Information Systems Efficiency Measurement and Management with Specific Focus on Healthcare Information Systems in India

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In the new normal of healthcare given the advent of technology transforming the perception of the healthcare sector in many ways including remote patient management and IoHT(Internet of Health Things) as integral parts that are connected by Information Systems" that form the backbone of delivery. There information systems need to be adapted constantly at regular time intervals for sustaining maximum efficiency. Thus, the Co-efficient of Progressive Adaptation stating that " the rate of change of progressive adaptation of the concerned information systems is directly proportional to the efficiency of the same. Vice-versa" indicates prominence for Healthcare Information Systems

Keywords: IoT. Information Systems, A.I., Society 5.0, Healthcare 4.0, Change Management, Adaptation and Sensitization.

1. Introduction

The shift from in-person consultations to tele consultation in the healthcare sector offers several potential benefits, including convenience, saving time, reducing the risk of transmission and offers greater access to specialists. However, adaptation of information systems, like tele consultation systems, is due to the fact that adaptations to new situations require accurate adaptation of the concerned systems on a timely basis (Haleem, 2021).

A noteworthy acknowledgement serving as an enabler to competitive advantage is the is the organization's capacity to adapt the concerned information systems (Salwe, 2010; Schilling, 2017). Not adapting the information systems accurately on a timely basis will result in steady reduction of efficiency of that particular information system and also deteriorate the quality/ functioning of that particular information system in by increasing room for errors, consuming the quantity of time more than what is required and being unable to adapt to the new situation in terms of demands faced by the company and external resources such as clients and the effect of the technological advent on external factors. The reason for this is that, the workload increases with the growth of the organization , increase in consumer database will require a much larger quantity of customer data to be processed in a much lesser interval of time. For example In recent times, there is a high priority requirement for healthcare information systems which include the healthcare information systems used in the IoT of healthcare also known as IoHT(Internet of Health Things) to process a large amount of patient data and also maintain confidentiality and provide the information of the right patient to the right doctor at the right time. Therefore, in order to achieve maximum efficiency of the healthcare information system with a competitive advantage , it is highly crucial to accurately adapt the concerned healthcare system internally for the concerned healthcare system to be able to integrate with and adapt to the technological advancements. This paper reports on a project that measures and increases efficiency of a tele consultation app, resulting in adaptation in the form of automation.

2. Methods

The specific purpose of this project was to review the company's teleconsultation App (EPICare) and improve it to increase user satisfaction. Literature review was conducted from online sources and relevant articles were shortlisted. This was linked to research on the topic of the Prominent role of IoT in the field of telemedicine ; the case for technology adaptation which involved literature review, thematic analysis which was holistically blended to practical implementation of IoT in the field of tele medicine during the Covid pandemic where **information systems** was used to connect the various IoT in healthcare devices. As the Co-efficient of Progressive Adaptation was used in this study as well, this was used an as **ontological link** to this study as well because the Co-efficient of Progressive Adaptation studied in the healthcare information systems used to connect the various IoT in healthcare devices can now be used to measure the efficiency of the efficiency of the information systems connecting the same IoT devices thereby shining light on further progress of this study where the Co-efficient of Progressive Adaptation can be used to measure the efficiency of the concerned information system .

2.1 Project Design

This project was executed in three phases: (i) review of the existing (old) EPICare App by the researcher, (ii) adaptation of the

existing (old) EPI Care App and (ii) review of the new EPI Care App by the researcher. In the phase (i), EPI Care was evaluated before various aspects of the system were upgraded (adapted). This version of EPI Care was designated the old version. In phase (iii), the App was evaluated after EPI Care was adapted by implementing various automations within the system. This version of EPI Care was designated the new version.

The concept of the co-efficient of progressive adaptation, which states that the rate of change of progressive adaptation of the information system is directly proportional to the efficiency of the information system at a given point in time (Mirlay V. , 2019; Mirlay, Prominent role of IoT in the field of telemedicine; the case for technology adaptation, 2022), provided the overall framework for automation linking adaptation and efficiency.

2.1.1 Phase (i)

The researcher tested/evaluated the old version as part of his job to determine the usefulness of the system in terms of user satisfaction. The researcher used the EPI Care App acting as a doctor and then a patient to experience what the users of the system went through to initiate and experience a teleconsultation session. Through this process, the researcher was able to evaluate EPI Care and document the various aspects of the App, in particular the steps required by a patient to use the App to request a consultation and the steps required by the doctor to use the App to initiate the consultation.

In phase (i), the researcher examining the steps clinicians and patients had to undertake when using the application to engage in a typical teleconsultation session. The researcher first evaluated the App from the patient perspective documenting the steps a patient went through to initiate a teleconsultation with a doctor. Every step/action that the patient was required to undertake, for example clicking on an option or entering information, was recorded. Next, the researcher evaluated the App from the doctor's perspective. Every step/action that the doctor was required to undertake, for example clicking on an option or entering information, was recorded.

The key data collected during this phase was the number of steps or the actions within the App that the users, doctors and patients, had to undertake.

2.2.1 Phase (ii): Automation in the App.

After reviewing the collected data, the researcher applied the concept of the coefficient of progressive adaptation in an effort to increase the efficiency of the system. The coefficient of progressive adaptation states that the rate of change of progressive adaptation of the concerned information system is directly proportional to the efficiency of the information system at a given point in time. This means that increasing/applying adaptations to the system will increase its efficiency. In this case, the adaptation considered was automation (Mirlay, Prominent role of IoT in the field of telemedicine; the case for technology adaptation, 2022).

To automate the system, the researcher evaluated the steps used by the doctor and the patient and noted which steps were irrelevant, time consuming, had room for error and could lead to user dissatisfaction. Applying the co-efficient of progressive adaptation, present method (**Pm**) represents the current steps used in the system; (**Es**) represented all of the steps that could be eradicated and **Θ** is the automation that could be done through revamping of the system to remove the eradicated steps (**Es**). According to the co-efficient of progressive adaptation, this should result in optimal efficient (**Oe**) of the system, (the new number of step required) (Mirlay, Prominent role of IoT in the field of telemedicine; the case for technology adaptation, 2022).

Consequently, the researcher recommended to the managing director and CEO that EPICare should be upgraded to a version that increased the efficiency of the system by removing the steps that were deemed no longer required, time consuming, had room for errors and caused user dissatisfaction. These were steps that were not required by the doctor or patient to effectively use the system, for example steps with repeating actions.

The recommendations were accepted and the EPICare App was upgraded to a new version in which the eradicated steps (ES) were removed.

2.3.1 Phase (iii)

The researcher then evaluated the new version of EPICare in the same manner as the old version by documenting the steps doctors and patients had to following in the application when conducting a typical teleconsultation.

The App's efficiency is measured based on the steps count in terms numerical count or time taken to execute various actions in the App, namely patients making an appointment and doctors initiating the consultation. The calculation of the efficiency of the information system is based on the following equation:

Efficiency=1-Time with **Oe** (**New Method**)/Time with **Pm** (**Old Method**).

Therefore, efficiency of the information system can be expressed as 1 - Time (**Oe**)/Time (**Pm**).

The number of steps required by a patient to book and appointment, and the number of steps required by the doctor to initiate the consultation in the new method were compared to the number of steps in the old method and efficiency was calculated based on the above equation.

3. Literature Review

Due to the advent of technology in the technological environment in any healthcare sector located in a given location , will tend to have to adapt constantly over steady time periods in order adapt to the technological requirements of the environment as well as the organizational environment (Merali, 2006). This is because the mentioned of technology adds new dimensions to the healthcare sector and even changes the perception of the healthcare sector by practically making the healthcare facility come

to the patient rather than the patient going to the healthcare facility. All this in aggregate tends to dimensionally change the perception of the healthcare sector thereby forming the "new normal" of the healthcare sector which includes remote patient management, IoHT (Internet of Health Things), IoMT (Internet of Medical Things) and tele health all in aggregate depend on healthcare information systems as the backbone of delivery. These Information systems being the backbone of delivery are meant to use the principle of knowledge management which is to provide the right information to the right person at the right time which in this case is the right doctor receiving accurate information of the concerned person in a timely manner.

Thus , healthcare is foreseen as the challenging areas of IoMT (Internet of Medical Things). This mentioned IoT in healthcare is challenged with connection, power, spectrum , bandwidth and costs. There are a number of challenges remain before the well-described benefits of tele health need to be fully realized. Other challenges to be analyzed are data security, data management, Interoperability, scalability, up gradation, regulation and standardization, cost efficacy, power consumption , environmental impact, A.I. in diagnosis of various diseases, Implementing Electronic Health Records ,mobile based I.T. challenges , scaling and **sustainability**. Greater broadband mobile adoption is a noteworthy point and the cost-effectiveness of standardized low-energy wireless technologies also contributes to this trend. All these can be solved accurately by constant adaptation. This constant adaptation of the healthcare information systems will enable the process of solving the challenges as well as resolving addressing privacy concerns in terms of patient data and patient controlled mechanism using pseudonymization technique to ensure that the details of the patients in the E.H.R. are secure thereby protecting the privacy. Electronic Health Records management in terms of large scale data being managed, infrastructure support and increased productivity too can be enhanced by accurate and timely adaptation of the healthcare information systems thereby reaping the many benefits from : Augmented Reality, Virtual Reality related implementation and the Metaverse in tele health . Implication that the resources and cost of operating XR-mediated realities are different and higher than physical reality. Electronic Health Records, integration of diagnostic assistants/voice assistants along with Real Time Health Systems and Real Time Health Analysis are indeed becoming part of the "new normal" of healthcare practice much like how remote patient management and tele health. Electronic health access, Smart Tracking, Strategic framework-Value Based Healthcare is highly crucial for adoption and adaptation of I.T. Systems management are also part of the "new normal" of healthcare which includes IoT in healthcare. Medical decision making transformed by IoT based technologies also influence the technological advent in the healthcare sector which of course includes the IoT of healthcare used in the process of remote patient management. All these to be implemented in remote patient management and tele healthcare. This also holds good for the Perception layer- devices and sensors and wearable devices too are integral part of remote patient management which includes the IoHT (Internet of Health Things or IoT in healthcare). This includes Oxygen, blood pressure and blood sugar are vitals are to be methodically monitored customizing the parameters for each patient Also included in this is IoHT/IoMT in the use of emergency medicine like the iVital used by HELYXON in their "step down I.C.U. " model which involves the requirement of medical data access and emergency response. Digital transformation and Society 5.0 too are integral parts of the "New Normal" of healthcare.

The remote patient management mentioned includes the IoT in healthcare which will be used for making diagnosis of the patient remotely like how iVital of HELYXON enables this process .Holistic AI in Medicine (HAIM) framework to facilitate the generation and testing of AI systems that leverage multimodal inputs. Digital transformation in healthcare , with Cloud and Big Data too integrate into the new "holistic framework" of integrated healthcare which as mentioned in aggregate forms the "new normal" of healthcare that is highly influenced by technology. Effect of Block chain in the healthcare sector as well to a certain extent influences and effects the mentioned "new normal" of healthcare.

This mentioned "new normal" of healthcare , is formed by the several dimensions that have been added to the healthcare sector including the change in perception by making the healthcare facility come to the patient practically rather than the patient going to the healthcare facility. These technologies impacting the healthcare sector happen to be Advancement of medical technology IoT in healthcare, record keeping , medical device integration as there is a major boost in the healthcare sector due to remote health monitoring, sensors, data management, Augmented Reality/ Virtual Reality in healthcare and Smart Hospitals. All these points in aggregate forming the " new normal" of healthcare have **healthcare information systems** as the **backbone of delivery** as mentioned above. **Information Systems** being the backbone, virtual care, IoT, A.I. and cloud in healthcare are analyzed further in detail with specific regard to automation of workflows. The functions of healthcare information systems include the process of data collection, data processing, information management and dissemination of the data required in the functioning operations of the organization. The process of planning systematically accurately combined with Information System Architecture Steering is a **key aspect** of **adaptation**. ISA changes on a continuous basis in order to yield the desired outcomes faced with the internal and external environments. A.I. integration into healthcare, new artificial intelligence algorithms, Real time Data ,Sensors , communication systems and algorithms, Industry 4.0/Healthcare 4.0 are all part of the integration and adaption for sustainability and competitive advantage. For this, strategic flexibility is crucial along with the three dimensions namely innovative, adaptability and technological aspect. Healthcare Information system and Information Infrastructure of the concerned healthcare Information Systems precisely in terms of adaptation and sensitization of the system to the healthcare technology platform. Systems not achieving integration and interoperability , systems not attaining full scale and with it becoming unsustainable , systems leading to effective use of information for supporting health action and local work practices are some of the key core challenges faced and addressed in terms of obtaining the optimum solution that is to implemented by the accurate strategy by combining change management and technology at the given interval of time based on environmental factor requirements. This thereby endorses the need to further interoperability of healthcare information systems/technology. Technology infrastructure. IS Architecture in the healthcare information systems which form the backbone of delivery and to also be useful in the healthcare sector for the purposes of enterprise resource planning ,data warehousing,

data transfer and data analytical tools used to process healthcare related data. A.I. , Deep Learning and Machine Learning can significantly enhance the required process in terms of automation resulting in efficiency increase.

Thus, the healthcare Information Systems/technology needs to be adapted/ re-configured constantly at regular time intervals by accurately combining change management and technology in order to internally adapt the healthcare information systems to face the external environment and achieve the desired goals in the minimum time possible thereby attaining the optimum sustainability with the competitive advantage. Theoretical framework linking Operational flexibility, Management capability, Quality of Health Information Technology connected by healthcare information systems. Data analytics and bridging the knowledge gap along with implementing the principle of knowledge management which is providing the right information to the right person at the right time is to be integrally included in the mentioned healthcare information systems which using the stated principle of knowledge management will provide the information of the right patient to the right doctor accurately in the minimum possible time interval.

Adaptation is crucial for the process because healthcare information systems need accurately and timely adaptation on order to sustain by facing external requirements and technological advancements. These adaptations include an accurate permutation and combination of technological advancements such as Artificial Intelligence, robotics, data processing automation tools and my more in order to function in the new environmental situation where the amount of patient data will be very high in contrast to the previous past situation , more over needing integration to the IoHT devices and functioning accurately post adaptation. The requirement to adhere principle of knowledge management i.e. providing the right information to the right person at the right time is always a constant despite the dynamically changing environment of the healthcare sector.

Thus the integration of Knowledge Management System created a unique perspective from a strategic perspective in order to achieve optimal strategic management in a changing environment which has competitive factors indicating further evidence that information systems does require constant adaptation from time to time which includes the fact that for the purpose of information systems adaptation , adaptation in the form of automation does play a very crucial role. The expected outcomes of ISA can be achieved via the IS's adaptive way of functioning, as well as the co-evolution of the technological and the organizational aspects. Interlinking the technological aspects with the organizational aspects can be done by the process of re-configuration. ISA requires constant development/adaptation, which includes automation as a crucial component. Therefore the adaptation capacity of the concerned information system to the changing environment internally for the purpose of integrating into, adapting to sustaining in the new and constantly changing external environment is widely acknowledged to serve as an enabler of competitive advantage and sustainability, for one of the reasons being that Information Systems Architecture is considered to be an aspect that keeps changing continuously in the organizational aspects that are aligned with the technological aspects in order to yield the desired outcome continuously while facing the internal and external environments. For this, just technology alone will not be adequate . Accurate combination of technology and change management together will be required for the implementation of the accurate strategy. This point is clearly endorsed by the advent of the Covid pandemic which acted as the catalyst in making remote patient management , IoHT IoMT and tele -health the "New Normal" of medical practice even after the Covid pandemic. This is strengthened by the example for this can be the effect of the Covid pandemic on the healthcare sector globally.

The Covid pandemic acted as the catalyst in changing the perception of the healthcare sector thereby forming the "new normal" of healthcare by practically enabling the healthcare facility come to the patient rather than the patient going to the healthcare facility due to the use of remote patient management and remote healthcare enhanced by the IoHT/IoMT. A study noted that the use of telemedicine became important in 2020/2021, because of the COVID-19 pandemic and hailed the importance of artificial intelligence (AI) for enabling the **automation** of telemedicine. Artificial Intelligence, and big data, remote surveillance, Real-time solutions, IoHT in underdeveloped areas , Chronic illness management are highly informative and are strengthened by the fact that Smart healthcare systems are becoming the 'new normal' of healthcare practice along with remote health monitoring and remote patient management. The healthcare sector therefore requires continuous reconfiguration of Information and Communication Technologies that are to be measured strategically.

Another key aspect of adaptation is automation. Automation plays a role in reducing human/manual interventions reaping the beneficiary numerous additional advantages such as increased efficiency at a lower cost, increases in the area of productivity and integration, improvement in the aspect of personalization and enhancement of flexibility and optimum planning thereby moving up the value chain This mentioned adaptation in the form of automation for the concerned information systems can be done internally using internal engineering based on various requirements needed to complete the task at that given point of time given increased workload, requirement to process much larger data more accurately in a lesser time interval which will constantly be increasing in terms of requiring higher demands to be fulfilled.

Value based healthcare too adds value to this study. This once again indicates the huge scope for medical decision making transformed by IoT based technologies much like the 4th Generation Data Management as there is very likely to be a huge shift/ paramount change dimension of the healthcare sector due to the advent of technology which includes A.I., ML/, Deep learning , Cloud, Big Data and the requirement of processing very large amounts of healthcare data accurately in the minimum possible duration of time. This can be enhanced by process of data mining and business intelligence processed in healthcare.

PESTEL factors need to be analyzed in descending order of priority in order to make the decision for internal adaptation of the healthcare information systems in order to adapt to the external environment which is dynamic and constantly changing partly due to the advent of technology. The close connection between dynamic capabilities and knowledge management adds value to this study in terms of exploring this connection further.

Future scope like other sustainability dimensions like technological sustainability, environmental sustainability and social sustainability are yet to be explored and worth investigating in the future as the core focus of this study is to determine to accurate strategy to implement this mobile I.T. into the research with the information systems. 17 significant application in healthcare to be analyzed further as well thereby linking the research work to the global disruptive innovation in the regard of healthcare information system adaptation is to be taken into account. Specific focus on automation, adaptation, machine learning thereby managing and measuring information systems efficiency. Managing extremely large volume of patient data present in cloud and Big Data with utmost accuracy in the minimum time duration possible can be enabled if the Co-efficient of Progressive Adaptation is applied. As previously noted, adaptation of the information system is linked to the efficiency of the system previously proposed the coefficient of progressive adaptation, which states that the rate of change of progressive adaptation of the concerned information system is directly proportional to the efficiency of the information system at a given point in time. The coefficient of progressive adaptation may be represented as Optimum efficiency (Oe) = Present methods (Pm) * Θ - Eradicated steps (Es). Θ is the main co-efficient or the adaptation be done to the information system. When this adaptation is applied, the process of the information system itself changes. The present method, represented as (Pm), reduces in the number of steps that are required to complete the procedure. This drastically reduces any room for errors, thereby increasing not just the efficiency of the information system but increases the speed as well.

The above literature review has been analyzed by comparing and contrasting existing algorithms that manage and efficiency of healthcare information systems with specific focus on healthcare information systems. The constant and timely adaptation of healthcare information systems/technology also aims at resolving challenges such as the risk of cyber hacking, data security risks and data protection and integrate methods such as the Lamport Merkle Digital Signature method for signature generation and verification making use of the Central Healthcare Controller along with verification and authentication. Industry 4.0, Healthcare 4.0 and Society 5.0 relating to the healthcare sector forming the "new normal" of healthcare with added dimensions of technological advances can also be enhanced by 5G integration. A.I., Automation, Robotics, Big Data and Cloud indicate to optimize the efficiency of processes such as data processing, data storage, cloud computing all which are included- for cost effective management of medical resources and use the mentioned principle of knowledge management. This point is endorsed by the example used in the decision making process Circumflex Hierarchical Representation of Organization Maturity Assessment" (CHROMA) model for decision making by the process of optimizing the data. For this the accurate combination of technology and change management for the given healthcare information system/technology at the given time interval needs to be accurately strategized. Gap between technological capacities and organizational needs have to be determined as well. This includes the possible combination of Cloud and Block chain in the given healthcare information systems. Thus the requirement for adaptation of the given healthcare information systems also involves deep structural changes in the information systems. This means the Co-efficient of Progressive Adaptation needs to be applied in the core of the information systems in order to re-structure the given healthcare information system and/or the infrastructure of the given healthcare information system internally in order to obtain adaptability and sustainability externally. This can indeed add to the accurate reshaping of the evolving healthcare sector which has new dimensions that change the perception of the entire healthcare sector which evolves into the "new normal" of healthcare practice. Robotics Process Automation in healthcare information systems too indicates to be an enhancement factor despite the challenges faced in the process of implementing the required Robotics Process Automation in the given healthcare information systems. For this , the challenges such as cognitive challenges in the alignment of information representation in the era of technologies and big data and the Adaptive Cognitive Fit" (ACF) framework that explains the influence of information facets and AI-augmented information representations on human performance need to be analyzed along with the Information Processing Theory and Cognitive dissonance theory to advance ACF theory and a set of positions. M.L and A.I. to improve human performance in order to determine the accurate solution to be strategized and optimally implemented. Here too the Co-efficient of Progressive Adaptation appears to be useful based on past research practically implemented at HELYXON which increased the efficiency of the main step of the process through automation by internal re-structuring of the healthcare information systems of the concerned EPI Care platform resulting in **50%** of the time being saved. Robotics Process Automation can enhance similar results if implemented accurately in the concerned health care information systems. Artificially intelligent technologies that can adapt information representations to overcome cognitive limitations are necessary for these complex information environments , this adaptation can be strategized accurately referring to the Co-efficient of Progressive Adaptation.

Thus to specify change management and more over how to adapt the information systems using the Co-efficient of Progressive Adaptation the clear indication to compare and contrast UTUAT with the Co-efficient of progressive adaptation appears highly significant and also to compare and contrast the Data Envelopment Analysis along with all the other algorithms and methods that manage and measure efficiency of information systems with specific focus on healthcare information systems. (Haleem, 2021; Deimler., 2011; Alolayyan, 2022; Dykgraaf, 2021; Mishra, 2022; Madanian., 2023; Sim Yee Wa, 2022; Pal, 2022; Lutfi, 2022; Xi, 2022) (Dwivedi, 2022; Amyot, 2022; Soenksen, 2023; Nguyen, 2023; Hertzum, 2022; Yayla, 2022; Davis, 2022; Pedro, 2023; Kamaruddin , 2022; Rob233) (Mourdi, 2023; Muneeb, 2023; Pela'ez, 2023; Hallioui, 2022; Amir, 2022; Zhang, 2022; Badakashan, 2022; Khatib, 2022; Praveen, 2022; Rani, 2023) (Vyas, 2022; Jimoh, 2022; Sharma N. C., 2022; Khadidos, 2022; Webber, 2022; Pal, Blockchain-Integrated Internet-of-Things Architecture in Privacy Preserving for Large-Scale Healthcare Supply Chain Data, 2022; Gupta., 2022; Pandey, 2023; Ghazal, 2023; Action, 2022) (Sharma K. a., Applications, Tools and Technologies of Robotic Process Automation in Various Industries, 2022; Komalasari, 2023; Pramod, 2022; Samuel, 2022; Martorrel, 2022; Nurhayati, 2019; Rouidi, 2022; Yellin, 2006; National Academy of Engineering (US) and Institute of Medicine (US) Committee on Engineering and the Health Care System, 2005) (Haleem J. S., 2021; Mirlay,

Prominent role of IoT in the field of telemedicine; the case for technology adaptation, 2022; Fung, 2013; Chi23). (Mirlay, Importance of Constant adaptation in the field of Management INformation systems in the banking Industry, 2019; Mirlay, Importance of Constant adaptation in the field of Management INformation systems in the banking Industry, 2019).

Findings from the above literature review can be linked to the practical examples where information systems were adapted using the Co-efficient of Progressive adaptation thus resulting in increased efficiency that could be measured.

In this practical example, there was a step by step procedure of approximately 15 steps to complete the report and submit the same. As some of the steps were redundant and had a lot of room for errors, these steps needed to be terminated. Automation was thus implemented to this process through internal engineering of the information systems thereby automating the same and enabling the entire process to be completed in an approximate 11 steps. This automation increased the efficiency of the process and also enabled the organization to complete the work in a lesser time interval thereby saving the company more than 410 man hours per anum. So referring to the mentioned ontological link between the findings from the study in aggregate to the findings from this practical example, there was a clear indication that the Co-efficient of Progressive Adaptation in the information systems used in the banking sector (Al-Nakib Noofal Ahmed Mohsen Mohammed, October 2015; Jayachandra Bairi; S.J. Ho, 2008; Management Study Guide; Panagiotis G. Trivellas, February 2013; dangolani, 2011; Ngelechei, 2016; S.J. Ho, 2008; Obasan Kehinde A, 2012; Mirlay, Importance of Constant adaptation in the field of Management INformation systems in the banking Industry, 2019) (Mirlay, Importance of Constant adaptation in the field of Management INformation systems in the banking Industry, 2019; Mirlay, Prominent role of IoT in the field of telemedicine; the case for technology adaptation, 2022). This Co-efficient of Progressive adaptation in the field of information systems used in the banking sector, can be applied to the information systems used in other sectors such as the healthcare sector as well. The crucial points observed in this research were :

- **"Nth"** moment adaptation in a progressive manner.
- Eradication of steps that are no longer required at regular timely intervals.
- Direct proportionality to change management and efficiency of the concerned information system.
- Inverse proportionality of efficiency of the concerned information system to the eradication of steps to the "nth" moment adaptation (Rhee, Cho, & Bae, September 2010; Asmah, Ofoeda, & Gyapong, August 2016; Rejikumar, December 2015; Thomas Guyet, December 2007; Munir, 2016; Canadian HR Reporter, 01/2011; Panagiotis G. Trivellas, February 2013; Obasan Kehinde A, 2012; Lacity & Wilcocks, 09/2016; Aggarwal, 2022) (Mirlay, Importance of Constant adaptation in the field of Management INformation systems in the banking Industry, 2019; Mirlay, Prominent role of IoT in the field of telemedicine; the case for technology adaptation, 2022).

The important research questions in this research were : what research has found so far ?, what has not been found so far ? , Indication of the Co-efficient of Progressive Adaptation in the field of information systems and the existence of the Co-efficient of Progressive Adaptation in the field of information systems.

This research within the capacity of the literature review included did not find any papers that specify how the efficiency of information systems can be measured using the Co-efficient of Progressive adaptation (Campanella, Della Peruta, & Del Giudice, 03/2017; Mirlay, Prominent role of IoT in the field of telemedicine; the case for technology adaptation, 2022; Mirlay V. , 2019) thus noting in the research gap that , there is a clear indication to explore the Co-efficient of Progressive Adaptation in the field of measuring efficiency of information systems even in the healthcare sector .i.e. information systems that connect the various devices forming part of IoHT (Internet of Health Things). This point also endorses the Co-efficient of Progressive Adaptation as the Ontological link between the research findings in this research work to the findings in the information systems used in healthcare. This point is strongly endorsed by the table below which contains the literature review of articles from various journals examining various methods/models of efficiency management in which the current work done, current gap and scope forward are analyzed (Mirlay, Prominent role of IoT in the field of telemedicine; the case for technology adaptation, 2022; Mirlay, Importance of Constant adaptation in the field of Management INformation systems in the banking Industry, 2019).

Thus, the analysis of various models to measure information systems to measure efficiency of the information systems that have been studied so far, clearly indicate gap in the area of efficiency management and measurement of the concerned information system. Precisely because areas that have not yet been covered by prominent models of managing and measuring information systems' efficiency have not till date included focus on adaptation/automation and eradication of steps no longer required, timely adaptation of the information systems step by step process , specific efficiency measurement, specifics of information systems adaptation to increase efficiency, efficiency increase by reduction of steps, new methods to improve and measure information systems efficiency and requirement to adapt to big data and other technological advancements. That is why this study aims to fill the gap in the area of information systems management and measurement with special focus on healthcare information systems (Nandakumar, 2020; Daniyan, 2022; Delgadillo, 2022; Khan, 2020; Ponsiglione, 2021; Gaur, 2023; Ayubi, 2019; Paulo R. a., 2020; REIS, ABREU, CAMPOS, & DE SOUZA; Luisa Rosas-Hernandez, 2021).

As information systems form the backbone of healthcare delivery, this study further explores how the Co-efficient of Progressive Adaptation can be practically implemented and measuring the efficiency in the information systems used in the healthcare sector.

Telemedicine solutions, such as tele consultation systems make use IoT devices and other technological adaptations such as artificial intelligence, big data, cyber security, remote diagnostic solutions and virtual assistants connected by healthcare information systems. As highlighted by prior literature, constant adaptation is required in operating these information systems. This study reports how a project utilized the coefficient of progressive adaptation to apply adaptation to a teleconsultation App

to increase and further measure the efficiency of teleconsultation system (Mirlay, Importance of Constant adaptation in the field of Management INformation systems in the banking Industry, 2019; Mirlay, Prominent role of IoT in the field of telemedicine; the case for technology adaptation, 2022).

Therefore the ontological link creates a holistic blend specifying and endorsing the following results

Explanation of how these results met the objectives are as follows :

4. Results

The above mentioned data in the research done as per the methodology specified, is linked to the holistic review by ontologically linking the Co-efficient of Progressive Adaptation practical in the practical work observed in the project to the findings of the research from the literature review done in the concerned domain specifics.

Explanation of how these results met the objectives are as follows

To Describe the Adaptation of EPI Care Guided by the Concept of the Co-Efficient of Progressive Adaptation :

As mentioned above under the titles of how the project was conducted as well as the results title, in this particular context , as the explanation of how EPICare works is elaborated, it was proposed to the company by the researcher that the **step by step** process is very elaborate , time consuming, having a lot of room for errors and causing user dissatisfaction. Thus, the proposal was explained using the Co-efficient of Progressive Adaptation which states that : *The rate of change of progressive adaptation of the concerned information system is directly proportional to the efficiency of the Same. Vise-versa*. Thus , when ***adaptation in the form of automation*** was done to the healthcare information system used in the consultation platform , the main part of the process when tested in the lab could be done in **50%** of the usual time taken in the same process **before** the healthcare information system was adapted using automation. Thus, referring to the phase 1 and phase 3 mentioned above, observing the pre adaptation version and the post adaptation version of the platform there was a clear increase in efficiency by 50% thereby how the Co-efficient of Progressive Adaptation's statement was useful in terms of increasing efficiency of this particular information system of this particular healthcare platform EPICare (Mirlay, Prominent role of IoT in the field of telemedicine; the case for technology adaptation, 2022).

To Determine an Appropriate Measure of Efficiency:

According to the co-efficient of progressive adaptation, the efficiency of the process/system should be improved after adaptation and reduction of steps. To measure the efficiency of the EPICare system (consultation process), a simple time measurement is used where the time to complete the steps in the process is recorded. In the consultation process, with the template which is automated, the process (time for the patient to initiate a consultation and the doctor to respond to the request) completes in 1.5 minutes or 90 seconds. Without the template (un-adapted system), the process takes 3 minutes or 180 seconds. Therefore, 90 seconds can be saved with the template being automated for each consultation.

Efficiency was measured by using the following equation:

1. Time (**Oe**)/Time (**Pm**).

From the example presented, the efficiency of the system is 1 – 90/180 = 50%. Thus, the efficiency of the new method increased by 50% compared to the old method.

Very clearly examining the results and the two phases in which the project was done , the **50% increase** in efficiency **post adaptation** of the healthcare information system was a noteworthy point. This is a very clear indication that , the Co-efficient of Progressive Adaptation recommended to adapt the mentioned healthcare information system can also be used to measure efficiency of the concerned information system and/or any information system by **comparing efficiency** and **time taken** to complete the process **before and after** adaptation is done by adapting the concerned information system process. This point is particularly endorsed by the phase 1 and phase 2 of the projects along with the results mentioned above in which the efficiency before adaptation and the efficiency after adaptation was calculated and noted to have increased by 50%.

To Determine if the Adapted System was more Efficient as Suggested by the Co-Efficient of Progressive Adaptation:

Very similar to the first objective, referring to the statement that : The rate of change of progressive adaptation of the concerned information system is directly proportional to the efficiency of the same, Vice-versa, referring the results mentioned above as well as Phase 1 and Phase 2 of the project , the results from the observations of the study done by practical implementation of the concerned healthcare information system did show the **50% increase** inefficiency. Thus the adaptation in the form of automation did result in increase of efficiency of this particular information system used in this particular healthcare platform EPI Care.

5. Conclusion

The project had three specific objectives: (i) to describe the adaptation of EPI Care guided by the concept of the co-efficient of progressive adaptation; (ii) determine an appropriate measure of efficiency; and (iii) determine if the adapted system was more efficient as suggested by the co-efficient of progressive adaptation.

The results of the project show that EIP Care benefited from applying the co-efficient of progressive adaptation and it may be postulates that other healthcare information systems could also benefit. In general, from an industry perspective automation in the field of healthcare information systems may lead to benefits such as saving labour costs, improvements in quality and

consistency, reduction of waste, increased predictability of outcomes, higher throughput and data driven insights as suggested by Dias (2014). Other benefits of intelligent automation are technological re-imaging of healthcare, streamlining digitization, accelerating progress, greater diagnostic precision, enhanced patient experience and increasing efficiency, which would otherwise not be possible. Automation could also potentially lead to a reduction in errors and increased speed of the information system. The results of this study demonstrated the benefit of increased time efficiency (Mirlay, Prominent role of IoT in the field of telemedicine; the case for technology adaptation, 2022; Mirlay, Importance of Constant adaptation in the field of Management INformation systems in the banking Industry, 2019).

The focus of technology accuracy is on data management, the right information to the right person at the right time. In the case of healthcare information systems, this means the information of the right patient, comprising of all the relevant and required information, to the right doctor/s on a timely basis. The patient information is arguably the most important (Buchnowska, 2011) which contains the previous records of the patient, current complaints and specifics, specific treatment course and information confidentiality. Adaptation, as demonstrated by automated templates in EPI Care underscores this point (Mirlay, Prominent role of IoT in the field of telemedicine; the case for technology adaptation, 2022; Mirlay, Importance of Constant adaptation in the field of Management INformation systems in the banking Industry, 2019).

The project showed that efficiency could be easily calculated using a simple time/reduction in steps calculation. This may be applicable to other systems that require users to undertake steps/actions within the App where the number of steps/actions can be calculated. This allows one to focus on specific aspects of the App and reduce unnecessary steps/actions to increase efficiency in the operation/execution of the App. As demonstrated in this project by automating various steps in the EPI Care App, time efficiency was increased by 50%.

Furthermore, this study aims to examine the relation in comparison and contrast to Six Sigma in healthcare information systems and how efficiency is increased and measured using Six Sigma with specific focus on the DMAIC .

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