Cloud Computing- A Boon To The Pharmaceutical Sector

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Abstract— The pharmaceutical industry's primal motive is discovering, developing and producing pharmaceutical drugs for medication. Technological innovations and advancements are an inevitable part of the job for people working in the pharmaceutical sector, so it is critical that learning takes place with these industry- specific challenges in mind. Whether it is determining patient preferences, conducting a drug trial, defining an individual's market access strategy or leveraging technology to communicate complicated concepts to patients or staff, pharmaceutical industry learning is a rapidly-changing and dynamic field. In this paper, the categories and service models of cloud computing, its technological intelligence, wide range of applications in medical services and healthcare, and challenges in today's generation with respect to the pharmaceutical sector are presented. The Microsoft Cloud empowers organizations of every size to re-envision the way they bring together people, data, and processes that better engage customers and patients, empower employees and care teams, optimize clinical and operational effects, and digitally create a transformation in health.

Index Terms— Electronic Health Records (HER), Genome sequencing), ImageZone, the snowflake solutions effect.

I. INTRODUCTION

Cloud computing provides computing services which are delivered remotely to clients through the internet. It is a subscription-based infrastructure that provides services such as databases, software, networking and storage It supports collaborative and mobile applications and services. Increased flexibility, larger storage, high automation and reduced costs are a few advantages cloud computing serves. Using cloud computing improves healthcare services delivery for patients. During the last decade, the focus of the pharma biotechnology industry has changed and is now primarily focused towards developing personalized therapeutics. Consequentially, supporting initiatives around genome sequencing plus high throughput analytical technologies have lead to an incompatible data torrent. Resultantly, the sector is challenged by the lack of suitable solutions to optimize business costs via collaborative innovation across the value chain. Large pharmaceutical firms such as Pfizer, Roche and even Eli Lilly are increasingly employing predictive simulation models in collaboration with companies such as Entelos, to understand the implications of biomolecular interactions at a systems level.

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These industries are subject to types of laws and regulations that govern the testing and patenting of these drugs. Productivity of this industry faces a dismal future since organizations' discoveries and developments in new products remain more or less the same, innovation has declined and the market conditions are getting harsher with each passing day. Altering the discovery and development process will be vital in shaping the pharmaceutical sector and in addressing some of its key challenges in the near future.[6]

II. TECHNICAL ASPECTS

Unlike the typical drug lifecycle which can take approximately ten years from discovery to approval to hitting the chemist's shelves, cloud computing seems to be moving at a faster pace. In a report on the Life Sciences sector last year, Accenture stated that cloud computing had gone "from an intriguing idea to a core capability so quickly that leading Life Sciences companies are approaching new systems architectures with a 'cloud first' mentality". The report claims the flexibility, scalability and responsiveness provided by cloud computing made it "a compelling choice" for Life Sciences companies moving into new markets or launching new products or services.

Amazon Web Services (AWS) is already being used by Life Sciences companies to create scalable and easily available IT infrastructures to compute, store and share data. Among the use cases it lists for pharmaceutical companies, biotech companies, academic libraries and research centers are drug discovery, genome sequencing and data distribution, bioinformatics, scientific collaboration and centralized data management.

First, as a **Software as a Service (SaaS)**, the cloud offers healthcare organizations on-demand hosted services, providing rapid access to business applications and fulfilling customer relationship management (CRM).

As an **Infrastructure as a Service (IaaS)**, cloud solutions can offer on-demand computing and huge storage for medical facilities.

And lastly, as **Platform as a Service (PaaS)**, the cloud can offer a security-enhanced environment for web-based services along with the deployment of cloud applications.

Nightscout - Nightscout extracts data from blood glucose meters, translates it into an ordinary format, and then transmits it to a service in the Cloud. Children, parents, and guardians can now view blood sugar levels and receive alerts in a real time manner via a mobile device , web portal or even a smartwatch.

The Nightscout solution provides a wonderful illustration of what cloud computing can do for the pharmaceutical industry. We have moved way beyond discussions about basic cost savings or financial flexibility, and can now focus on the opportunities that focus on what the world's largest super computers are creating. The most motivated and visionary among us will take complete advantage of cloud computing to bring new categories of products and services to market quicker than ever possible before, leading us into a new era.

Further cloud-based listening tools can increase understanding of what patients experience during clinical trials, reducing trial dropout rates, speeding up drug development, and increasing the safety of the patients.[5]

III. WHY CLOUD?

Adopting cloud computing solutions make healthcare operations even more convenient, efficient and cost effective.

The cloud offers on-demand computing by using the latest technology to access, deploy and use networked information, resources and applications. In most cases, end users are sure to find that cloud computing is the best choice for their healthcare business, as it's often less expensive than having multiple computers in various medical rooms — each needing the appropriate hardware, updated software, and network accessibility to store, upload, and retrieve patient or other medical data.

With IT on the rise, cloud-based electronic health records (EHRs) are beginning to have an impact on the health industry.

An example of cloud as a workflow enabler in the life sciences sector is the transformation of the marketing analytics capability at Genentech, a major biotechnology company. Despite being a leader in new age biotherapeutics, Genentech does not employ a typical sales force to drive its products. The company's representatives work with clinicians to stimulate demand by getting them to use the products. As a result, the sales force at Genentech is expected to demonstrate excellent knowledge about the product portfolios and possess skill sets to obtain information on products in real time. To maximize product adoption through a consultative selling approach, Genentech combined mobile communications along with cloud computing.

Coming to the other end of the spectrum, cloud computing has witnessed growing application in the field of molecular modeling. In a recent program launched by Pfizer to identify new molecular interaction targets, the company leveraged cloud computing to deploy the molecular docking program to analyze antibody interactions to accelerate drug development. As a result, pharmaceutical biotechnology companies tend to look at deploying an integrated environment such as Cloud through the lenses of integrating all existing IT infrastructure under a common umbrella. This myopic approach fails to consider IT as a critical asset, which could link critical business activities and facilitate collaboration.

Cloud services eliminate upfront capital costs for hardware, servers and software. They provide quick, convenient access anywhere, anytime from a simple Internet connection. Cloud computing provides a more predictable cost structure for technology and software with no unwanted surprises or unforeseen circumstances.

Cloud-based high performance computing (HPC) gives researchers on-demand access to computing resources and virtually unlimited storage.[4]

IV. THE SNOWFLAKE SOLUTIONS EFFECT

There are certain aspects of the drug discovery process that can be streamlined using cloud-based solutions, but there is a very ordinary obstacle organizations encounter when it comes to migrating to the cloud – customizability. Pharmaceutical organizations that have a lot of legacy on-premise software find it costly, tedious and difficult to upgrade because they have created unique systems, much like a snowflake, for each specific task. Upgrading and recreating these niche implementations across all systems can be extremely challenging, but now organizations are becoming very comfortable with cloud technology which enable them to address their software needs from a more holistic approach. Organizations are working with cloud vendors to create solutions that address multiple pain points in the drug discovery process, rather than a solution with a single function. This holistic approach adds value as the speed of software deployment in the cloud provides organizations with an advantage, increases efficiency and improves an organization's overall time to market.[7]

V. CHALLENGES

For the medical industry, the difficulties must exist, by analyzing the case, cloud medical development problems and challenges are summarized as follows:

(1) System segmentations are independent of each other. China's present medical information system is usually only to carry out independent business, the system and the system between each other closed, interactive enough, so that the data is more dispersed, the information does not reach the most basic sharing and exchange, continuity and poor coordination.

(2) Lack of theoretical demand analysis. Medical construction through cloud is an integral part of business application development, but this lacks the overall planning.

(3) The construction of vertical information system errors. In the development of cloud medicine, the construction of 100 million Yuan information system, child health care and maternal health care system and so on greatly improved the information management level and emergency response capability of the relevant departments. Obviously, because the information system is vertical construction, the original division of the business sector communication is much more complicated.

(4) Lack of capital investment, technical talent shortage. Another major issue is the problem in the capital, technology, talent and other resources being relatively scarce. On one side of the coin, the regional medical construction system itself is relatively complicated, needs long-term investment in the construction of a

systematic project, the need for a lot more money, talent support, and the government's support. The other side of the coin, exposes regional health construction including medical, health, health care, economy, IT and other professional sectors. Hence, the lack of talent restricts the rapid development of medical information.

(5) Medical information construction standards are not unified.

The lack of medical and health information construction is due to the lack of a unified, recognized evaluation criterion. The health sector is still in the process of gradual establishment and improvement. As the construction standards and technical specifications lag, the overall development of hospital information is badly affected. [1]

VI. THE CLOUD – A BOON FOR THE PHARMACEUTICAL SECTOR

The healthcare sector has been relatively slow in adopting cloud computing technology.

However, times are changing and increased awareness of the benefits of such features such as flexibility, back-up, and recovery capability in case of single point of failure, as well as remote access to services and information, have resulted in a spike in cloud uptake.

New cloud-based systems are quickly emerging that offer significant value to patients and medical service providers. Using the cloud helps medical devices to wirelessly collect data for storage, computation, accessibility, and sharing. Frequent alerts can be sent if data breaches occur, allowing for backup and quick recovery. Device manufacturers can also provide **big data** services to their clients even if the client does not have any computing hardware. Furthermore, patients can use devices at their comfort level and upload indicators to the cloud where the physician can easily assess the data.

The unexpected transformation of biomolecular research into a data intensive enterprise has brought to fore a host of concerns for high throughput biology.

Biop Medical, a startup medical device company, has developed a new probe that makes use of high-resolution optical and imaging techniques to identify cancerous and pre-cancerous cells in epithelial tissue. Biop developed its solution on the scalable IBM Cloud platform, using a simple drag-and-drop process to add services as needed. The graphical user interface (GUI) medical professionals use to access and analyze data is hosted on virtual servers in the IBM Cloud.

Cloud-based platforms permit real-time collaboration with providers resulting in data management with more agility by healthcare organizations. The use of cloud services contributes to quicker data management in connection with patients and more efficient monitoring of chronic diseases.

ImageZone is a cloud-based medical image sharing platform designed to provide a digital alternative to the traditional methods of sharing radiology images on CD's and hard copy films. The platform allows healthcare providers to securely access and share patient medical images, such as MRI's, X-rays, mammograms, ultrasounds and CT scans, in real time.

Privacy and security are very important, particularly in light of the increased attention being paid to the Health Insurance Portability and Accountability Act (HIPAA). Cloud computing can reduce risk through encryption, various firewalls, and intrusion detection resulting in an improvement in HIPAA privacy and security compliance. With cloud computing, data is more secure, making records safer and more permanent

Biometric methods, for example, fingerprint scanning and palm vein scanning, have been used in hospitals and healthcare systems to reduce insurance-card fraud, easily identify patients, and link patient data in various healthcare institutions. This eliminates unnecessary repeated clinical laboratory tests. The lifetime EHRs (Electronic Health Records) thus go wherever the patient goes and the patient is no longer tied to one assessment center.

Pharmaceutical companies increasingly look to their services to form the basis of their regulated applications and data, so they can focus on their core business of bring safe, effective drugs to market as soon as possible.[3]

VII. TRENDS OBSERVED IN DIGITAL PHARMA INDUSTRY

A. Digital Patient Communication

For several years, drug stores have been making use of new technology to communicate with patients to notify about pickups, manage refills, etc. Patients are used to receiving automated phone calls or text messages. However, current trends are starting to move further. Patients are beginning to have greater expectations from all healthcare providers for the kind of communication that lets them take control of their own health. Engaging with patients and building healthy relationships can slowly build trust and help change the corporate culture. Patient-centric approaches will help pharma move forward into a world where people expect to be better informed, educated, and more controlled.

B. Health Apps

In today's generation, most patients use at least one health app. These apps are usually provided by patient groups and only 32 percent of surveyed patients blindly trusted apps produced by pharmaceutical companies.

This is most likely because of the reputation this sector has for being greedy and being more concerned with profit than patients. For this reason, pharmaceutical companies should consider building a better relationship with patient groups and with patients as individuals. Health apps to manage specific conditions can be developed in a partnership between multiple companies and patients. Those apps can help companies gain better data about outcomes and compliance as well as providing patients with education and information..

VIII. THE INTERNET OF THINGS

Many companies are starting to use Internet of Things (IoT) to manage high levels of quality assurance needed for pharmaceutical manufacturing. For instance, Pfizer is using RFID tagging to reduce fraud.

Combining IoT with education could significantly increase patient compliance and their outcomes. For example, medicine bottles reveal information to their owner about when they were last opened. This can be useful for patients

with executive dysfunction or other problems that can hamper their memory.

Also, encouraging patients to wear fitness trackers can allow doctors and pharmacists to track sleep, diet, and even weather.

On a more pharma-specific level, smart pills are likely to start to spread through the healthcare ecosystem in the future. This will help with compliance and allow bio-data to be retrieved. One company is making smart spoons that are used by Parkinson's patients to track the incidence of tremors.

IX. BIG DATA

Data can be used to market both directly to patients, and hospitals or physicians. By knowing what kinds of patients most benefit from a specific product, marketing can be more finely targeted and avoid unnecessary hassle. This kind of data allows existing treatments to be refined and improved as well as cross-referencing to clinical trials so that new drugs can be brought to the market easily.

Companies will be able to use detailed information to establish which existing patients would be more likely to use and benefit from a new product. All of this will improve both sales and outcomes. Also, companies will also have to take steps to guarantee patient privacy and follow HIPAA regulations. A balance will have to be maintained between privacy and improved outcomes.

Real World Evidence (RWE) is also impacting access to treatments by helping insurance companies and even charities know which treatments they should be financing for.

X. CRM AND MARKETING AUTOMATION

The amount of data retrieved helps support Customer Relationship Management (CRM) software for pharmaceutical and healthcare companies. This allows for improved relationships with customers and will definitely improve sales.

CRM solutions can integrate with health apps, electronic medical records, and data gathered from large numbers of existing patients to give the impression of a patient-centric approach. As pharma becomes more digital, companies will find that CRM goes from being a perk, to being essential to their business. CRM solutions need to be specifically designed for their respective pharmaceutical companies, rather than off-the-shelf software.

Improving the use of existing patient information, clinical trial data and integrating them into one system will allow for the seamless handling of the entire procedure.

The pharmaceutical industry is changing, and digital pharma is becoming the new norm. These major trends will move us even further from the monolithic and monotonous past into a more agile and patient-focused future. To manage these trends, pharmaceutical companies need the right software to handle their big data needs and CRM solutions designed specifically for them.[8]

XI. CONCLUSION

In the upcoming years, the market for cloud computing is expected to experience rapid growth as regulation issues are ironed out and security fears settle down. The future will see a further explosion of data, and a marketplace that is increasingly globalized and essential.

As such, pharmaceutical companies must ensure their technological infrastructure can cope today and withstand the demands of tomorrow.

Cloud-based solutions have proved to be a boon for the pharmaceutical industry. If institutions and organizations alter their business models to reflect these

technological advances, stagnant productivity can be completely eradicated and innovative drugs would be produced recurrently. The cloud-based technologies provide organizations with technological enhancements today, to facilitate the discoveries of tomorrow.

Moreover, we can expect to see cloud enabled technologies gain momentum in the pharmaceutical industry. Empowering medical research with the vast computing resources of the cloud has the potential to dramatically improve all of our lives- after all, at some point in life, we are the patients![2]

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