

Upgrading of Data-driven Enterprise Management and Consulting Service

-- Taking Healthcare Industry as an Example

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Abstract. As mobile Internet, cloud computing, big data, the Internet of Things and other technologies arise and develop, everything can be digital and the means of data collection, analysis and processing become diversified and more effective. The value of data has transformed from process input and output into directly driving enterprise operation and management. Enterprises can not only collect and store massive data but also drive management upgrade by data. For healthcare industry, with the application of digitalization technology, the number of data in this industry continues a rapid growth, and data has become an engine propelling healthcare enterprises to improve management continually. This paper took data reform as a starting point to discuss the enterprise management upgrade schemes in healthcare industry.

Keywords: Enterprise Management; Consultation Service; Data Driving; Healthcare.

1. Introduction

The rapid growth of world's population calls a higher requirement on healthcare quality and efficiency. In general, healthcare management refers to all mechanisms used to prevent diseases, prolong life-span, accelerate group health and treat diseases. The data-driven healthcare management research utilizes statistics-based mathematical model to conduct healthcare management on groups or individuals. The popularization of electronic health record provides a data basis for the research of data-driven healthcare management, and the application of mathematical model provides a theoretical foundation for the research of data-driven healthcare management. In China, the systematic, normalized and delicacy management will be the sole way out for future healthcare industry under a fierce competition, and the key to implementation lies on data, that's to say, data will be the most important tool for the management reform of healthcare industry, and data management ability will even become one core competitiveness.

2. Concept and Characteristics of Healthcare Big Data

2.1 Healthcare Big Data

Healthcare big data as a digital production factor with major development prospect refers to the healthcare-related data generating in the process of disease prevention and treatment and health management[1]. Healthcare big data governance can be expressed as: healthcare-related units use modern medical information analysis techniques, means and tools to form a full life cycle data analysis process integrating collection, management, integration, analysis and mining. Figure 1 shows the available health care big data covering the whole life course[2]. Data driving refers to collecting massive data by Internet or other relevant software, establishing data structure through mass data resource, synthesizing parallel retrieval data, and building and simulating a data-based automatic decision-making model. In short, data driving is making decision based on data model analysis and taking actions.

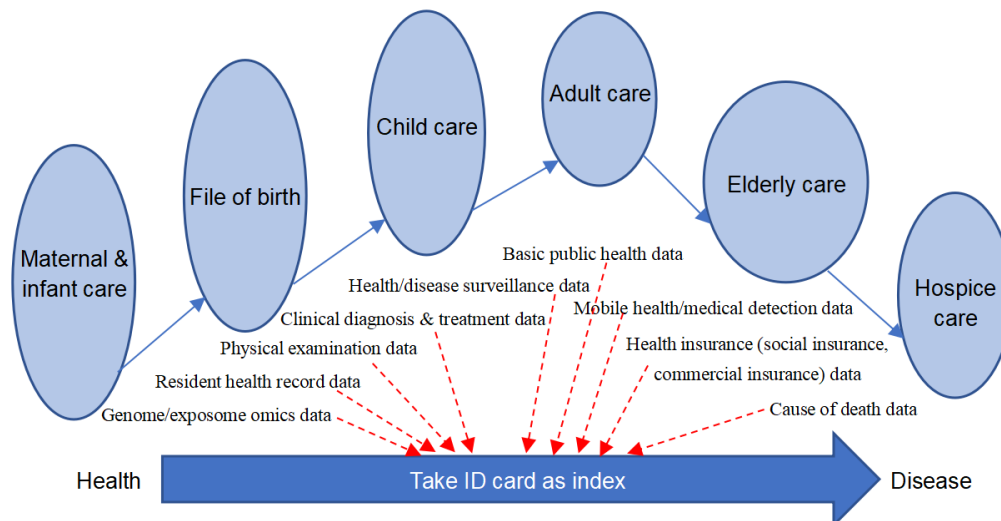


Figure 1. Available healthcare big data

2.2 Characteristics of Healthcare Big Data

2.2.1 Platform

The increasingly penetrated healthcare technology makes medical industry and health service agencies to acquire mass data from different channels, while the platformization of healthcare big data makes the storage, quick processing and sharing of big data to be possible. At present, the common platforms include CPU-based MapReduce healthcare big data analysis, prediction and processing platform, Hadoop-based open-sourcing big data processing platform, etc[3].

2.2.2 Exponential Growth

In the past ten years, the global healthcare data showed an explosive increase. The progressive medical informatization, digitization and intelligence as well as the quick development of online health communities and widely use of wearable devices enable the hospitals, community health service centers, physical examination agencies, medical IT enterprises and other healthcare-related organizations to accumulate a lot of healthcare data. These data refine the perceptual fineness of healthcare service process, providing an opportunity for the innovation in healthcare field [4].

2.2.3 Diversification

Diversification emphasizes on the multi-source heterogeneity and rich media of healthcare big data. The source of healthcare big data includes but not limit to medical service, public health service, medical security, medicine supply security, health management, and so on. The representation of data covers the texts represented by doctor's advice, figures represented by physiological data, images represented by imaging examination as well as scenarios data represented by individual health behavior and activities.

3. Data-driven Upgrade Path of Management and Consultation Service for Healthcare Enterprises

At present, China's healthcare industry develops unbalanced and upgrades slowly. As an important basic strategic resource, healthcare data provides three management upgrade paths for enterprises in this industry.

3.1 Expand Enterprises' Healthcare Service Scenarios based on Healthcare Big Data

According to the current information state and data collection scope of healthcare big data, its main application scenarios include individualized health management service scenario, medical and health service scenario, public health service scenario and medicine service scenario.

3.1.1 Individualized Health Management Service

(1) Individual health risk assessment and intervention

On the basis of gene data collected from physical examination and wearable intelligent monitoring device as well as the correlation of nutrition data, environmental data and biochemical data, a platform with open data boundary could be built, and more mature big data analysis and AI technologies could be used to help users to establish holistic health image, making individuals to accurately master their health state and existing health risk and compare and analyze the data of physical risk factors, so as to achieve efficient and humanized clinical intervention and health guidance.

(2) Self-health management

Healthcare big data can improve the quality of data obtained on people with chronic diseases and ensure the exploitability of data in electronic medical record and health record. High-quality data contributes to the establishment of chronic disease risk assessment system and facilitates people to make self-assessment. Combining with intelligent wearable device, AI-aided decision-making system and block chain data protection technologies, individualized health intervention guidance can be given to people with chronic diseases[5].

3.1.2 Medical Health Service

(1) Assistant therapy

By building a uniform platform and using data mining technology to analyze the correlation between data information during medical care, clinic decision can be made in a better way[6]. For example, make intelligent processing and recognition of medical images based on a large number of clinic diagnosis and treatment data by using AI technologies, so as to provide intelligent assistant diagnosis and treatment and imaging diagnosis services.

(2) Medical resource allocation

The establishment of open data sharing platform enables all kinds of medical agencies to share information, and the co-analysis of people's feature properties can achieve the optimal allocation of medical resources of all levels and types.

3.1.3 Public Health Service

Data governance can give play to its scenario-driven advantage in public health service. Starting from an overall situation, it integrates population statistics-related information, biogeographic information and the data information of diseases from various sources and their risk factors, utilizes big data processing and data mining technologies to timely and accurately evaluate the disease transmission situation, and further makes quick response and effective decision on public health events.

3.1.4 Medicine Service

Healthcare big data governance is capable of assisting pharmaceutical enterprises to predict drug demand, perform research and development of new drugs, and discover the side effects of drugs. Data governance can effectively promote the quality of healthcare big data, and easily find out the relationship between disease law and drug demand, thereby adjusting the research and development input of drugs and optimize the whole pharmaceutical industry chain.

3.2 Data-driven Intelligent Enterprise Management Structure

Intelligent enterprise is a new management mode and organizational form under the data driven background, which is a deep integration of advanced information technology, industrial technology and management technology. The construction of intelligent enterprise facilitates to transform and upgrade production relation inside the enterprise, complete the harmonious docking with Internet+ social productive forces, further release the staffs' innovation power and benefit creating power, and provide impetus for the sustainable development of enterprise[7]. The technical structure of intelligent enterprise needs to deeply fuse cloud computing, big data, Internet of Things, mobile interconnection, artificial intelligence and other advanced technologies with production construction,

operating management and other links, in order to support the technical innovative structure of the entire intelligent enterprise, as shown in Figure 2.

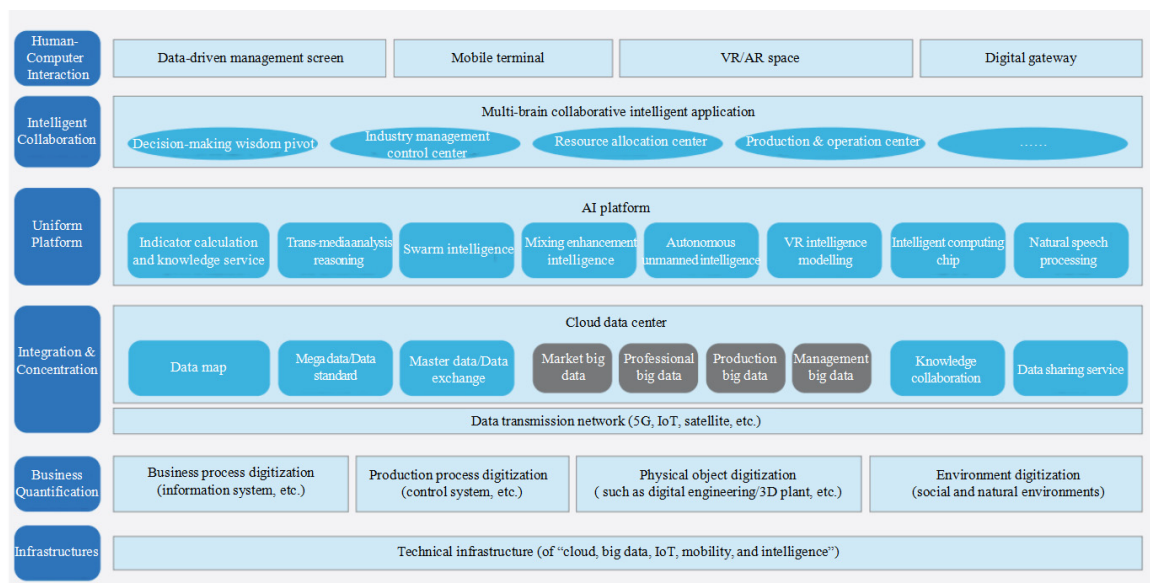


Figure 2. Technical innovative structure of intelligent enterprise

In the practices of data-driven management reform of healthcare enterprise, intelligent enterprise stands in a holistic enterprise perspective to reinforce IoT construction, deepen big data mining, and propel management reform and innovation, and should abandon the technical transformation idea of “local optimization”. Whatever medical products or services, only starting from the overall efficiency of market demand, production, purchase and sales could a true path be explored. In the data-driven reform, data should be understood and applied from the following three aspects:

- ① Comprehensive digital dimension: carry out digital transformation on total elements of enterprise, and implement the comprehensive quantization of internal business process and the perception of statistical probability of external market;
- ② Comprehensive interconnection dimension: break through system barriers, eliminate information island, and realize equipment interconnection, interpersonal intercommunication, human-machine interaction, knowledge sharing and value creation, thereby endowing enterprise management with “wisdom”;
- ③ Comprehensive intelligence dimension: drive enterprise management to shift from single and independent intelligence to comprehensive intelligence, realize comprehensive perceptive intelligence, equipment intelligence, systematic intelligence and collaborative intelligence, and achieve an nested driving mode of innovation, technology and management.

3.3 Improve the Agility of Enterprise’s Supply Chain Management by Data Driving

For healthcare enterprises, confronting the uncertain healthcare market environment and diversified customer demand at the post-pandemic period, the enterprises must enhance their abilities of responding to uncertainties and quickly make response to form core competitive advantage. Agility is an ability of enterprises to cope with unknown situation, identify threats in business environment and turn uncertainty into controllable opportunities, which covers the full-service ability in organizational structure, information system, logistics process and way of thinking [8]. The agility of an enterprise is mainly determined by whether its supply chain is agile, and an agile supply chain involves four key links: purchase, research and development, production and sales (as shown in the figure 3). To cope with uncertain market environment, the manufacturers could make tests on the changing market by some small batches, such as trail sale and AB test mode, explore potential users

from feedback information and data, and supply goods in small batches according to production and sales cycles. The most important thing is the data-driven C2M flexible supply chain can make flexible response to the sudden change of market demand.

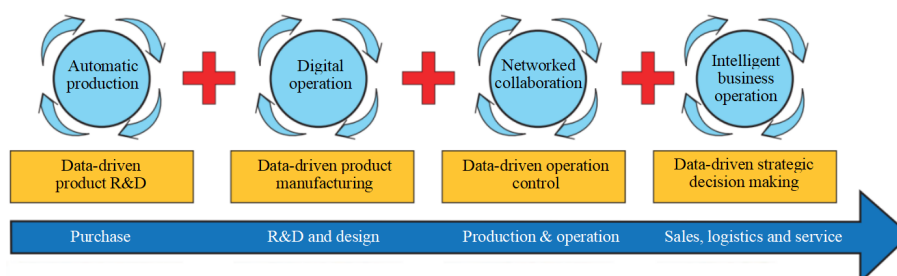


Figure 3. The agility of enterprise's supply chain management

Taking medical apparatus and instrument products as an example, China's medical apparatus and instrument companies are featured by small scale, disperse distribution, disordered management and great in quantity. In China, there are more than 18,000 medical apparatus and instrument companies, 90% of which registered capital are less than 20 million yuan [9]. Most of these small companies adopt B2C mode and the production pattern of traditional industry times. In essence, their production pattern is a "push type" production. The manufacturers are centered by enterprise or products, pursue single variety, large batch and low cost, and release the products to the market and users through mass marketing and distribution system. This production pattern had obtained great success in the era when suppliers dominate the market, but in current times when medical apparatus and instruments are universally overproduced, the manufacturers could only survive on price war, leading to that bad money drives out good. Small companies may consume too much resources in the price war, then face adverse conditions and even fail in the competition.

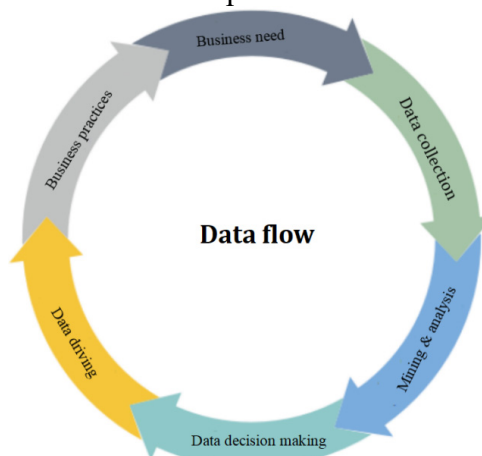


Figure 4. Data-driven closed loop model

To solve above problems, it is necessary to reform with data-driven supply chain mode, adopt C2M (i.e., customer driven manufacturer) business mode, and use industrialized means to realize large-scale individualized customized production, to satisfy the individualized and diversified demand of consumers. In nature, C2M is a "pull type" production pattern: big data technology transfers user data and information to manufacturers swiftly, then manufacturers begin to focus on users to purchase, produce and distribute. Meanwhile, through all kinds of relevant technical means, business process optimization and organizational redesign, product variety becomes more, batches smaller and response quicker, finally forming a flexible supply chain system. "Flexibility" refers to that the whole supply chain of an enterprise could make rapid response to market demand, that's to say, the manufacturers can meet both "more varieties and small batch" and "single variety and large batch". The major characteristic of a flexible supply chain is: whatever small order or big order, the

companies can realize uniform and controllable quality with nearly the same cost and make quick and timely delivery. For the enterprise, a flexible supply chain can increase sales opportunity and reduce inventory risk to the minimum.

Enterprises form a data-driven closed loop model in the C2M mode (As shown in the figure 4), no longer predict market changes by “guess”, but test the changing market through some small batches. They can also adopt some flexible and innovative ways such as trial sale and AB testing mode, mine potential customers from feedback information and data, and supply goods in small batches according to production and sales cycles. The most important thing is the data-driven C2M flexible supply chain can cope with the sudden change of market demand flexibly [10].

4. Conclusion

In the face of uncertain market environment and varied customer demand in the post-pandemic era, continual reform is the only rule for healthcare enterprises to survive. Data driving refers to that enterprises take data as a main production factor based on process, method and technology. Rich medical big data provides a feasible upgrade path and abundant scenario applications for the development of health industry. Data-driven management reform has become an important guiding mark for the high-quality development of healthcare industry. In general, transformation is a complicated systematic project requiring certain policy guidance and environment construction, so it needs joint efforts of the government and enterprises.

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