Value chain building and business model in the mobile device healthcare industry – the case of China

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Abstract: Although mobile device healthcare (MDH) industry is developing fast, people do not have a deep understanding of its value chain, and further, its business model. In this paper, I analyse the development of the MDH industry in China, then clarify the total market scale of MDH. Based on these, I discuss key segments in the value chain of the MDH industry and unveil the business model of MDH firms. After that, the change brought by the mobile devices for the traditional healthcare industry is investigated. Finally, six cases of MDH firms in China are raised and discussed in detail.

Keywords: mobile device healthcare industry; business model; value chain; China.


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1 The mobile device healthcare industry

The mobile device healthcare (MDH) sector is the result of a combination of various industries, including mobile devices, internet platform, healthcare, medical equipment and medicine industry, etc. Currently, it is characterised by a continuous improvement and by a rapid development at the world level. In China, the MDH is one of the key projects foreseen by the Ministry of Health. It matches the trends in the country of medical reform heading to market oriented, customisation and digitalisation.

The Healthcare Information and Management System Society define the MDH as follows: medical information, diagnosis and treatment are transferred using mobile communication technology.

At present the MDH is based on mobile terminals, such as mobile internet platforms, intelligent mobile phones and tablet PCs. By means of these mobile terminals it is
possible to offer medical information processing and diagnostic healthcare services. Examples are mobile phone medical care APPs, remote patient monitoring, registered appointments, online consulting, chronic disease management and health management, interactive personal medical care equipment, wireless access to electronic medical records, etc (GSMA Mobile Health Research Report, 2011).

The MDH industry involves several segments. Mobile healthcare terminal includes portable therapeutic equipment, wearable intelligent medical devices, intelligent mobile phones, tablet PCs, and mobile terminals of hospital information systems, etc. These segments can be analysed according to three different perspectives.

From the demand perspective, customers of mobile healthcare cover infants, youth, pregnant women, working people and aged people. Among all these, working people and aged people are the most important target customers. Even if aged people are in many cases not able to use complex mobile medical devices and services smoothly, they still can enjoy the benefits of the mobile medical services with the help from relatives, friends or community medical centres (United States FDA, 2011).

From the perspective of the disease treatment, mobile healthcare technology can simplify the management of chronic diseases, favour an early detection of serious illness, prevent common diseases, facilitate postoperative rehabilitation, etc. Since there are more than three hundred million chronic patients in China, and the recovery period of chronic illness requires a lot of time, there is a need for long-term and continuous care. Therefore, many patients with problems such as respiratory distress, cardiovascular diseases, diabetes, cancer and other chronic diseases represent important customers for the MDH industry (Bi, 2013).

Finally, from the perspective of the final target, there are two different categories of MDH: informational MDH and therapeutic MDH (Table 1).

Table 1  Market segments of mobile healthcare

<table>
<thead>
<tr>
<th>Function</th>
<th>Informational MDH</th>
<th>Therapeutic MDH</th>
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<tr>
<td>Electronic medical record, hospital information system, customer relationship maintenance</td>
<td>Smart phone with sensor/tablet PC applications</td>
<td></td>
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<tr>
<td>Healthcare information consultation</td>
<td>Intelligent medical equipment (desktop or wearable)</td>
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<tr>
<td>Diagnosis appointment, referral service</td>
<td>Chronic disease management and detection application system</td>
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1.1 Informational MDH

Informational MDH focuses on the information transition or on the solution of asymmetric information. It covers the following three categories.

1.1.1 Electronic medical record and hospital information system building

In 2010 the Chinese Ministry of Health promulgated the ‘basic framework and data standard of electronic medical records (for trial implementation)’. Electronic medical records are an integrated system using electronics to create, save and use the data on clinical diagnosis/treatments/interventions. It records all the clinical information in the medical history of patients. Electronic medical record has two main advantages. Firstly, doctors, patients and other authorised person can acquire any health data completely,
accurately and instantaneously, under any circumstance. Secondly, authorised people can use the given information to take timely and accurate decisions and can effectively maintain the customer relationship, ultimately enhancing the customer satisfaction (American College of Occupational and Environmental Medicine, 2005).

Electronic records can combine different information systems of the hospital. They cover all the information processing of all clinical departments, including collecting, summarising, processing and displaying all the clinical diagnosis and treatment information. It is the ideal information platform for medical institutes aiming to realise a clinical informatisation. There are currently hundreds of hospitals using online electronic records in China (Liu, 2014).

1.1.2 Healthcare information consultation
Through mobile medical terminals, informational mobile healthcare operators set up the information sharing platform that allows sharing healthcare information with authorised people. At the same time, it attracts subscribers with different ages, different diseases, and different locations. For example, it can send healthcare information to the subscribers in the long term through WeChat or other social media platforms. WeChat has more than 600 million users and, as a strong emerging social tool, it can bear the function of healthcare information platform in the MDH industry. After gathering a large amount of users, healthcare information platform generates huge business value (Mao, 2013).

1.1.3 Diagnosis appointment and referral service
Diagnosis appointment and referral service through mobile device medical platform is a good example of ‘online-to-offline’ service. For example, in China the ‘Good Doctor Online’ website, which will be described in more details later on, is the first mover of this ‘online-to-offline’ model in the market. Through mobile internet, patients can search authoritative doctors about different diseases or contact doctors for referral services. This can benefit the hospitals, helping them improve the patients’ medical experience and also effectively allocate the resources (Xu and Zhao, 2014).

1.2 Therapeutic MDH
There are three kinds of therapeutic MDH, including intelligent medical devices, intelligent mobile phones/tablet PCs with sensors, and chronic disease management and detection application systems.

1.2.1 Intelligent medical devices
This is a kind of combination between physical devices and virtual networks. Medical device manufacturers add built-in information transmission modules and communication interfaces inside the detection or treatment equipment. This allows users to transmit their real-time test results to doctors. Differently from the traditional desktop equipment, wearable intelligent devices can be worn by patients for continuous and timely data detection and transmission. The monitoring data on blood glucose, blood pressure, and blood oxygen from wearable medical devices can be then connected with smart phones. At the same time, with the support of the cloud storage technology, data can be stored
and analysed through the cloud. Then data can be connected with the case system and with the monitoring centre of the hospital. In case of abnormal phenomena for the body, the devices can provide early warning and timely suggestions on diagnosis and treatment (Teng and Zhang, 2006).

1.2.2 Intelligent mobile phones/tablet PCs with sensors

Intelligent mobile phones/tablet PCs can provide more medical services. Taking smartphone as an example, the detecting probe is inserted into the earphone end of the intelligent mobile phone, a specific APP is downloaded and opened, and then it is possible to examine the physical signs. Data and images can be displayed on the smartphone in real time. Mobile phone camera can also be used to shoot human body images and to monitor the patients’ health index in real time. In this way heart rate, blood pressure, and even electrolytes are used to help users to predict the potential incidence of a disease (Bennett, 2012).

1.2.3 Chronic disease management and detection application systems

There are more than 300 million chronic disease patients in China. In US, 86% of people over 65 years of age suffer for at least one chronic disease (diabetes mellitus, cardiovascular diseases, chronic obstructive pulmonary diseases, asthma, arthritis, rhinitis, cancer, etc.). This huge group of patients with chronic diseases is sufficient to form a large network. Within any chronic disease group, management and application systems can get millions of active and dedicated users, which can allow users to manage their own illnesses and get help in time (Burton, 1999). And more, with processing of large data based on sufficient quantity of medical treatment, the correlation between symptoms, causes, treatment and other factors of various diseases will be resolved in statistical sense. This can help patients manage their health more effectively.

2 Market size estimation of MDH industry

2.1 Global MDH market size estimation and MDH development phase in the USA

The development of the MDH industry in the USA has experienced different phases, starting from fragmentation, passing to integration and then to the widespread adoption, as indicated in Table 2 (Chen, 2014).

The Global Mobile Communications System Association released a report according to which by 2017 the development of the mobile device medical market will globally have a value of $23 billion in revenues.
Table 2  MDH Industry development phases in the USA

<table>
<thead>
<tr>
<th>Stage 1</th>
<th>Stage 2</th>
<th>Stage 3</th>
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<tbody>
<tr>
<td><strong>User experience</strong></td>
<td>Consumers acquire services independently, through tablet PCs or smartphones.</td>
<td>Consumers acquire integrated services through tablet PC or smartphones.</td>
</tr>
<tr>
<td><strong>Characteristics</strong></td>
<td>For some specific diseases, mobile applications offer services with limited functions, for example remote monitoring.</td>
<td>Embedded or wearable devices with multiple expansion functions. Integrated with electronic medical records, reimbursement systems, predictive disease guidance, etc.</td>
</tr>
<tr>
<td><strong>Problems to be solved</strong></td>
<td>Technological and clinical feasibility.</td>
<td>Payment and reimbursement of medical expenses.</td>
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Source: Accenture Research Report (2011)

Figure 1  Prediction of China mobile healthcare market capacity (unit 100 million) (see online version for colours)

Source: [http://www.qianzhan.com/qzdata/detail/149/160106-d021cc5d.html](http://www.qianzhan.com/qzdata/detail/149/160106-d021cc5d.html)

2.2 Estimation of the Chinese MDH market size

The estimation of the MDH market size is implemented by specific authority advisory bodies. AI Media Consulting (iiMedia Research) is a leading mobile internet marketing agency that focuses on third party data mining and integration. It is the first research authority specifically focused on mobile internet applications, electronic commerce and other internet related industry research in China. In 2012, among all market information
research members of the Chinese Association of Market Information Research (CAMIR), AI Media Consulting officially became the only one acting on the mobile internet industry in China. According to the estimation of AI Media advisory, the Chinese mobile medical (services) market size was about 1.86 billion RMB in 2012, and it is expected to reach 12.53 billion RMB in 2017. From 2011 to 2014, the average annual growth rate reached 18.64%. From 2015 to 2017, the average annual growth rate is expected to amount to 50.52%. That is to say, the mobile healthcare industry in China will experience a rapid growth stage (China Mobile Healthcare Market Research Report, 2015).

3 Analysis of the MDH value chain

3.1 Differences between traditional medical services and MDH services

The value chain of traditional manufacturing industries consists of the following stages: research and development, manufacture, logistics, marketing and post-sale service. Through these stages, traditional manufacturers can realise both value transmission and value adding. The MDH industry is a combination between real economy and virtual economy. Its value chain is therefore different from the traditional manufacturing industry value chain.

First, the R&D of MDH service includes not only the development of medical equipment and mobile terminals, but also the development of applied software and medical services information systems. They can be managed simultaneously without limitations of time and space. At the same time, they can be developed in coordination each other in order to benefit from synergy effects.

In traditional healthcare industry value chains, in order to ensure that the various elements of the transaction can be exchanged (for example information, logistics, billing, etc.), buyers and sellers must show up in the same location and at the same time. The exchange of these elements happens in the hospital. The hospital is the unique platform for the occurrence of all phases (registration, reservation, check, clinics, prescription, payment, drug delivery, transfusions, etc.). All the information exchanges, payment clearings and service deliveries happen within the hospitals, which have to play each role very efficiently. This imposes great pressure on them.

Figure 2 The value chain of traditional manufacturing industry (see online version for colours)
The impact of the MDH on the traditional medical health is in terms of decomposition of market factors. By means of different platforms all the market exchange factors can stand alone and are not limited by location or time any more. Virtual platforms do not require any specific location or exchange time. Over time, this will greatly reduce the requirements for the exchange and it will accelerate the feedback from authorised people. The market capacity will have therefore the possibility to be exponentially expanded, given that exchanges can take place everywhere and at any time.

**Figure 3** Components of the traditional medical service (see online version for colours)

**Figure 4** Components of the MDH (see online version for colours)
In the healthcare industry, with the help of platforms, hospitals will not be the necessary location for the market exchange anymore. Overload caused by too many visitors and the consequent low quality of services in hospitals will decrease. The infrastructure of the health industry can completely change. Information platforms such as search engines or portal sites can be used for marketing activities. Alipay or other third party payment platforms can be the trading platform. Mobile APPs are now a preferred platform for healthcare and services, monitoring chronic diseases. B to C websites play instead the role of trading platforms for online drug purchases. Data platforms store the patient’s electronic medical records. Figures 3 and 4 show the difference between the value chain of traditional medical service and mobile device medical service.

3.2 Components of the MDH value chain

The value chain of the MDH industry has several components. In particular, there are four main parts in the platform: final clients, healthcare payers, equipment and medicine providers, and mobile device medical service providers (Chen, 2014).

1 Final clients. Patients with various diseases, healthcare recipients, hospital doctors and staffs are the end customers of the MDH. Patients can get better and more convenient treatments, monitoring, maintenance, and benefit from effective disease prevention by means of mobile device medical programs. Hospitals and doctors are the final destination of all the connections. The hospital can manage systematic services and analyse the patient’s electronic medical records through mobile medical solutions.

2 Healthcare payers. The insurance company and the government are direct payment parties for medical services. The increase or decrease in the total medical expenditure has a great importance for them. At present, most of the Chinese medical expenditure are reimbursed by the government. The market share of commercial insurance company is lower than government or state owned companies. The insurance system controls the cash flow of the medical system and decides which drugs and medical testing services can be included in reimbursement (Ling and Xiao, 2012).

3 Equipment and medicine providers. The tangible economy in the MDH includes pharmaceutical companies, medical devices and equipment manufacturers. Through the mobile internet technology, together with marketing activities and services, medical healthcare manufacturing companies can expand the demand, improve their revenues and profits, and increase their market share.

4 Mobile device medical service providers. This category includes mobile internet providers, mobile application providers, medical service call centres, etc. They connect the users and providers and provide channels to allow mobile medical services to reach the end users. These channels include cloud storage services, background service centres for the application of mobile phones, wireless internet and mobile internet service providers, etc.
3.3 Characteristics of the MDH value chain

3.3.1 Moving from product orientation to customer orientation

In China, the medical value chain is currently product oriented. The attention to customer demand is very low because of the shortage of medical resources.

The MDH industry is an emerging field. In this industry, different firms are now entering the market and competing with different business models. It is very important for these firms to differentiate from their competitors.

In order to move towards a demand oriented value chain, there must be a more professional and effective collection of customer feedbacks. The core of the value chain is now moving from product design to customer feedbacks, to be then used for a revision of product design (Accenture Research Report, 2011).

The traditional medical value chain covers a lot of stages, from research and development to the product marketing and to services. The disadvantage of product orientation is that it only follows the characteristics of the product, ignoring customer’s requirements. It therefore does not lead to a true differentiation of the company in the market positioning.

A customer oriented MDH value chain solves this problem. Before carrying out R&D activities, the firm needs a deep customer demand analysis, after which then designs its product according to demand (GSMA Mobile Health Research Report, 2011). With the preliminary demand analysis, the risks can be decreased. The procedure of customer oriented mobile medical service is composed by several steps (Figure 5).

Firstly the company analyses the customers’ needs and the market segments in order to decide its market positioning, then it designs and develops the product according to the analysis. After these two steps are completed, the company starts the traditional value chain phases such as input procurement, production, marketing, sales and post-sale services.

![Figure 5 Customer oriented mobile healthcare procedure (see online version for colours)](image)

Focusing on customer-orientation is important for the MDH value chain. It will help the company jump out of existing product lines, using customer-oriented thinking, focusing on research about users’ experience and users’ needs, realising disruptive innovation, and reshaping the industry boundaries. Products can be designed for specific market segments, reaching a clearer positioning. Enterprises can also reduce the risk of huge sunk costs and fixed costs in R&D and production. A customer oriented value chain enables enterprises and stakeholders (customers, distributors, suppliers, etc.) to engage in a ‘win-win’ relationship based on mutual trust. After the different parties establish economic, technological and social ties, a customer-oriented value chain will effectively reduce transaction costs and time costs (Bain and Company Research Report, 2010).
3.3.2 Improving production efficiency through the virtual value chain

A virtual value chain is based on the physical value chain. In particular, it represents the informatisation of the physical value chain. A virtual value chain includes two components: the high value added part and the basic part. As regards the MDH industry, any part of the virtual chain can be used for the collection, organisation, selection, synthesis, and distribution of the information. The traditional value chain model is combined with the process of information processing and utilisation (Mintzberg, 2005).

MDH tries to improve the efficiency of healthcare services. Some patients can get online preliminary answers about their disease and avoid the pain of rushing among different hospitals. The hospital can also treat people efficiently and this is a particularly important aspect due to the shortage of healthcare service provision in China.

3.3.3 The significance of the virtual value chain for the small and medium sized enterprises in the MDH industry

The establishment of the virtual value chain is of great significance to the MDH industry. A virtual value chain sets up two parallel value chains for enterprises, so as to inject vitality and enhance their competitiveness. It can create value in dealing with physical space and virtual space simultaneously, comparing to the use of just physical space. For China, whose medical resources are particularly restrained, this aspect plays an even more crucial role.

1. Virtual value chains can reduce the minimum efficient scale required by the economies of scale in traditional value chains. Since the cost of utilising and processing information for enterprises decreases, the curve of scale economies changes. Cost is no longer a major obstacle for competition and SMEs can fully exploit their flexibility, and try to be the first to grasp the emerging market trends and potential demand.

2. Virtual value chains can expand the effect of economies of scope. The low cost of information processing enables mobile medical companies to develop a variety of derivative and ancillary products with similar core modules. Even in the case of insufficient human resources, medical companies can still offer different types of customer services because of improved techniques.

3. Virtual value chains can improve efficiency of the medical value chains. Due to the short life cycle of mobile medical products and services, virtual value chain enables enterprises to grasp the value added activities in the market more clearly and accurately. It makes the strategy of the enterprise more pertinent, and easier to adjust according to the change of the external environment.

4 Business model and case studies in MDH industry

4.1 MDH business model

The MDH business models can be classified in different ways. From the perspective of the end customers, there are two kinds of business model. One is the B to B model whose customers are institutions, usually hospitals, pharmaceutical companies, and insurance companies; the other is the B to C model whose customers are patients. In the B to B
model money is charged from hospitals, pharmaceutical companies, and insurance companies. In the B to C one the money is charged from end users. In this last model, most of the revenue comes from sales of equipment, hardware and software, for example wearable hardware (Ministry of Industry and Information Technology of the People’s Republic of China, 2012).

4.1.1 From free to fee. B to C business model in MDH industry

The end users of B to C MDH are patients. Initially this business model is characterised by a free mode. The general purpose of the free mode is to quickly capture and expand the number of users by means of the release of trial versions, experience versions, limited free versions, etc. This mode induces in users a dependence on the product in a very short period of time. People’s living habits are subtly manipulated. Initially users can use the product or the service for free through a variety of marketing channels. When the pilot customers get good user experience, they increase the use frequency of the product and become dependent on it. Finally, the first faithful users spontaneously recommend the mobile medical applications to people around, establishing the roots of a positive word of mouth process (Figure 6).

Figure 6 B to C business model of mobile device medical (see online version for colours)

In the early stage, this business model uses its ‘free’ status to attract users (Jiang and Wang, 2013). Due to word of mouth, the scale of the firm can increase rapidly and its profit margins will be compensated because of the reduction in marketing costs. However the costs associated to the free version cannot be ignored; whether they can be compensated in a limited time needs to be further explored.

4.1.2 Solution to asymmetric information. B to B business model for MDH

The end user of B to B mobile medical products is the hospital. The medical information exchange platform is the entrance of this model. Due to data storage and processing requirements based on a large amount of users and large medical data, the platform plays an extremely important role.

However, the development of medical information exchange platforms sometimes has to face the resistance from hospitals and pharmaceutical companies. In hospitals, mobile medical information platform automation and large quantities of information processing might increase unemployment. The hospital original staff composition might become redundant, leading then to part of the information processing staff to lose their job. As far
as the pharmaceutical companies are concerned, the high drug price in China is mainly due to the information asymmetry between drug companies, hospitals and patients. With the continuous improvement of transparency allowed by medical information platforms, the information asymmetry is gradually disappearing. Pharmaceutical companies face more intensive competition, and the original high profit margin will be progressively eroded.

4.2 Cases studies of Chinese MDH business

We have chosen six firms as cases studies for the Chinese MDH business that are good representatives for the evolution of the Chinese MDH industry.

4.2.1 Spring Rain Palm Doctor: the first mobile medical APP (B to C) in China

Spring Rain Palm Doctor was founded in July 2011. After four years, Spring Rain Palm Doctor has 65 million users, 200,000 registered doctors and 70 million patients’ health data. Every day, people raise more than 110,000 health problems and expect the answer on the website of Spring Rain Doctor. It is the world’s largest mobile doctor-patient communication platform.

A survey of the Chinese Medical Association in 2009 showed that when there is physical discomfort, only 4.8% of Chinese urban citizens choose to go to the hospital. This means that more than 95% will not see a doctor at the initial stages of their disease. These people are the target customers of Spring Rain Palm Doctor.

Currently the Spring Rain Palm Doctor has released three versions of their applications: an iPhone version, an iPad version and an Android version. It is a mobile phone client which allows users to ‘self-diagnostics + enquiries + guide’. Spring Rain Palm Doctor Application was launched in November 2011. It achieved 1,800,000 downloads in five months, accumulating nearly 15 million users in the first two years. Every day there are about 50,000 active users.

The self-diagnostics function includes personalised intelligent ‘family doctor’ services such as self-inspection, remote monitoring, emergency assistance and special personal care. Client’s private health information function can send the corresponding health information in real time to a specific patient according to the daily climate change.

Product also combines positioning function: people can search, for examples, hospitals, pharmacies and specialists nearby (Huang, 2006).

The enquiry function allows the true interaction and real-time tracking between the patients and the hospital. The platform has opened two professional online enquiry services including departments of gynaecology and paediatrics. Users can check their own risk for potential diseases and enquire a professional doctor without having to pay any fee.

However, there are various kinds of cost for the Spring Rain when offering free service to patients. For example, the Spring Rain needs to pay doctors who answer questions. The service is until now provided to patients free of charge (for a limited time). But in the future Spring Rain plans to launch expert enquiry, pharmacy search parity and other functions with fees. In addition, Spring Rain Doctors APP launched a membership version in January 2014.

The monthly payment of membership is 8 Yuan (RMB). 50,000 paid members registered in the first month. Spring Rain Doctor will later extend the business model to
cooperation with qualified pharmacies. Users will be able to search more pharmacies, compare drug prices and then place an order to buy medicines.

This app tries to build an effective mobile internet channel for doctor-patient communication. It can bring the most qualified medical resources to the users with low cost, without any geographical and time constraints. Spring Rain obtained $3 million USD venture capital from Blue Run Ventures in the first round of financing. In the second round of financing in 2012 it raised $8 million USD.

4.2.2 The Good Doctor Online: medical search and doctor-patient communication platform (B to C)

‘Good Doctor Online’ is a professional medical service platform, which launched a completely free iPhone client. Until April, the Good Doctor Online has included more than 5,100 regular hospitals and 387,900 doctors nationwide. Through the mobile phone, customers can retrieve all common disease information, the relevant doctors, and hospitals in the whole country. Patients can search the local hospital and the hospital departments. They can query the doctor resume, the surgery time etc. They can even view patients’ evaluation of the doctor (Ling and Xiao, 2012).

The largest usage is related to the queries on doctors’ information. 3.5 million people visit the website every day. In the medical industry, information asymmetry is a serious problem. However, the Good Doctor Online tries to overcome this problem by opening its large database for free. At the same time, it provides online and telephone consultations with fees. Patients can consult for free the professional doctor for a limited number of times. After these limited number of times, if patients want to query more, they must pay. Patients who have been diagnosed or surgically operated, can express their thanks through different categories of small presents whose price ranges from about 0.9 USD to 16 USD. They pay through Good Doctor Online and the doctors who accept gifts can get the gift after the website deducts a ratio for management operating expenses.

In Good Doctor Online, staffs of more than 100 medical professionals conduct consulting services, including the collection of information, consultancy in the choice of the right doctor, and the coordination of timing for the appointments.

Recently, Tencent (HK0700, a very famous internet social company in China which owns the social software of QQ and WeChat) and Good Doctor Online achieved a strategic cooperation. In particular, they agreed to cooperate in online enquiry, outpatient reservation and other aspects. The two partners together try to enter the mobile device medical market using the medical information exchange platform as the breakthrough weapon. As of the end of 2013, more than 220,000 people have successfully visited doctors through the Tencent Medical Online (Chen, 2014).

Other internet companies which have been involved in the internet medical industry include Sohu (NASDAQ:SOHU), Sina (NASDAQ:SINA), etc. With more and more competition, there will be huge challenges to be faced on how to maximise the advantages of professional information platform, how to focus on user demand in R&D, and how to differentiate from competitors.

4.2.3 UFIDA: healthcare big data solutions (B to B)

With the growing importance assigned to electronic medical records, the storage and processing of medical big data has become an important issue. Comparing to other large
data areas, medical big data are more complex and usually non-standardised. This is due to two main reasons. On one hand, different brands and types of testing equipment (such as X light, B ultrasound or biochemical analysis instruments) generate a large number of data with different formats and different size. On the other hand, due to the complexity of the medical industry it is difficult to develop a unified data standard. As of September 2013, 17.5% of top hospitals used the mobile medical system. Top hospitals are those ranked as ‘tertiary hospitals’. In total, there are about 700 tertiary hospitals in China, but the mobile medical system used in most hospitals should be improved (McAlearney, 2003).

UFIDA started to be involved in the development of big data in 2009. Through the pharmaceutical industry management practice, UFIDA gradually designed pharmaceutical industry solutions, including business operation and management information systems. This system is based on good supply practice/good manufacturing practice (GSP/GMP). The system covers electronic medical records and healthcare records. It also includes medicine companies and a series of hospital issues such as, for example, financing, human resource management, supply chain management, distribution management, production management, quality management, etc. Its profit model is similar to the general software/hardware sales. The payment parties are the local governments or the hospitals (UFIDA Group Pharmaceutical Industry Solutions, 2016).

In addition, IBM, Oracle, China Mobile, Google, Qualcomm and other similar companies have also been involved in the medical big data business.

4.2.4 Taobao medicine hall: O2O model of pharmaceutical e-commerce (B to C)

Owing to the urbanisation trend and to the popularity of non-prescribed drugs, buying medicines out of the hospital has become more and more popular for consumers in China. The China Online Pharmacy Council Report shows that sales of B to C pharmaceuticals amounted to 400 million Yuan in 2011. There were six online pharmacies, whose annual sales reached nearly 50 million Yuan (RMB) for each one. The market size enlarged to 1.5 billion Yuan (RMB) in 2012. In 2015, the sales of pharmaceutical e-suppliers reached 15 billion Yuan (RMB).

Therefore, more and more drug distributors have joined the electronic commerce industry. Cooperation between the traditional e-commerce platforms and medical online shopping platforms emerged. Then there are Tencent QQ Medicine Mall, Health Passenger Network, Taobao/Tmall Medical Museum, Jingdong and Jointown Pharmaceutical Group, Global and Xinyi medicine, etc.

However, China is very strict in the control of online pharmacies. Before being allowed to sell, online pharmacies need to obtain the drug internet trading service qualification certificate from the government. These certificates are divided into three types: A, B and C. Type A certificate is for third party trading service platforms, and only for platform operations. Companies with type A certificate can operate the B to B business between professional medical institutions. They are transaction platform for medicine producers, medicine sellers and medical institutions. They are not allowed to sell to individual consumers. The Chinese government issued only 20 type A certificates in the whole nation. Organisations who hold a type B licence can involve in B to B medicine transactions between other enterprises, except those firms in type A. In the whole China there are 82 type B certificates. Firms with a type C certificate are allowed
to manage B to C businesses, but just selling self-operated OTC drugs to individual consumers. There are 270 type C certificates in the whole country.

According to ‘Provisional Regulation on the Approval of Internet Drug Business’ issued in 2005, if a firm wants to obtain the type C certificate to sell drugs to individual consumers, the firm must meet some conditions. The applicant must establish the drug chain retail enterprises according to the law requirements. Firms such as Taobao pharmacy, Jingdong (NASDAQ:JD) pharmacy which only cooperate with other pharmaceutical companies in the retail business do not own any retail firms, and therefore do not conform to the terms of the type C certificate.

Owing to the manifold regulations and restrictions imposed by the national policy, it is difficult to carry out marketing and promotion activities in this market. However, the purchase habit of the main consumer groups in China is changing now, and the cooperation between traditional e-commerce suppliers and pharmaceutical e-commerce suppliers has not stopped. The demand for drugs of patients is usually rigid, and the number of people who shop online is still growing rapidly.

One example is Taobao Medicine Mall. Taobao Medicine Mall was stopped and asked to make correction by Zhejiang Food and Drug Administration in June of 2011, because it did not have the qualification for online drug selling. After the correction, the Tmall Medicine Museum (Official Taobao Medicine Mall) opened again in 2012. In accordance with Taobao’s characteristics of complete category, there are six projects including OTC pharmaceuticals, medical equipment, health supplies, contact lenses, brand healthcare products, and traditional tonic in Tmall Medicine Museum.

Now there are nearly 80 retail pharmacies entering the Tmall Medicine. Pharmaceutical retailers in collaboration with Taobao make a profit sharing according to the sales. The network effect and the scale economies deriving from the 200 million Taobao users is the main reason that induces medicine e-businesses to be willing to cooperate with Taobao.

According to the Ministry of Commerce, only three of the top 10 retail pharmacies opened the online pharmacy. The bottleneck of online pharmacies is the expensive marketing and promotion. Therefore, the Tmall Medicine Museum provides an e-commerce pilot for the major entities that do not want to take any policy risk.

As to customers, there are two categories of target customers for the Tmall Medical Center. The first category includes the experienced online shopping customers, who buy medicine online for convenience and they prefer low price; the second category is made up by those who urgently need drugs, and who are not sensitive to price. The turnover rate of the price sensitive customers is high and it is very difficult to obtain their loyalty.

4.2.5 Nine An Medical: the combination of hardware and software for the two-sided market of healthcare management

Nine An Medical is the first domestic listed company providing mobile medical hardware equipment in China. Its iHealth series of mobile health management product line has a stable export market share, and a broad domestic market potential. With the permission of Apple Corp, Nine An Medical registered in the USA the trade mark ‘iHealth’. And at the same time it established a laboratory with about 50 people in the Silicon Valley (Tianjin Nine an Medical Electronic Limited Company, 2013).

From 2011, Nine An Medical introduced a series of hardware and free applications allowing intelligent blood pressure measurement, blood glucose measurement, weight
control, wearable smart watches, etc. In the future, its field will cover four directions including health, maternal and child wellbeing, security, and home furnishing. Nine An Medical has set up different branches respectively in USA (the already mentioned plant in the Silicon Valley), Hong Kong, and Paris. A new factory in China is also about to be launched.

The business model of Nine An Medical is the following: at the very beginning, it relies on hardware sales. When hardware business reaches a certain amount, this means that the firm can count on a number of loyal users and a two-sided market can emerge. Revenues can in fact be obtained also through platform services. In developed countries, besides the revenues coming from the hardware sale, the medical APP can realise stable profits by means of cooperation with doctors, business insurance companies and pharmaceutical firms. However in China, which is still a developing country, the medical APP platform still have difficulties in finding large customers and realise profits.

In the early 2014, the stock price of Nine An Medical continuously touched the maximum daily limit for several days, which reflects the highly recognition from the market. But its products still face some challenges. For example, achieving customisation from the detection data requires a large number of physical sample data and professional medical analysis models. In order to develop a real professional testing product, the company also needs to enter the national medical equipment approval system.

Except for Nine An Medical, there is another listed company, Sannuo Creatures, which launched small testing equipment based on smart phones and relying on its traditional biochemical technology. By inserting the headset jack, mobile phone data can automatically be transmitted and then stored in the mobile phone software. Keeping track of patients for more than three months, the software of Sannuo Creatures can customise health prescriptions according to patients’ personal data. At the same time, it can also help users better manage their blood glucose levels.

According to the standard for the mobile medical industry from the Global Mobile Communication Systems Association, iiMedia Research predicts that in 2017 China wearable portable medical equipment market sales will approach 5 billion Yuan (RMB). Other wearable devices for elderly and infants include small monitoring instruments, with built-in cellular radios, GPS and Wi-Fi modules, and acceleration sensors. It can be worn around the neck like a pendant and it allows identifying the location of the user. If the elder person accidentally slips, the instrument can send an alert to the emergency contact. For the baby there is an ankle wearable device which supports Bluetooth and companion APP. It can monitor the baby’s sleep, heart rate, temperature and the humidity of the surrounding environment. Parents can see these real time data in the specific APP, and receive alerts when an exception occurs.

4.2.6 Hospital WeChat platform: achieve low cost doctor-patient communication through WeChat (B to C)

In a very short period of about two to three years, WeChat has grown up to be the most powerful point to point information delivery media, with more than 600 million users. Many hospitals have opened their own WeChat Platform and usually every hospital has a We-hospital APP. A lot of users install and use this platform that provides first-hand information for patients with medical treatment. For example, School of Stomatology of Peking University uses WeChat’s powerful ability of information interaction, reducing
hospital information cost, and building the bridge for doctor-patient communication. We-hospital has the following characteristics:

1. **Easy to use**: Patients just scan the quick response code and then download the APP. WeChat’s voice function reduces the threshold of digital medical treatment. Even if the elderly are not able to use mobile phones keyboards, they can easily use the voice function for feedback of their opinions and suggestions. As regards hospital staff, they can choose to respond and deal with the patients’ questions flexibly. At the same time, they can send messages to a lot of people to achieve information transmission and communication using the batch sending function of WeChat.

2. **Realising service customisation**: when users submit questions, WeChat can reply automatically according to rules or code setting in advance through subscription service, for example the classification of clinic departments, daily visits list of doctors, and clinic closing information, etc. By means of WeChat, referral patients can confirm whether the expert she/he wants to visit is available before going to the hospital. Through an automatic service, hospitals can reduce the costs of customisation for those general questions.

### 5 Conclusions

MDH industry keeps rapid developing all over the world. I describe its business model and further clarify its value chain in this paper.

I explore the MDH industry, estimate the market size of MDH, and analyse differences between traditional medical services and MDH services. Based on these, I meditate the components of MDH value chain, and then deeply excavate its characteristics. Comparing to the traditional medical value chain, MDH makes great progress in different ways. It firstly moves from product orientation to customer orientation, then improves production efficiency through the virtual value chain, finally it benefits the small and medium sized enterprises (SMEs) through the virtual value chain.

The current business model of MDH has two main trends for the future development. One is B to C business model which is now moving from free to fee, another is B to B business model which is a good solution for asymmetric information in health industry. Finally, I raise six cases as examples for further understanding of the evolution process of Chinese MDH industry.

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