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Innovation Toilet and Barriers of Diffusion in Developing Country Case Study: TOTO Electronic Bidet Seat Toilet

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ABSTRACT

The innovation of electronic bidet seat toilet in Japan has diffused to more than sixty percent of Japanese household while it has low rate of diffusion in other countries especially in developing country. From this phenomenon, it is interesting to understand about the barrier of diffusion, which focuses on the adopter categories of diffusion, barrier factors and proposition of key success factors of the diffusion in Indonesia as one of emerging economic and the member of G 20. There have been few studies about diffusion of innovation toilet, and this paper especially examines the diffusion of new innovations on electronic bidet toilet due to its successful diffusion among Japanese household, and further became a standard fixture toilet in Japan. This paper also discusses the product life cycle of electronic bidet toilet in Japan, global diffusion, identifies adopter categories and barrier factors of diffusion in Indonesia. Finally, theoretical propositions are developed on the diffusion of innovation for electronic bidet toilet in Indonesia.

Keywords: Innovation toilet, Barriers of diffusion, Indonesia, TOTO Electronic bidet seat toilet.

1. Introduction

The success or failure of an innovation in marketplace depends on how customer adopts the product, rate of diffusion among adopter population and the large of the market in a period of time [18]. Diffusion of innovations and the adoption of new technologies involve a process that formally observed and also studied by behavioral sciences research [16]. The diffusion theory analyzes and explains the adaptation of new technologies and describes the process of social change. The diffusion of innovation product in every country has different rate and the barrier of the diffusion factors.

Electronic bidet seat toilet is one of innovation toilet products which successfully diffused among Japanese household and further became a standard fixture toilet in Japan. This product also already diffused in global market but the diffusion in some countries was very low especially in developing countries. To understand the product life cycle and adopter categories and barrier of diffusion in developing country, this paper explores about innovation made by the

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company, and how the company developed the product and also identify the factors that creating barrier of diffusion electronic bidet toilet in developing country.

The research paper questions are as follows. What is the difference between American bidet toilet invention and Washlet innovation by TOTO? What are the electronic bidet toilet diffusion adopter categories in Indonesia market? What are the barrier factors of diffusion electronic bidet toilet in developing countries? To answer these questions, this paper explores the innovation and barrier factors of diffusion of this product in Indonesia as an example of developing country.

This paper is divided into the following sections. First section, on product life cycle, diffusion of innovation and technology adoption life cycle, reviews theoretical side. The history of electronic bidet toilet in Japan and global diffusion is discussed in the following one. After that, diffusion chasm of this product in Indonesia, adopter categories, barrier factors of diffusion and proposition, are also discussed.

2. Literature Overview

2.1 Innovation product life cycle and Diffusion of innovation

There are six technology stages in market growth pattern, technology development, application launch, application growth, mature technology, technology substitution and technology obsolescence [11]. Diffusion of innovation was first described by Gabriel Trade and Georg Simmel at the end of nineteenth century to the beginning of the twentieth century. In 1927, Kermak and Mckendrick proposed a model as the innovation diffusion mathematical model [8]. In 1962, Rogers propose diffusion as the process through which an innovation is communicated through certain channels over time among the member of a social system [16].

Rogers's model diffusion is based on the classical bell shaped normal distribution curve, the curve represents the frequency of the adopter categories. Rogers (1983) also described innovativeness as the level to which an individual or other unit of adoption is relatively earlier in adopting new idea than other members in a social system. He classified adopters into five categories: innovators, early adopter, early majority, late majority and laggards [6]. There is around 2.5% of adopter which called innovator. The 13.5% of adopters are "Early Adopter". Early majority adopter category is around 34% of adopters. Another 34% of adopters are the late majority. The last 16 % of adopter is the laggards (figure 1).

In 1969, Bass tested a mix influence model for diffusion which includes external and internal influence. Bass relied on diffusion theory to model the timing of initial purchase of new products is based upon an assumption that the probability of purchase at any time is related linearly to the number of previous buyers [2]. In Bass model, there are two types of customer behavior which are innovative and imitative.

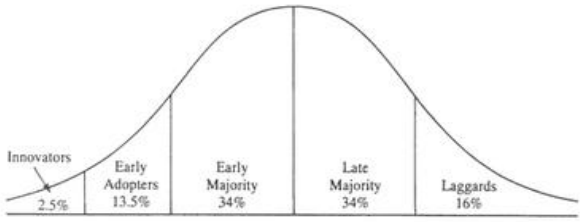


Figure 1 Rogers Adopter Categories

2.2 Technology Adoption Life Cycle

The technology adoption life cycle define classifying the market and its reaction to a high tech product [12]. In 1991, Moore describe about "crack in the bell curve" which showed diffusion could slipped and fallen in every stage of adopter categories [13]. The biggest

crack is between early adopter and early majority when innovation product cannot diffuse into early majority adopters (figure 2). Moore suggests that early stage of new product development should focus on innovators and early adopters as the reaction of product success or product failure [7].

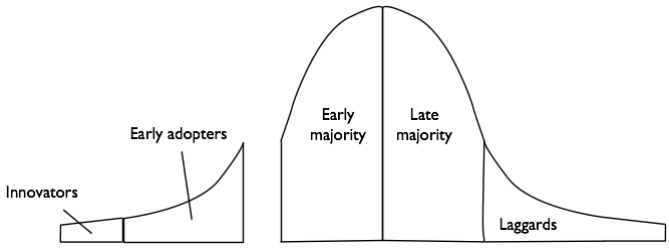


Figure 2 Technology Adoption Lifecycle

3. History of Electronic Bidet Toilet in Japan

3.1 American Bidet Toilet Invention

The history of bidet toilet in Japan was started in 1964, when TOTO imported Wash Air Seat product from American Bidet Company for sold in Japan. The Wash Air Seat was a combination product between flush and bidet toilet which had a nozzle to spray warm water, heated seat and blew warm air to dry purpose. In America, this product was designed for aging people and hospital patients who had difficulties in using toilet paper. Besides helping patient in medical procedures, bidet toilet could raise the people dignity by prevent poor hygiene. Hygiene may also be difficult for persons with movement and mobility impairment [5].

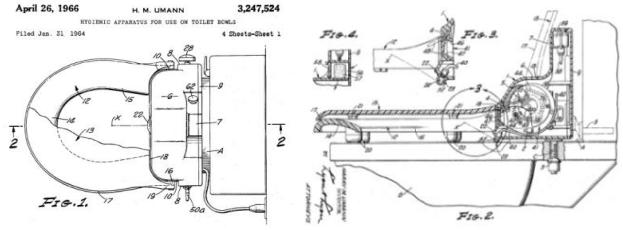


Figure 3. H.M Umann patent right (Source: United State Patent Office)

4. TOTO Electronic Bidet Toilet Technology Life Cycle

4.1 Technology Development Stage

Innovation is the development of invention and exploitation of invention into commercialization to the market [15]. Wash Air Seat has features such as heated seat, air blower, water heater and bidet nozzle. When TOTO still imported Wash Air Seat, company found some problems in this products such as lack quality of water temperature control, not a user friendly product and already broken after used around several months. The price product at the time was expensive for Japanese market. This product used manual control system by switch on and off system for the water heater which made the warm water condition was unstable and toilet was easily broken.

Around late 60's, Japanese Trading Company in association with United State found an US patent application and suggested this company to buy the patent right of hygienic apparatus for toilet bowl. The patent right belongs to Harry M. Umman which registered in United States Patent Office in 26 April 1966 (figure 3). Based on this patent right, in late 1970s, this company decided to create its own bidet toilet product called Washlet. The innovation in this product was focus on the electronic control system to control water heater, heated seat, air blower and nozzle. Based on this innovation, this company commercialized it and become the first mover in Japan electronic bidet toilet market.

4.2 Application Launch Stage

Around 1980, this company's R&D successfully developed automatic electrical control by using integrated circuit to control water temperatures, nozzle system, warm air blower and heated seat in Washlet. This innovation of electronic control system was the revolution of technology fusion between

ceramics and electrical device in Japan [10]. Around that time, Japan was in the era of R&D in development and application of integrated circuit experiments.

When this product introduced to the market 1980s, there was challenge to convince the Japan market to accept technological toilet product. In this early stage, the market size is very small and prices of these products are too high for customer. The customer bought it for medical purpose and the curiosity of the new toilet product concept. The customer segment mainly at the first time was hemorrhoid patients and post delivery woman. The company was success in electronic bidet toilet market when Japanese market recognized this product from its commercial promotion around 1980s. The market approach by commercial promotion to create market awareness has made the company success in diffusing the product to Japanese market. At that time, not only this company introduced electronic bidet seat, other Japan toilet makers such as Inax with its bidet toilet also competed in this market.

The company tried to penetrate the market by strengthening the marketing chain with Japanese plumbing firms. To promote the product, the company lent this product to plumber families to use and experience it in trial time periods. Another way to increase public awareness of the products is by installed this bidet toilet seat in some public spaces which gave opportunity to the people to experience the product. The company also spread the Washlet Map to give information to the public where they could try it freely. Japanese plumbing firms could influence others through interpersonal communication as opinion leader.

4.3 Application Growth Stage

In 1985, TOTO Company developed its own plastic technology based on structural analysis improvement. Around this year, the hot water heater tank material was changed from copper material to nylon resin. Based on the information from company's marketing division, most of the customer's complaints about the product were its quality, but only a few complaints in price and product usages. Most of the customers asked to repair the product and willing to continue in using this product again. Based on this condition, this company saw it as an opportunity and potential market demand in the future.

In this stage, Japanese market recognized TOTO brand as a manufacturer of electronic bidet seat after the successful commercial campaign: "Even your buttocks want to be washed" which was thought by copywriter Takashi Nakahata in 1982. This campaign became very famous by the TV commercial which showed Japan actress, Jun Togawa as a commercial model (figure 4). The product marketing which used TV commercial advertisement in 1980s was one of its success factors to give Japan customers the knowledge stage of new product. The product marketing was to develop public awareness of new life style in washing the back side with water to improve people hygiene. In the beginning of the promotion, the company used unique tag line which raised people awareness of the product. Most of customers decided to buy it after they already had experience to use.

Figure 4. Washlet commercial TV campaign in Japan 1982 (source: TOTO)

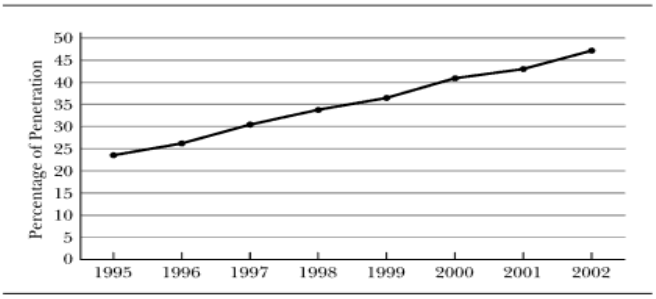
4.4 Mature Technology Stage

In this mature technology stage, the number of bidet toilet seat supplier in Japan

increased, which made high diffusion to the market. In around 1992, this company launched ozone deodorization technology as a respond to market demand in reducing toilet smell. Around this year, Washlet shipment was gradually raised around 4 million packs shipment. In 1996, this company developed water efficient technology which called "sequential valve system". In this year, the product used Al_2O_3 material in instant hot water tank. At this time also, the shipment increased from 4 million packs into 9 million packs shipment.

Customers could choose many types of electronic bidet toilet seat which available in Japanese market. In this stage, the technology features which provided by each product are almost same. Around 1995 to 2002, there was an increasing penetration of electronic bidet toilet within Japanese household from 24 percent to 47 percent. The increasing of supply in bidet toilet seat market had made the price reduced and the number of installed products in household increased. In 2003 (figure 5), there were around 60 percent of households in Japan were equipped with such high-tech seats (Japan Times, 2007).

Beside G types and S types, this company continued to develop new bidet toilet type series. In 1991 it launched the Z series to the market, which was the integrated toilet type. In 1999, this company launched new product which called Apricot. As a respond to end user demand to have warm water all the time, this company applied new water efficient usage technology system which called "wonder wave cleansing system". This water system alternates strong and weak pulse of water, more than 70 times per second, achieve outstanding cleansing which uses approximately one-third of water required from earlier products, and cuts electricity needed to heat the water by half. The product shipment packs reached around 13 million packs each year (figure 6).



Source: Adapted from Economic and Social Research Institute, Cabinet Office (2003).

Figure 5. Penetration of Electronic Bidet Toilet in Japanese Household

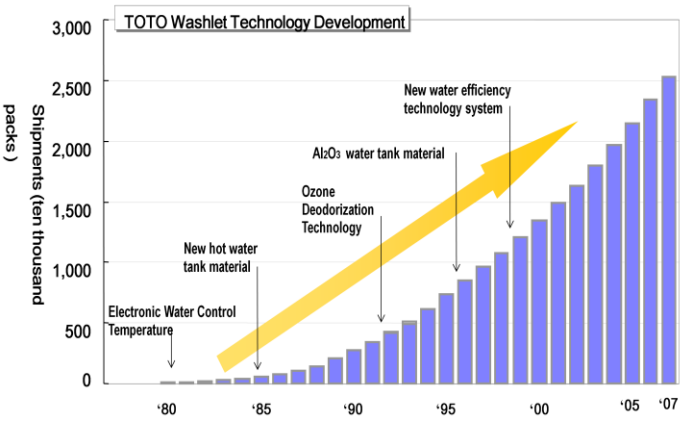


Figure 6. Washlet Technology Developments (Source: TOTO)

5. R&D and Quality Control

5.1 Research and Development

Since 1980, company's R&D already developed technologies such as electronic water control temperature, new hot tank material, ozone deodorization technologies, Al_2O_3 water tank material and water efficiency to stabilize the warm water temperature. As an innovation product, Washlet has three main technology features such as water controller, warm seat and deodorizing. The innovation in this bidet toilet is continued by adding comfortable electronic features to the product like electronic sensor and MP3 player.

5.2 Quality Control

By applying such programs like Total Quality Management, time based competition and benchmarking, companies have changed to perform activities in order to raise efficiencies, improve customer satisfaction and achieve the best practice. To maintain total quality control, Washlet molding process is controlled by professional skill worker, and uses automatic injection molding machines which automatically work in 24 hours. Beside automatic inspection, the company uses numerical visual inspection in production. In assembling process, each worker attaches 400 points parts controlled by special staffs with high technology standard inspection. This product equipped and transported by high quality safety standard from factory to the customer.

The information of product failures during manufacturing and selling are collected. From this information, company develops new product and improve the existing product. Based on long experience and scientific basic, this company will check its long term reliability product by carrying out accelerated test. Basic technology is the origin of the product development and only good quality product can be developed and commercialized. In development stage, every possible failure which could occur in the future and how customers used the product is monitored.

6. Global Market Diffusion

TOTO started its global market in 1977 with the establishment PT Surya TOTO Indonesia, a joint venture companies in Indonesia as a manufacturing base and continued to penetrate into market for more than ten countries in the world. This company created Five-Polar global structures which consist of Japan, United States, Europe, China and Asia Oceania. In the global market strategy, this company continues to promote new life style with toilet bowl and bidet toilet product. To enter the global market, this company also faces government regulation in many countries, which have limited standard of water consume for the toilet [20].

Today in global electronic bidet seat toilet market, TOTO faces many competitors from Japan and other countries. The Japanese competitors in global competition are Inax and Matsushita Manufacture which promote high end products. An American company from San Francisco, Brondell, also launched high tech toilet product. European toilet maker, Kohler, promotes its high tech toilet with cleansing function, heated seat and warm air dryer. From South Korea, Hyundai Company, also promotes electronic bidet toilet seat (figure 7).

Figure 7. Bidet Seat Toilet in global competition

7. Diffusion Chasm of Electronic Bidet Seat Toilet in Indonesia

In Indonesia, PT Surya TOTO Indonesia imported electronic bidet seat toilet from Japan and introduced it to the Indonesian toilet market. The diffusion of the product is slow and has limited product type in the market. The company sells this innovation product in high price, higher than other substitute product. This company promotes it by joining the housing exhibition and opening some show rooms in strategic locations at big city to increase market awareness. To penetrate the market, the company focuses on increasing distribution channels.

Most innovator adopters for this product in Indonesian are from high income segment, which is only a small number comparing to total Indonesian population. This segment mostly has experience to use similar product type outside Indonesia. This segment is willing to take risk of using this innovation product for its benefit. The early adopters of this product are from high class international hotel and high class apartments. The number of early majority is very low, which made the diffusion of this product is stopped in early adopter phase.

8. Barrier Factors of Diffusion Electronic Bidet Seat Toilet in Indonesia

Based on literature research, there is some access issues related to the barrier of diffusion innovation product. These issues are physical, cognitive, affective, economic and social as the internal factors [3]. Physical factors are related with accessibility to buy the product, technical limitation and after sales service. Cognitive factor is about the understanding how the product works. Affective factor discusses the customer motivation to use the product. Economic factors are related to high price and customer willingness to pay. Social factor related to culture, norm and bath room design. The other issues of external factor are infrastructure. Infrastructures, related with water and electric supply accessibility.

Economic Factor

According to the World Bank in 2009, the Indonesia Gross Domestic Product is worth 514 billion dollars or 0.83% of the world economy. Compare to basic flush toilet, the electronic bidet toilet product is relatively expensive for most Indonesian people. Even there is high demand for flush toilet product; demand in electronic bidet toilet is still low because of its expensive price. In Indonesia, some parts of this country still learn about how to develop appropriate water supply and sanitation [14].

Physical Factor

To buy the product, the customer has to buy it at big distributor and only some specific places sell this toilet type. The small number of distributor channel which sell this product can make this product hard to diffuse in society [9].

Cognitive Factor

It needs process to adapt new technology which provides comfort features. To change the behavior from basic flush toilet usage into multi features of electronic bidet toilet, it needs time for customer to learn and feel the benefits of the product. Most of people in Indonesia do not familiar with innovation technology in electronic toilet. Most of the toilet type in Indonesian households is squat toilet with shower spray without electronic equipment. Customers have to feel that this product can increase the hygiene standard. If the customer feel that it is difficult to use the product, it will be hard to diffuse the product

Affective Factor

Most Indonesian people motivation to buy the latest type of electronic product is to increase the social status and easy to identified by others as a life style attractive to community [14]. The first impression of high technology product is difficult to use and people have to change attitude toward the new product. Sometimes reluctant arise when people have to change their behavior into new life style. To increase social status this product is not easy to show to other people like other electronic products. In diffusion model, Rogers define observability as the degree to which the results of an innovation are visible to others [17].

Social Factor

Religion, culture and other factors of social psychology dictate an individual's

approach to sanitation [1]. There are around 88.22 percent of the population religion is Islam which requires a person all possible cleaning as part of purification rituals for praying. Water is needed to clean body part from feces materials. The need of plenty water in daily toilet activity has made the bath room design in the most Indonesian housing is wet toilet type, and without electrical connector facility. There should be an electrical installation preparation before using electronic bidet toilet.

Infrastructure Factor

The instable electrical supply condition in Indonesian households has made electronic component in electronic bidet is easy to broken. Low water quality and unstable water supply are also the potential condition to make this product easy to broken.

9. Theoretical Proposition

The diffusion of electronic bidet toilet in Indonesia is based on the following theoretical proposition.

Proposition 1. The more customer understand the benefit of the product, the more opportunity customer to adopt the product.

In Indonesian toilet market, most of the product dominated with conventional flush toilet with shower spray as the bidet. People need to be educated how to use electronic bidet seat properly and feel the comfort compare to the previous product. The company has to promote this product by giving information access for product penetration such as TV, internet or magazine.

Proposition 2. Public place is the strategic place for the people to be familiar with the product.

In order to educate people to be familiar with high tech product, the company has to introduce the product in strategic place where many people visit it. In the case of electronic bidet seat, the best places to install the product are super mall, executive club, office, five star hotels and high class apartment.

Proposition 3. The more available product in the market, the sooner people will adopt the product

Urban areas are likely to enjoy greater production and distribution efficiency which enhance customer access to a new product [19].The company has to develop many channels to distribute and promote this innovation product. The company has to develop collaboration with new retailers to introduce the product to the potential province outside the capital city Jakarta.

Proposition 4. The company has to more aggressive to promote the product to innovators and early adopters.

The company has to identify the innovator and early adopter customers in Indonesia who understand and seek the electronic bidet toilet. These adopters are people with high purchasing power with high ability to buy and willingness to pay the product. The high class households, apartments, hotels, offices and executive clubs could be the focus of the target market segment of this product. The company has to commit with long term relationship with these customers and provide after sales services.

Proposition 5. The product must be suitable with local consumer preference in product's technology features.

The electronic bidet toilet seat has many features which provide comfort for all season in sub tropic areas. When this product brought to tropical countries, there are some features which could be eliminated because of climate condition. The difference of user preference of the product features could be the source of differentiation product. The company could

make collaboration with architect, retailer and develop customer club in order to close with the customer preference and as an information source to develop innovation product. In this community the customer who has adopted this product could persuade potential customer to adopt the product in word of mouth communication.

Proposition 6. Infrastructure support in electrical and water supply stability are the important factors to support diffusion of innovation.

The problems in developing country are instable water and electrical supply. The product could not diffuse into early majority if the infrastructures do not support it. It needs government effort to provide good water quality and electrical supply stability. If the water and electrical infrastructure in Indonesia already stable, there will be more opportunity to diffuse this product.

10. Summary

This study addressed a product life cycle of electronic bidet toilet in Japan and barrier of diffusion in developing country. The diffusion of electronic bidet toilet in Japan started when Japan developed American invention of bidet toilet into new innovation bidet toilet. The diffusion rate of this product increase when the company added new innovation features, this innovation followed by other electronic bidet toilet manufactures which made higher diffusion in Japanese household. In global diffusion of this product to developing country, there are some barriers which made this product diffuse slowly in Indonesia. The barrier factors are economic, physical, cognitive, affective, social and infrastructure. The proposed framework suggests six key success factors of diffusion electronic bidet toilet in Indonesia. The more customers understand the benefit of the product, the more opportunity for customers to adopt the product. Public place is a strategic place for people to be familiar with the product. The more available product in the market, the sooner people will adopt the product. The company has to be more aggressive to promote the product to innovators and early adopters. The product also has to be suitable with local customer preference in product technology features. Infrastructure support in electrical and water supply are the important factor diffusion of electronic bidet toilet in Indonesia.

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