the internet, which can measure, communicate, and act all over the world.” IoT is a foundation stone in industry 4.0 due to its capability and potential to change existing business (18). IoT can be used for the forecasting also as it is accurate because of the quality of the data generated because in IoT data generated from each smart devices are collected analyzed without any other intervention of humans or computers (19). CISCO reported tremendous growth in IoT and its application to the business communities by 2023 (20). There are tiny smart sensors used in various domains like home, logistics, factory automation, etc... which generates vast data and communicate with each other by exchanging the data (21).

Due to IoT's capabilities of higher efficiency, effectiveness, security, and decision making using free communications between conventional devices, it is perceived as a paradigm-shifting idea. With the help of IoT devices are seamlessly integrated, interconnected, and communicated across the environments and physical objects (2). With the pervasive interaction, things work together and reach a common goal with advanced services. (2 & 3). As per (4) Things and network both became more valuable when connected and interacted with each other.

### C. IoT adoption in the Service Sector

IoT has many implications in the service sector also. Due to its capabilities, it has been widely used in the service sector. IoT improves the productivity of manpower with the automation data collection, which has a high level of data quality. Also, IoT will increase the quality of human life (22). (23) Have suggested the use of IoT into the fintech sector, where IoT can be used as an option to the mobile payments. IoT can be widely used in the smart home scenario, in which a user uses certain sensors and smart devices which can share the data and communicate with each other for the home automation (24).

(25) have illustrated IoT communication framework requirements for the healthcare services sectors, such that they can be offered by web services. (26) Examined the plan and execution of an M2M application over as of now accessible answers for traffic management. The utilization of IoT in savvy urban communities with specialized arrangements and best-practice rules embraced in the Padova Smart City venture are examined (27). IoT based Smart car parking is also investigated by several authors for a smart city. (28) investigated a smart parking system by using IoT and cloud computing, which consist of on-site IoT module enables real-time monitoring of each car parking space. (29) Developed an IoT based cargo monitoring system, in which a wireless sensor network is used to collect the real-time information about cargo and products both.

### D. Application of IoT in Healthcare

Like every other industry, IoT has been widely used in the healthcare industry also, for patient monitoring and providing better healthcare services. With the sustainable growth and increment in the technology across the globe, now it is imperative to look beyond the conventional method to provide healthcare with the better technological innovations and disrupt the healthcare industry (30). With the ability to gather and store data as well as performing complex permutations in a real-world environment makes IoT useful for healthcare (9).

Internet of things has numerous applications starting with remote monitoring and continuing with the smart sensors (30). It is not helpful to the patients only in keeping their life safe, but also useful to physicians and commercial hospitals delivering of care with patient engagement and satisfaction as the patient can spend more time with their medical expert (30). Also, it has been recognized as a useful tool to aid patient's assessment, treatment, and management in real time (9). IoT based healthcare devices will provide early detection of potential exacerbations and inform patients as well as professionals such that patients can be treated promptly (30). Technological Pervasiveness is increasing day by day as new devices are coming into the market. (31). IoT has proven its capabilities regarding its usefulness as pervasive service mode can be achieved, and healthcare services can be provided on a better rate (32).

IoT is a boon for some chronic disease like heart failure, where continuous and real-time monitoring is required for heart rate, pulse rate, body fat, etc. Heart disease is the most common type of chronic disease nowadays in India, mostly observed in elderly patients.



In the traditional healthcare delivery system and nowadays also, the patient must call healthcare services and then healthcare service is provided to them, but what if the patient becomes unconscious and is not able to contact for its healthcare? On the other side, some disease- damages are irreversible before the patient gets any treatment. It becomes a necessity to identify harmful disease and disorders on an early basis to provide proper care at the appropriate time. For which there is a need to change the passive healthcare form into a pervasive, real-time form where a doctor, patients, hospital and all other medical expertise are connected with different devices on a single platform (32). Table 1 consists of various types of IoT devices which are available today, and that are the capabilities of their devices, as different devices come with the different kinds of abilities, based on which their use can be decided. For example, Fitbit Flex 2 is waterproof so that it can be used for measuring activities like swimming. On the other side, IoT devices are not just a smartwatch, it may have a different shape and a different use also, like OmateUngaro and can be worn on the finger, as they have a ring shape. The complete list of the available devices is listed in Table 1, which was compiled from (www.smartgeekwrist.com/best-smart-jewelry) accessed on 7th March 2019.

**Table-1: IOT wearables in healthcare: Recent smart jewelry examples**

<u>Name</u>	<u>Worn</u>	<u>Health base functionality</u>
Bellabeat Leaf Urban	Neck, wrist, clip	Activity and sleep, Stress, Menstrual cycle
Ringly Luxe smart ring	Fingers	Activity tracking (steps, distance, calories burned). Mindfulness – meditation and breathing exercises
Fitbit Flex 2	Wrist	Activity (including swimming) and sleep tracking
Misfit Shine (with Bloom Necklace)	Wrist, Neck	Activity (Inc. Sports) and sleep tracking
Ringly Luxe smart bracelet	Wrist	Activities (steps, distance, calories burned)
OmateUngaro	Finger	None – vibration alerts for calls and text
Michael Kors access bracelet	Wrist	Activity tracker with sleep monitoring.
Mira wellness & activity bracelet	Wrist, clip	Activities (steps, elevation, calories burned, distance). Motivation (gives fitness tips)
Joule earring backing	Earring backing	Continuous heart rate tracking. Activity tracking and level measurement
Netatmo June	Bracelet	UV bracelet hat is designed to keep you safe from the sun's harmful rays
Good metric	Ring	Stress management (detects stress levels by measuring electrodermal activity)
Grace	Wristband (bracelet)	Automated tracking and cooling device for women experiencing menopausal hot flushes

(source: www.smartgeekwrist.com/best-smart-jewelry).

### E. Flexibility

Flexibility is the ability to respond to the changes. Healthcare service should be evaluated based on the availability of the physician or registered medical

practitioners in case of emergency, capacity to return to the changes for the internal operations. In the healthcare service industry, inability to meet the demand has more severe and dared consequences in compare with any other service industries like restaurants, beauty salons hotels, banking, etc (31). As in healthcare services, not only the financial loss is there, but a potential loss of human life will be at stake for inability to serve to the change (Increase) in demands for the healthcare. For example, a disease is sprayed than a more significant number of patients will require healthcare services, and the inability of a healthcare service organization to react to that will put the lives of all patients and many more citizens on stake. Healthcare organizations are challenged to develop flexible strategies as like any other service sectors it must invest more for getting enough slack resources to provide the services. However, like any other organization, healthcare cannot charge high to compensate for their investment. In the healthcare sector, there are many kinds of hospitals like primary care centre, specialty and super specialty hospitals, which are spread from a small village to the large and big metro cities with certain types like for profit, not for profit, regional, military and teaching hospitals, etc. In healthcare sectors, the effectiveness of a service is more critical unlike the efficiency in other service sectors and poor service may result in patient death also. IoT adoption in hospitals can bring real time monitoring, Patient information management, and healthcare management (32). In other words, with the IoT adoption, a healthcare service provider can measure and control several things, which leads towards the higher information about what is happening around. For achieving that flexibility must be pivotal as evident from the extant literature.

### F. Agility

The agility of an organization is the ability to excel simultaneously on operations capabilities of quality, delivery, flexibility, and cost in a coordinated fashion (33). It is more of a customer focused or respond to the environment. Agility works best in the volatile environment when there is a high variety of services that must be produced. "Agility is the ability to do so quickly and in variety of situations" (34). Healthcare organizations must produce a high variety of services, as every disease is unique, and every patient is different, every medicine has a different mechanism of action and adverse drug reaction. Every patient has different kind of reaction to the same or a different drug with the same or different levels or stages of diseases. In the healthcare sector, the environment is fast-paced, challenging, and decision making is important and often urgent. As in healthcare, late decision can have a dared consequence on patient life, including coma and death. Also, if decision making takes prolonged period, then the challenge to the medical staff will deteriorate into stress, which will negatively impact the performance of medical staff and ultimately healthcare service performance can be affected (35). Organizations need to be able to understand the needs of the customers and undertake actions to respond with ease, speed, and dexterity (36). Organizations required the ability to obtain feedback on the customer experience and response swiftly to the needs which are identified (37).



## III. HYPOTHESES DEVELOPMENT

### A. Linking IoT Adoption to Flexibility of healthcare organization

As per (38) integrated system design with the information sharing will increase the flexibility, as with the help of integration, IoT devices will communicating the data with each other and creates the value for the operations in healthcare. It is possible because with the help of IoT real-time and rapid access to information is possible and respond, time will be decreased because of the access over the information. On the other side, IoT can create a well-integrated platform for monitoring the patients as well as internal operations like medical equipment, staff availability, surgical and pharmaceuticals also. Moreover, integration and information sharing will help the hospitals to react in the case of sudden market changes and improves the competitiveness and effectiveness for the organization (3).

**H1: IoT adoption will have a positive impact on the flexibility of healthcare organization**

### B. Linking IoT adoption to Agility of healthcare organization

For Agile system information, Pervasiveness is essential, as information is more transparent and more pervasive, a better system can be created which can handle simultaneous operations at a time. IoT extends the concept of internet connectivity and makes information more pervasive (32). On the other end, IoT allows seamless integration and interactions among different types of devices like sensors, monitoring cameras, and other instruments (39).

**H2: IoT adoption will have a positive impact on the agility of healthcare organization**

### C. Linking Flexibility of Healthcare organization to Agility of the Healthcare organization

Basically, by definition, flexibility is competencies of an organization, which has an internal focus. (40) In a healthcare organization, internally focused skills may be the availability of medical staffs, instruments, required medicine, and other equipment. Like any other industry, the healthcare sector is also volatile, and a high level of uncertainty is there. In this case of uncertainty, several patients cannot be predicted, and the organization must be ready to deal with the situation.

Whereas agility is the capability of an organization, which is externally focused. (41) In other words, agility is about how a firm can respond to market turbulence. Firm's agility deals with the speed, quickness or rapidness and therefore, responsiveness. The agility of a healthcare organization is measured by how a firm can quickly deal with the more numbers of patients and provide the healthcare in the presence of market turbulence, despite having the limited resources like medical staff, instruments, and medicines. (42)

Flexibility is a crucial antecedent for agility. The flexibility of organizations deals with the number of patients, availability of drugs, doctors, medical staffs, instruments, etc... which is vital to handle responsiveness of hospitals towards the patients with a quick and speedy response.

**H3: Flexibility of healthcare organization will have a positive impact on the agility of healthcare organization**

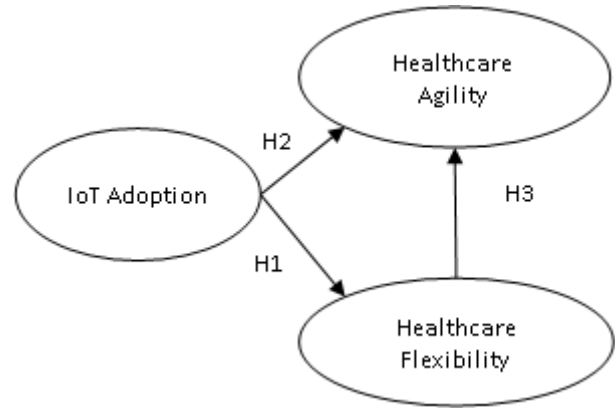


Figure 1 – Proposed study Model

## IV. METHODOLOGY

### A. Data collection and sample demographics

Since the investigation meant to assess impacts of IoT appropriation on the flexibility and agility of health institutions, the examination expected to fuse doctors, executives, and other restorative staff for approving the proposed relationship. The survey built up a database of emergency clinics and doctors' the nation over, fundamentally focusing on the urban areas which are notable for unrivalled human services and therapeutic offices. Specific online information base and sites utilized for gathering the data and insights regarding the specialists and medical clinics. For instance, Data. In ([www.drdata.in/list-doctors.php](http://www.drdata.in/list-doctors.php)) gave a complete detail of the specialists with their addresses and contacts. Comparable data is additionally acquired from other online entrances like Sehat.com ([www.sehat.com/](http://www.sehat.com/)). Such contacts were further cross confirmed through checking online interfaces of a few noteworthy emergency clinics in these goals. The examination likewise used the well known web-based interface of Practo.com ([www.practo.com/](http://www.practo.com/)) for the contacts. We have the subtleties of specialists and emergency clinics. Then the criteria were connected for concluding the rundown of the specialists. The examination joined the channel that the specialist must have no less than two years of work involvement in their particular fields and subject matters.

An email containing an introductory letter and a connection to top off a poll for partaking in the review was sent to 1289 contacts, trailed by two updates as a reminder.

The introductory letter demonstrated the, classification confirmation, meaning of imperative terms related with the examination and the motivation behind investigation. The investigation got 221 finished reactions for checking the legitimacy of the proposed affiliations. Table 2 demonstrates the example profile.

Table 2 – Respondent Demographics

	No.	Percentage
<b>Age</b>		
Less than 30 Years	21	9.5
30 – 35 Years	83	37.56
35 – 40 Years	78	35.29
40 years and above	39	17.65

Experience		
Less than 5 Years	19	8.6
5 – 10 Years	79	35.75
10 – 15 Years	81	36.65
15 years and above	42	19
Specialization		
ENT Specialist	43	19.46
Physiotherapist	51	23.08
Neurologist	36	16.29
Dentist	49	22.17
Others	42	19

### B. Measures

The investigation includes three constructs (Latent). The measures for all the three elements were embraced for utilization in this examination. The investigation made broad writing look for choosing a measure. The examination went from pre-pilot, pilot and final investigation, the pre-pilot consider was through master based investigation and examination. A gathering of specialists and analysts (10 specialists and 4 scientists) were mentioned to basically break down the chose, to which they recommended releases and redresses in the measures for the examination which were joined. Finally, the measures were additionally exposed to a pre-testing with 27 specialists having an experience more than 3.5 years and pursued by gathering of specialists as Q-sort made a decision in sets of 2 specialists as judges till the Cohen's Kappa, inter-rater dependability and crude understanding score came to above 0.9. Such process and methods guaranteed vigour, significance and fittingness of the study things for estimating their proposed build. With such experienced respondents as pre-test members; the pre-test stage guaranteed the estimation things have enough face and substance legitimacy. An exploratory factor investigation was additionally directed on the last estimation things. Every one of the things were found to stack on expected factors after the exploratory factor examination results were acquired utilizing SPSS 20 programming. This guaranteed the deliberate factors can be additionally used for speculations testing. Each idle first-request factor had around four estimation things that were estimated utilizing a seven-point Likert scale (1 = emphatically deviate; 7 = unequivocally concur). The underlying poll things before pre-pilot think about remained at 19, which decreased to 14 preceding pilot contemplate, trailed by Q-arranging after which the last survey had 10 things concluded speaking to 3 develops. The build of adaptability at last had 4 estimation things and the rest of the develops of Agility and IOT reception at long last had 3 things each. The subtleties are given in Table: 1.

### C. Non-Response Bias

The examination assessed the nonattendance of non-response bias through right on time and late reaction correlation (43). No noteworthy contrasts were distinguished among the methods. With Mann – Whitney U – tests were performed for the two classes of reactions that did not uncover any important contrasts ( $p > 0.05$ ) over the firm size and industry classification. This recommended the nonappearance of any noteworthy non-reaction inclination.

### D. Common Method Bias

An evaluation of common method bias was esteemed fundamental since a solitary member for each firm was drawn nearer. Investigation of Harman's single-factor trial of normal technique predisposition indicated 3 clear factors with eigen esteems  $> 1$ , clarifying 72.1% of all out fluctuation clarified. The main factor clarified 43 percent Variance. Next, a corroborative factor examination to Harman's single-factor show was connected (44). The model's fit lists of  $\chi^2/df = 1.89$ , NFI = 0.92, CFI = 0.89 and RMSEA = 0.045 recommended dismissal of a solitary factor demonstrate. Subsequently, regular strategy inclination isn't of critical worry in this investigation.

Table 3: Constructs, definitions and Measurement Items

Construct name	Definition	Measurement Items	References
Flexibility	Flexibility is an extent to which, healthcare organization can respond to the changes	<ul style="list-style-type: none"> <li>Ability to respond and accommodate variations in patients</li> <li>Ability to respond to and accommodate periods of medicine stock out</li> <li>Ability to respond to and accommodate periods of non availability of medical staff</li> <li>Ability to respond to and accommodate periods of non availability of instruments</li> </ul>	Sezen (2008)
Agility	Ability to excel simultaneously on operations capabilities of quality, delivery, flexibility, and cost in a coordinated fashion	<ul style="list-style-type: none"> <li>When needed, we can adjust our operations to the extent necessary to execute our decisions</li> <li>My firm can increase its short-term capacity as needed</li> <li>We have a wider range of adjustments that we can make to our operations than our competitors</li> </ul>	Menor et al., 2001 Glogor et al., 2013
IoT Adoption	IoT adoption is an extent to which people are continuously use the wearable technology of IoT for the said purpose	<ul style="list-style-type: none"> <li>Using IoT for a Healthcare purpose is a good Idea</li> <li>Using IoT for a healthcare purpose is Pleasant to use</li> <li>Using IoT for healthcare purpose is Fun</li> </ul>	Venkatesh and Davis, 2000

**V. RESULT AND ANALYSIS**

Each variable in the study was measured using multiple items as highlighted in Table 3. The rational flow of the study was:

- Questionnaire development based on extant academic and practitioner literature
- Construct items were adapted with context and established scales for better understanding and relevance
- Q-sorting technique: Two-judges for two rounds (until inter-judge reliability, i.e., raw agreement score, Cohen's KAPPA value reached 0.9) to ensure the relevance of the questionnaire items and also incorporate the sector-specific viewpoints.
- Construct-wise EFA conducted and Chronbach's alpha values checked to ensure reliability.
- CFA (confirmatory factor analysis) done followed by SEM to find the path coefficients.

The constructs were responded by the hospital-side representatives and items were measured using a seven point Likert scale with 1 = strongly disagree and 7 = strongly agree. Convergent, discriminant validity and reliability checked (provided in tables 4 and 5). While convergent validity highlights the extent to which there is consistency in measurements items, discriminant validity refers to the independence of the Dimensions, i.e., the extent to which measures of the three constructs are distinctly different from each other. The outcomes of the exploratory factor analysis show that all items loaded on their respective factors with loadings above 0.70. For further testing for discriminant validity of the constructs, average variance extracted (AVE) have been computed for each construct and compared with the squared correlations between constructs (45).

As can be seen from Table 4 and subsequently from Table 5, the AVE for each construct was higher than the squared constructs correlation with other constructs as required for validating discriminant validity (46).

The reliability of the constructs was assessed with Chronbach's alpha (Table 4) and all the reliability values calculated as >0.70, which is considered acceptable (47).

*A. Measurement Model*

**Table 4: AVE, Composite reliability, and Cronbach's alpha**

CONSTRU CT	Item no.	Item Loadin gs	Compos ite Reliabil ity	AV E	Cronbac h's Alpha
<b>Flexibility</b>	4	0.831- 0.912	0.911	0.87 7	0.933
<b>Agility</b>	3	0.789- 0.891	0.896	0.79 8	0.914
<b>IoT Adoption</b>	3	0.842- 0.887	0.902	0.80 4	0.909

**Table 5: Discriminant validity**

Constructs	Flexibility	Agility	IoT Adoption

<b>Flexibility</b>	<b>0.878</b>		
<b>Agility</b>	0.289	<b>0.799</b>	
<b>IoT Adoption</b>	0.314	0.201	<b>0.812</b>

As part of the confirmatory factor analysis (CFA), the measurement model was estimated prior to structural model and CFA was conducted to verify the measurement model (Anderson and Gerbing, 1988). The overall model fit of the measurement model was acceptable [For unconstrained model]:  $\chi^2 /d.f. = 1.22$ , IFI = 0.97, CFI = 0.97, NNFI = 0.96, RMSEA = 0.036]. With all specified factor loadings highly significant, the model indicates good convergent validity among the measures of each construct and good convergent and discriminant validities act as indicators of satisfactory construct validity.

In the structural model analysis of the hypothesised paths overall fit has been evaluated. The structural model (i.e., measurement and path model combined which was shown in Figure 1, Path Model) fit well as indicated by the following model fit statistics: Model fit (full model, n = 221):  $\chi^2 /d.f. = 1.19$ , GFI = 0.91, IFI = 0.99, CFI = 0.98, NNFI = 0.98, RMSEA = 0.033).

**Hypothesis 1, Supported:** H1 proposed a positive relationship between IOT Adoption and Flexibility. This hypothesised path was supported at  $p < 0.05$ ;  $t = 2.244$ .

**Hypothesis 2, Supported:** H2 proposed a positive relationship between IOT Adoption and Agility. This hypothesised path was supported at  $p < 0.05$ ;  $t = 2.334$ .

**Hypothesis 3, Supported:** The relationship of flexibility to agility was supported at  $p < 0.01$ ;  $t = 9.065$

These are summarised in Table 6.

**Table 6: Structural model: SEM results for direct effects**

Relationships	Coefficient	t- value	Remark/status
IOT Adoption → Healthcare Flexibility	0.189**	2.244	Supported
IOT Adoption → Healthcare Agility	0.198**	2.334	Supported
Healthcare Flexibility → Healthcare Agility	0.679***	9.065	Supported
Model fit (n = 221): $\chi^2 /d.f. = 1.88$ , GFI = 0.90, RMSEA = 0.033, CFI = 0.98, NNFI = 0.98, IFI = 0.98			



## VI. DISCUSSION AND CONCLUSION

IOT adoption is very vital in the current context of healthcare care delivery in healthcare organizations. Today's healthcare customer, i.e. the patients, are more learned and more aware of their rights and requisites. Healthcare service sector happens to be one of the most highly competing sectors of service where customers want to be more and more involved and participative in the care delivery process. On the other hand, the hospital administrations all these years have stayed naïve and somewhat indifferent towards high-end technology adoption. However, current patient-centric focus and need for being more customizable and more focus towards readiness have started hospital managers towards being motivated to invest more in advanced technologies and give importance to being flexible and agile from their care service delivery end. In this context and technology-need backdrop, IoT adoption and analyzing its efficacy and impact on flexibility has become pivotal. This study outcome bears testimony to the validating facts that IoT adoption in the healthcare organization context has provided positive outcomes. The empirical validation, with data from the hospital administrators, confirm the proposed hypotheses.

All the three hypotheses regarding IoT impact on flexibility, IoT impact on agility and in turn, flexibility on agility find positive and significant relationship support with strong path coefficients endorsing the validity of the proposed linkages. Thus IoT adoption adds to the superior delivery capabilities of the hospital by having a better-nuanced understanding and status update not only about the patient body needs, treatment status and care delivery progress, but also it helps hospitals achieve the overarching goals of superior service levels, better connectivity with their multiple SKU suppliers and stakeholding partners.

The adoption of IoT based platform and technologies thus adds to the servicing capability of the hospitals which reflects in their patient-centric flexibility and in turn, more readiness for facing sudden dynamic changes and process needs. Thus this study provides a validated framework with immense managerial implication as the outcomes of this paper highlights the importance of implementing IoT in healthcare context and validates empirically to the fact that healthcare organizations who have implemented IoT have gained from the system, and immense process-oriented positive outcomes have been achieved in terms of flexibility for the healthcare organization in terms of care delivery flexibility and agility. The empirical support further highlights and supports the fact that enhanced flexibility also bolsters the care delivery process agility for the healthcare organization. This study has immense academic as well as managerial implications from a business perspective. From theoretical perspective, this study aims at establishing a nuanced understanding of how IoT adoption leads to superior dynamic capabilities for the organization in service sector context, especially in the healthcare backdrop. From a business standpoint, this study may act as a pivotal motivator to managers who are sitting on the fence and finding it difficult to decide whether to go for IoT adoption in their organization context or not. This study substantiates the gains and highlights how IoT adoption has provided hospitals with better care delivery abilities manifested through superior care delivery flexibility and in turn high end added agility.

## VII. LIMITATIONS AND FUTURE RESEARCH

Like all major empirical research, this study also suffers from the basic limitations of lack of generalizability and added focus towards sector specificity. Moreover, this being a perception based data driven empirical study, the user limitations of cross-sectional studies remains. In this case, this might be prominent as IoT adoption might be a time-dependent event and longer or advanced implementation stage of IoT in the hospital context might have different perceptual implication. This study did not take time or duration of IoT implementation as any control variable, and that might affect the result as a short term versus long term implementer proportion might have brought in biased view in the outcomes. However, given the constraints of time and lack of data on IoT implementation and more importantly, lack segregation in terms of stage of implementation or adoption of IoT in the healthcare context might have affected the study. However, precaution was taken towards common and non-response biases. The future scope of further probing and analysis remains in terms of segregating the IoT implementation based on maturity and stage of implementation and subsequently trying to analyze the gains and outcomes in terms of separate multi-group study in the presence of a control variable. However, despite the limitations, this study opens up newer horizons of looking and assessing service-sector flexibility and emphasizes and motivates how advanced adoption of technology in service-sector context can play a pivotal role towards superior care delivery and getting equipped with higher order dynamic capabilities.

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