

Evolution of Sanitary Pads: From the Traditional Product to a Tethered Digital Platform

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ABSTRACT

Digital platforms have made a dramatic impact on the modern economy. Firms with business models anchored on digital platforms are generating unprecedented value. Much of this value comes through unlocking the power of data. Exemplars are companies such as Didi, WeChat and Alipay. Previous research has illuminated many aspects of such digital platforms and how they unlock the value of data. However, we have more to understand on how traditional companies, built on value chain-based business models, can create similarly unlock the value of data. In this paper, we study a traditional product, namely sanitary pads, to demonstrate how traditional firms can unlock the value of data similar to what digital platforms can do. This paper will discuss the role of sensors and how sanitary pads can be extended into digital platforms.

Keywords: Digital platforms, data, digital transformation

1. INTRODUCTION

The twenty-first century has ushered in a new digital era. Today, almost all firms have either already conducted or are about to engage in several initiatives to explore new digital technologies and exploit their benefits [1]. With the rapid advancement of digital technologies such as the Internet of Things (IoT), sensors, Artificial Intelligence (AI), and cloud computing, the use of data has exploded in every industry and every business. QR codes are replacing fliers; all types of tickets are going digital; now, it is a fingerprint or an iris. Similarly, newspapers and famous fashion magazines such as Vogue and Harper's Bazaar are primarily read digitally.

Many physical products are becoming digital. And as they do, these products also become massive sources of data. This data is also being used to provide several new digital experiences. Video apps use users' browsing history to analyze their preferences and push similar videos, leading to software addiction. LG Electronics and other home appliances have also added artificial intelligence (AI) to make users' lives more convenient. According to LG's official website, their TV uses data from smart home appliances via Wi-Fi communication to

change the picture and sound according to the content of the video to give users better visual and auditory effects. Delivery apps generate data in terms of customers' orders, delivery locations, GPS, allowing consumers to register with a regular local store on a digital platform for long-distance shopping. Through these examples, we can see that big data analysis is being applied in various industries with different strategies. It may not be seen through the eyes, but it profoundly affects every aspect of our daily lives.

Interactive data is at the heart of new technologies that are changing the functionality of many traditional products. Interactive data is a continuous streaming of data as users interact with products. Take the example of smart mattresses that generate interactive data through sensors. The smart mattress is a research hotspot in the field of intelligent health care based on the Internet of Things (IoT). By generating data through sensors on a user's sleeping position, mattresses can be customized for various softness and adjust the shape of our spines. The product has crucial enabling significance for competent medical care using cloud platform storage, big data analysis, and other technologies [2]. On the other hand, non-essentials like sunglasses are not as ordinary as they seem. With the power of data from sensors, sunglasses

can now be used not only as protective shades but also as unplugged earplugs. It plugs into the side and allows users to control audio, voice controls, and automatically pairs with the phone. Downloading an external smart-phone application also allows much more customization to the sunglasses, such as recording wirelessly, using "Find my Glasses." With the help of big data, traditional products are becoming more diverse and functional. Customers can consume a single product with multiple functions and low prices. By comparison, the industry that generates the data is more competitive than other industries.

The manner by which many products are collecting data, they also have started operating as digital platforms. Digital platforms are business models that are anchored on creating value through connecting various entities and generating exchanges using interactive data. For example, Facebook connects friends and facilitates social exchanges among them. Didi connects drivers and riders and facilitates the sharing of offering and consuming rides. These kinds of exchanges were rare among products. However, now with the kind of data products can generate, they can offer a broader range of features and services. Tennis rackets can facilitate players to connect and arrange pickup games using interactive data. Toothbrushes can connect users to dentists. Subramaniam and Piskorski described them as tethered digital platforms, wherein new digital platforms are tethered to traditional products [3].

This paper discusses one such traditional product - sanitary pads, that is evolving into a tethered digital platform.

According to the AskCI Consulting Co., Ltd., the market demand for women's care products is expanding on account of women's raising awareness toward physical health [4]. Specifically, China's expenditure on menstrual products is also growing, leading to ascending demands upon sanitary pads. Furthermore, a significant number of women in China are using menstruation apps such as Dayima and Meiyou (known in English as Meet You) to record and analyze their body information, indicating a new rising demand for data collecting and analyzing. In the Women Health App Market in 2016, Dayima ranked first by occupying 60.1% of the user coverage rate in the industry; the number of monthly active users of Meiyou came to the top, reaching 13.189 million [5]. However, rather than direct capturing data from users, apps like Dayima and Meiyou gather data through users' manual input, which results in the gap between users' actual body records and what is shown in the apps. In this case, women do not have products that could provide them with valid data to ensure their health. Based on the current vacant market, evolving the traditional pads into intelligent ones and the tethered digital platform to provide precise and reliable data is reasonable and meaningful.

The research on how traditional products such as sanitary pads can compete in this digital era is limited. Hence, the purpose of this paper is to explore how the digitally transformed sanitary napkin industry competes with data. Our paper is structured as follows: First, we present a literature review on digital platforms and how traditional products can act as digital platforms. Then, we offer our core framework that focuses on three parts: how we use sensors for our product; the composition of the platform users; services that are provided in the tethered digital platform. After we discuss the framework, we will present a marketing plan. Our article is broadly about how traditional products can engage in digital transformation and remain relevant in the modern digital era.

2. LITERATURE REVIEW

2.1 Platforms and Digital Platforms

2.1.1 Platforms

Platforms generate exchanges. By mediating different groups of users [6], the platform works as a business model that promotes exchange between platform users [7]. Restaurants are a type of platform where buyers and sellers exchange foods and currency. Operators and consumers exchange services and currency on platforms such as beauty salons or auto maintenances. Other than products and services, information is also an element of platform exchanges. A restaurant may know a customer's preferences toward foods through the orders. Cashiers of shopping malls may know a customer's size and style of outfit when checking out. However, platforms and their users get benefits only when the exchanges actually occur. For instance, in shopping malls, the exchange only happens at the moment when customers are checking out at the cashier counter no matter how long they spent and what they did in the shopping mall. If customers do not buy anything in the end, no products, services, or information are exchanged.

2.1.2 Digital Platforms

Digital platforms, as software-based platforms [8], facilitate exchanges using data. It can be regarded as an extensible codebase that incorporates various modules that are designed, developed, and provided by third-party developers [6]. Take Meituan, a food delivery platform in China, as an example. It cooperates with various third parties, such as restaurants, coffee shops, bakeries. Users of Meituan can place online orders remotely. What is more, Meituan, as a digital platform, breaks the limitation of space. Users can glance over and order from large quantities of restaurants located at different places without driving from one place to another. In addition, exchanges of data and information happen everywhere and at every time on the digital platform, regardless of whether deals actually occur between buyers and sellers.

Many digital platforms, like Amazon, Facebook, Taobao, capture and analyze users' browsing history and suggest potential contents that may appeal to their users. The scale of data and information exchange generated by digital platforms is way more massive than that facilitated by traditional platforms.

2.1.3 Tethered Digital Platforms

Firms competing in today's markets have to find design structures that tie their value chains to new platforms. This is called tethered platform [3]. Compared with digital natives like Amazon and Taobao, tethered digital platforms are born with mature products. Based on tethered digital platforms, traditional products can create massive exchanges of data and information as those digital natives do.

A tethered digital platform has four essential components -- a sensor tied to the product; data generated by the sensor when using the product; platform users who can easily make exchanges; and platform services generated through those exchanges [3]. The data created is tethered as the scope and competitiveness are tied to the product.

Applications of tethered digital platforms have appeared to many traditional physical products. For example, a car company's smart car is linked to a navigation system. It can associate with a digital platform that customers can use on their mobile to do other things like navigating to a Starbucks with an advance order.

2.2 Advantages of Digital Platforms and Tethered Digital Platforms

2.2.1 Multi-sided Platform Users

Hagiu and Altman emphasized the benefits of shaping regular products and services into multi-sided platforms that welcome multiple groups and the advantages of facilitating interaction between customers and these groups [9]. Van Alstyne et al. also affirmed that "facilitating interaction between external producers and consumers" (p. 4) is a way for platforms to create value [10], thus further affirmed the necessity and feasibility of including third-party entities in the user list of a digital platform. Third-parties, or complementors, that are attracted by the interactive data from the product and platform will develop complementarities that appeal to more end-users [11]. While there are also value-chain-based complementarities in the production ecosystem, the data-related complementarities generate in the digital platform have a far broader scope and commercial potential [12].

Most products have their complementors; however, traditional industries barely focus on the complementor network from the external entities. Once the

complementary entities and relevant services are well excavated and utilized, they will broadly expand the traditional revenue pool.

2.2.2 Network Effects

According to Katz and Shapiro, McIntyre and Subramaniam, and Slaughter, network effects commonly indicate the phenomenon that the utility a user derives from the product or service varies upon the number of other users, include individuals and organizations, who also consume the same product in the "network." [13-15]

Network effects can be classified into direct and indirect categories. Direct network effects, also known as same-side network effects, are directly related to the number of customers on the same side of the platform [16]. They occur when the value of a product rises, accompanied by the number of people using it directly rises [14]. Whereas indirect network effects, deriving from the extension of the user network [17], exhibit how the product value for individual customers increase when the variety of complementary goods or service increases in the network [18]. Based on the network effects, the more the network participants are, the richer the data is on the platform. This value attracts even more users to improve further the scale of data and value [10]. Many digital platforms, such as Amazon, Alipay, and WeChat, benefit greatly from network effects both directly and indirectly. Take WeChat, a popular communication App in China, as an example. For direct network effects, individual users may attach more value to this chatting App when their friends or other new users register on this platform. From the perspective of indirect network effects, the increase of quantities of other groups of entities enhances the value of WeChat towards primary users.

2.3 The Value of Sensor

Many traditional businesses such as banks, grocery stores, and restaurants have connected their services to specific digital platforms and thus gathered considerable data of their products, services, and customers. For businesses that sell value-chain-based products, the development of modern digital technologies provides them with one more choice: the use of sensors.

As one of the essential components of tethered digital platforms, sensors can be positioned on the products to collect every single product user's real-time and product-in-use information individually. They can gather refined, precise, and reliable data as long as they are sophisticated enough. Such information will further accumulate and contribute to a digital envelope representing the related physical product and its use [19].

Digital envelopes and sensors have been used in industry 4.0 for many aspects in various businesses to

either mitigate the cost by improving operational efficiency or expanding the scope of revenue through extended services at both internal and external levels. Based on the interactive data from sensors, many conventional products have evolved into intelligent ones. For instance, by analyzing the sleep patterns of individual users, a smart mattress can adjust its contours or even connect to other smart furniture to enable better sleep. The Nest thermostat connects its product-in-use information to external entities like cars and smartphones to analyze the optimal times of operating different appliances at home. Smart electric toothbrush like Oral-B offers customized brush heads based on the interactive data from the sensors.

In addition, unlike some modern industries born with digital platforms, traditional products barely have ways to capture interactive data. Even with the help of a tethered digital platform, a medium is still needed to connect the product and its in-use information to the tethered digital platform. In other words, conventional products need sensors to equip themselves with enough product-in-use information with high qualities to be competitive in modern industries with consumption ecosystems.

2.4 Digital Platforms and Digital Ecosystems

Digital ecosystems are networks of data generators and data recipients. According to Subramaniam, the ecosystem becomes digital when the fundamental interdependencies are propelled by new digital technologies and associated data connectivity [12]. There are two sides in the digital ecosystems: one side of manufacture and one side of demand, representing production ecosystems and consumption ecosystems in digital ecosystems. As Valdez-de-Leon had mentioned, digital ecosystems are organized and connected with modularity but not by hierarchical authority [20].

Digital ecosystems are the branches of digital platforms. They are approached and given opportunities from both the production and demand sides. As the number of users grows, so does the software's database. The Uber platform, for example, has generated 7 billion drivers, overshadowing local taxi drivers, and Hein stated that it was the broad network effect that builds digital platforms [8]. As more customers and drivers join the software, Uber receives new data and generates it into its

database. Over time, the digital ecosystem has expanded while collecting more data.

These types of ecosystems have been described as consumption ecosystems, where ecosystems depend on how customers interact with the platform and how they use the platform. Traditional products can also be transferred into consumption ecosystems by shaping them into tethered digital platforms.

3. FRAMEWORK

Figure 1 below represents our framework.

Based on the theoretical concepts mentioned in the prior session, we use sanitary pads as an example to see how a traditional industry that builds on value-chain can evolve into consumption ecosystems by shaping itself into a tethered digital platform.

Four aspects will be illustrated in this part: 1) a framework that shows the core ideas of this transfer; 2) how we use sensors; 3) the composition of the platform users; 4) services provided in the tethered digital platform.

The whole process can be visualized into a pyramid shape, indicating that each step is based on accomplishing the former steps. One of the critical steps is the use of sensors. By positioning a sensor in each sanitary pad, the traditional pads evolve into smart ones. In this upgrading process of shaping smart sanitary pads and the tethered digital platform, however, sensors are only the means of getting interactive data. Such data is also the bedrock and core strength of everything. The data captured by the sensors will be immediately uploaded into the tethered digital platform and then integrated and analyzed to further support the platform services.

As the figure shows, unlike the traditional products that focus on value-chain-based services, a tethered digital platform makes it more achievable to expand the revenue pool and provide more after-sale services built on complementor networks. Thus, apart from the primary users of the smart sanitary pads, external third-party entities are also a part of the platform users. Because of interactive data, all the services on this platform are data-driven based. The tethered digital platform working as a bridge facilitates exchanges among primary users and third-party entities. Some platform services come merely from the primary users, while others come from complementary entities.

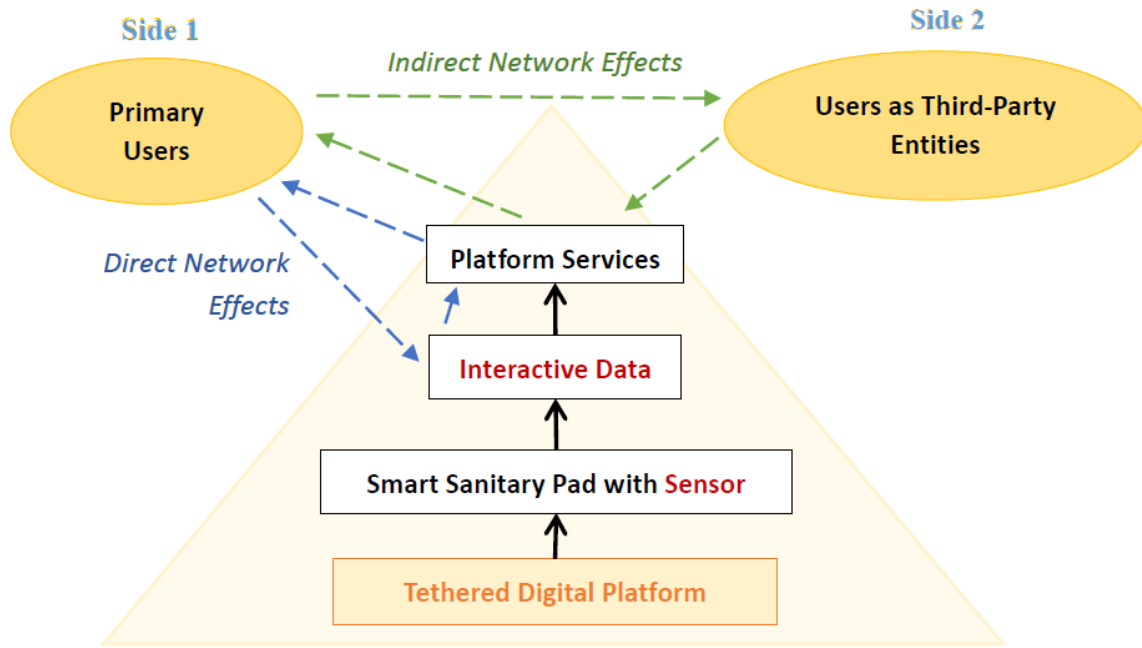


Figure 1 Framework of Shaping Sanitary Pads as A Tethered Digital Platform

3.1 The Use of Sensor and Tethered Digital Platform

As we mentioned before, it is significant for traditional physical products to equip with sensors to gather the interactive data that can be shared with multiple users so as to promote their evolution as a tethered digital platform. A traditional product such as sanitary pads needs sensors to generate interactive data and operate as a digital platform.

In our case, sensors will be positioned in each smart sanitary pad, capturing the product-in-use information of each user. Every sensor has a unique coding. Users are expected to download the tethered digital platform on their smartphones or other digital devices to decode the sensor and connect it to the platform they have logged on. Sensors will immediately start to work once they have been activated. The product-in-use information of each user will be privately listed in the platform for them.

In order to equip the tethered digital platform with enough interactive data that can support the analysis, sensors need to capture various kinds of data. This includes: 1) the time and duration of the period; 2) the real-time menstrual blood volume; 3) vaginal secretion; 4) menstrual colic level; 5) location; 6) moving status; 7) searching history. All the data will be analyzed further and lead to various services through the tethered digital platform.

3.2 Platform Users as Primary Users and Third-Party Entities

As shown in the framework in the former sub-session, platform users consist of two parts: primary users and external third-party entities. These two groups of users are equally crucial for implementing consumption ecosystems.

3.2.1 From Regular Customers to Digital Customers

When analyzing the rapid development and growth of digital-native companies, an evident fact is nonnegligible. The massive quantity of interactive data from digital customers often contributes to an impressive scope of value for improving and expanding companies' data-driven products and services. Compared with those digital natives whose primary customers are initially digital, firms that sell sanitary pads have no digital customers at all. This lack of digital customers is the main reason that impedes the traditional sanitary-pads industry from getting interactive data.

In other words, without digital customers, the firms that sell sanitary pads will have no access to accumulate essential and powerful interactive data. Thus, these firms are unable to establish a digital envelope to support the data-driven services further either.

Therefore, converting the primary regular customers of the smart pads into digital ones is dramatically significant. Conducting as a tethered digital platform also creates opportunities for the smart sanitary pads to accomplish customer transfer. The smart sanitary pads and the tethered digital platform will obtain a new

customer digitally as a stable interactive data source whenever a new customer downloads and logs on the tethered digital platform. As time goes by, the tethered digital platform will accumulate a considerable scope of interactive data. In addition, the more data from users that the digital envelopes cover, the more influential the platform's data analysis ability will be. With such an ability becoming more powerful, the data-driven services of the smart sanitary pads and the platform will be more impeccable.

restaurants, pharmacies, hospitals, psychological counseling and therapy institutions, the industry of smart furniture, and so forth. All of these complementors are included in our tethered platform user list. They can enhance value for our tethered digital platform by creating new external complementary services and shaping the tethered platform into a digital community with diversity and inclusion. We will further represent how these external third-party entities will enrich the platform services in the next sub-session.

3.2.2 Third-Party Entities from Complementor Network

For smart sanitary pads, complementors could be such external entities as navigation apps, supermarkets,

3.2.3 Network Effects Contributed by Digital Customers and Third-Parties Entities

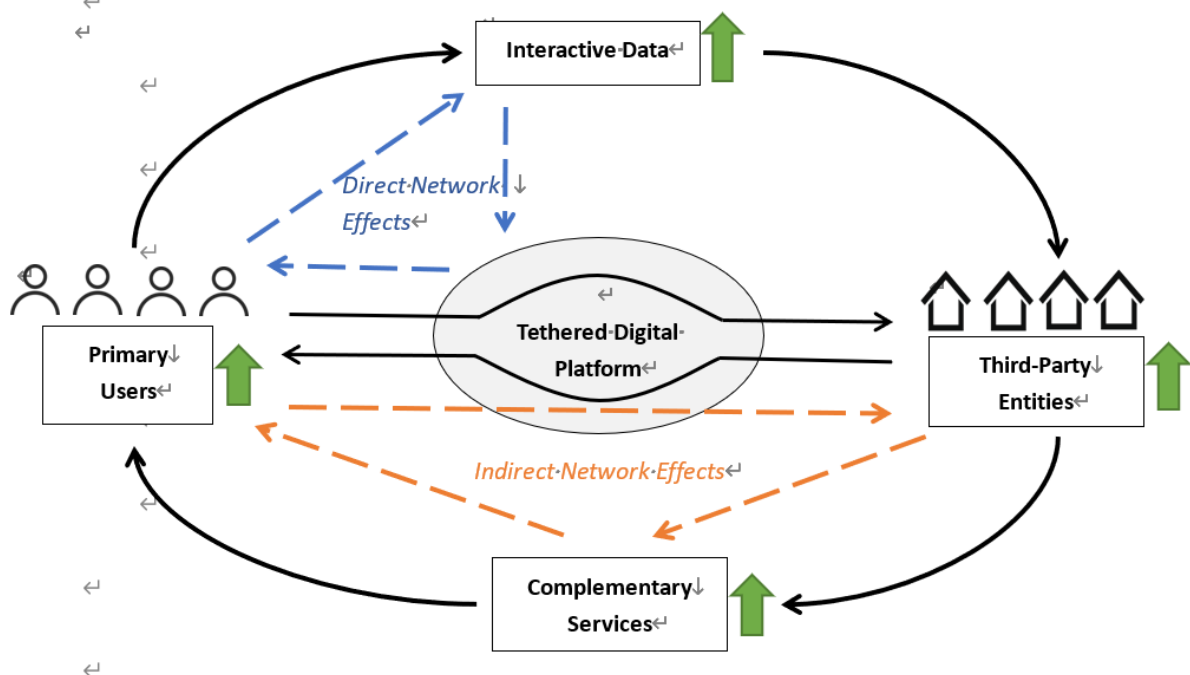


Figure 2 Network effects contributed by digital customers and third-parties entities

Based on the tethered digital platform, traditional products such as sanitary pads can leverage the two types of users, primary users and third-party entities, to combine direct and indirect network effects and make them into a positive cycle. As shown in Figure 3, the tethered digital platform works as a bridge, connecting each user and the external third-party entities. The increasing number of customers using the smart sanitary pads and the tethered digital platform will lead to the constant growth of the interactive data that our platform controls. From the direct network effects perspective, the smart sanitary pads' data-driven product features and services can be improved due to gaining more customers. On the other hand, at the level of indirect network effects, these substantial primary users and the related data with a high scope of value are potential business opportunities with great attraction for the complementors. With plentiful third-party entities entering the platform, those

entities may form competitive relationships and thus improve the diversity and quality of their products to stand out from the crowd of other entities. Platform value will be enhanced during such competitions and therefore appeal to more individual customers.

3.3 Platform Services

After generating and analyzing the interactive data captured from sensors, our tethered digital platform can provide users with data-driven services. These services can positively reinforce our network effects both directly and indirectly.

Some of the services are merely generated from the primary users and tethered digital platform of the smart sanitary pads through collecting and analyzing interactive data from primary users. To be specific, all the original data from the customers will be listed on our tethered

digital platform. Users have private access to their record of body information. By analyzing users' product-in-use information, our platform will give users their body condition feedback on the time, duration, volume of every period. Suggestions about healthy diets and proper exercises that can mitigate menstrual colic can also be made when the platform finishes the comparison analysis upon the menstrual colic level of users with different lifestyles. With the data of users' body records and searching histories, we may know what our users are facing or concerned about. Thus, the platform can lead users to relevant chatting and helping groups.

All of the services above are based on the interactive data from primary users of pads and the tethered digital platform. The rising number of users of our intelligent pads and platform will further enrich and precise our interactive data, thus, in turn, benefiting users by strengthening our data-driven services. During this process, the direct network effects of the smart sanitary pads will be enhanced.

In contrast, other services are derived from the connection within individual users, the platform, and the complementary entities. These services are apt to enhance the indirect network effects of the whole digital ecosystem as individual users attach more value to the tethered digital platform when the number of complementary entities rises.

In this aspect, we will either work as a bridge to connect individual users and third-party entities or as a transfer station that offers services from those entities for external services. Navigation applications, various stores like supermarkets, restaurants, and pharmacies will be invited into the platform so that our users can acquire shopping guidance from the platform. For instance, our platform can suggest whatever types of products and stores nearby the users with the help of these entities and data of users' location. Users can also do E-shopping on our platform. After checking out, home delivery services will be provided since delivery companies are also on the platform. In addition, institutions of psychological counseling and therapy and hospitals will enter the platform as well. Users can make doctor's, immunization, or psychological therapy appointments, do online counseling, or even accept the science education on the platform. Our platform offers remote assistance by contacting users' families and the emergency center of nearby hospitals. Apart from menstrual-related body records, sensors also gather users' moving status and location. Smart furniture thus will be connected to our platform. When the sensor captures the signal of the user's sleeping, for example, our digital platform will turn off the light and curtain. These services all build on the external complementary entities. The indirect network effects will be constantly reinforced when our tethered digital platform cooperates with more and more complementors.

4. MARKETING PLAN

4.1 Customers Transition from Regular to Digital

The engagement of digital users' allowing us to create more precise and extensive data is at the heart of everything. Therefore, transferring customers from regular to digital is a prior emergency for our smart sanitary pads. While sensors and the tethered digital platform will facilitate, to reach this goal, we still need some incentives when it comes to the marketing plan. For example, we will lower the price of the smart sanitary pads as a competitive tactic, offer registration rewards for new users and friend invitation rewards for old users. In addition, smart sanitary pads will be provided to college students for free to propagate their use and gather data. This will not only create a solid platform for future product development, but also gather a significant amount of data in the early stages. Following the trial time, we will solicit comments from the students based on their experiences. These comments from prior users toward the product can also be utilized to get prospective consumers to join us. The more digital users there are, the more accurate the data collected will be; thus, the more value will be generated for all parties.

4.2 Work with Third-Party Entities

With the increasing number of customers using our smart sanitary pads, we will definitely gain more digital customers and interactive data. Working with us benefits third-party entities a lot. Firstly, our platform can provide a vast source of customers for third-party entities. Also, with the permit from customers, some of the interactive data can be shared with other entities. Additionally, many of the third-party entities on the tethered digital platform can be each other's external complementors as well, which indicates that third-party entities that work with us acquire not only a source of customers but also a source of their own external complementors. Relying on our tethered digital platform, they can even develop a network of their own products.

4.3 Maintain Users Engagement and Adhesiveness

To stimulate user consumption, we will establish a perfect incentive mechanism. Customers can get points by daily check-in, sharing our app, making comments, posting messages, etc. These points can be redeemed for products, services, or discounts on their next purchase. We will also reciprocate with gifts or other services to express gratitude to our residential customers. Furthermore, the platform will create promotional activities regularly, both online and offline. To raise our social standing, we will invite experts or spokespeople to spread the word about our smart sanitary pads and hold

live streaming sales on other commercial digital platforms. We will regularly connect with consumers to obtain real-time feedback on the product and actively update it on our digital platform. More importantly, we are pleased to support further research in women's health by providing our interactive data with users' permission and collaborating with such organizations as the Women's Health Research Association, hospitals, or individual researchers of women's health. By doing so, we can improve our reputation and instill trust in customers.

4.4 Privacy of data

Users decide which parts of their data they wish to share with third-party users to reassure them. Furthermore, they have the option to discontinue their sharing at any moment. As previously said, we will construct our review process. We are committed to collaborating exclusively with reputable institutions and hospitals and ensure that our data's origins and direction will be transparent and available to the public. Third parties who utilize our data will publicly thank our users on the official website; or distribute modest rewards based on consumer preferences. Sincere collaboration is the foundation of trust. Our goods are intended to improve consumers' health awareness and are a modest step toward better developing medical research on women.

5. CONCLUSIONS

Firms in this digital era inevitably have to compete with data. Much previous research has verified the significance and validity of unlocking data value through digital platforms. Based on this research, we further analyzed how traditional legacy businesses that built on value chains, such as the business of sanitary pads, can also leverage and utilize the value of data. By using smart sanitary pads as an example, we highlighted how other traditional firms can also establish tethered digital platforms of their own and use sensors to capture new kinds of data. We described how sensors and the tethered digital platforms, other legacy firms too can accumulate considerable quantities of interactive data and provide users with dynamic data-driven services. Furthermore, tethered digital platforms can also diversify services significantly as external complementary entities are also included as a side of the platform users. Bridging by the tethered digital platform and interactive data, different sides of the platform reinforce both direct and indirect network effects, making the platform and the product more serviceable and influential in every aspect.

While we try to describe the transferring process as detailed and operable as possible, there are still inevitable limitations for our design of shaping traditional products into tethered digital platforms, especially when it comes to the practical level. Although conventional products

can all create their tethered digital platform, theories and models are, to some extent, too idealistic to accomplish in reality. For example, collecting valid data and building a platform may be challenging to carry out. Limited by the current technological level, sensors are not panaceas that can capture whatever data that firms need. Also, the spending on sensors and maintaining platform operation can be costly, which implies that firms with limited funds reservations may find it hard to operate as a tethered digital platform. This is especially the case for newly established companies. Lacking platform operation experiences and skills are also likely to put legacy companies in a difficult position where user engagement and stickiness may be low. Concerned about privacy problems generated by sensors and platforms, customers may be unwilling to accept the new transformation and upgrading of products.

However, although the above limitations may not be eliminated in the short term, the value of utilizing sensors and establishing tethered digital platforms is incalculable. By illustrating how the product of traditional sanitary pads should compete with data by shaping itself as a tethered digital platform and what are some practical marketing strategies used, we hope to explore a method for the traditional sanitary pads industry to be more competitive and comply with market requirements. Also, we hope to provide other similar firms based on the value-chain business model with valuable guidance, strategies, and insights.

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