



Literature Review Document

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The benefits of Digital Transformation for the Healthcare Ecosystem

Table of Contents

| | |
|--|----|
| 2. Literature Review..... | 2 |
| 2.1 Digital Transformation in Healthcare Ecosystem..... | 2 |
| 2.2 Business model..... | 4 |
| 2.2.1 Business model patterns..... | 4 |
| 2.2.2 Current hospital business model..... | 5 |
| 2.2.3 Current health care service chain..... | 5 |
| 2.3 New digital technologies in healthcare..... | 6 |
| 2.3.1 IOT opportunities for improving the healthcare system..... | 7 |
| 2.3.2 Big data analytics..... | 7 |
| 2.3.3 AI in health care..... | 8 |
| 2.3.4 Blockchain in health care..... | 8 |
| 2.4 Functional operation in a digital hospital..... | 9 |
| 2.5 Healthcare business ecosystem..... | 10 |
| 2.6 Benefits of Digital Healthcare Ecosystem..... | 12 |
| 2.7 Problem Statement..... | 13 |
| 2.8 Research Question..... | 13 |
| 2.9 Summary..... | 14 |

2. Literature Review

2.1 Digital Transformation in Healthcare Ecosystem

Hospitals are experiencing a full-scale digital revolution. Some highlighted benefits are improved patient access and health outcomes, lower costs, and enhanced competition. The demand for healthcare services is expected to increase due to an increasing proportion of youth, increasing economic status, an ageing population, greater health awareness, and changing attitudes towards preventive healthcare. Also, the emphasis shifts from health care to health and well-being (Sarwal et al.,2021). Future research should emphasize treatment and prevention, early identification and healthy lifestyles, and improving energy and well-being. Global needs to use this opportunity to build healthcare platform systems. Emerging technologies such as mobile networks, IOMT (Internet of Medical Technologies), cloud, big data analytics, 3D printing, blockchain, digital wallets, drones, and robotics are fueling the emergence of new sector titans in the medical field. Machine learning and AI are increasingly used in healthcare and other businesses to make descriptive and predictive decisions. Regarding management, technology-enabled digital analytics companies often have to compete for business in the healthcare industry. Well-established institutions such as retail stores, businesses, hospitals, theatres, universities, etc., are being disrupted by start-ups in every sector, including education, finance, healthcare, and entertainment.

In the automotive, housing market, IT, banking, and many other industries, we are currently experiencing Industry 4.0. Successful businesses use open platform-based business practices that include ecosystem stakeholders. Google and Microsoft are partnering with and

investing in healthcare start-ups. Their focus is now on making decisions using big data and AI, ML, blockchain, and Analytics. The healthcare sector must undergo a 4.0 transformation soon. Health facilities and small clinics now have only a limited number of health workers (Carmen-Alexandra and Dragos, 2021). The transformation to Healthcare 4.0 includes digital patient information, cloud computing, mobile internet, IOMTs, connected people, considerable data health information, AI, machine learning, and blockchain. Therefore, developing personalized healthcare and creativity in healthcare diagnosis and treatment are vital priorities. As with various technological changes throughout Industry 4.0, this may take some time. It would be prudent to be prepared for upcoming events. The guiding idea of Healthcare 4.0 is "health is more than health." Curing disease is the current priority in health care. The Future of Health and Well-being focuses on primary and secondary care, early identification, healthy lifestyles, livelihoods, and wholeness. "Health" also has intellectual, psychological, and spiritual aspects.

2.2 Business model

The business model (BM) as a framework represents the rationale for generating revenue by having a group of components with specific linkages. It represents the value an employer provides to one or more client groups. It also includes information about the company's organizational structure, the ecosystem of partnerships, and assets and relationship capital to develop, enhance and deliver this value. A business model describes how a company conducts its operations and generates revenue. The Consumer Value Proposition (CVP), Value Creation Formula, and Partner Network are essential for Healthcare BM. Determining consumer segmentation and distribution methods for each group is critical. The value formula outlines how technology adds value to businesses and customers while creating value for itself. It identifies pricing structures and forecasts profits and costs for each client type. An essential aspect of the business strategy is the partner ecosystem that works together

to develop and distribute products and hospital aids to specific client groups. There is much literature on the subject, and academics and industry are interested in it. The healthcare platform concept is fully explained in that study (Shubham et al.,2020).

2.2.1 Business model patterns

Some examples of business model formats include Razor and Blade, Freemium, Long Tail, Sharing Economy, and Cloud business models such as Software as a Service (SaaS) and Platform Software (BaaS). IaaS (Infrastructure as a Service), Interface, Bi-Market, and more. They consider the architecture concept for healthcare applications (National Digital Health Mission, 2020). In the platform, companies facilitate high-value interactions between manufacturers, network operators, and consumers. Knowledge and connections are their essential resources and the foundation of their economic creation and strategic advantage. Platforms add value by enabling connections between external suppliers and customers.

2.2.2 Current hospital business model

The hospital industry was mostly asset-based and shareholder base. A team of entrepreneurs and organizers manages and maintains the buildings. Doctors, nurses, and other support staff may work for wages or be contracted. Analyzing hospital expenditure, projects, land, and structures account for about 40-50% of the total costs, the health department accounts for 40%, and the remaining 10%-20% comprises labour and administrative costs. Establishing a greenfield can take three to five years due to government processes and regulations. About 30% of all marketable bonds are made up of equipment, most of which is imported. The need to update some expensive technology (such as MRIs and CT scanners) as it becomes obsolete further increases the costs of significant advances. Prolonged treatment times, erroneous diagnoses, rising costs, and a shortage of doctors are expected. Also, there is a lack of direct data exchange between diagnostic facilities, medical professionals, and

patients. Hospitals can become more reliable, cost-effective, and patient-friendly by using new technology and implementing joint business strategies (Gehde et al.,2020).

2.2.3 Current health care service chain

All of them are familiar with how patients navigate the network of health services. Figure 1 shows all the service providers, employees, and distribution companies. Figure 2 depicts the healthcare environment, which includes materials and front- and back-end operations. It is well recognized that none of the businesses is controlled by a single entity; Instead, they work together to provide holistic services to the patient. Solutions are in the banking, transportation, and healthcare sectors. It is also common knowledge that all businesses use software systems and follows the rules and regulations. But the results are published in the patient pays each specialist separately (Ulrich et al.,2020).

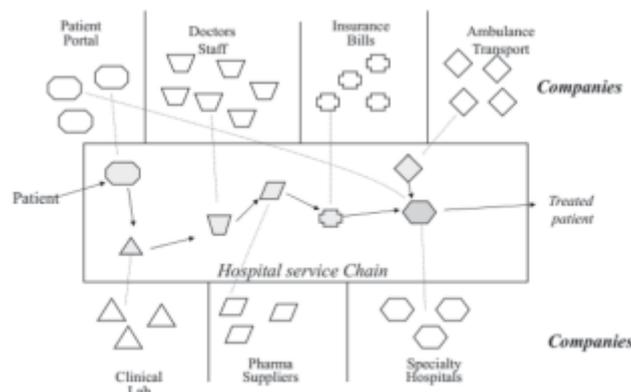


Fig 1: Hospital Service Chain

2.3 New digital technologies in healthcare

The health sector is integrating digital technologies when doctors and nurses often communicate with patients via mobile broadband; electronic tablets with detectors that capture data via the digestive system are used in healthcare. Data security; delivery of drugs,

blood, and organs via drones; Government clinics perform robot-assisted procedures. They are very accurate and comfortable (Sikandar et al., 2022). With 3D printing, customized surgical instruments can be manufactured. Osteoporosis can heal 40-80% faster when created using 3D printers. Safeguard patient and medical information and share it with appropriate parties using blockchain as a shared database. AI helps to accurately identify chronic diseases like cancer and diabetes, cholesterol, and heart health. Invoices, reports, and other records are processed using NLP and AI. Clinical research and treatment practices will be transformed through the analysis of big data acquired by IOMT, improving the ability of healthcare professionals to deliver digital care.

2.3.1 IOT opportunities for improving the healthcare system

The Internet of Medical Things (IoMT) is the connectivity of medical devices that provide critical data to computer programs that regularly evaluate and interact with healthcare IT systems (Salehi-Amiri et al., 2022). IoT-enabled ICUs, emergency care facilities, and medical centres will enable the transfer of electronic exchange and patient critical care statistics. There are many advances in connecting medical equipment, such as ultrasounds, thermometers, glucose monitors, and electrocardiograms. They are used to monitor patients' physical health, intelligent bedrooms in medical facilities to eliminate the need for nurses, and smart medicine containers in the home that instantly publish knowledge to the cloud.

2.3.2 Big data analytics

The data should be collected, including the variety available (including variations in formats, structure, and content), data generation and processing speed, and integrity. Whatever happens, the data must be checked, cleaned, verified, and examined by medical practitioners who know the human factor. One cannot go wrong when working with patients. Big data should help in clinical decision-making. What must information be collected and processed from patients, medical devices, organizations, and the local environment to achieve

the desired results? Making decisions based on clinical data is a complicated process. It involves extrapolating knowledge from disparate patient sources and using patient/data correlations to translate records, understanding clinical notes collected from various sources in an appropriate setting, manipulating large amounts of clinical image data, and extracting significant useful information and biomarkers. Genetic data analysis requires a lot of computing power. Adding clinical data adds complexity, and recording patient behaviour using various sensors and their multiple social interactions and communications is critical. There are many methods of using the information to make decisions (Batko and Ślęzak 2022).

2.3.3 AI in health care

AI should significantly contribute to the modern healthcare industry, enhancing rather than improving the work of doctors. Along with monitoring other pathological conditions, including diabetes, high cholesterol, infertility problems, and heart health, AI helps diagnose and plan chemotherapy (Hong et al., 2022). A vast collection of clinical data and images is used by the Clinical Decision Support System (CDSS) to identify individuals accurately. AI uses intelligent algorithms to ease the burden on doctors by helping people manage their medications, monitor and understand their patient records, and disseminate straightforward, professional advice. AI uses patient clinical data and academic literature to make critical clinical discoveries, improve existing treatments, and develop new therapies. Combined with AI and ML, clinical research and treatment systems are expected to be transformed by integrating smartwatches and various biological devices, improving the ability of healthcare practitioners to provide online care. Health professionals depend on intermediaries such as therapeutic bodybuilders and pharmaceutical wholesalers to fulfil their essential duties. AI technologies such as natural language understanding can help identify critical information such as billing amounts, bank details, timings, locations, and associated stakeholders from the

flood of unorganized invoice documents a business receives. Here you can quickly process hundreds of payments from numerous suppliers, customers, or services annually.

2.3.4 Blockchain in health care

Medical record digitization allows data sharing and cloud storage. Hospital services are mandated under the Personal Data Protection Bill, the proposed Digital Information Security Act (DISA), and various related laws to adhere to high regulatory requirements and protect patient and medical records. Blockchain will enable individuals to be more secure and control their patient history. Also, to expand coverage under government schemes like Ayushman Bharat, blockchain technology can be used for automated authentication and authorization, reducing the need for multiple stakeholders to exchange documents back and forth and speeding up claims handling. India's 'e-health' electronic health records/electronic medical records (EHR/EMR), remote patient monitoring, medical informatics, and smartphones are some of the sub-segments of the Indian digital healthcare sector. The mHealth category is predicted to dominate the market by 2024 as more and more individuals will use health and fitness apps to monitor and track daily activities. Wearable health wristbands that measure virtually natural health, booking doctor visits using a mobile app. Accessing reports online, communicating with a specialist via video chat, and bringing medical records and information to a medical website on a smartphone are advanced across mHealth (Attaran 2022).

2.4 Functional operation in a digital hospital

The patient admissions, hospitalizations, practice guidelines, consultations, and referrals are stored in the hospital's Internet technology. Electronic prescriptions and signatures were launched in the medical facility. Requests for X-rays, blood tests, sensitivity

tests, ECGs, and MRs are entered into the database. Thanks to a secure cloud-based storage solution, the healthcare team and patients can access all generated data (records, results, bills, etc.) anytime, anywhere. Electronic signatures and remote monitoring manage treatment recommendations and specific information. A pharmacy, inventory tracking, and billing systems should record such entries and exits electronically. A closed-loop medication administration system ensures the proper medication is administered to the right patient at the right time (Tortorella et al., 2022). A centralized control network must be used to operate emergency infrastructure, including smoke detectors, security, electricity, and water. Medical equipment is interconnected with other intelligent information systems, financial and administrative functions, and related contributions in digital hospitals. It increases employee productivity, raises process quality, and ensures patient safety. Medical professionals and individuals need to be informed inside and outside hospitals about the purposes of telehealth and mobile medicine.

2.5 Healthcare business ecosystem

A network of autonomous businesses cooperating in the healthcare industry to acquire competitive advantages through mutually beneficial connections. As members improve the movement of ideas, skills, and money across the system, the ecology development. Ecosystems are formed due to the interrelationships of interaction, coexistence, and resilience. Four restrictions now affect trade (Russo Spena and Cristina, 2020). They are organizational standardization, technological expansion, product standardization, and service adaptation. When referring to the architecture of a product, "modularization" describes a system in which functional areas are carried out by different, often independent hardware components whose interfaces are specified by a set of appropriate methods to allow component replacement. Commodities provide value when combined, just as actions can be

taken individually. The same modular design in product layouts also occurs in organizational structures in figure 2.

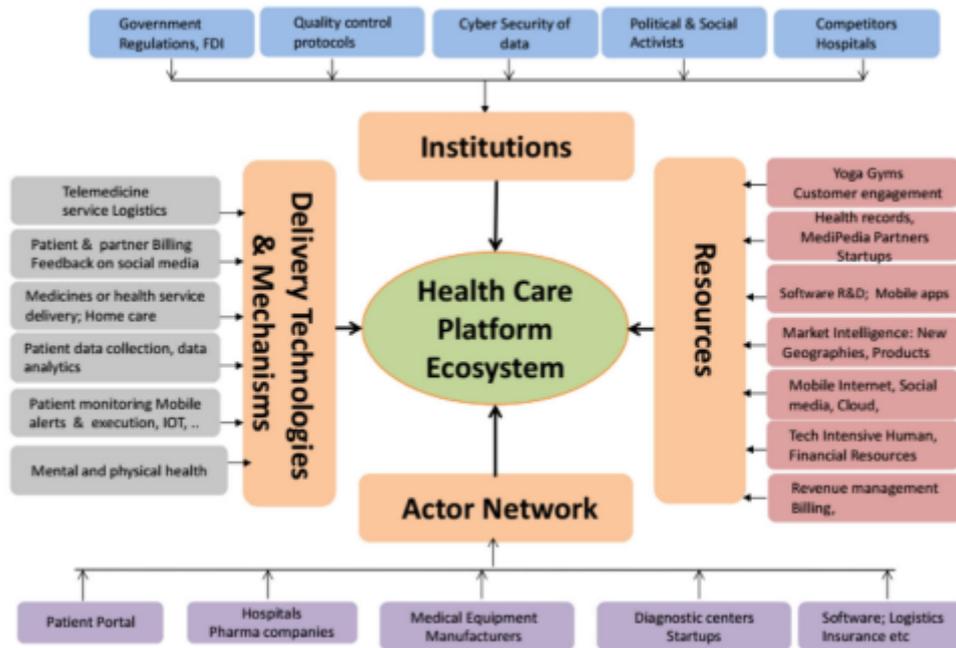


Fig 2: Healthcare Ecosystem

Algorithmic adaptability enables the production of interconnected critical systems by multiple manufacturers with minimal collaboration. Modularity helps integrate the autonomous but interrelated businesses of an ecosystem. Ecosystems require complementary innovations and suppliers of goods or services from other industries and are not constrained by contracts but are highly interconnected. By using protocols, standardized platforms, and terms of engagement, ecosystems promote alignment. By expanding coverage, improving efficiency, and saving costs, healthcare ecosystem providers can learn from different businesses and apply the technological capabilities of the ecosystem model. Healthcare communities can encourage innovative approaches and significant gains by increasing collaboration and efficient use of information among partners. A recent development is the

application of platform ecosystem concepts in healthcare (Morley and Floridi 2020). Walmart has opened cost-effective outpatient clinics, and digital giants such as Google, Amazon, Microsoft, and Apple offer telehealth and cloud computing with medical records. There are currently 5000 entrepreneurs in business in India. Also, patients seek higher quality services and healthcare choices than in other industries, such as banking and retail. Novel categories such as accessibility are made possible by big data, IoT, drones, blockchains, and new platforms for engagement. Others. Innovative ecosystem services are made possible by increasing reliable and affordable data-sharing systems.

2.6 Benefits of Digital Healthcare Ecosystem

Health ecosystems have many significant benefits. And they provide quick access to various external capabilities that would be too expensive or time-consuming to develop in-house. It is also essential for businesses looking to profit from innovation activities, a sector where ecosystems work better than existing hospital paradigms. Ecosystems can expand much more quickly than the more integrated healthcare approaches. Recruiting collaborators and growing the network is easy because of their modular design and specified protocols (Morande and Vacchio, 2022). Ecosystems offer a high level of resilience and adaptability. They are accommodating when there is a great deal of ambiguity, as these must be quickly adjusted to changing patient demands or emerging technological advances. They focused on the digitalized healthcare environment on healthy living, vitality, spirituality, intellectual and psychological concerns and well-being, primary and secondary care, and early treatment at sites with traditional and non-traditional care delivery actors. Such a system can be created and should exist in the future. Communicable and non-communicable diseases affecting physical and mental health will be problematic in the connected future society. They must use emerging innovations to detect their prevalence and spread potential, develop diagnostic tools, find pharmaceuticals and distribute them to the less fortunate. Healthcare

professionals and other custodians of patient records must develop efficient data management to take full advantage of the revolutionary promise of big data. However, the difficulties are considerable, especially for specific data types, including protected health and personally identifiable information. Providers must effectively develop a procedure for complex privacy, cybersecurity, business, and regulatory factors. With the possibilities of advances in artificial intelligence (AI) and related technologies, providers now have more excellent opportunities to create clinical, logistical, and business value by exchanging patient records. For example, businesses like Platiron, Tempus, and Genotyping have significantly increased value using AI and algorithms to analyze patient information. To capitalize on these opportunities, companies exchange data with multiple vendors that offer services that improve patient data safety.

2.7 Problem Statement

The conventions described tried-and-true fixes for standard problems. Christopher Alexander, an organizational scholar, established the idea of patterns for planning cities, structures, and projects. Each design begins by describing a situation that frequently occurs in our surroundings, followed by a basic answer that will never be repeated in the same way a thousand times. By creating solutions that can be used and transferred to others, problem-handling methods help reduce complexity while being more effective and efficient.

2.8 Research Question

- (i) How do you implement digital transformation in the healthcare platform?
- (ii) What are the benefits of using new technologies in the Healthcare Ecosystem?
- (iii) Whether the patient fulfilled personally when digitalized hospital systems?

(iv) How does the medical professional give quick treatment in the emergency using the digitalized hospital?

(v) Do you ensure patient information safety and confidentiality in the digital transformation?

2.9 Summary

In summary, collecting health care data, using that data to develop software for diagnostic methods, developing computerized health equipment and tools, and educating health practitioners to provide digitized treatment were essential. Therefore, government support and public-private partnerships are needed to realize early development and transform healthcare marketing. Academics, staff, and students in IT, healthcare, big data, and intelligent systems can collaborate on progress through joint seminars and conferences. Providers often cannot release sensitive medical data without patient consent because authorities have set rigorous criteria. Modern cloud technologies simplify the process of creating and implementing statistical rules. However, it took ages for everyone to develop complementary technologies and products that eventually became profitable and met people's needs. Similar restrictions apply to treatment in digital services. Co-inventions comparable to benefits, costs, applications, practices, and government regulations are required on operating models and other technologies (robotics, self-driving cars, intelligent personal assistants, innovative health care, etc.). With more interaction between individuals and society, it can move faster, in medical infrastructure will be possible by 2025.

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