BUSINESS TRANSFORMATION OF HEALTHCARE THROUGH TECHNOLOGY AND INNOVATION

(*With a focus on hospitals*)

at

Infinity Communication Studio

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Executive Summary

The healthcare industry is at a crossroad and the actions taken now will define the industry for the next two decades. As healthcare players embark on the journey to integrate digital technologies into their business operations, it is imperative to understand the industry's need for technology, the benefits that can be offered by integrating digital technologies and evolve a roadmap for an organization to transform its business using digital technologies.

Since this project is more focused on the hospitals and how technology will help in shaping the system into a better model which can improve patient-care, reduce cost and increase safety; it is important to understand the business process of how a hospital actually runs.

The key business processes of a hospital are mapped out and detailed into following functions such as:

- Patient Management
- Appointment Management
- Facilities Management
- Inventory Management
- Medicine Management etc.

Since the objective of this report is to understand how the technology can change the healthcare industry (especially hospitals), it is important to understand first how technology has evolved and undergone tremendous transformation.

To emphasize the need for digital transformation, the digital disruption is discussed that is caused by the Gartner's nexus of forces like:

- Mobile and Pervasive Computing
- Big Data Analytics
- Social Media
- Cloud Computing
- AI & Robotics
- IoTs

The digital transformation is especially necessary in hospitals to reduce cost, increase operational efficiency and unlock new sources of growth and revenues with new patient experience.

Three key areas of digital transformation are customized and adapted from Capgemini and MIT namely: customer experience, operational processes and business models. They are further divided making up to nine elements essential for Digital Transformation: customer understanding, topline growth, customer touch points, process digitization, worker enablement, performance management, digitally-modified business, new digital business and digital globalization.

We explore how hospitals can implement each transformational building block.

The hospitals need to digitize their core business to drive new levels of efficiency. The starting point can be mapping the strategic objectives of the areas of business with available technology and expected outcome of the same. A high level roadmap is provided which can form the basis for drawing up a specific roadmap for a particular organization by dividing into action items (integrating for connected value chain, strategic digital alignment, and automation at scale), challenges to implementation and expected outcome.

A technological dossier is created with technological interventions for business transformation of hospitals (current technology landscape) and NextGen Technologies for hospitals

A detailed account of this technology with their usage and benefits are provided. Technologies mentioned are HMIS, EHR, mHealth, Telemedicine, Portal technology, self-service kiosks, surgical and service line technologies, Hybrid operating rooms, healthcare wearables, infection detecting technologies, patient friendly technologies etc.

NextGen technology include Artificial Intelligence, Virtual reality, augmented reality, remote monitoring tools, medical tricorder, pharmacogenomics/genome sequencing, drug development, nanotechnology, robotics and 3D printing

Any technology intervention requires proper planning, fundamental rethinking of the business model, the process actors, inputs & outputs. There is a significant effort required to be invested in change management. Certain challenges which can be potential roadblocks to the

transformation program, if not addressed at an early stage of implementation. To name a few these challenges are:

- Lack of Impetus
- Harnessing Advanced Technology
- Cybersecurity
- Staffing shortage
- Regulation etc.

An implementation roadmap which can be used as a starting point by any hospital to draw up a transformation program specific to them is provided. we are categorically dividing the technologies into four phases based on their benefits such as financial, quality of care, operational efficiency of the healthcare institution versus the implementation difficulties like risk, readiness, complexity, cost etc. forming an 'inverted S' shaped curve symbolizing the maximum valuation path. The technologies are also mapped out according to traction, momentum and take off phases.

A detailed example showing how a patient-centric approach with interconnected digital ecosystem gives not only a more personalized and frictionless experience but also interconnects all the healthcare providers to leverage it to their benefits – which is one of the aim that this project wants to highlight.

The report ends on the note what can healthcare learn from other industries as the landscape of the healthcare industry is changing and pushing it into uncharted territory? We can borrow lessons and business models implemented in other industries like hospitality sector, automobile manufacturing, media, retail and financial institutions as they all have one common denominator – that is, the economic concept of supply and demand.

1. Introduction to Infinity

Infinity communication studio is Ahmedabad based innovative mass communication studio with more than 30 years involvement with furnishing customers with traditional and out of box advertising arrangements over all media stages. The organization has practical experience in the full range of Advertising &Branding and key interchanges for its customers as a one stop shop. Limitlessness correspondence studio has made a specialty for itself in the business.

1.1 Service Portfolio

Infinity communication studio has carved a niche in the industry and most of the clients are long term clients. Atul Chakravarty (Owner Infinity communication studio) believes in long term relationships with clients rather than a transaction focused approach. This ensures that Infinity communication studio is considered a "partner" by majority of the customers rather than a "vendor". This positioning helps Infinity communication studio generate positive word of mouth and strong client references for new business. Infinity communication studio has serviced multiple clients from these segments with their full service play offerings.

Infinity communication studio is a full services play communication studio. They have a comprehensive service portfolio with the following offerings:

Creative advertising campaigns	Exhibition design and execution	Developing brand strategy	Industry and Product photography	Media planning and buying
Event management	Corporate Identity	Corporate product film and audio visuals	Web design	Brochure and Catalogue design
Copy/creative writing	Newsletter development and design	Content development	Publishing	Graphic design

1.2 Market segments for Infinity communication studio and their respective clients:

Infinity communication studio has experience across multiple industry verticals and handles a diverse portfolio of clients. The major verticals for Infinity communication studio are:

Lifestyle & Hospitality	Engineering	Healthcare	Energy & Power	Automotive
Oil & Gas	Telecommunications	Education.	Real Estate & Infrastructure	Banking & Financial Services

Infinity Ads based out of Ahmedabad, Gujarat is a correspondence studio with a full administrations play portfolio. Infinity Ads use at least one kinds of generally utilized and famous showcasing and advancement channels – from open air, print, TV, computerized, web based life, radio, and rustic - to guarantee their customers arrive at their individual objective gatherings and crowds. It offers full set-up of administrations that guide in the development of a business or brand's effort and thusly their business' capacities. The organization has different customers under various divisions (characteristic rundown and classified to Infinity correspondence studio correspondence studio and its accomplices):

ENGINEERING & MANUFACTURING

- → Transformers& Rectifiers (I) Limited
- → Harsha Engineers Limited
- → Abakus Solar
- → Kanoda Energy
- → SAVAS Engineering

ENERGY SECTOR

- → GSPC LNG
- → Gujarat State Petronet Ltd.
- → ADANI GAS

BANKING & FINANCIAL SERVICES

- → Gujarat Venture Finance Limited

IT & TELECOM

- → Intellicon Private Limited
- → QodeNext India Private Limited

AUTOMOTIVE

- → Concept Hyundai
- → Nine Bridges Harley-Davidson
- → CARTEC Honda
- → Morris Garages

Business Transformation of Healthcare Industry through Technology and Innovation

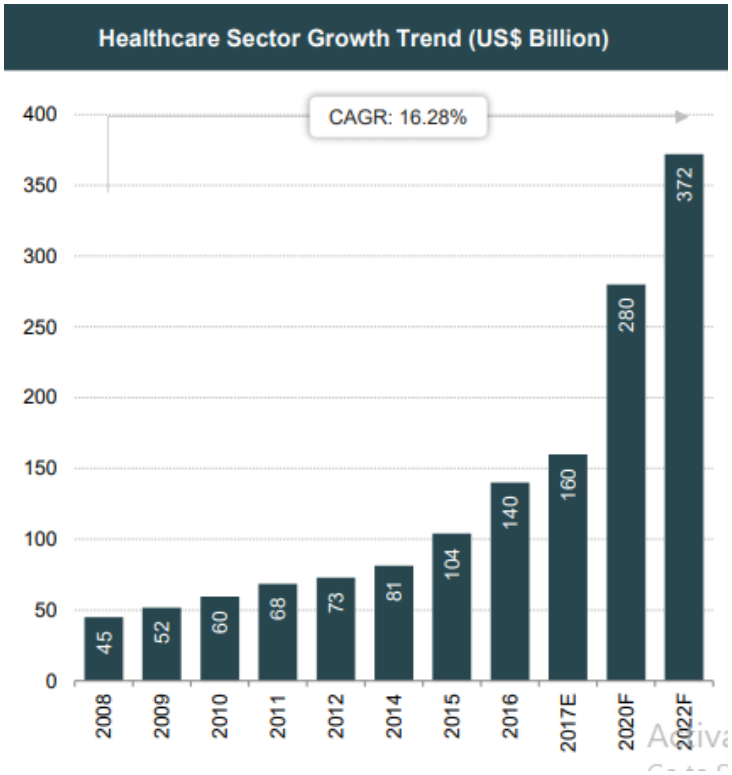
2. Introduction and the background

2.1 Background of the healthcare industry

The healthcare industry aims at treating patients and ensures well-being of the citizens. It is amalgamation of the following:

1. Service
    a. Hospitals
    b. Clinical Practices
2. Products
    a. Medical devices & equipment
    b. Pharmaceuticals
    c. Biotechnology
3. Finance
    a. Health insurance, Mediclaims – both private sector and government welfare schemes
    b. In India we have government schemes such as Ma Amrutam, Janani Suraksha Yojna, and Janani Shishu Suraksha Karyakam etc.

Figure 1: Healthcare Sector Growth



Source: Frost and Sullivan, LSI Financial Services, Deloitte

As shown in the figure above, during 2008 – 2022, the healthcare market is expected to record CAGR of 16.28 % and the total industry is expected to reach USD 372 million by 2022 in India.

Over the years, the life science and healthcare industry has evolved and integrated newer and radical ways of delivering wellness. The introduction of the health insurance into mainstream consciousness and the entry of corporate entities into the hospital segment have been major inflection points in the last few years. Apart from this, the generic revolution, the technology intervention into medical devices and a whole new segment of lifestyle diseases and their cure have changed the industry.

The last few years have seen digital technologies disrupting all major industries in the world. Unlike many other disruptions, these technologies have had a high impact on the individual and society also. The life-science and health industry is also undergoing large scale disruption as many related companies are now building their foundation on interoperable data, open and secure platforms, and consumer driven care.

Due to these changes, the healthcare industry has to innovate and reinvent with a view to transform the industry. And technological innovations are going to play a major role in it.

2.2 Need for the project:

The healthcare industry is at a crossroad and the actions taken now will define the industry for the next two decades. As healthcare players embark on the journey to integrate digital technologies into their business operations, it is imperative to understand the industry's need for technology, the benefits that can be offered by integrating digital technologies and evolve a roadmap for an organization to transform its business using digital technologies.

Consumers are using various health related technology to manage and change their behavior. These medical devices or wearables are major sources of data for the health industry. Better usage of this data would help in transforming healthcare to a more patient-centric and holistic approach. In order to combat traditional barriers of healthcare and to become more care oriented – various technological interventions would be needed to streamline the entire ecosystem.

2.3 Scope of the project:

- Overview of healthcare industry
- Overview of the different technologies used
- Gaps in the healthcare industry
- Benefits from using these digital technologies in the healthcare industry
- Case studies/ success stories
- Barriers to technology adoption
- Implementation strategy for digital technologies
- Cross- industry fertilization/ recommendations
- Future scope

2.4 Assumptions and Limitations:

- The project will be based on solely secondary data.
- No customer feedback or industry survey is envisaged.
- Recommendations are based on analysis and not empirical data.
- Ethics of using technology is a complex issue and commands an entire project of its own. But for this report, we would talk about it briefly in barriers/challenges section.
- The primary focus of this study would be the hospitals and their allied sectors. The other sectors would be studied to the extent of their interlinkages to the hospital and patient care segments.

2.5 Deliverables and Benefits:

- This report addresses its impact on healthcare and its practitioners with emphasis on Indian environment.
- Citing various reports on the digital healthcare technologies, particularly defined by digital medicine, AI, robotics, genomic advances, IoMT etc.
- The purpose of this report is to focus on the technologies as the new means of solving significant challenges in the today's healthcare ecosystem.
- It also emphasizes the need of digital skill among the practicing professionals and enhancing their role so that they could give more time in taking care of the patients.
- An overview of key digital technologies, globally with their impact so that organizational development needed for the future can be defined like agile working, needed training, structured leadership etc.
- Report also focuses on the core ways these technologies will change the healthcare by highlighting how it will improve productivity, operational efficiency and performance in the hospitals.
- The report describes technological use across administrative, operational, financial and clinical delivery.
- It sets out to adopt these technologies by overcoming various barriers and challenges.

- It focuses on the future impact and provides the examples of people who are already adopting the change. The purpose is to cast light on this exciting topic by taking priorities and trade-offs into the consideration in Indian healthcare system.
- The report tries to bridge the gap in the understanding of these technologies in healthcare and also attempts to address the complex issue of ethics associated with it. It tries to address the concerns such as data privacy and governance, safety measures, human involvement, societal inequalities, biases etc.

2.6 Methodology

1. Secondary data is collected from various reports from reputable sources like Delloitte, Accenture, McKinsey, PwC, Teradata, Harvard Business Review etc. The detailed list of the sources/references are attached at the end of the project
2. Case studies – in order to highlight the technological advancement that is being done in the healthcare field various companies are cited along with their products. The information about the products/services is taken from the organization's website itself.

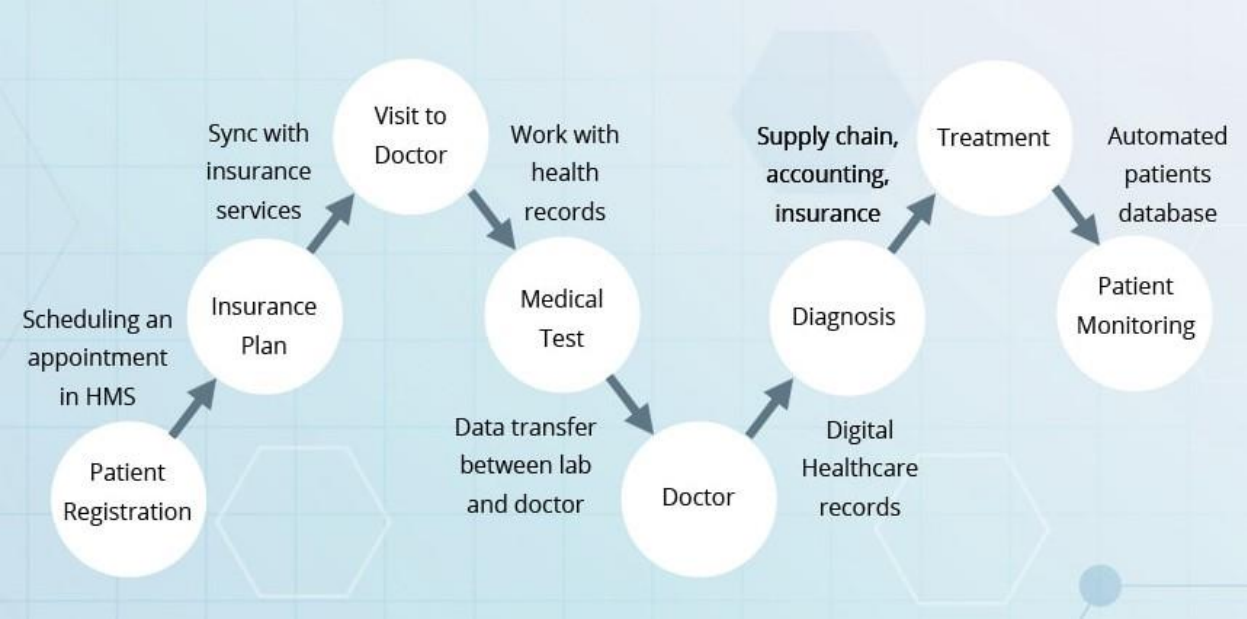
3. Business Processes of the hospitals

Since this project is more focused on the hospitals and how technology will help in shaping the system into a better model which can improve patient-care, reduce cost and increase safety; it is important to understand the business process of how a hospital actually runs.

"**Business Process** can be defined as a collection of related, structured activities or tasks by people or equipment in which a specific sequence produces a service or product for a particular customer or customers."

- It helps in getting alignment and understanding among various business units and geographies on how things currently operate. More often than not, especially in very large organizations, many managers and key stakeholders do not have a big-picture view of what other parts of the organization are doing.
- It helps in defining how employees are doing their work now, which will help define the gaps between the current and future states. This is critical when it comes to organizational change management and training initiatives later on in the project.
- It helps in determining the key operational pain points. It helps in defining the future operational model and business processes. It identifies the gaps between the current and future jobs, roles, and responsibilities. This is critical from an organizational change management perspective.
- It defines key performance indicators (KPI) to help drive business improvements and accountability

Figure 2: Key Business Process of a hospital



Source: existek.com

A hospital, generally, operates with the following departments:

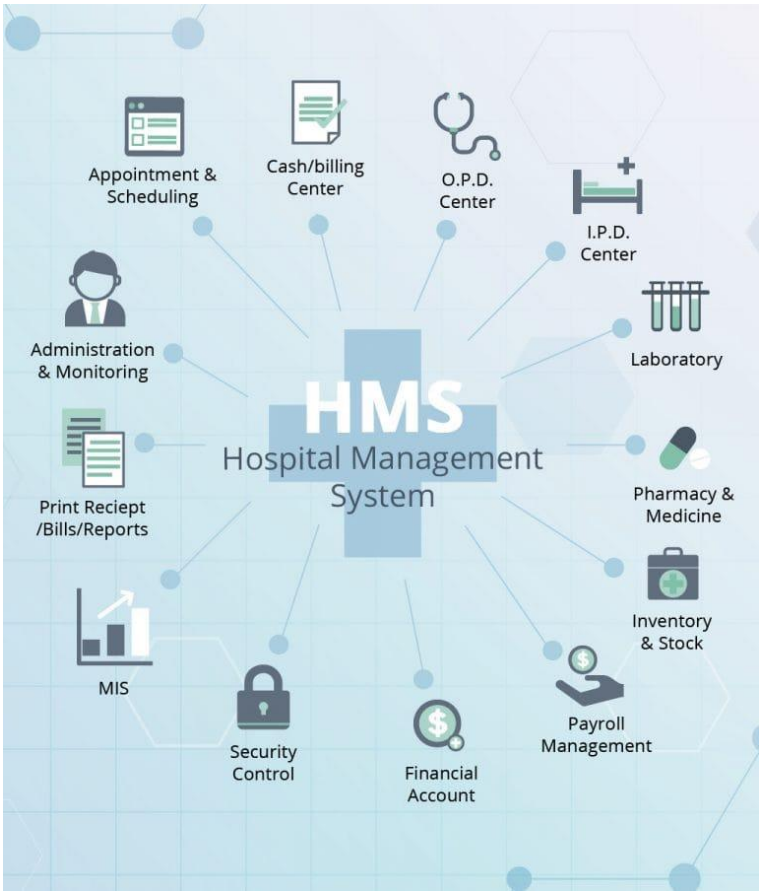
1. Front Office/OPD Management
2. Patient Management (appointments and registration)
3. Departments for patient care (radiology, pathology labs, pharmacology)
4. Billing
5. Medical stores
6. Accounting (billing, insurance processing, materials management, ledger)
7. Payroll

A hospital management system automates the business processes of a hospital using technology. The objectives of implementing a HMIS are:

1. Automation of business processes
2. Improved operational efficiency
3. Integration of various processes
4. Single source of truth
5. Data collection at source

6. Elimination of redundant processes
7. Reduced human intervention
8. Availability of reports and analytics

Figure 3: Components of Hospital Management



Source: existek.com

When considering on how to efficiently operate a hospital, planning and setting priorities are important stages. It is important to outline the functions and the benefits that a hospital expects.

Patient Management: Controlling the patient flow, registering them, getting the data on patient's health condition, viewing their treatments, checking their medical histories, reports etc.

Appointment Management: Arranging the schedule of the doctors according to the patients' bookings, organizing the availability of the specialists, offering remote visits in case of emergencies etc.

Facilities Management: tracking and monitoring room availability, the occupancy status etc.

Inventory Management: controlling and managing the amount of clinical inventory and maintaining efficient supply chain

Staff Management (Human Resources Administration): updating the job description, the hospital structure; tracking the recruitment reports

Accounting: organizing the financials of the hospital as well as the patients, storing the payment details of the patient, expenses, revenue, overall profit etc.

Insurance Service Integration: recording the patients' insurance details like the policy number, insurance company, information about their policy

Medicine Management: list of drugs usually prescribed for the treatment of the specific disease, records of every drug used on a patient during their treatment

Lab Tests Management: data of different tests result for the particular patient

Reports Management: storing the already processed data – this is important because it helps to analyze the performance

Business Intelligence: to define a problem and eliminate it for business profitability and high consumer satisfaction level

Help Desk & Support: for handling various issues and requests

Table 1: Hospital Business Processes

	Hospital Business Process	Description
Clinical	Medical Records / EHR	Process of electronically collecting, storing and retrieving complete personal health data that is delivered across different healthcare settings.
	Medication Administration	Ability to electronically document medications at the bedside or other patient treatment areas.
	Charge Capture	Electronic capture of information for use in a medical claim document, a critical element of the overall revenue cycle. Without a reliable charge capture process, poor coding and lost charges can cost healthcare organizations a lot of money.
	POE (Physician Order Entry)	Electronic entry of medical practitioner instructions for the treatment of patients (particularly hospitalized patients) under his or her care. These orders are communicated over a computer network to the medical staff or to various departments (e.g., pharmacy, laboratory, radiology, etc.). These systems improve patient safety by providing alerts related to the orders.
	Preference Card Management	Indicates the instruments and supplies preferred by each clinician for specific procedures. These cards provide the basis for business, financial and operational decisions. They provide data to track the cost of each procedure and patient charges.
	Drug Formulary	A list of prescription and over-the-counter (OTC) drugs, both generic and brand name, that are available through a patient's health plan. A health plan may only pay for medications that are on the formulary. Outpatients pay varying co-pays for drugs that are on the formulary. For drugs that are not on the formulary, patients may pay a larger percentage of the cost of the drug, sometimes 100%. Formularies vary between drug plans and differ in the breadth of drugs covered and costs of co-pays and premiums. Most formularies cover at least one drug in each drug class, and encourage generic substitution (also known as a preferred drug list).
	Product Standardization	The process of eliminating duplicate product types which serve the same clinical purpose.
	Performance Management	Systematic process of creating a work environment in which people are enabled to perform to the best of their abilities, and by which an agency involves its employees, as individuals and members of a group, in improving organizational effectiveness in the accomplishment of agency mission and goals.
	Point of Use	Place where and/or time when a product or service is used.
Operational	Sterilization Processing Department	Service within the hospital in which surgical instrumentation and medical equipment are cleaned, prepared, processed, stored, and issued for patient care. The process may also be integrated with the distribution of disposable supplies for surgery and other patient care areas.
	Biomedical Engineering	Function within the hospital that ensures medical technology is used appropriately and safely, performs properly, and is managed cost-effectively. Staff are involved in the initial checking and installation of equipment, preventative maintenance, and planning for equipment needs. (from www.vanderbilt.edu)
	Receiving	Taking possession of products in order to stage them for inspection, place them into inventory, or deploy them for immediate use. The receiving process usually must be successfully completed before invoices can be paid. (from www.vanderbilt.edu)

	Purchasing	Acquiring goods or services to accomplish the goals of an organization. The major objectives of purchasing are to maintain the quality and value of a company's products, minimize cash tied-up in inventory, maintain the flow of inputs to maintain the flow of outputs, and strengthen the organization's competitive position. Purchasing may also involve: development and review of the product specifications, receipt and processing of requisitions, advertising for bids, bid evaluation, award of supply and service contracts, and capital asset acquisition. (from www.businessdictionary.com)
	Distribution	Chain of businesses or intermediaries through which a good or service passes until it reaches the end consumer. A distribution channel can include wholesalers, retailers, distributors and even the internet. Channels are characterized as "direct" or "indirect forms". A direct channel allows the consumer to buy the good from the manufacturer. An indirect channel allows the consumer to buy the good from a wholesaler. Direct channels are considered shorter than indirect channels. (from www.investopedia.com)
	Inventory Management	Inventory management is primarily about specifying the size, quantity and placement of stocked goods. Inventory management is required at different locations within a facility, between locations, or within multiple locations of a supply network to protect the regular and planned course of production against the random disturbance of running out of materials or goods. The scope of inventory management also concerns the fine lines between replenishment lead time, carrying costs, asset management, forecasting, valuation, visibility, future price forecasting, physical inventory, available physical space, quality management, replenishment, returns and defective goods and demand forecasting. (from www.inventorymanagement.com)
	Contract Management	Creating, managing and tracking contractual arrangements for goods and services. Various attributes of each contract, including pricing, terms, effective dates, etc. are tracked in a central repository.
	Returns	Working with vendors to return products.
	Recalls	Implementing internal protocols to monitor potential hazards and alerts from vendors, communicate identified issues within the hospital, identify products impacted by the recall, and remove recalled products. This includes assessment of patient impact.
	Demand Planning & Spend Analytics	Demand Planning involves forecasting of a hospital's changing demand for products/services, and adjusting ordering patterns to compensate for these changes. Spend Analytics utilizes hospital spend data to evaluate potential savings opportunities through standardization, utilization, and contracting options.
Financial	Revenue	Generating charges to insurance companies, government agencies and individual patients for the provision of services to a patient. The process is needed in order to establish justification for reimbursement to meet contractual terms agreed upon by both the paying agency and the healthcare organization.
	Financial Accounting	Preparation of financial statements for decision-makers, such as stockholders, suppliers, banks, employees, government agencies, and owners. Measure and monitor a healthcare organization's performance and report results to interested stakeholders including regulatory bodies.
	Accounts Payable / Receivables	Management of records that show amounts a healthcare organization owes to suppliers, but has not yet paid. When an invoice is received from a supplier, it is added to the file and then removed when it is paid. Thus, AP is a form of credit suppliers offer to healthcare organizations by allowing them to pay for a product or service after it has already been performed or received.
	Capital Planning	Process for determining whether a healthcare organization's long-term investments such as new equipment, replacement equipment, new buildings, new products, and research development projects are worth pursuing. Budgeting for major capital or investment expenditures.
	Rebates / Chargebacks	A type of incentive to increase sales. An amount paid by way of reduction, return, or refund on what has already been paid or contributed. Rebates are used extensively in healthcare in lieu of list prices for product sales. Chargebacks occur in the healthcare distribution industry when the supplier sells a product at a higher price to the distributor than the price they have set with the end user. The distributor then submits a chargeback to the supplier so they can recover the money lost in the transaction.

4. Introduction to Digital Transformation

Since the objective of this report is to understand how the technology can change the healthcare sector (especially hospitals), it is important to understand first how technology has evolved and undergone tremendous transformation.

"**Digital transformation (DT)** – the use of technology to radically improve performance or reach of enterprises" – Boston Consulting Group

4.1 The Digital Disruption

In 2016, World Economic Forum's annual meeting at Davos, the hot topic for the discussion was regarding Industry 4.0 in context with government and the civil society. There is no denying that the Digital and Cyber systems are bringing forth the fourth industrial revolution.

Figure 4:

Navigating the next industrial revolution

Revolution	Year	Information
1	1784	Steam, water, mechanical production equipment
2	1870	Division of labor, electricity, mass production
3	1969	Electronics, IT, automated production
4	2014	Digital Enterprise

Source: Wikipedia

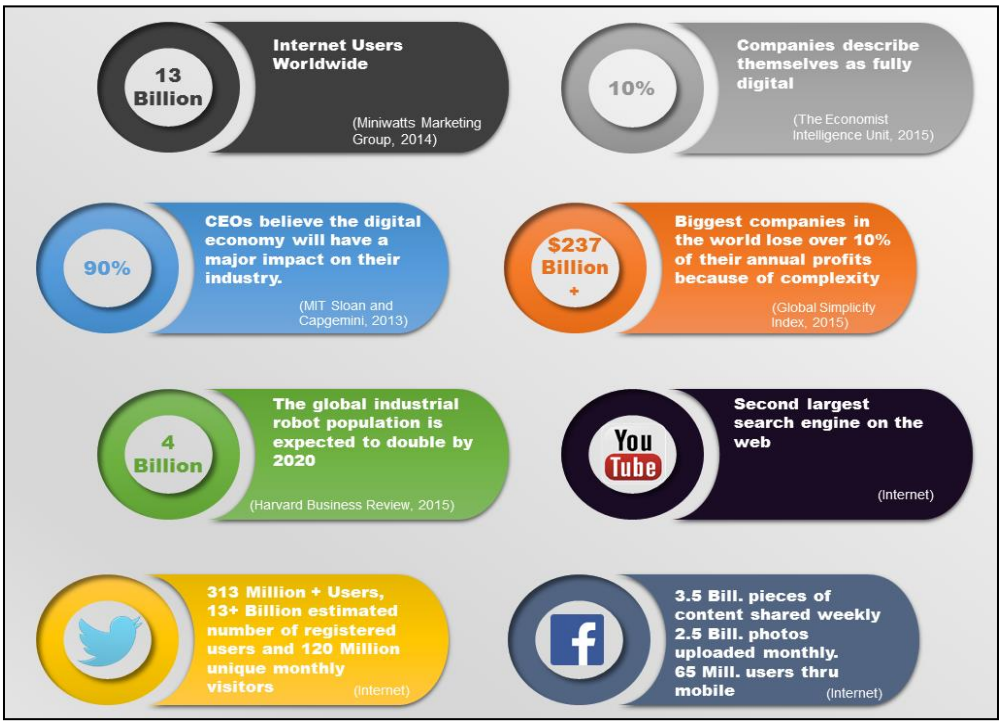
The generation of electricity and the steam engine in 18th century brought about the first industrial revolution and dramatically changed the economic landscape. Today, internet, robotics, AI (Artificial Intelligence), data analytics etc. is doing the same.

In 2005 around 500 million devices were connected to the Internet, today there are about 8 million. This number is estimated to increase to almost 1 trillion by the year 2030.

The industry experts and researchers have observed that the rapid improvements in the computing power of these technologies are in pace with the Moore's law. Plummeting cost of various devices such as computers, smart phones, drones etc. is the testament to the fact that the world is becoming more connected.

Right policy and business decisions regarding linking of the physical and digital world could generate around $11.1 trillion per year by 2025. Technology has never before been responsible for social disruption. The digital revolution has forced the organization to transform and redefine their business processes and IT systems as the digital technology has ramped up the competition and have caused disruption in the various industries

Figure 5: Technological Data Points



Source: (mentioned in the figure itself)

4.2 The Nexus of Forces

(term coined by Gartner, Inc.)

Digital Revolution has made traditional models obsolete and has given rise to new, agile, networked models. The harbingers of this change, also known as, the nexus of forces are:

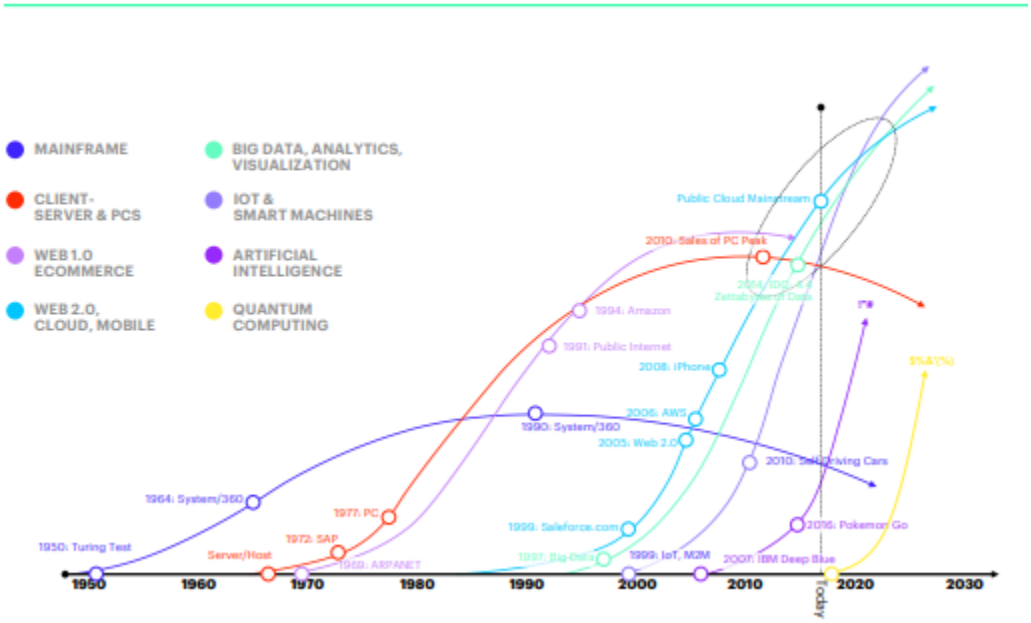
1. Mobile and Pervasive Computing: Pervasive means "existing everywhere", in terms of technology – it means embedding microprocessors in everyday objects and being connected completely and constantly in order to communicate the information. It relies on wireless connectivity, electronics and the Internet.
2. Big Data Analytics: Cost-effective and innovative form of information processing of the big data (which is high-volume, high-velocity and high-variety in nature) to gain insight from it and helps in decision making.
3. Social Media: It is transmission of content created to be consumed, promoted, distributed, discovered or shared to many in an online environment for the purpose of communication and social activities. It is also referred to as Web 2.0 as it convergences human interaction and technologies such as mobile, video etc.
4. Cloud Computing: It can be defined as scalable and elastic IT services, software or infrastructure delivered in pay-per-use method through Internet technologies.
5. Artificial Intelligence and Robotics: It is a technology that appears to emulate human performance through learning, decision making, understanding complex content, engaging in natural dialogues, cognitive computing etc. Its application can be found in automated vehicles, automated speech recognition and detecting potential risks and providing aid by understanding large, complex data quickly.

   Robotics is a branch of engineering that involves the conception, design, manufacture, and operation of robots. This field overlaps with electronics, computer science, artificial intelligence, mechatronics, nanotechnology and bioengineering.
6. Internet of Things (IoTs): The Internet of Things (IoTs) is the network of physical objects that contain embedded technology to communicate and sense or interact with their internal states or the external environment.

4.3 Why the digital transformation is necessary?

The nexus of forces promise to disrupt the traditional ways of doing business and will force organizations to transform their business models and business processes to integrate technology. Integrating technology will allow organizations to improve their efficiency and create new customer engagements along with radical business models (like Netflix). This section will explain the need for digital transformation for hospital segment.

Figure 6: Combinatorial effect of technology



Source: Accenture: Reinventing Business with Digital

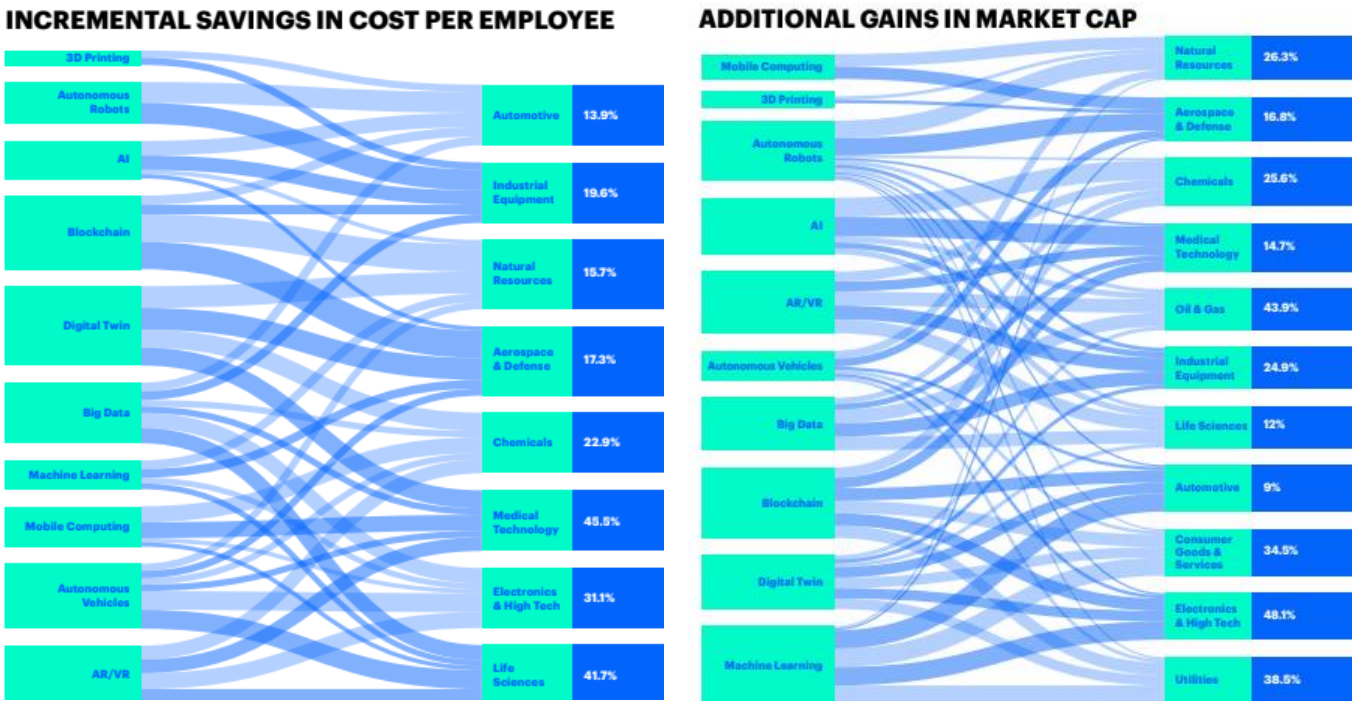
Hospitals no longer perceive digitization as an end state but as an ongoing process that aims to achieve two objectives:

1. Greater operating efficiency
2. Unlocking new sources of growth and revenues with new customer experiences

By investing in the digital technologies, the above mentioned twin goals can be leveraged to enhance patient experiences and optimize the operational efficiencies.

As shown in the figure below, engaging with technologies like 3D printing, robotics, AI, block chain, big data, machine learning, mobile computing, AR/VR saves the incremental costs per employee in the life science and medical technology field by 41.7% and 45.5% respectively and increases the market cap by 12% and 14.7% respectively.

Figure 7:



Source: Accenture- Reinventing Business with Digital

Hospitals are facing pressures from customers, employees and competitors to begin or speed up their digital transformation. However, they are transforming at different paces with different results.

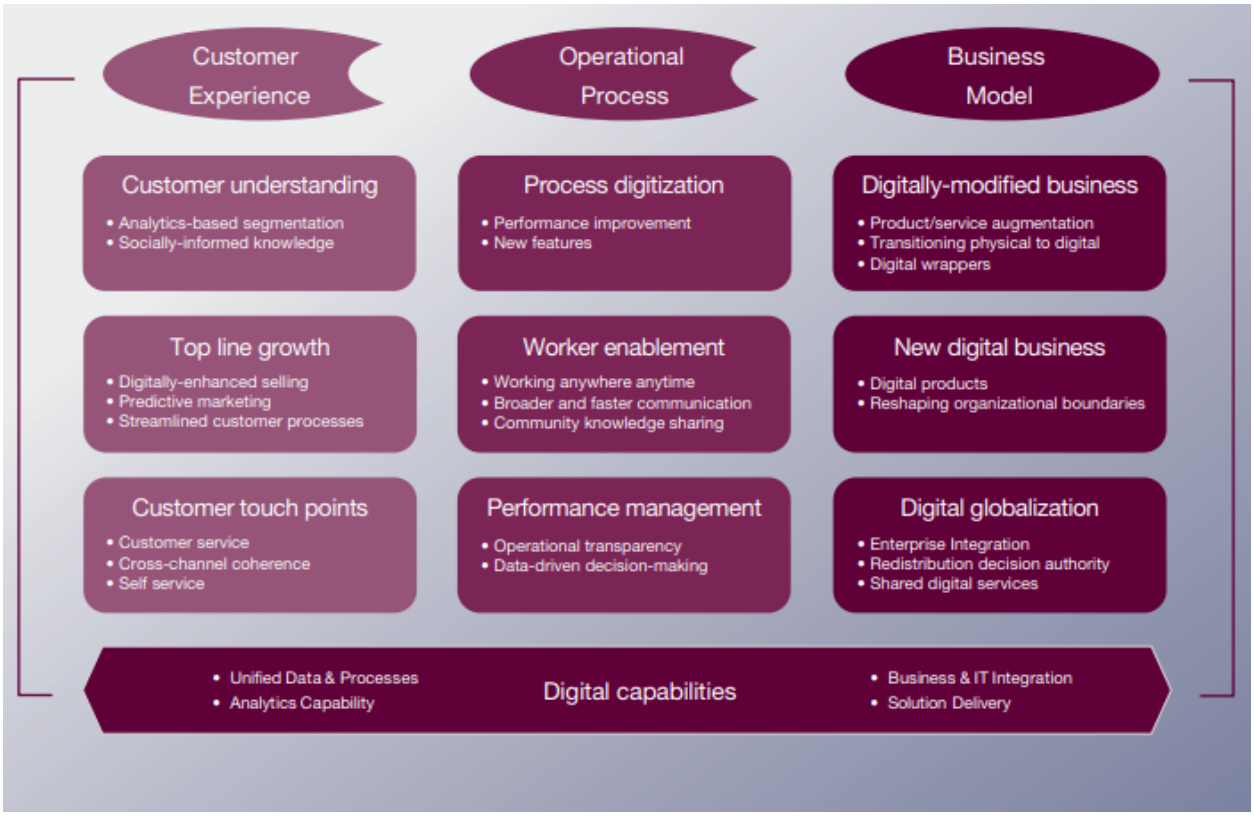
A digital transformation cannot be called successful just by implementing new technologies but from transforming the organization by taking the advantages that these new technologies provide. Digital transformation initiatives are centered on enhancing customer experience, operational processes and business models. This transformation must be top to bottom and more focused on “how to drive change” rather than “what”.

Engagement, government and KPIs will allow the people throughout the enterprise to identify "what needs are to be met." Successful DT is about reshaping the existing valuable strategic assets in a new advantageous ways.

4.4 Building Blocks of Digital Transformation

In this section we discuss three key areas for digital transformation based on Capgemini and MIT model which are namely: customer experience, operational processes and business models. They are further divided making up to nine elements essential for Digital Transformation. We explore how hospitals can implement each transformational building block.

Figure 8: Building Blocks for Digital Transformation



Source: Capgemini and MIT: Digital Transformation – A road map for billion dollar organization

1. Customer Experience

1.1 Customer understanding: Hospitals must embrace the use of social media campaign to promote the technologies they have, the kind of procedures they are doing, the specialist they have in-order to reach the patients. Also, creating educational digital tools for the patients while not directly promote the services of the hospital but does increase the hospital's reputation. Building digital communities for giving advice and garnering loyalty from clients in medical services/products. Exploring social media can be one of the ways to understand the customers' satisfiers and dis-satisfiers.

1.2 Top line growth: Using the analytics of the patients' record, the hospitals could tailor make the treatment plan. This makes the entire duration of the treatment for the patient more empathetic and less clinical. With the help of portal technology, the patient could access their treatment and become active participant in their care. Streamlining the administrative processes that frustrate patients like appointment scheduling, bill-payments and access of insurance claims through mHealth apps that provide online booking and payment solutions. A dedicated IoTs center can act as the fulcrum of the digital transformation. The aim is to make use of the real-time analytics to make data-driven clinical decisions using dashboards and advanced modeling.

1.3 Customer touch points: Customer service of the hospitals can be enhanced through patient-friendly technologies like self-service registration desk, central scheduling, speech automated systems, master patient index, wireless connectivity, bedside computer terminal, bedside medication verification etc.

2. Operational Process

2.1 Process Digitization: Using Hospital Management Systems increases the efficiency and scalability of the business process. Automating certain tasks like registration process decreases the need for staff so that they can focus on more productive work like taking care of the patient rather than drowning in paper work. EHRs also reduces the doctors need for paperwork and also improves the quality of care as they are built with alerts and helping making clinical decisions. In R&D drug department, automation of the repetitive

processes helps the researchers to focus more on innovation. The data derived from the automatic task could be used for further analysis while data mining.

2.2 Worker Enablement: Telemedicine and mHealth apps have transformed one-way communication between doctors and patients into broader communication. Due to these technologies, the doctor can now treat and remain in contact with patients remotely. This also enhances patient experience as they can pursue the knowledge about their health through online apps and can contact doctors whenever necessary to get advice.

2.3 Performance Management: Electronic Health Records have data inputted in them about patient's history, allergies, existing conditions, and existing medications being consumed by him. It also has the data about the treatment done, medication given by the nurses and in build alert system in case of prescribing medicine that the patient is allergic to and a guideline with suggestions for appropriate treatment – all these features help to minimize the human errors thus increasing the performance of the healthcare provider.

3. Business Model

3.1 Digitally-modified Business: Transforming the business processes is the key for the survival in this digital age. We must find a way to enhance physical services with digital offerings and to use digitization for sharing of content across all the organization silos. A hospital could stay true to its traditional model but can use telemedicine to expand their customer base and improve patient experience.

3.2 New Digital Business: Hospitals could introduce sensors and wearable technology for their chronic patients so that they could accurately track their patients' health and vitals without relying on the patients' testimonies. Usage of portal technology enables the patients to have an integrated multichannel experience including information on their health records, availability of doctors, education and other benefits.

3.3 Digital Globalization: Any hospitals would like to expand from local operations to national, multi-national, even perhaps, global operations. Digital technologies augment the organization to gain traction in other regions while still remaining locally responsive.

4.5 Suggested Roadmap

The hospitals need to digitize their core business to drive new levels of efficiency. The starting point can be mapping the strategic objectives of the areas of business with available technology and expected outcome of the same. A high level roadmap is provided here which can form the basis for drawing up a specific roadmap for a particular organization.

Table 2: Suggested Roadmap

ACTION ITEMS	CHALLENGES TO IMPLEMENTATION	EXPECTED OUTCOME
Integrating for connected value chain: Integrating software and hardware digitally (Hospital management system) through the business process of the hospital and digitally connected and accessed by the required personnel.	Proper HMIS must be opted for a particular hospital as different hospital may have different needs. There could be friction between different emerging digital technologies. A regulatory framework is need for the IT system.	More cohesive and connected value chain is enabled. There is reduction in technological spillage and debt.
Strategic digital alignment: Ensuring consistent digital technology strategy (as in instead of opting the latest and greatest technology, a proper research must be done to choose more productive technology)	Poor alignment of the technology across the business process, i.e. which costs more and has low benefits. Not anticipating the technological disruption	Creation of direct and beneficial linkages between the business and the strategy.

Automation at scale: Automating at the scale to optimize the business process. For example, self-service kiosks, online booking portal, virtual assistants etc.	High upfront costs Short execution time Unreasonable expectations	Cost optimization and reduction in human errors across key enterprise and business processes and operations.

Source: Customized and adapted from Accenture: Reinventing Business with Digital

5. Technology Interventions for Business Transformation of Hospitals (current technology landscape)

As stated in the previous section, digital transformation is rapidly occurring. It is necessary for the hospitals and other allied sectors to adapt to it as a smart hospital is the one that leverages the IT that directly impacts the patient. Hospitals should adopt different strategies, develop new capabilities and transform in order to remain competitive and become more patient-centric.

Clinic Management Automation

There are various hospital management systems that help automate a clinic. Nowadays, instead of just storing and presenting the data. They help in optimizing the utilization of the resources. It calculates the number of required employees and balances the occupancy rate. The system manages the general processes like dealing with different healthcare service and equipment providers automatically. It also analyzes and sends alert notifications to the users. The main purpose of HMIS (hospital management information system) is to remotely manage the patients and providers activities that could be easily accessed by authorized personnel. This creates a patient-centric and well-managed environment.

It also tracks number of doctors available and calculates their working hours. This helps in ROTA management, that is, to create an accurate schedule of each employee. This is important because it manages the resources and keeps smooth running of the supply chain to meet the demands of the patients.

Interaction between different facilities is possible and HMIS can analyze the staff efficiency, financials, revenue, supply management, inventory etc. This will help in generating future strategies and policy decisions for better, improved management.

Appointment management for the patients is also possible through HMIS. The patient can find the information about the visiting hours of the doctors and their availability so that they could book at their convenient time. The medical specialist gets the data about the next patient's visit while the patient himself will get a reminder through electronic communications such as SMS, email or receive an automated voice call.

The HMIS organizes daily tasks. It supports the smooth operation of vital components in hospital administration.

Electronic Healthcare Record (EHR)

The doctors with the help of healthcare record management system could handle the patients' information all in one place. This makes it more efficient for the staff to access the patient file and check the disease history, lab results or enter and save any new data to it. The process of patient registration speeds up. Due to the computerization, the paperwork drastically decreases and the doctors could spend more time on treatment rather than documentation.

EHR helps in creating a database with useful information about medical histories, lab results, prescribed medicines and treatment. They are also a platform for communication as a patient moves from one location to another – this helps to track the patient information.

The hospital records management keeps track of all the surgical procedures, stores doctors as well as patients' data. It can perform analysis and generate reports.

The centralization of the patient information will help to use that data for more data-driven and precision medicine in the future.

Accounting Software

As the name suggests hospital accounting software manages finances. It estimates the patients' payments and their billing status.

As the above mentioned systems are accessed by authorized personnel only, there is data security compliant with all the necessary regulation. Also, it is safe to say that these soft wares are the inevitable part of the modern healthcare institutions.

Benefits:

They help in creating a distinct, effective and efficient healthcare delivery model. Its implementation stores all the records, provides co-ordination between patients and providers, improve day-to-day operations, helps in implementing policies, and manages finances, supply chain and human resources.

The main objectives of HMIS are:

1. Better patient care
2. Reducing the operating costs
3. Better decision making
4. Better interaction and coordination among the different departments
5. A single point of control

mHealth

mHealth is not only about wireless connectivity but it enables the doctors and patients alike to check on their treatments and health on the go. It allows free access to information to both of them. It can be used for orders and documentation as well.

It empowers patient to become more active in their healthcare processes. mHealth provides opportunity to take healthcare out of the doctor's office, out of pathology labs and into the patient's everyday life.

These devices provide wealth of information for doctors. There are variety of applications that allow more interaction between a doctor and a patient. Portable EHRs are also possible with the help of some apps. These devices and apps come with built-in security features to protect the privacy of the patients.

Telemedicine/Telehealth tools

Telemedicine is tremendously beneficial in rural settings where accesses to the resources are scare. Telehealth is also cost beneficial as full assessment through video chat with a doctor can reduce the fees as oppose to traditional office settings. Also, out of office costs are also reduced for employees and employers.

For a viable telehealth infrastructure good connectivity and supportive government initiatives are necessary especially in rural areas. The different elements of telehealth are:

1. Wireless Connection
2. Cameras
3. TVs

4. Bidirectional video feed

Benefits of adopting a telehealth technology is that it will reduce the cost of admissions of the patients that require acute care. Also, real-time referrals or consultations can be done. It also emphasizes on taking care of the patient outside the IPD (In-Patient Department).

Healthcare staffing management technology

Such a technology would help in scheduling at optimal rate without sacrificing patients care in order to keep labor costs in check as they make up almost 50% of expenses in most hospitals. It also gives an assessment to the hospitals to make sure they are not understaffed based on patient registration. This could also prevent excess overtime or calling outside consultations whenever required.

Portal technology

As the patients become more involved and active in their own healthcare, Portal technology is one of the tools that gives them access to their health records and interact with doctors online. This technology helps patient to be more educated about their health. It empowers the patient and drives them towards becoming more responsible. It also gives them power as they become an active participant in their care.

Self-service kiosks

This helps rush processes like hospital registration. Patients can fill up the necessary forms themselves without any need to talk to someone. This can reduce cost on staffing also some patients are more comfortable to do it themselves. Automated kiosks assist with verification, signing paperwork and other requisites or use it to upgrade their information. Tablets could be used for the same purpose for remote outpatients.

Care should be taken that human-to-human interaction is not completely eliminated. If a patient wants to speak to a staff or need any help, they should be able to ask for it. They are similar to the self-check-ins at the airports and can be positioned at OPD and ER registration areas.

Surgical and service line technologies

By working in conjunction with the doctors and the nurses, the management can come up with best strategies for the surgical technologies. As the surgical equipments have high upfront cost, it is better to opt for equipments that have a productive reputation rather than just blindly purchasing the latest technologies.

Minimally invasive procedures are the latest trend that has been made possible through the robotic surgical systems, for example: the da Vinchi Surgical System, which has become integral part of training different procedures to graduates.

Intraoperative MRI is also a unique tool that can be used *during* neurological surgeries to remove tumors. It has helped the surgeons to be more precise in their removal of anomalies. Further, it can also be used as a diagnostic tool when not in use to continually get the return-on-investment.

Hybrid operating rooms (OR)

Hybrid ORs ensures best utilization of time and space in the hospitals as well as the specialists. It is an environment that allows a surgeon to practice minimally invasive as well as open surgical procedures. They cost several million dollars, so a small hospital would not be able to invest in it right away. Moreover, to get ROI it must be used frequently and it must be made sure that it is not tied up by only one specialty all the time. A more economically viable alternative could be a mobile hybrid OR.

Healthcare trackers, wearables and sensors

Sensors and wearable technology could be as simple as an alert sent to a care provider when a patient becomes ill. It also provides data points to detect any abnormalities.

These devices are playing an important role in the future of the healthcare as they are empowering the patients to take care of their own health. They help patients manage their weight, stress level and cognitive capabilities. These devices are all in rage because they make patients the point-of-care. For example: Fitbit Ionic (monitors sleep and tracks workout), Muse headband (for successful meditation session) etc.

Wireless communication

It can advance the internal communication in a hospital setting like using systems such as Vocera Messaging – that provides secure platforms to send messages such as lab results to one another over smart phones, web, or third-party clinical systems while still tracking and logging the send/receive messages.

Infection detecting technologies

Such a control program keeps a hospital compliant with the safety regulations as it detects if and when there is a problem. For example, PCT (Procalcitonin) test detects sepsis earlier – this prevents overuse of antibiotic drugs. Such technologies have their upfront cost but on a long term it is cost effective as it allows the hospitals to diagnose the infection and manage it early thereby reducing the cost of utilizing expensive antibiotics.

Patient-friendly technologies

Reputation of a good hospital is measures by its volume of patients. Just as the Health IT and surgical technology enhances the reputation, investing in patient-friendly technologies is also critical.

Following are the seven technologies that would make a difference:

1. Central Scheduling: A single number for scheduling appointments and other tests for all the departments in a hospital make it easier for the patients to book and does not require from them to call different numbers for different tasks.
2. Speech-assisted Automated Attendant Systems: With a voice recognition phone system, hospitals can decrease staff overtime. It also mitigates the issues with dropped calls.
3. Master Patient Index (MPI): A database containing unique identification for each patient. The patient can go to the registration desk, show his/her ID and skip the filling of unnecessary forms as their information is already stored in the index.
4. Wireless Connectivity: Similar to restaurants, offering friendly Wi-Fi service would make it easier for patients/visitors to pass time in waiting area.
5. Bedside Computer Terminals: Enables patients to see the processes happening and also help healthcare workers in updating the records.

6. Bedside Medication Verification: It adds a layer of safety for the patients. The nurse can scan it for confirming that the patient is receiving his medication correctly and also patient too can see it every day.
7. Online Bill Payment: This can improve hospital's account receivables and also make it easier for the patients to make a payment.

6. NextGen Technologies for Hospitals (3-5 year horizon)

Most of the technologies mentioned in the previous section are more or less scalable and achievable in today's hospital setting if required concentrated efforts are made towards it. In this section we would discuss about advanced medical technologies that in the future would be very helpful to improve the healthcare. Few of the organizations have developed these technologies and are in the beta phase of its implementation. We would also have a look at them.

1. Artificial intelligence

"Artificial intelligence (AI) is a branch of computer science concerned with building smart machines capable of performing tasks that typically require human intelligence." – Builtin.com

Various applications of AI are in the fields such as healthcare, automotive, finance and economics, cyber security, government, law-related professions, video games, military, hospitality, audit, advertising, art etc.

Artificial intelligence has the potential to redesign the entire healthcare industry. By mining the medical records through AI algorithms, we could design treatment plans, disrupt medical imaging and manufacture drugs way faster than any healthcare professional.

Atomwise: It is a start-up that was uses supercomputers to root out therapies from a database of molecular structures. In 2015 they used the above mentioned method to redesign existing medicine for the treatment of the Ebola virus. The company's AI technology found two drugs that could potentially decrease the Ebola infectivity significantly.

Google's DeepMind: This AI algorithm has outperformed the radiologists on pre-selected data sets to diagnose the breast cancer on average by 11.5%.

2. Virtual reality

"Virtual reality is a simulation of the real world."

It can be used in fields such as education, architectural and urban design, digital marketing and activism, engineering and robotics, entertainment, fine arts, healthcare and clinical therapies, heritage and archaeology, occupational safety, social science and psychology.

Virtual Reality (VR) can be used to train future surgeons and also for actual surgeons to practice operations. For example, OssoVR and ImmersiveTouch are the companies that have developed software programmes with promising results.

A recent Harvard Business Review[1] study has shown that VR-trained surgeons have 230% boost in their overall surgical performance by being faster and more accurate when compared to their more traditionally trained contemporaries.

VR can also be beneficial to the patients in the pain management. For example, it can be used in getting a woman through labor pains by equipping her with VR headsets to visualize soothing images.

3. Augmented reality

It is an interactive experience of a real-world setting where the objects that reside in the reality are heightened by computer-generated perceptual data, some across multi-sensory modalities, including visual, haptic, olfactory, auditory, and somatosensory." – MarxtentLabs

Applications of AR are found in social interactions, video games, industrial design, healthcare planning, practice and education; spatial immersion and interaction, flight training, military, navigation, tourism, broadcast and live events etc.

Augmented reality is different from VR on the aspect that it does not make its users lose touch with the reality. It can be used by medical students to train as well as enable the surgeons to enhance their capabilities.

[1] https://hbr.org/2019/10/research-how-virtual-reality-can-help-train-surgeons

Microsoft Hololens can be used to study anatomy via the HoloAnatomy app – this gives more detailed and accurate virtual depiction of the human anatomy without the need of cadavers.

4. Remote monitoring tools

A home monitoring system can reduce costs and unnecessary visits to a physician's office by automatically transmitting data to a remote center and if there is something wrong with patient, they can be contacted. It may sound invasive but is great for patients with serious and chronic illnesses.

Essentia Health implemented a home monitoring system. They observed that the rates of readmission for their heart disease patients fell to a mere two percent. Since hospitals can be penalized for readmissions in certain countries - home monitoring systems may offer a solution to avoid those penalties.

5. Medical tricorder

The exponential progress in the medical technologies have made possible the conception of palm-sized gadgets that can measure ECG, oxygen saturation, blood pressure, heart rate, temperature etc. These gadgets are sometimes equipped with camera for telemedical purposes.

BioSticker is a FDA-cleared device that despite being thin and tiny it can measure body position, respiratory rate, gait, heart rate, sleep status, activity levels and skin temperature.

6. Pharmacogenomics and Genome sequencing

Personalized medicines or tailor-made treatment plans according to the individuals are the forefront of the healthcare industry as these allows anticipating the onset of diseases which in turn benefits the overall healthcare efficiency and diagnostic accuracy. It can also reduce the immense amount of cost due to adverse drug reactions, readmissions and misdiagnosis.

Tools for big data analysis for pharmacogenomics are still under development but data analytics and data aggregation for the purpose of population health may be the next big advancement on the horizon.

The Human Genome Project cost approximately $2.7 billion. Genetic tests are extremely expensive yet highly beneficial as they reveal to which condition a patient is at risk and with the help of this information preventive steps could be undertaken. It also gives information about drug sensitivities, intolerance or allergies towards a particular substance.

Illumina, a DNA sequencing company has unveiled a new machine that is expected to one day test a whole genome for less than $100 and they are working towards making it cheaper than general blood test.

7. Revolutionizing drug development

The process of developing new drugs is very long and very expensive. But with the help of A.I. and *in silico* trials this process can be improved and can speed up the time to the market, all the while saving costs and lives.

Companies like Recursion Pharmaceuticals are using A.I. to develop novel drug solutions.

In silico drug trials are computerized simulation of the clinical trials. Currently, the technology is not that advanced to completely simulate it but significant process has been made. For example, Virtual Physiological Human Institute have created virtual models of human physiology to be employed in several research projects especially to study heart diseases and osteoporosis,

8. Nanotechnology

"Nanotechnology is a field of research and innovation in which materials or devices are built on the scale of atoms or molecules."

It can be used in fields like nanomedicine, nanobiotechnology, green nanotechnology, energy applications etc.

Nanomedicine is the next era of the healthcare as the nanoparticles and nanodevices will operate as precise drug delivery systems, cancer treatments etc. Small, smart pills like PillCam were first used in 2014 for noninvasive colon exams. Grapheal, a French company, has recently demonstrated its smart patch that allows continuous monitoring of wounds and its graphene core can also stimulate wound healing.

9. Robotics

"In Robotics with help of computer science and engineering intelligent machines are designed to help and assist human beings in various applications."

Robotics is widely applied in military and industrial area, agricultural robots, autonomous drones, kitchen automation, domestic robots, in the field of sports – are also seen.

Surgical robots, pharmabots, disinfectant robots or exoskeletons – robotics is the fastest growing field in medicine.

10. 3D-printing

"In 3D printing, also known as, additive manufacturing construction of a three-dimensional object from a CAD model is carried out."

Currently this technology has aided in printing bio tissues, artificial limbs, pills, blood vessels etc. 3D-printing living skin along with blood vessels are proved to be crucial for skin grafts of the burn patients. Prosthetics can also be 3D-printed. Also, "polypills" – that contain several layers of drugs to help patient to take only one medicine for all their modalities and also adhere to their therapeutic plan.

7. Challenges to the transformation of the healthcare industry

Any technology intervention requires proper planning, fundamental rethinking of the business model, the process actors, inputs & outputs. There is a significant effort required to be invested in change management. This section highlights certain challenges which can be potential roadblocks to the transformation program, if not addressed at an early stage of implementation.

1. Harnessing Advanced Health Technology

As in the current tech landscape both the hardware and the software are changing, it is important for the Healthcare executives to initiate IoMT in the daily lifestyle. A connected healthcare environment must be developed in various software applications such as appointment management system, laboratory information management system and patient administration system through AI and machine learning.

In order to harness the potential of healthcare technology, healthcare executives need to forge closer relationship with medical manufacturers and software development companies as they can share information about how to develop new business models to improve the new technological adoption in healthcare.

2. Information and Integrated Health Services

Medical devices and AI-integrated softwares produce massive amount of data such as administrative data, connected device data, patient surveys, patient medical records, transcripts and clinical notes.

But most healthcare institutions lack advanced architecture and data management systems to efficiently manage the unstructured data collected from multiple sources. This is the problem that can be solved by transitioning to non-relational databases that can handle large data.

A model must be planned for all management layers – operational, strategic and tactical by partnering up with reliable service management process that supports the integration of the healthcare systems.

3. Cybersecurity

Connected devices and other patient record information systems are vulnerable to malicious attacks from hackers. Data breaching is the grave concern for the healthcare providers. In order to combat data theft and loss of information, a robust cybersecurity system is needed in the healthcare.

Proper and careful digitization plans must be made to maintain cybersecurity in healthcare, like:

1. Limiting the access to connected medical equipments to only trusted users
2. Structuring proprietary networks and spending on segregating external and internal medical devices on the enterprise networks
3. Following application development security protocols
4. Building a centralized system to manage information
5. If there is outsourcing of IT processes that contains sensitive information only reliable and certified third-party provider must be contacted

4. Rising Healthcare Costs

The cost structure of the healthcare ecosystem depends on many stakeholders from device manufacturers to pharmaceutical companies, from payers to insurance companies. The ever rising cost of healthcare directly impacts the revenue of the hospitals as it discourages the patients from continuing their treatment which ultimately lead to poor health outcomes.

A timely strategic plan is required to reduce the healthcare costs:

1. By providing local healthcare variations to the patient by healthcare providers/insurance companies

2. Empowering patients to choose high-value plans that fit their pockets

3. Reducing the number of medical tests for patients

4. Negotiating prescription drug costs for the patients

5. Investing in IT healthcare such as revenue cycle management software as well as fiscal management systems can reduce operational costs of the hospitals

6. Developing consensus with the pharmaceutical companies

5. Payment Processing and Invoicing

Effort must be made to develop effective medical billing processes and procedures model where the financial incentives must be associated with patient outcome rather than quantities of service provided. Such a new payment model not only reduces healthcare costs but also addresses the concern of unnecessary medical tests.

Quality over quantity payment model plays a key role in improving patient outcomes at a lower cost. A suitable healthcare payment processing models that include invoicing can be created by hospitals according to their own business structures such as flexible invoice management dashboard, separate IP and OP billing queue screen, advance collection and

adjustments to provide a patient-centric solution. Moreover they could break the entire payment into small installments to help patients/payers in planning their financing.

6. Pressure on Pharmaceutical Prices

Rising costs of prescription drugs is one of the major challenges in the healthcare industry as it has reduced the spending on it by the patients. Few of the reasons for the rising costs could be that there is no market check; there is no person/entity that reasonably determines the drug prices.

A regulatory body should be formed that includes representative from all the stakeholders from healthcare and pharmaceutical industries that can at least control the hiking in the prices.

7. Healthcare Staffing Shortages

There is significant shortage of doctors when compared to the patients that are out there. Using telehealth can help in many ways as live streaming; remote patient diagnostics, store and forward imaging can improve access to healthcare even in remote places.

Influx of technologies in professional development and improving infrastructure provide efficient healthcare workforce shortage solution

8. Lack of Impetus

Many Healthcare executives are skeptical about the benefits of emerging medical technologies – this result in bureaucratic investment processes that prevent a healthcare institution from engaging in useful digitally enabled business changes.

Healthcare industry has been slow in adopting technology but at the same time technology development has sped up. Hence, the gap has widened.
Another issue can be lack of awareness regarding the opportunities or threats of digital transformation.

9. Regulation and reputation

Healthcare executives are highly cautious of mobile and social technologies because of security and privacy concerns. If a mobile device is hacked or lost it can give outsiders access to highly confidential data on patients. The reputational repercussion of such an incident is too risky for any executives to consider. A hospital's image is based on trust with its patient and government.

While these regulatory concerns are very much real, they should not stop healthcare organizations from advancing. Tools can be implemented to protect confidential information on phones/tablets that wipe the devices entirely if they are lost.

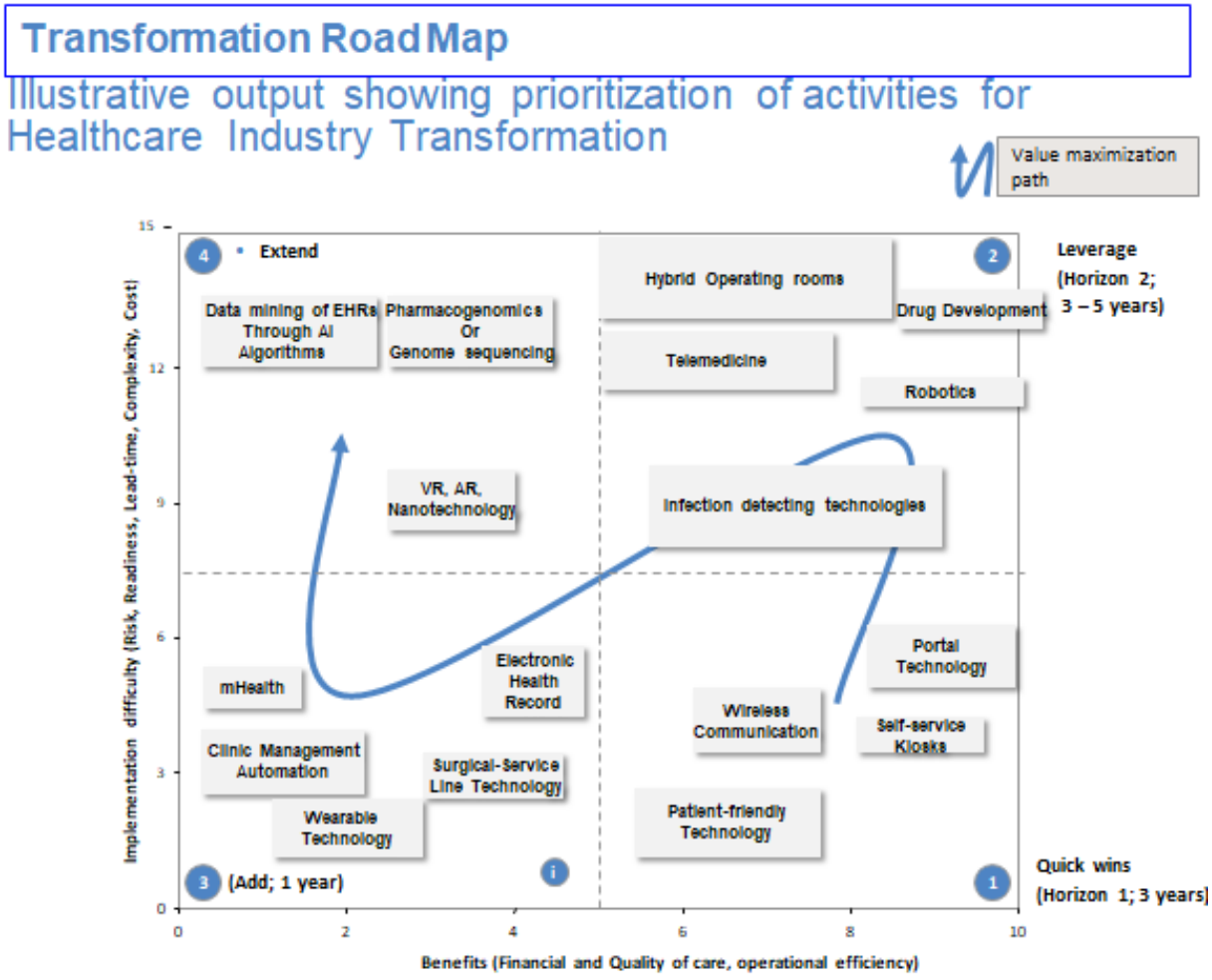
10. IT Difficulties

Digital initiatives are the foundation of technology-enabled process and data, analytics and solution delivery. Many hospitals are severely lacking in their information technology infrastructures and capabilities. It is difficult to get good understanding about the patients when patient data is not in a proper data system.

8. Implementation Road Map

This section provides an implementation roadmap which can be used as a starting point by any hospital to draw up a transformation program specific to them.

Figure 9: Transformation Road Map



Source: author

As shown in the above figure, we are categorically dividing the technologies into four phases based on their benefits such as financial, quality of care, operational efficiency of the healthcare institution versus the implementation difficulties like risk, readiness, complexity, cost etc.

Phase 1 - Most of the technologies are for making the life easier for patients by streamlining administrative processes, making registration and booking of appointments easier, empowering them and making them more responsible for their health.

Phase 2 deals with improving the quality of care and also decreasing the operational costs. Working towards development of drugs that are more personalized is going to be the forefront to improving the quality of patient care. Infection detecting technologies lower the risk of hospital required infections (which is the leading cause of readmissions) and implementing Hybrid operating rooms and Robotics that free ups the operating time. Hence, more number of patients can be treated on time. This not only increases the patient outcomes along with reputation of the hospital but has impact on the revenue cycle also. Telemedicine broadens the care giving range of the hospital to the areas that have scare access to the healthcare.

Phase 3 can be considered as adjunct phase that could be implemented while phase 1 and phase 2 are still being rolled out. They are the technologies that must be implemented for the better overall outcome. The purpose of a Clinic Management system is to improve the operational process so that the healthcare providers could focus on the patient-care rather than documentation. Having a solid EHR system not only provides data set for future precision medicine but also makes patient aware and doctors accountable for the patient's health. We are trying to transform the healthcare ecosystem to be more patient-centric hence empowering the patients to take more active role in their treatment through mobile apps, sensors and wearable technology is one of the ways. The data derived from these devices helps the physician to get better understanding about habits of their patients. Investing in suitable surgical equipments to increase the better outcomes of the patients and making sure proper and precise trainings are provided to surgeons that increase their accuracy and performance.

Last phase has to deal with all the data that all the technologies in previous phases are going to generate it and leveraging it to truly transform the healthcare. Using data mining, predictive analysis – precision medicine and tailor-made treatment plans can be possible. Of course, there are other technologies that can augment the medical field like AR, VR – but I personally feel that they are extra embellishments that could be undertaken after the rest of the transformation is complete.

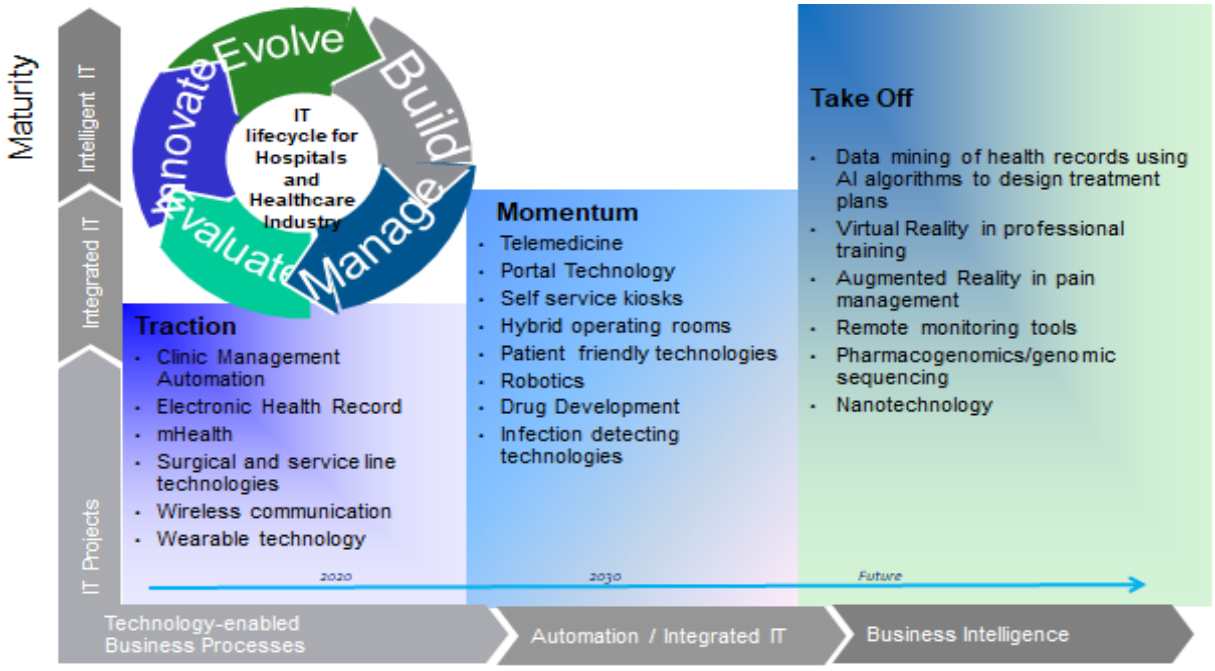
Another way to understand this IT Implementation road map is through understanding the technologies as a way they would push the transformation forward.

As shown in the figure below, there are technologies that are going to serve the purpose of **traction**, that is, they are going to pull the healthcare transformation to the surface – in a way, and you could say they are the beginning points.

Then comes the **momentum** phase, where the transformation really takes place as more and more implementation of digital initiatives is serving the purpose of improving the operational efficiency, patient outcomes, cost effectiveness, easing the resources for the patients to use etc.

Take off phase is the phase of experimentation where we have achieved the foundation of improved healthcare ecosystem but now is the time to harness it and revolutionize the entire ecosystem.

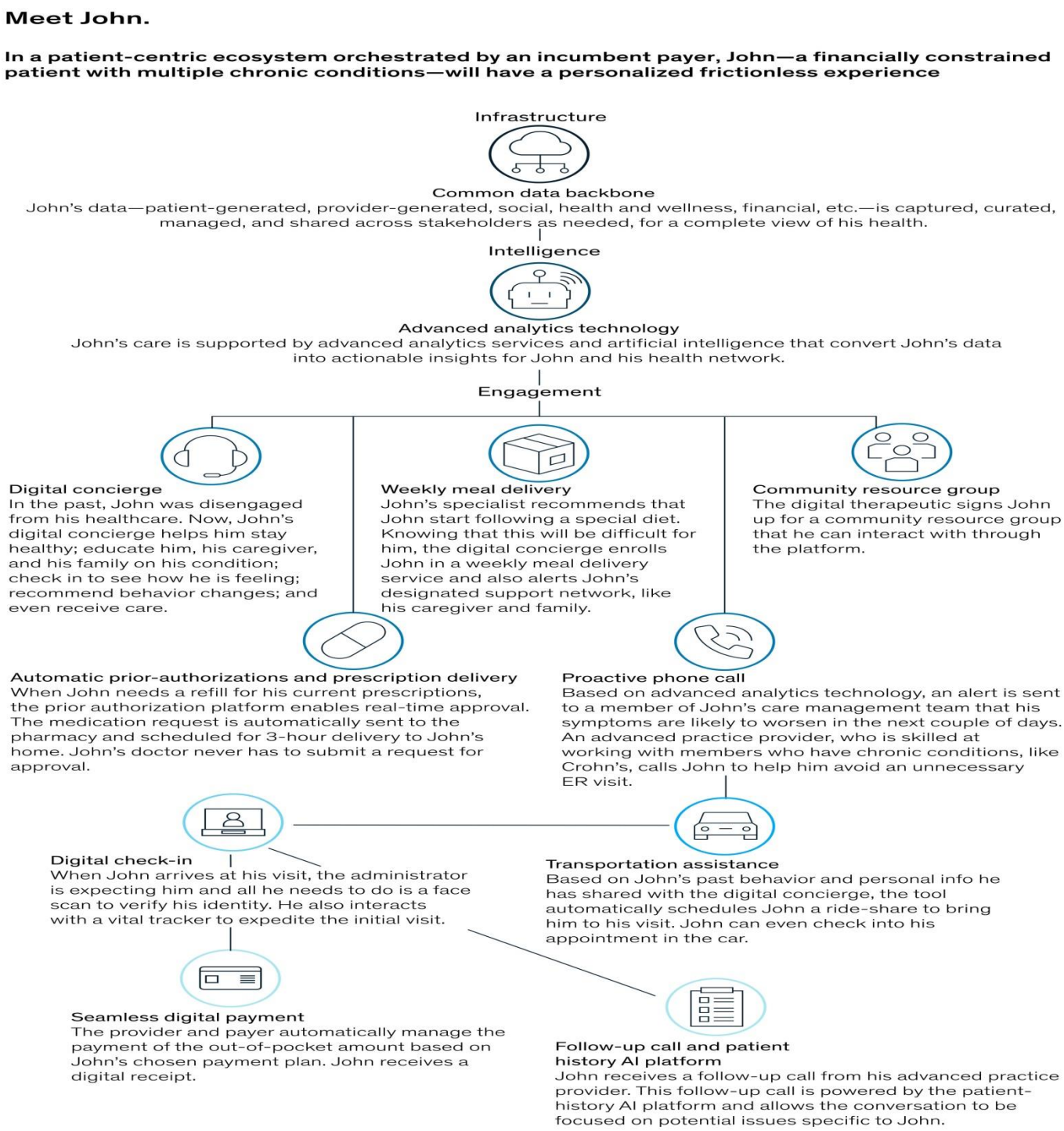
Figure 10: IT implementation road map in healthcare



Source: author

Let us study with an example how the ecosystem of connected medical technologies can help the patient as our end goal is to create a patient-centric and holistic approach

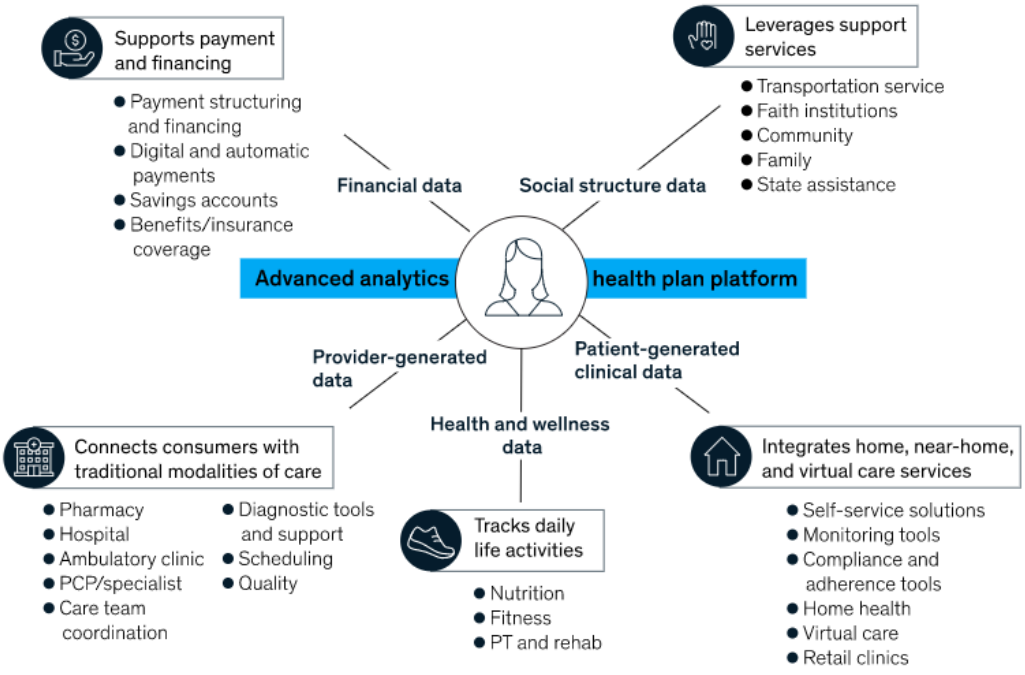
Exhibit 1



Benefits of digital transformation

With the help of various digital technologies, we can create a new healthcare ecosystem where the patient is the center of it

Figure 11: Healthcare Ecosystem with the patient at its center



Source: McKinsey Report – The next wave of healthcare innovation: the evolution of ecosystem

By institutionalizing all the medical technologies, we are confronted with lots of useful data. This data can revolutionize the entire healthcare ecosystem and make different elements of healthcare more cohesive to one another and take on a more holistic approach to patient care.

One of the key reasons as to why this transformation should take place is to reduce the healthcare cost. India is one of the top countries for medical tourism due to high quality of care for relatively lower costs when compared to the developed nations. Yet, the average healthcare costs of an Indian family (in urban and rural areas) keeps on significantly rising year-on-year basis.

As the insurance coverage of these families is limited, most of them depend on their household income/savings to meet the costs. But almost 21% of families have to depend on borrowings.

Data also reveals that India is affected by 70:70 paradox, which means 70% of the healthcare expenses are incurred by the people from their own pockets and out of which 70% is spent on the medicines alone.

As the people are utilizing private healthcare more than public healthcare systems in both rural and urban areas – it causes significant burden on them

The challenge for the policy makers, public health organization and insurance companies is to improve the financial performance, increase the cost effectiveness along with improving the overall health indicators and quality of care. The data from various digital technologies help with this.

All the stakeholders in the healthcare industry must investigate in these technologies and also in predictive, statistical data modeling to analyze the derived data so that an accurate future can be determined based on the past findings.

Goqii – a wearable technology start up in India is working with an insurance service providers to enable the above mentioned usage as the wearables are one way to monitor patient's habits and provide an assessment of their lifestyle. Thus, the insurance providers can leverage these findings to customize their policies depending on where the customer lives, their age, the hospital plan they use to have etc.

These insurance companies can in turn share the information to public/private healthcare providers who can develop better products or services and increase their marketing ROI as the understanding of customer increases through feedback and social media activity.

Other Benefits include (pertaining to hospitals):

- Streamlines the administrative process
- Leverages the virtual technology to improve patient experiences
- Enhances clinical and operational decision-making with healthcare analytics
- Improves communication and co-ordination of care through patient relationship management platforms

9. Learnings – From other Industries

What Can Healthcare Learn from Other Industries as the landscape of the healthcare industry is changing and pushing it into uncharted territory? We can borrow lessons and business models implemented in other industries like hospitality sector, automobile manufacturing, media, retail and financial institutions as they all have one common denominator – that is, the economic concept of supply and demand.

1. Lesson: There are simultaneous demands for standardization and personalization, and both must be met.
Example: *Retail, restaurant and hospitality industries*.

Reduced reimbursement is forcing hospitals and other providers to "do more with less," reinforcing the need for productivity and efficiency. Healthcare has already been characterized as one of the most widely inefficient sectors in the economy as it is, and many economists are looking to the retail, restaurant and hospitality industries as models to change that.

Some of the industry's brightest minds are exploring the connotations behind "big medicine," suggesting it does not have to stand in stark opposition to patient-centered care. Big medicine is a term used to describe standardized care delivery, often in large, integrated health systems with hospital-employed physicians.

Comparing modern healthcare delivery to The Cheesecake Factory that has quality food, predictable experience and reasonable prices, sadly healthcare is lacking in all three.

Healthcare providers need to master two types of care delivery: factory-like efficiencies for predictable procedures and the customized care coordination for specialized cases. For example, a 65-year-old, relatively healthy patient in need of a knee replacement has different needs than an 85-year-old nursing home resident with underlying dementia, heart disease, diabetes and no family in the area.

Healthcare providers must be cognizant of these distinctions while balancing demands for increased efficiency and standardization.

2. Lesson: When provided with more convenient delivery options that do not compromise quality, consumers change habits in a heartbeat.
Example: *Retail industry and media.*

Healthcare and retail are increasingly intertwined, but particularly with the current boom of urgent care centers and retail clinics as well as telemedicine.

This trend mirrors major changes in entertainment and book retailing that have accelerated over the past five years. The accessible and convenient nature of tools and outlets like Netflix, iPads, Kindles, OnDemand television, Hulu and YouTube helped shove bricks and mortar stores like Borders and Blockbuster into bankruptcy. There is a similar parallel in the newspaper industry, as readers continue to gather news from social media and websites opposed to print subscriptions.

Patients have more choice in how, when and where they receive care, and they're prepared to walk away from hospitals that don't meet their expectations, including expectations of convenience.

3. Lesson: Consumers expect risk management and security innovations in new delivery platforms.
Example: *Banking industry.*

Banking and healthcare information technologies share a variety of parallels. Both are dealing with highly sensitive information, so consumers' banking habits are suggestive of the demands they will place on Health IT. Customers are beginning to expect their healthcare experience to resemble their banking experiences as they expect high security and risk management from both.

Automatic teller machines (ATMs) — which first went into use in the 1970s — are to banking what electronic medical records are to healthcare. Now, more consumers are transitioning to

online and mobile banking and are happy in doing so.
EMRs haven't progressed at the same pace, however. People have anxiety over EMRs, and half are worried that their health data can be lost, damaged or corrupted. In the future, customers are going to demand electronic access to their healthcare data, just as they do with their financial data, but this demand cannot be met unless security issues are addressed.

Another example of patients expecting similar experiences in healthcare as they experience in banking is the way in which they have come to expect risk management in individual care delivery. Benchmarks and comparative data have become more valuable as healthcare providers are expected to place more emphasis on potential hazards as the patients not only want to know more than their blood pressure numbers but they want to know how those figures compare to others in their age group.

4. Lesson: Industries must adopt new communication tactics when performance information goes public.
Example: *Education.*

The language, criteria and method for how hospitals differentiate themselves from one another — and consequently "sell" themselves to patients — has changed due to the availability of information. Quality and performance data has broadened the stage for comparison. Before, hospitals may have competed with a cross-town competitor over certain quality metrics, but those dynamics have since expanded on regional and national levels.

The geographic expansion coincides with the rise of new ideology, such as preventive care and patient-centered delivery.

This trend is similar to reviews of any product online — cars, restaurants, blue jeans — but holds close resemblance to ratings of public and private schools across the country.

Many hospitals are reinforcing increased provider-patient communication: Some are hiring chief patient experience officers or medical communication specialists to make discussions about services and costs less intimidating and jargon-filled.

Conclusion

While making decisions in the future, the healthcare enterprises will have to consider a range of challenges that emerge that could potentially be solved by new technology and also keep the changing market landscape in mind.

To thwart these challenges it is essential to map the strategies, requirements and preferences of the payers as well as the providers and then create an implementation approach.

For a better healthcare, Technology and humans must go hand-in-hand. This is the only way forward. Technology can aid and improve our lives. This co-operation can result in amazing achievements.

In medicine and healthcare, digital technologies:

1. **Helps to transform unsustainable healthcare systems into sustainable ones**
2. **Equalizes the relationship between medical professionals and patients**
3. **Provides cheaper, faster and more effective solutions for diseases – technologies could win the battle for us against cancer, AIDS or Ebola**
4. **Simply leads to healthier individuals living in healthier communities.**

Learnings from the internship

1. Knowledge of different technologies that could improve the operational efficiency of the hospitals, reduce the costs as well as provide new sources for growth the better the patient experience.
2. Knowledge about the business process of a hospital.
3. Designed a research-based study: outlined the scope, assumptions, limitations, deliverables and benefits of the project
4. Developed research expertise while finding relevant data for the project
5. Problem solving (recommending) to transform the business process of the healthcare with focus on hospitals
6. Understood the role of journals
7. Designed an IT implementation roadmap that formed an inverted –s shaped curve that symbolizes the value maximization path
8. Understood how to write a report on par with the reputed consulting firms
9. Learnt about the technological support structure sin the healthcare industry
10. Got to know about the career development opportunities
11. Learned to manage time properly
12. Use of initiative
13. Creative thinking
14. Communicating results
15. Personal organization
16. Adapting to an unfamiliar environment
17. Realistic assessment of one's own performance
18. Experienced professional working environments and activities
19. Learned various theoretical models and customized and adapted them in my own research project
20. Understood the importance and the role of previous research done in the similar field

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