A

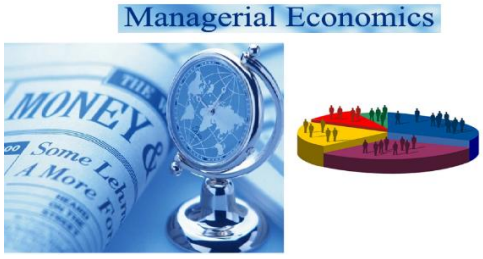
Project Report

On

Role of IT in Health care sector in India

In

Managerial Economics



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INDEX

Abstract

The purpose of this report is to analyse the health sector of India, and to assess how the role of Information Technology has helped this sector in improving the delivery of health care services; various ideas that can improve the status of health IT in India are discussed. Secondary data is used. Several articles published in the national journals are also used. India is a hub of IT, and its increasing use in the health sector through electronic health records, telemedicine, digital health knowledge resource, hospital information management system, e-learning technologies big data and healthcare analytics, can cement its' position in the world health care sector. On the basis of certain challenges that are faced in this sector in terms of non-availability of internet facility in the remote areas and lack of proper infrastructure and absence of policy, recommendations are suggested on measures that will boost the IT infrastructure, thus enhancing the over-all growth of the nation's health sector.

Introduction

Role of Healthcare Sector in India

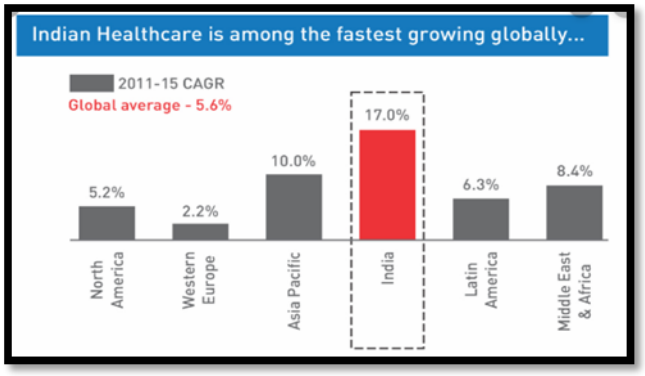
An Indian IT industrialist and co-founder of Infosys, a multinational corporation providing business consulting, engineering, technology and outsourcing services, N.R. Narayana Murthy rightly said, "Effective use of technology is important to deliver healthcare. By leveraging technology, you can bring down lack of access and cost of healthcare. In India lack of financial strength to avail healthcare is a major challenge. Although we have enough health care support, often it doesn't reach the poor and needy. In this scenario, technology is the best solution."

A First Post article published last year which states that “India compares unfavourably with China and the US in the number of hospital beds and nurses. The country is 81 percent short of specialists at rural Community Health Centers (CHCs), and the private sector accounts for

63 percent of hospital beds, according to government health and family welfare statistics.”

Information Technology has got a greater potential to improve and to develop the Quality, efficiency and the safety factor of health care. Circulation of IT sector into health care has been generally on the lower side however because of the problem in accepting and using of the systems in the sector. But the studies show that workers plan to increase the investing power. People will invest only if they have a guarantee of quality and reliable profits from the investment. The causes because of which the implementation of IT in this sector is not showing results is mostly due to increased cost and the complexity that people face during the installation. Many still face this changing cultural or technological advancements a bit difficult to handle. Seen the potential that of IT, both the private sector and the public sector have been in this process to promote the use of IT in and across the health care sector. Various efforts could be taken like - Incentives which would be a step forward to standardize the records or any protocols to enhance the operability inside the organisation. Moreover, any policy that could have a great impact in further investments should be considered resourceful.

Healthcare sector is one of the most important sectors which need the maximum amount of



technological advancements for the smooth functioning of its procedures. Yet it is neglected in all manners. A recent report which was featured across the media indicates the expenditure done by the Government of India on the Healthcare sector is just 1.4% out of its overall GDP, and making it one of the lowest ranked countries in the world which has no focus on healthcare. India might get compared to those of developed nations, where the huge systems are implemented like the National Health Service which is also called NHS which runs perfectly and vastly in the UK, people also say that this type of systems cannot be developed and if developed, will not be able to be maintained in India. India's healthcare is in a lot of sense the same of that of US's but that too when it had just begun to develop its healthcare sector. So of course, when we compare, we could see that how much India lags behind both of these countries.

We as the people always feel that India must make a renewed model which might resembles that of the UK and the US keeping in mind the requirements of course, then being left behind and that too on a vast scale and the country's image shall also improve. While the adoption of the technology or the alterations of the health models takes place, we should also keep in mind the few Key factors like – Diverse and Huge population and also its limited resources. The western system models have been developed keeping in their key factors in mind as these models have been made for the developed country, India might not benefit from the same if it gets completely replicated. This current trend to replicate the US healthcare system can be harmful for us as a developing Indian healthcare industry.

Facts and Figures: -

- "Indian Family spend Rs. 600 pm on healthcare which is 11% of their total income" as per (WHO) report.
- India's health expenditure turns out to be 5.2% of its GDP, whereas even developed nations spend 7-10% of GDP on healthcare. US – 14%.
- "India healthcare industry is estimated at Rs. 1000 billion. Of which only Rs. 200 billion is accountable as per pharmaceuticals" – (CII-McKinsey study)

Analysing the above stated statistics about the salary of the general people which they are willing to spend on their healthcare. Now, considering that in our country 140 million of middle-class and upper-class people reside, who in fact have a much more capability to spend on this sector than the per capita average of Rs. 600 per family, so the potential that the healthcare sector holds is enormous. Moreover, the upper and middle class are growing at more than 4% per annum with an annual income of Rs. 8200 billion. These people have a great confidence on the services that have been provided by the private hospitals and are very much happy to pay if they are given back eminent services. Whereas the rural sector is facing a different challenge overall. The shared provision of poverty and ill-health is something that is understood by everyone. There is proof about how mishandled the resources, outcomes and the efforts are when being divided between the rich and the poor in both the urban and the rural case. The studies show that poor people do not receive their divided share of the funding for health, comparing them with the above poverty line population. All of believe that the above stated factors lead to this stalling problem that is not ready to leave. But if one problem arises, there is always a solution present to solve it. Stating the solution present in this case, as once every country has been in our shoes so we must analyse their way of coming out of this problem, it's just that they were very enterprising due to which they found a great

solution to the problem that was arising at that moment and India need to start doing the same.

The developed nations have three strong points in this sector which are 'Health Insurance sector', 'Information technology in healthcare', 'Political will'. Firstly, coming back to the Insurance sector, they have developed it at a great pace because of which the high-end or non-economical services have now been affordable to their whole population. Secondly, they have come up with the use of Information Technology in a very effective as well as efficient manner which we lack. Lastly, they have got the political will by which when the demand arises, they are given what they require and are being look after by.

Any Indian who has been abroad and got sick, who visited the doctors in those countries will always guarantee that an Indian doctor is as much efficient in doing their work and as capable as their international competition and a lot much cheaper too. So, the problem is not at all with the quality of our doctors but we are lacking at a point here that is the policies, technology and the procedures that are being delivered to us by the healthcare sector. Because of which we believe that the problem here is not that much of a fuss or difficult to handle as we are portraying it to be.

LITERATURE REVIEW – (Links to the other readings/ references)

- "AI (Artificial Intelligence) will not replace physicians. However, physicians who use AI will replace those who do not". Many are afraid of AI taking over the physician's work. But it won't happen – the human factor will always play a leading role. But physicians with no digital skills will not benefit from what digital health offers. We have to move from incidental healthcare to continuum-based healthcare. To do so, we

don’t need more technologies. They are already here. We need a culture change with a focus on prevention, instead of pumping money into hospitals. More political engagement and investment in the digitalization of healthcare systems are needed. Time is running out; technology is developing very quickly, faster than the legal framework. We not only need empowered patients but also empowered healthcare professionals.

- “Technology is not neutral” - Tasmin Rose, Federal Political Reporter at News Corp Australia. Like money, the more data we acquire, the more things we can do with it. Good things but also terrible ones. In a diverse demography like India with a population of more than 1.33 billion, the challenge is how to design a new digital ecosystem where people benefit most from Big Data, not big tech dragons. User-unfriendly IT solutions for clinicians are killing the digital solutions, leading to burnout of medical workers, and creating a barrier between the physician and the patient. We need systems that make work easy. Hence India adoption, as a nation have to move from incidental healthcare to continuum-based healthcare. To do so, we don’t need more technologies. They are already there. We need a culture shift with a focus on prevention, instead of pumping money into hospitals.
- The real challenge lies in how technology can replace people in some tasks without stripping healthcare away from human touch. What Marie Sklodowska-Curie once said is timeless. AI, algorithms, Big Data - if we know how the technology works, we will no longer be afraid of it. For that to be implemented on a full-scale in India, the Government should focus on small wins and build them up instead of starting big projects and delivering nothing at all. Aiming at a perfect solution has no sense. Digitalization in healthcare must be a process of adaptive change.

- India's expenditure on the health sector as a per cent of GDP has inched up just 20 basis points over the last four years (2015-2019). It currently spends just 1.4% of its GDP on health, one of the lowest proportions in the world, a figure which is much lower than in neighbouring countries like China (3%) and Sri Lanka (2%). Moreover, the country ranks 145 on the healthcare access and quality index, thus lagging way behind its BRICS peers. These numbers readily reflect India's ailing healthcare system. And what is appalling for a country like India, which will continue to be the world's fastest growing major economy, is its severe health crisis. Another challenge in this sector is the inaccessibility of healthcare information to citizens which widens the gap in the healthcare scenario. Moreover, it's hard to ignore our conventional healthcare structure with frequent piles of papers which can easily be misplaced, leading to medical errors due to loss of information.
- Technology will address the challenges of the traditional systems by streamlining the processes. The healthcare space sets an example of a sector enacting massive changes. Digitisation has penetrated to our daily lives and the time is ripe to leverage technology that will create patient-centric healthcare systems that can improve response time, reduce human error and save costs. Technology is bridging the gap and altering the way doctors and patients interact with each other. This is nothing but a revolution and transformation that the healthcare services are witnessing today with advanced medical technology, improved and precision diagnostic and therapeutic tools.
- The Health care sector, backed by IT is becoming more organised and more patient-centric. According to NASSCOM findings, the Indian healthcare IT market was about $ 1 billion in 2014 and is pegged to grow around 1.5 times by 2022. Currently healthcare software market comprises of only 9 per cent of the total healthcare IT

market in the country. This is not all; around 60 per cent of the health-tech focussed start-ups have incorporated over the last eight years.

- The health care industry of India stood at Rupees 4 lakh crore (US$ 61.79 billion) in FY17 and is expected to reach Rs 8, 60000 crores (US$ 132.84 billion) by FY22. The healthcare sector in India represents a huge opportunity to leverage technology to improve critical processes that today pose a big challenge in the delivery of quality healthcare. These include reaching millions who are geographically spread across the country, providing better and more accurate diagnosis, managing operations and facilitating effective collaboration and dialogue between doctors and healthcare workers. This will lead to a wider reach in the lives of the people in the country, and they will be able to reach the readiness, with which the diseases, of any severity can be well-addressed.
- The question though remains, how we can use technology to improve healthcare delivery for everyone in India. Individuals, especially people living in rural areas, face challenges in gaining access to healthcare. The diversity and vastness of the country can pose some of the hardest problems to tackle, but here technology can play a major role in lessening the physical barriers, and make accessibility a reality.
- The convergence of technological solutions with cloud computing, data analytics telecommunications and wireless technologies will improve accessibility and manage labour shortages more efficiently in the healthcare industry. Benefits derived include easy accessibility irrespective of geographical location, fewer errors, fast response for emergencies, and improved patient experience. The cost of providing medical services has also been rising steadily. As technological innovation better integrates with healthcare delivery, it will enable scale and lower costs, thus driving up adoption. And

adoption will be further driven by the automation of critical processes at hospitals in administration, finance, billing, patient records and pharmacies.

- Even though telemedicine has been receiving a lot of interest afterwards and feels like a recent phenomenon, it has been around for over three decades now. The World Health Organization (WHO) defines Telemedicine as, "The delivery of healthcare services, where distance is a critical factor, by all healthcare professionals using information and communication technologies for the exchange of valid information for diagnosis, treatment and prevention of disease and injuries, research and evaluation and for the continuing education of healthcare providers, all in the interests of advancing the health of individuals and their communities." According to an NIH (National Institutes of Health) report from 2008, NASA played an important role in the early development of telemedicine to provide healthcare to astronauts when they were in space. Today, it serves a similar purpose - providing healthcare to those who lack access. This can be done by entering into public private partnerships so as to provide the project more sustainable financial support. We are already seeing such models emerge that can be gold standards for implementation of telehealth in India. One such model is the recent PPP entered into by Apollo Tele-Health Centre. A Hindustan Times article describes in detail about the telehealth centres set up by this partnership in Kelong and Kaza in Himachal Pradesh that have facilitated more than 3,000 consults and provided emergency care for over 200 people in the region, which was otherwise an unnoticed arena where people struggled to receive proper medical facilities.
- Adoption of technology also comes with its share of challenges. Ratan Jalan, the Founder and Principal Consultant at Medium Healthcare Consulting, a boutique consulting firm, and the CEO of Apollo Health and Lifestyle Limited between 2000

and 2008, understood the challenges first hand having tested such models. He states that: “Most of the tele-consultation providers haven’t really taken off because they haven’t adequately addressed the challenges at the ‘receiving’ end - where the patient resides. A patient is less likely to take up complete control of the patient-physician dynamics with a ‘remote’ physician and would like to involve the ‘local’ physician whom he trusts. And unless that physician is adequately compensated and integrated in this solution, I don’t see it taking off. In fact, that was the challenge we faced, even when I was looking at telemedicine project at Apollo almost a decade ago.” Jalan’s concerns are certainly valid. Firms in the space must consider physicians in the community and find ways for them to adopt such technologies, in the process they can gain the long-term confidence of the local people and in the process such pilots can proliferate, thus significantly strengthening the existing health care scenario in India.

- Lybrate, which is a Delhi-based healthcare sector start-up, that was started around 2013 with the mission to bridge the gap or the access to the healthcare sector. The

direct-to-patient mobile app has been designed for the healthcare delivery unit providing healthcare tips which have been customised to the people and also the access given to an online designed database for the physicians. Its nearest competition has always been Practo (founded in 2008), it was always backed by the benefits of Tencent, that was one of the China’s biggest and strongest internet investor, and Google has also been. Practo has been created to be a platform company that provides for the connection of the patients to different healthcare services such as to booking

arrangements, many diagnoses tests, and obtaining different medication. This is an encouraging start to what could be a high control, prevalent use of expertise to improve healthcare transport.

- Saurabh Arora, CEO, Lybrate, in a recent press interaction said, "We are very honoured at being recognised as the 10th Most Innovative Companies world over. It is a validation of our efforts of fixing the real problem of Indian healthcare that is inaccessibility of healthcare in the country, which has long been a serious issue. We are single-mindedly focusing on solving this core problem with the innovative use of technology and enabling doctors and patients to communicate with each other online from anywhere, anytime. We are delighted to share the recognition with our users who guide us to innovate more and make the product more seamless and convenient to use."
- Thus; we can rightly say that the Indian healthcare segment is very much deep and diversified that have got various opportunities and also emerging in every single sector – could be any providers, investors or any medical knowledge. With increasing competition in the market, organisations were cognizant of all the new encounters and the exploration of the latest businesses which are dynamic in nature and the trends which are impacting the segmentation. The new and desired players in the market are building their interest and the entry strategies and various domestic players which are exploring new and developed care model to stay ahead of others. These courses of events rightly mark the growing momentum in the health care sector in India that is strongly backed by the burgeoning Information technology sector.

Ideas

- The worldwide revenues with an estimate of $2.8 trillion, the healthcare business or can say sector is the world's major industry. Due to India's large inhabitants makes it a very important performer in this sector. While the healthcare sector could have been generally classified into two areas, as (I) Medical diagnostics and (ii) Therapeutics; it involves care, testing, procedures, treatment and any other service or involvement, tending, rehabilitative, relaxing, convalescing, preventive, and other health related determinations or combinations that were involved, as well as reproductive health care and emergency medical handling, in maintain the system of medicine. Technologies for healthcare comprises of gear, equipment, machinery and even the methods for diagnostics as well as for therapeutics that may be used in relative sense to delivery of healthcare services.
- The healthcare industry in India is sincerely witnessing a large surge of activity and even the beginning of a rapid stage of evolution. Emergent healthcare parts like diagnostic chains, medical device producers as well as the hospital chains in the region are heavenly attracting great investments from a set of diverse venture entrepreneurs. Engineering is also playing a wonderfully crucial role in the direction of a better understanding of the mechanical challenges that revolves around the healthcare sector in India, and needs to be instantly spoken about. Engineers can mature, adapt, and help instrument the technological enablers of nonstop innovations in this health care that will have a great impact for the creation of an overall vigorous system of health care in India.
- The health care sector in India is projected to reach $372bn by 2022. With developments in the technology sector for the healthcare industry, the awareness amongst the community to lead a healthy life is on an all-time rise. The awareness of

people particularly for their healthcare is consequential in the acceptance of more well-organized and innovative arrangements along with hospitals and other healthcare facility workers. With the constant adoption of new- age technology, the healthcare business is going through a major revolution and is likely to move towards "Value-Based Care".

- The two most talked about technologies – Artificial Intelligence (AI) and Blockchain will take the Indian health care industry through major changes, in the following ways, in the upcoming years:
    - **AI to determine the sector's progress** - AI helps in creating a personalised atmosphere for both patients and healthcare facility providers. Today, several many companies have incorporated the use of AI to streamline their organizational work for enhancing the output. Therefore, many healthcare specialists anticipate that applying AI all across our healthcare work administration would result in 10-15 % of increase in efficiency in next 2 years. Also, within the AI's agenda, machine learning acts as the core which will strengthen human and machine communication, which is a major enhancement to our existing and obsolete health care sector in our country. A significantly positive effect on diagnostics, risk analytics and drug finding verticals – is probable.
    - **Big Data will result in a precautionary care** - Healthcare industry has been getting contented with data organization. Thus, it is very much expected to see analytics explanations which will struggle to investigate conduct viability, drug utilisation, and also the self-care programmes exact to chronic situations. Furthermore, success of healthcare doctors and nurses will depend upon leveraging analytics competences. It is likely to be expected that almost 50%

of the healthcare companies would have capitals to access, share and also analyse real world big data for separate circumstances. Moreover, several investigators have found that the acceptance of big data is projected to touch USD 34.27 bn by 2022.

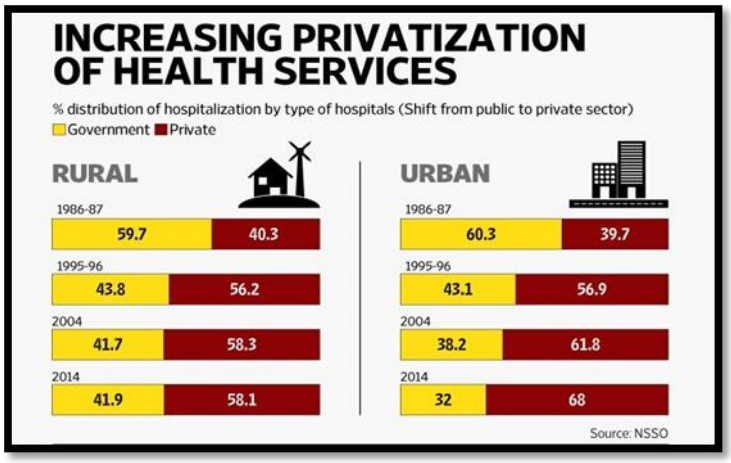
- **Blockchain to bring in many healthcare efficiencies -** Blockchain has been shown a gain of popularity in the past some years and now the slabs of the technology are set to come collected into real viable implementations. The other ways in which way the technology is going to make an effect on healthcare providers may be abridged as follows - by restructuring and providing transparency in procedures, eliminating mediators wherever possible, providing a guard in contradiction of counterfeit drugs and reducing pointless healthcare costs. These process improvements will lead to a happier future of the healthcare industry, at large
- **Cloud technology set changes in the healthcare scenario -** Cloud Computing has started to already become a requirement in healthcare sector. Last few years has already set the beginning of Cloud Computing in healthcare business. The forthcoming year is likely to focus on adopting Cloud Computing based suitable and cost -effective healthcare facilities. Many hospitals are altering their everyday procedures by including microelectronic health accounts and digital paper filling effort. Cloud Computing is very well set to progress the way healthcare industry is at work. It is going to deliver the very quickest and the easiest access to business claims and customer relationship supervision. Moreover, it offers great storage facility for medical and non-clinical records with an enhanced security environment.

- Healthcare sector in India has seen a tremendous growth in the past few years in terms of technological advancement and improved quality of services. With the advancement in technology and improvement in medical processes, the experience of a patient right from the registration to the discharge formalities has changed completely. Nanotechnology is slowly but steadily making its way towards contributing to the medical sector of our country. Scientists have developed “Nanobots” that are capable of unclogging arteries and thus preventing the cases of heart attacks. Researchers are in the process of developing nanoparticles that will be able to cure neurological disorders in a better way. Nanotechnology is an area that has a lot of scope for further providing path-breaking technology in this field.
- Virtual Reality in the healthcare sector, have made significant developments in conditions such as autism, lazy eye, chronic pain etc. A lot of people associate virtual reality only with cinema but virtual reality has a lot more applications than that. Many labs use virtual reality to treat chronic pain. Virtual reality is also used for speedy recovery from fatal brain injuries. It also helps in medical education as a lot of institutes are using it to give the students live experience by streaming surgical operations. This revolutionary solution is safe and affordable at the same time. Technology in India when it comes to healthcare is growing with a steady speed and the country is sure to experience some technological marvels in the future.
- The key goal of the amalgamation of Information Technology with the health care sector in India is to attain “universal access to good quality health care services without anyone having to face financial hardship”. India's current infrastructure is not enough to start to cater to the always-growing demand in the sector. Information Technology is inclined to play a vital part with IT claims being used meaningfully for social-sector systems, on a large scale. The hospitals that have been empanelled under the government assurance scheme are mostly IT-enabled and linked to the servers in

regions. The recipients can use a smart card that would permit them to access healthcare amenities in any or all empanelled hospital. In addition, few new computer and mobile-phone built e-health and m-health creativities were launched on World Health Day (April 7, 2016). These also include the Swastha Bharat Mobile App for information on illnesses and its symptoms, conduct, health alerts and warning tips; the ANMOL-ANM operational tablet application is an added benefit for health workers, e-RaktKosh is a blood-bank management information system and "India Fights Dengue".

Sequencing – the chronological developments in the Healthcare Sector in India

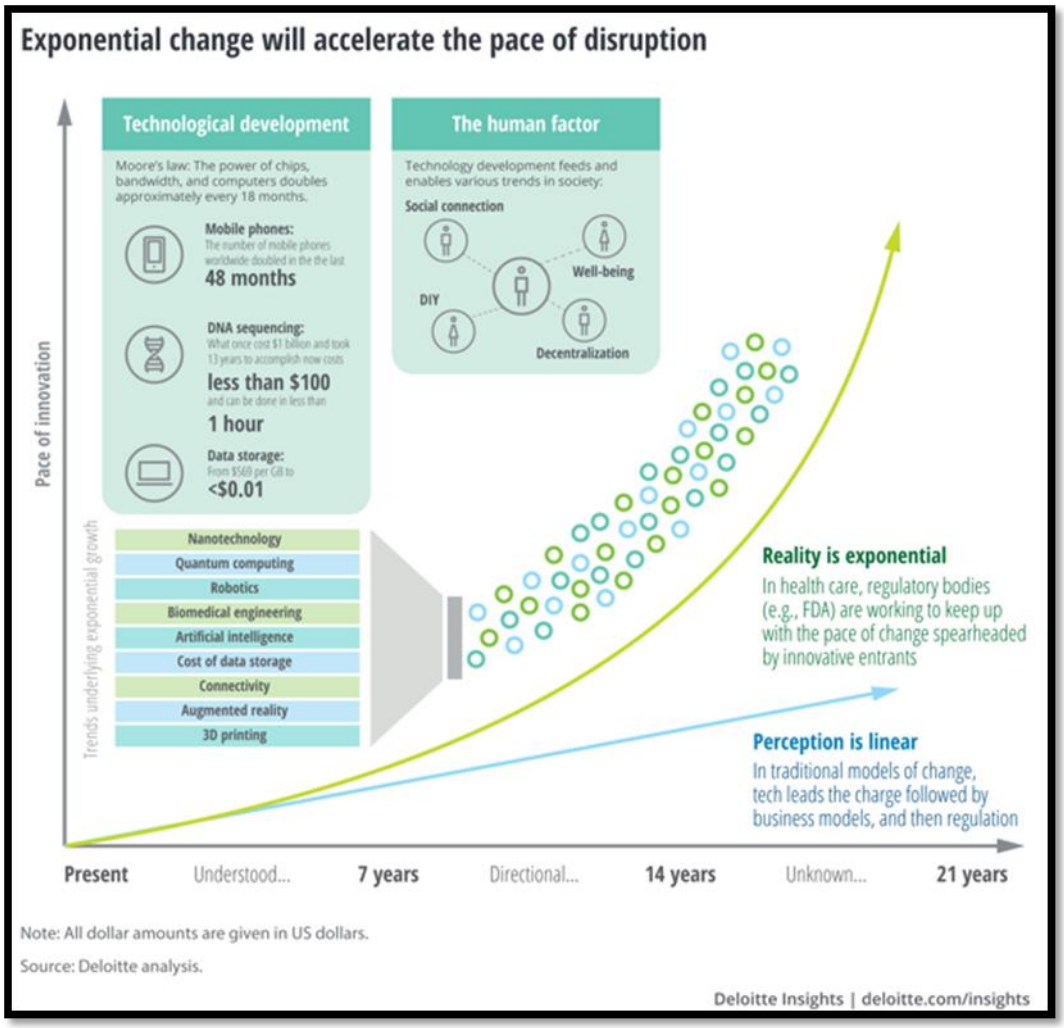
The progress of the healthcare sector in India for over the past 35 years has been a huge different variety. The government has not correctively distributed to the healthcare as a fraction of the country's GDP has dropped down to 1.40% in 2018-19 from 1.47% in 1986-87. Indication shows from the ground assist that we have made progress in the mother and child health by founding public health systems in urban as well as the rural areas. The funds contributed by the National Health Mission for this project has been a success if we see the numbers. But India has failed to invest into healthcare, in the last score of nineties. In the year 1986-87, 60% of the people utilized the public health services and the rest of the people had already shifted onto the private healthcare. The surveys show that meanwhile in



the 1990s, the necessity of Indians on its private healthcare sector has risen suddenly. But by the year 2019, the inclination that was towards the public sector more was reversed, with only 41% people left to avail the public healthcare services. If we analyse the data, it says People used to spend around ₹3,560 per admission into the hospital in 1986-87, which has seen a sharp increase to around 18,270 in 2019.As per the shown figure in the side sourced from NSSO, we can see that the privatisation of Healthcare in both the rural and the urban sector and the change seen is of a drastically different level. The necessity for the services in hospitals has been continuously climbing in the country, in both rural and urban region of the state where people are demanding superior quality and wants some standards set for the healthcare sector. The development in the sector of Healthcare is subject to the private sector, completely dissimilar to the increased government supremacy in the developed nations. One recent research shows that around 80 per cent of the good and skilled doctors are working in the private sector, thus making the scenario

The year 2019 has been a difficult phase for India's healthcare sector. Some private healthcare businesses struggled to stay without any failure as organisation balanced profitability and cost.

But the good news is that as per the health economists, industry analyst, investment experts and the government have seen a promising future in the next decade. Health care market is estimated to reach approximately $372 billion by 2022, as per IBEF report. Ministry of Health & Family Welfare is planning to further improve its healthcare budget to 2.5% of GDP by 2025. The Indian Government has also developed a Sustainable Development Goals targeted to be achieved by 2030. This is an attempt to end poverty, ensure health and peace for the people. On the side of private healthcare, analyst sees increase in investment. The rising adoption of automation, digital technologies and more will be the key drivers for growth. The future of healthcare is changing as technology has changed the way medicine is practised. As a health IT tool, powered by artificial intelligence, clinical decision support systems (CDSS), a broad term covering software used to help professionals in healthcare to make accurate decisions, have become standard in large institutions of healthcare institutions.



The Digital India push has been seen more healthcare facilities which adopt features like electronic health records/medical records (EHR/EMRs).

According to the Data, the global CDSS market valued at $488.2 million in 2018 and is expected to reach up to $1.17 billion by 2026.

Strengths of Healthcare sector in India:

- Hospitals with great medical facilities and technology at a relatively low cost.
- Increase in the count of hospitals and medical experts.
- High success rate and good reputation in surgery in advanced.

Weaknesses in the Healthcare sector in India:

- An absence of quality healthcare poses a great challenge.
- Lack of infrastructure or outdated medical technology.
- Investment in Research & Development is low, which is one of the major weakness of healthcare in India.

Opportunities that Healthcare sector have:

- Change in the current supply and demand, provide a significant opening and base for investment in health sector in India.
- The Hospitals needs a bit of an upgrade from the existing infrastructure that resides in India. The requirement and availability will help investors of foreign to penetrate the healthcare industry of India.
- A strong need for the Medical devices has also opened up an opportunity.
- India can easily attract Medical Tourism as at the moment and worldwide India is getting popular in providing healthcare service at lower cost with the good quality.

Threats that Healthcare sector faces:

- Fear is that this wide gap could be filled by the investment of foreign countries in healthcare sector
- Mainly FDI might have an impact in making the healthcare highly unaffordable
- Most of the devices used in medical have their production outside the country and due to the imports, an unfavourable duty structure makes imports cheaper than manufacturing in India because of which the scope of the local manufactures gets limited.

Practical Application relating Concepts –Conclusion

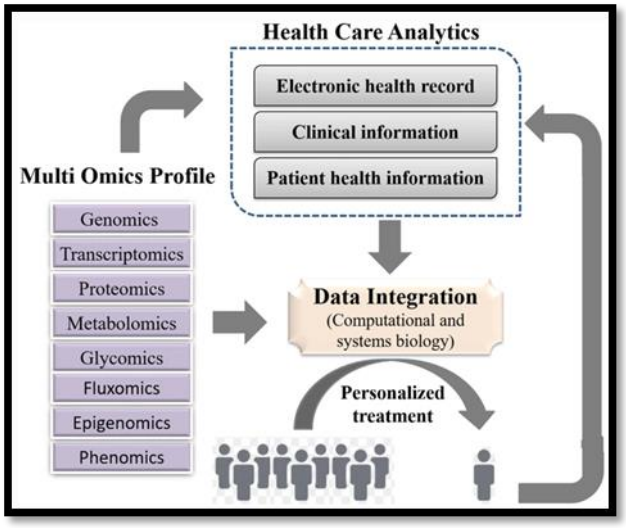
- In the current years, the healthcare industry in India is growing exponentially. This growth id at a rapid pace, which can be majorly attributed to the increased expenditure and investment from both the public and
- private investors. The most significant feature of the health care sector in India was the year 2018, where there was increase in investment from the private sector. The emergence of reputed global players investing through Foreign Direct Investment (FDI) route played a very important part in the growth of the healthcare sector in India.
- Presently the rise in incidents of lifestyle diseases can be seen, the rising demand for affordable healthcare, the emerging of technologies like tele-medicine. And the increasing role of the government in sector of healthcare investment are the major factors for driving the Indian health care industry. The government of India has been very active with involvement towards the development of the healthcare sector in India. As per a recent prepared report of Niti Aayog (policy think tank of the Government of India), the government of India will increase expenditure on

healthcare from 1.1% to 2.5% of the GDP in the coming four years and to 5% in the following five years (by 2025). It clearly shows that the nation is set on the path of good growth in healthcare for every individual of the country.

- The state of healthcare access and quality in India has almost been similar for the past few years with better facilities provided in the year 2018. The Indian government has remained focused on providing systematic facilities in the healthcare sector. The Govt. of India implemented the 'Ayushman Bharat National Health protection Mission' in August 2018. This health scheme defined a benefit cover of Rs 5, 00,000 per family (on a family floater basis) every year for secondary and tertiary care hospitalization. The Government of India has also launched other schemes, viz., 'Mission Indradhanush' with an aim to improve the coverage of immunization in the country by achieving at least 90 percent immunization coverage in India by December 2018.Thus from the business point of view, 2018 was an iconic year for Indian healthcare sector, as the industry giants took over a number of established multispecialty hospitals and healthcare groups. Thus with a huge array of opportunities available and lenient FDI policies, the global players from other developed nations have also started investing in Indian healthcare sector.
- In the year 2019, India has witnessed a significant increase in the number of single speciality hospitals and clinics, thus changing the façade of the under-penetrated health care sector. Initially, healthcare categories such as eye-care and dental care were already popular in the industry. But with the success of the 'Bouquet hospital' model now, other categories like fertility, oncology and maternity, and endocrinology are making their way up into this sector. The emerging start-ups and the large players are betting big on the national healthcare to generate profit in the growing boom. The other trend is of "Budget Hospitals" which has already become popular in the

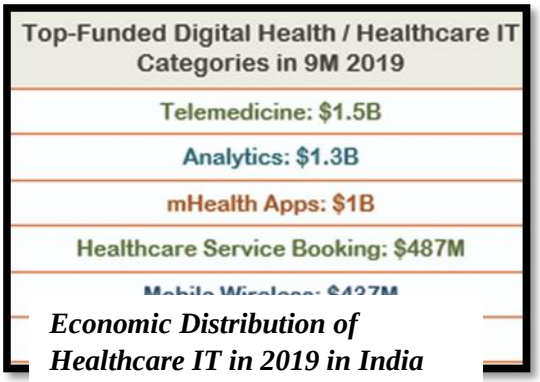
demographics of South India and will headline the health care sector in 2019. In India, majority of the population belongs to middle and lower economic strata. With the growing demand for good medical facilities at affordable prices, the "Budget Hospitals" will gain popularity in the country. In 2019, India will emerge as one of the most preferred healthcare destinations amongst the foreigners, also. Especially, medical tourism from the Sub-Saharan countries is expected to grow nearly by 20%. Thus; with competitive medical facilities being available in India compared to the western countries, India's medical tourism is expected to grow further in the upcoming year.

- Big Data has majorly changed one of the ways we collect, manage, analyse and leverage the data in any industry. Health care sector is not any different. The application of big data analytics in healthcare, is known as health care analytics and has a lot of positive and life-saving outcomes that has already been implemented in India. Big data refers to the vast quantities of information that is created by the digitization of everything that gets consolidated and analysed by specific technologies. A biological system, for example, a human cell exhibits molecular and physical events of complex interplay. Hence, in order to understand the interdependencies of various components and events of such a complex system a biomedical or biological experiment usually gathers data on a smaller and/or simpler component. Consequently, it requires multiple simplified experiments in order to generate a wide section of map of any given biological



phenomenon of interest. This indicates that more the data we have, the better we understand the biological processes. With the implementation of this particular idea, modern techniques have evolved at a great pace. Therefore, for instance, one can imagine the amount of data generated since the integration of efficient technologies like next-generation sequencing (NGS) and Genome Wide Association Studies (GWAS) to decode human genetics. Such integration of modern-day technology can help largely in constructing the base for a proper implementation of IT in the health sector. NGS (Next-generation sequencing) has thus greatly facilitated the sequencing and reduced the expenses for generating whole genome sequence data. The expenses for complete genome sequencing have drastically fallen from millions to only a couple of thousand dollars. NGS technology has resulted in an increased volume of biomedical data that comes from genomic and transcriptomic studies. According to an estimate, the number of human genomes sequenced by 2025 could be between 100 million to 2 billion. Hence, we can rightly say that predictive algorithms and big data analytics can raise the accuracy of diagnosis of patients, like never before.

- **Practical Applications** – i) There are several Indian start-ups who have chosen some selected niches in order to offer clinical decision support solutions. There are many broken areas that can be solved with AI-enabled solutions. One such successful implementation of technology in Healthcare is NIRAMAI (Non-Invasive Risk Assessment with Machine Intelligence), which was co-founded by Dr. Geeta Manjunath and Nidhi Mathur. With a Ph.D. from the Indian Institute of Science and having an expertise of 25 years in the IT innovation at Hewlett Packard Labs and Xerox Research, Dr. Manjunath was



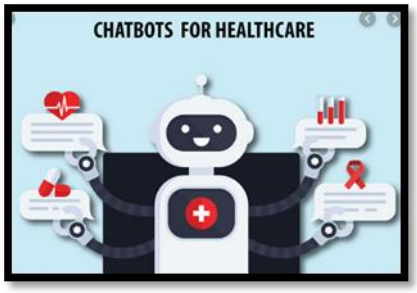
Economic Distribution of Healthcare IT in 2019 in India

well-versed in how science and technology can be knit together to produce smarter and more effective results. She was accompanied by Mathur, a senior product manager at Xerox Research who was responsible for finding product-market fit for technology research being conducted at the company. Their hands-on knowledge of what is catching up on the market, made a great fit for the creation of NIRAMAI, an AI-based clinical decision solution that provides for radiation-free, non-invasive, non-touch, breast cancer screening solution for hospitals and diagnostic centres. The solution is popular in India for its accuracy, affordability, privacy-awareness feature and thus can be used for women of all ages, including the women under 45 years. As the solution is portable, it also makes it amenable for screening camps in the rural areas and the corporate health camps. NIRAMAI, has in its' core the technology called, "Thermalytix", which uses a high-resolution thermal sensing device and cloud-hosted AI-based solution for the purpose of analysing thermal images. NIRAMAI's technology can detect breast cancer at a much earlier stage than the traditional methods or self-examination. The early and timely diagnosis is pivotal for improving clinical outcomes especially in cancer, a number which is surging in the country;

ii) According to a recent report in Economic Times, the Indian market for wearable devices more than doubled in the second quarter of 2019. The research firm, International Data Corporation has attributed this growth to the era-worn wearables, which include wireless earphones that track health and fitness. The Indian population that is extremely health concerned is on an all-time rise, and this only goes on to increase the prospects of IT in the health care sector.

- On the back of growing popularity of mobile internet in the country, the future for telemedicine services in India looks strong. An accessible pool of data is also being created by concepts like e-Diagnostics that can be leveraged by Healthcare Analytics

to ensure more efficient services and reduce the risk of medical errors. The next



development is the evolution of chatbots as health assistants, wherein about 39% of India's online population uses these chatbots to get information about health care professionals with appointment details and also helps in updating patient records. They can also thus help patients to easily request prescription refills and pay bills while providing helpful, actionable alerts such as appointment reminders. In the 21st century India, which is filled with millennials who value convenience over everything else, given their tight work schedules, this valuable integration of Information Technology with health care can lead to a robust growth of the country's health sector, as whole.

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