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Balance between Privacy Protecting and Selling User Data of Wearable Devices

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ABSTRACT

Smart bracelets are capable of identifying individual data, which can synchronize the step count, mileage, calorie consumption, heart rate, sleeping data and even the pictures users uploaded with the APP. This feature is so convenient on one hand but makes us lose control of our privacy on the other hand. With poor privacy protection mechanism embedded in these wearable devices that hackers can easily invade and steal user data. In addition, most smart bracelet companies have not made a clear declaration of which third parties are able to get users' data, nor how long will the user's physical and health-related information be stored. These companies understand well that large amount of the user's movement and physiological monitoring data are valuable, because each user's information can be a unique sample. As soon as the smart bracelet companies collect extensive and diverse samples, they can figure out a variety of specific and practical applications through excavate data.

Therefore, the research questions of this study are 1. how do smart bracelet companies strike a balance between protecting consumer privacy and selling user data to get more business opportunities? 2. In order to achieve this balance, what kind of strategy should smart bracelet companies adopt? This study addresses what measures smart bracelet companies take as well as what attitude they hold through literature review and the comparison of Fitbit, Xiaomi and Garmin's privacy policies. Meanwhile we adopt PEST analysis model and Porter's diamond model to engage external analysis of three main vendors in order to have a further understanding of the environment in which the industry is poised. At last, we apply the stakeholder analysis to determine what strategies the companies should take in correspondence after identifying the direct and indirect stakeholders of the smart bracelet companies.

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This research outcome indicates that beneficial tangible service is the main factor affecting consumers whether to share their data with wearable vendors, but vendors have to be aware of the impacts of privacy issues by selling user data. It is possible that consumers resist buying the wearable products if they find their privacy is disturbed. Furthermore, this study is valuable not only to wearable device vendors to strike balance between privacy and profits but also policy makers to figure out the necessity to get involve in personal data protection over wearable device market.

Keywords: wearable devices, smart bracelet, user privacy, PEST analysis, diamond model, stakeholder analysis

1. Introduction

In the era of Internet of Things (IoT), smart devices become affordable and indispensable to enjoy smart life style by using the capacity of perception, computing and transmission. With the rise of health awareness, people pay more attention to the benefits of doing exercise, which makes sports business rise in recent years. To capture this trend, major wearable device vendors have launched smart bracelets and smart watches, which enable people to monitor their physical conditions anytime and anywhere.

However, the wearables market is not growing as analysts originally anticipated. Last quarter (2016 Q3), unit sales across the entire market grew just 3% year over year, according to IDC data. That is quite a slowdown from the first quarter of the year, when wearable unit sales with an amazing number 67%. The growth momentum over wearable device market mainly comes from the smart bracelet. Fitbit is occupying the world's leading position with the market share of 29.4% in 2016 Q1 while Xiaomi gets the second place with the market share of 22.8% and Garmin, the third, with the market share of 5%.

Smart bracelets have a characteristic of identifying individual, which can synchronize the step count, mileage, calorie consumption, heart rate, sleeping data and even the pictures users uploaded with the APP. This convenience makes us lose control of our privacy, so with poor privacy protection mechanism embedded in these wearable devices that hackers can easily invade and steal the user data. Most smart bracelet companies have not made a clear declaration of which third parties are able to get users' data, nor how long will the user's physical and health-related information be stored. These companies understand well that large amount of the user's movement and

physiological monitoring data are valuable, because each user's information can be a unique sample. As soon as the smart bracelet companies collect extensive and diverse samples, they can figure out a variety of specific and practical applications through excavate data.

2. Literature review

There are five sections in this chapter. The first section is introduction of smart bracelet; the second section will introduce the US smart bracelet company, Fitbit; the third section introduces PEST analysis; the fourth introduces the diamond model, and the last section introduces the stakeholder analysis method.

2.1 Wearable device

The term "wearable device" is familiar with Google's Google Project Glass in 2012. In 2013, different kinds of smart watch as well as smart bracelet have been launched while Apple CEO noticed that Apple Watch would come out in 2014 and officially launch on March 2015, which makes wearable device catch customers' attention deeply.

The characteristic of wearable device is to be able to wear, more accurate than the human brain, faster data operations, and combined with human needs in a variety of sensing functions and cloud services. Industrial Economics and Knowledge Center (IEK) divides wearable devices into five types: glasses type, watch type, wearing-as-a-cloth type, wearing-as-a-band type, and attached type.

Moreover, the wearable devices can divided into five fields based on its application market segment: information and entertainment, fitness and health, medical and care, safety and preservation, professional and special. The fitness as well as medical care are two major application markets for wearable devices, which develop earlier and faster.

2.2 PEST analysis

In analyzing the macro-environment of an organization, it is important to identify the factors that might in turn affect a number of vital variables that are likely to influence the organization's supply and demand levels and its costs (Johnson and Scholes, 1993).

The analysis examines the impact of each of the factors on the business. The results can be used to take advantage of opportunities and to make contingency plans for threats when preparing business and strategic plans (Byars, 1991). Kotler (1998) claims that P.E.S.T analysis is a useful strategic tool for understanding market growth or decline, business position, potential and direction for operations. The use of P.E.S.T. analysis can be seen effective for business and strategic planning, marketing planning,

business and product development and research reports. P.E.S.T. also ensures that company's performance is aligned positively with the powerful forces of change that are affecting business environment (Porter, 1985).

Economic conditions affect how easy or how difficult it is to be successful and profitable at any time because they affect both capital availability and cost, and demand (Thompson, 2002). Economic conditions are influenced by political and government policy, being a major influence affecting government decisions. The socio-cultural environment encapsulates demand and tastes, which vary with fashion and disposable income, and general changes can again provide both opportunities and threats for particular companies (Thompson, 2002). Technology is widely recognized by various literature on strategic management (Capron and Glazer, 1987; Johnson and Scholes, 1993; Jan, 2002), as part of the organization and the industry part of the model as it is used for the creation of competitive advantage.

2.3 Diamond model

Michael E. Porter proposed "Diamond Model" in the book "The Competitive Advantage of Nations" in 1990, saying that the country is the most basic competitive advantage of the enterprise because the country can create and sustain competition conditions, the government not only affect business decision-making, but also the core to create and sustain production and technology development.

Porter believes that there are specific elements for industry development and the form of industry will change due to the interaction between different elements.

Diamond model is used to explain the industry development in different countries.

There are six factors in Diamond model :

- Factor conditions: special performance of production in the specific industry.
- Demand conditions: domestic market demand for products or services from the industry, including the downstream industry.
- Related and supporting industries: whether the related industries and the upstream industries are competitive.
- Firm strategy, structure and rivalry: the organization and management of enterprises within the industry, as well as the situation of market competition.
- Government: playing the role of impact, which have a certain degree of influence.
- Chance: Some conditions that will change the country's competitive advantage and industrial environment.

2.4 Stakeholder analysis

Participatory methods are widely seen as essential to address the difficulties of environmental policy and decision-making. Stakeholder analysis is one of the most popular approaches to better understand the interests of the main parties. According to the early definition by Grimble and Wellard (1997), “stakeholder analysis can be defined as a holistic approach or procedure for gaining an understanding of a system (.) by means of identifying the key actors or stakeholders and assessing their respective interests in the system”. For more specific definitions, also see the reviews by Brugha and Varvasovszky (2000) and Reed et al. (2009).¹ However, although extensively applied, stakeholder analysis in the narrow sense is often done on an ad hoc basis (Reed et al., 2009) and laundry lists of concerns are collected (Hermans and Thissen, 2009). Stakeholder analysis is criticized as somewhat wanting with respect to analytic quality and academic rigor, and there seems to be considerable confusion over the concept and practice (Reed et al., 2009). On the other hand, earlier papers already recognized that stakeholder analysis can encompass various methods of analyzing stakeholder interests (Brugha and Varvasovszky, 2000). The classic paper by Grimble and Wellard (1997) observed developments parallel to stakeholder analysis that can support decision-making in the case of conflicting objectives (multi-criteria analysis) or can address policy disputes (conflict or alternative dispute resolution). Recent systematization has provided a typology of stakeholder analysis methods (Hermans and Thissen, 2009; Reed et al., 2009).

3. Research method

This study aims to explore what strategies smart bracelet industry can make to balance protecting consumer privacy and sharing information with third parties, then discuss whether the government should be involved in protecting consumer privacy. This study uses the industry analysis method and the external environment analysis through secondary data to understand the environment of the smart bracelet industry, and then uses the internal analysis to scope to a company. Ultimately, this paper will give substantial views and suggestions to the company.

Fitbit, smart bracelet company in United States, holds nearly one-third market share of the world in 2016 Q1. According to information provided by FactSet, a multinational financial data and software company, about three-quarters of Fitbit's revenue comes from the US market in 2016 Q4. Consequently, this study focus on Fitbit's state of operation in the United States.

4. Model analysis

This study will analyze how the environment in United States affects smart bracelet industry by PEST analysis.

4.1 PEST analysis

Political Analysis

Safe harbor was developed during 1998-2000, allowing the European Union and the United States to circulate personal identify information. It is also a self-regulating policy and mechanism, which is set up to meet government regulatory and legislative objectives.

The European Committee decided to implement Safe harbor in July 2000, allowing the transmission of EU data to US companies with certification. However, the European Court announced in October 2015 that the earlier International Safe Harbor Privacy Principles framework was ineffective. Shortly thereafter, the European Committee and the US government began to talk about a new framework and reached a political agreement on February 2, 2016.

The US-EU Privacy Shield is a framework protecting Cross-Atlantic exchange of personal information for commercial purposes. One of the aims is to make it easier for US companies to obtain personal information from EU entities under EU privacy laws. The US-EU privacy shield is a substitute for Safe Harbor, although the privacy shield has made significant improvements, but three major concerns remain, including the removal of data, the collection of large amounts of data, and the clarification of the new ombudsman mechanism. The European Committee adopted the framework on July 12, 2016 and entered into force right on the same day.

The new requirements for participating companies are as below :

- Informing individuals about data processing
- Providing free and accessible dispute resolution
- Cooperating with the Department of Commerce
- Maintaining data integrity and purpose limitation
- Ensuring accountability for data transferred to third parties
- Transparency related to enforcement actions
- Ensuring commitments are kept as long as data is held

Economic Analysis

Since the outbreak of the financial crisis of 2008, the United States has undergone Subprime mortgage crisis. Large financial institutions bankruptcy, unemployment rate soared 10%, bulk commodity prices plummeted, confidence of financial market

collapsed, which brought the world into depression. In order to resist the weak economy, US government implement QE policy in November 2008.

From the economic data released recently, we can find that the unemployment rate, GDP growth rate, purchasing managers index, consumer confidence are better off from the third quarter of 2016. Without a doubt, the United States has become the most robust country in mature market due to the US business technology development and innovation.

Social analysis

Most Americans think it is important for them to keep their privacy in the common activities, and these thoughts will be more obvious when they know who is collecting information. They believe that it is reasonable for companies or other organizations to collect and store data, but because the Americans have very low confidence in the privacy and security of various maintenance records, the type of organization that retains data and the time of data storage will have a certain impact on them.

Pew Research's report found that Americans would consider many factors when making decision in privacy-related circumstances. Such as the value of the benefits, their living environment, their feelings towards the company collecting data, what happens after their data is collected and how long these data will be stored. While many Americans are willing to share personal information in exchange for tangible benefits, they tend to be very cautious about disclosing their information, especially health information because they worry about the negative effect when they are trying to get the insurance, credit, or to find a job.

In addition, according to the research from eMarketer, young people are the main wearable user. eMarketer also estimated that about 60% of adults between 18 and 34 years old will be wearable users, which is much higher than the 17.6% penetration rate of the population in 2017. The reason why young people are interested in wearable devices is that they are curious about fitness tracker, which has low price and clear product position that is meaningful to this group but not others.

There is another interesting survey found that the initial users are mainly male among the wearable users, but the user group becomes different after the fitness trackers continue to expand. Women are under the incentive to lose weight and keep shape so that they become the main consumer groups ultimately.

Technological Analysis

The entry barrier of wearable market is not high because every vendor can develop smart bracelets with similar functions, such as measuring heartbeat, calculating

the number of steps, recording walking mileage while the only difference is accuracy. If consumer buy the smart bracelet as consumer electronics products, then it will be acceptable as long as the deviation is not too exaggerated.

In terms of functionality, although we expect the smart bracelet can do more, for example: measuring blood pressure, blood sugar, body fat and so on, the technology has not yet been breakthrough to do so.

Data transmission technology is similar as well, the data will transmit to the phone through Bluetooth, and then uploaded from the phone to the company's cloud server for management and storage. The difference between manufacturers is that after they have obtained the health information collected from consumers through the smart bracelet, how they will use the information and what kind of value-added services they will provide to meet the consumer's need.

4.2 Diamond model

Factor conditions

In the near future, the labor force cost only physical power and time should no longer be classified as factor condition, because the robot as well as artificial intelligence will completely replace this low-level labor force someday. When the day comes, "limited resources "will no longer be a problem to United States.

Demand conditions

In 2016, Gartner Personal Technologies Study conducted an online survey of 9,592 objects in Australia, the United States and the United Kingdom between June and August 2016, in order to understand consumers' attitudes towards wearable devices. The results show that the use of fitness trackers has entered the early stage of mainstream (19%) and the utilization in the United States is 23%. In addition, consumers buy fitness trackers are usually for themselves, only 34% of the fitness trackers are given as a gift to others. Instead of technology fans or early adopters of science, mainstream consumers are the drive for smart watches and fitness trackers to grow continuously. The biggest obstacle fitness trackers and smart watch suppliers have to overcome is consumers believe that the value of these devices is not attractive enough.

Related and supporting industries

Although the market penetration is not as good as smart bracelet, smart watches, the most powerful competitors to smart bracelet, are still optimistic because of the software applications. For instance: Fitbit acquires Pebble and Vector, recruiting the former's software engineers, UI designers under the command, and take the latter's smart watch R & D design team as well as software platform.

In terms of upstream manufacturers of smart bracelet, PMOLED is widely used in the 6-inch display. In the PMOLED industry chain, there are equipment manufacturers (development / etching, coating / packaging, inspection / testing), material manufacturers (ITO Glass, organic materials, polarizing plates, and sealants), and assembly parts manufacturers (driver ICs, circuit boards, and passive components) as upstream manufactures. Midstream manufacturers are OLED display panel production and module assembly, while downstream applications include computers, communications, automotive, consumer electronics, and aerospace and so on.

According to Display search statistics, shipments of PMOLED in 2014 are 53.36 million, and will increased to 60.22 million in 2018. PMOLED is competitive in the 6-inch display market because of its simple structure and low manufacturing costs. It enhances the steady growth of shipments due to the benefit from wearable market.

Firm strategy, structure and rivalry

The growth rate of wearable devices market is gradually declining, and even some people predicted that the market would gradually shrink. Many wearable device manufacturers have shut down, but because of the reduction in the number of manufacturers, the entire market intensifies competition. Coupled with the function of wearable device has overlapped with smartphones, smart bracelet operators have to find ways to differentiate in order to survive. For example: Fitbit will soon be set up their own software store for wearable devices, because a new wearing device software store will help the development of Fitbit, especially when Fitbit is currently expanding its partnership with corporate group users as well as the healthcare industry. In addition, Fitbit also acquired a payment company called "Coin" in 2016. The purpose is to develop mobile payment function for its bracelets, watches and other wearable devices. The market research firm IDC's report shows that in the global wearable device market, is forming a three business-led pattern, namely, Apple, Fitbit and China's Xiaomi, which sales mainly in the Chinese market. Therefore, Apple watch stands as the biggest competitor of Fitbit in the international market.

Government

The US Congress pass the 21st Century Cures Act final version on December 7, 2016, to protect the United States from the legislative level that United States will provide 4.8 billion US dollars to carry out a series of innovation Research and development in the next 10 years. The bill also stipulates that the Food and Drug Administration (FDA) will receive \$ 500 million to approve procedures. The reforms required by the bill include speeding up the approval process of certain antibiotics, speeding up access to medical equipment, and providing new guidance documents for

drug discovery.

On the other hand, the relaxation or exemption approval of health care products, such as smart bracelet or calorie monitoring APP can give smart bracelet operators a new option to enter healthcare field rather than just focus on fitness.

Chance

There is no breakthrough in science and technology in smart bracelet yet, the global financial markets or exchange rates have not changed significantly, and there is no incidents that business or government cannot predict or control the in advance. Consequently, using existing resources to achieve product differentiation is the way to keep competitive in smart bracelet industry.

4.3 Stakeholder analysis

Table 4-1 Types and Strategies of Stakeholders

		Stakeholder's potential for threat to organization	
		High	Low
Stakeholder's potential for cooperation with organization	High	Mix blessing Strategy : collaborate <ul style="list-style-type: none"> Third-party applications suppliers 	Supportive Strategy : involve <ul style="list-style-type: none"> Customer employee R&D team Manufacturer
	Low	Non- supportive Strategy : defend <ul style="list-style-type: none"> Government Competitor 	Marginal Strategy : Monitor <ul style="list-style-type: none"> None

Source: this study

Mix blessing Stakeholder

Third-party application suppliers are more likely to cooperate with Fitbit, but they are also threatening because third-party apps may be another way that attracts

consumers to use smart bracelet. The third-party applications with entertainment will make consumers more motivated to use smart bracelet like the game “Wokamon”.

In exchange, Fitbit will share the data with third-party application suppliers, so that they can better improve their content, and consumers will be willing to use smart bracelet and its app continuously.

Supportive Stakeholder

This type of stakeholder is high cooperation, low threat, including customers, employees, R & D team and manufacturers. They work hard to help the company have better development and make profit. Just like smart bracelet users, when they find some problems of the smart bracelet, they may send an e-mail to inform the industry, so that the company can improve their products.

Non-supportive Stakeholder

This type of stakeholder has low cooperation with the company, and it is threatening, including competitors and the government. The biggest competitors of Fitbit are Apple and Xiaomi. In order to prevent them grabbing Fitbit’s original or potential customers, Fitbit need to come up with the corresponding strategy, such as the acquisition of Pebble and Coin to provide different services for consumers.

5. Conclusion and Suggestions

After organizing and analyzing data in this study, we think that it is an inevitable trend for the wearable operators sharing user information to third-party application vendors. "Information sharing" has already become a new business model in the IoT era. Third-party application vendors just have to analyze the data shared by wearable operators, and then they can advertise accurately to customers who are interested in their products or services. This may make customers increase their consumption, so that they create profits for third parties, and wearable operators can withdrawal commission.

From government's point of view, its involvement of protecting consumer privacy is not high. It regulates smart bracelet operator to protect user privacy through legislation and promulgating policies. However, previous data also shows that people is willing to use their own information in exchange for tangible services, especially when the services are beneficial. For instance, "Are you willing to provide your relevant health information to let us provide a suitable fitness plan for you?" Many people may agree, because the advantages outweigh the disadvantages. This kind of behavior makes people leak their privacy out, as long as their lives are not being disturbed, it will be acceptable to use personal information in exchange for a good service.

Therefore, the study believes that the key to protect consumer privacy is users

themselves. If the user himself is a person who pay attention on his own privacy, then he has to think twice before he accepts the service, after all, the more suitable services, the more relevant information is in need.

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