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Key Factors Influencing Elderly Persons' Willingness to Rent Assistive Devices via a Product Service System

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Abstract: This study examined elderly persons' attitudes toward renting assistive devices through a product service system and the key factors influencing this decision. First, potentially influencing factors were extrapolated from the existing literature, expert interviews, and questionnaires. Next, a logistic regression model was used to examine the factors impacting elderly persons' willingness to rent assistive devices. The results showed that the practicability dimension of "key features of rented assistive device" significantly influences elderly persons' willingness to rent assistive devices. The findings offer key policy implications and insights for industries formulating assistive device rental strategies for the elderly population.

Keywords: product service system; assistive device rental; logistic regression

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1. Introduction

The problem of an aging population is not only complicated and multi-faceted but is also one of the important issues in the world. The obvious aging of a country's population structure affects not only individuals or families, but even the overall development of the entire country [1]. In other words, the problems arising from an aging society have profoundly affected the social structure and involved economic development and national security. Long-term care in Taiwan has received increasing attention amid its gradually aging society. Taiwan has reported an annually increasing dependency ratio, with the birth and mortality rate curves intersecting in 2020 and the population rate reporting an initial surge followed by a downward trend [2]. Consequently, it is expected that Taiwan's elderly population will face a caregiver shortage. Assistive devices (ADs) are assistive technology devices that are modified or customized to enhance, maintain, or promote the functional capabilities of persons with disabilities [3]. Taiwan is expected to become a super-aged society by 2025. The US Bureau of Economic and Business Affairs showed that about 42% of the elderly population over the age of 65 years requires ADs [4]. The Taiwanese government will continue to fund up to TWD 60 billion in long-term care in response to its growing aging population. The government is currently promoting an AD-friendly policy that provides advance compensation services to help consumers in their AD purchases. Further, Taiwan's government and AD industry are focusing on promoting device sales.

Users obtain ADs from medical equipment supply stores, social welfare institutions, or AD centers. However, there is fierce price competition in the AD industry because consumers tend to prioritize the price of ADs over improved independence in daily living through the use of such devices [5]. Plausible solutions include AD recycling or rental services that can meet the needs of short-term use and frequent replacement of different AD types. This not only plays an important role in the long-term development of the care industry but also conforms to the environmental sustainability trend across the globe [6]. Notably, the approach is consistent with A.L. White's concept of "servicizing", which

advocates replacing product purchases with services that provide the function of a product, thus reducing the production and sales of the physical product. Thus, servicizing ADs could maximize resource and energy efficiency and minimize waste generation.

Product service systems (PSS) have risen from the level of theoretical research to the level of strategic implementation of many enterprises. The design object of PSS includes the complexity of products and services, and its implementation requires enterprises to invest a lot of manpower, material resources and resources, which will bring great transformation pressure to enterprises [7]. Product homogeneity, sustainable demand, increasing emphasis on user experience, and other factors force manufacturers to shift from a single product design and production mode to a system solution mode that provides customers with products and services [8,9]. Emerging technologies, especially cloud, analytics, and new technologies such as AI and the Internet of Things, are empowering companies to transform more. However, enterprises must involve their employees in the process; otherwise, authentic transformation cannot be achieved. Another focus is to provide employees with the right tools to become part of the solution, work with more feedback, and be data-driven and customer-centric. PSS is a system of products, services, supporting networks, and infrastructure designed to improve competitiveness, satisfy customer needs, and have a lower environmental impact than traditional business models [10–12]. A business model adopting PSS can do the following: provide higher quality products and more customized services to customers, provide differentiation and create retention and loyalty; reduce resource consumption and environmental impact of products during their life cycle, improve business efficiency, and help create new jobs [7,13]. With a well-designed PSS, operational performance can be improved to a level that cannot be achieved solely through hardware improvements, with great potential for sustainability [12,14].

Research has investigated the relationship between product development and consumer attitude toward a PSS. The findings suggest that, when viewing a product and related services as a whole, design and evaluation processes can contribute to more sustainable development [15,16]. Accordingly, this study evaluated the attitude of elderly persons toward AD rental using a PSS model. It further examines the importance of the type of AD to understand key factors influencing the willingness to rent ADs among the elderly population. The findings provide insights for the promotion of a PSS for AD rental and the formulation of relevant government policies. To achieve the aforementioned research objectives, the study first extrapolated factors potentially affecting the elderly population's decision to rent AD by referencing data from the extant literature, expert interviews, and questionnaires. It then used a logistic regression model to evaluate the factors influencing elderly persons' willingness to rent ADs.

2. Theoretical Background

2.1. Product Service System

PSS is a system of products, services, network players, and supporting infrastructure that is designed to be competitive, satisfy customer needs, and have a lower environmental impact than traditional business models [17,18]. PSS is defined as an "integration of products and services to meet consumer needs. It is a means of replacing physical products with solutions with enhanced performance" [19–21]. PSS approaches aim to meet the needs of customers by providing intangible services in lieu of the sales of physical products, improve the efficiency of resource use, and reduce waste generation through the reuse and remanufacturing of products and raw materials, thereby reducing the environmental hazards caused by products over their life cycle. Therefore, PSS is considered as an important tool for sustainable development [18,22]. In recent years, researchers have proposed many classification methods for the services of PSS [16]. Brezet classified PSS according to the services provided as follows: (a) supporting services during designing, production, and distribution of products; (b) service at the point of sale, e.g., sales techniques and customer education/training; (c) various concepts of product use, e.g., leasing, sharing, and pooling; (d) maintenance services, e.g., cleaning and repair; (e) end-of-life (EOL) services,

e.g., refurbishing, reuse, and recycling [23]. Tukker divided PSS, which consists of tangible products and intangible services, into three categories: (a) a product-oriented PSS focuses on traditional sales of products supplemented by other services. The services are usually attached to existing products, and the value of products is enhanced by including additional services to the product; (b) a use-oriented PSS has traditional products playing the central role. However, the transaction model is not for selling products, but for suppliers to own products and provide services in different forms, product rental or sharing; (c) a result-oriented PSS, on the other hand, does not involve any product, and its focus is not on products sold in the market, but on services provided by suppliers through products [20]. One of the basic elements of PSS is to change the original consumption habits of suppliers or consumers through leasing. Based on leasing, their habits are changed from purchase to lease, and the originally sold products are converted into services. Consumers can only use the functions brought by products, while the ownership of products remains with suppliers. In this way, suppliers can effectively offer services and control waste recycling [7,10,24,25].

PSS' tenets of service offering and waste recycling can be achieved only through a rental service model [10,24]. As a result, PSS also stimulates enterprises to develop more durable, recyclable, valuable industrial materials and less fragile products, which reduces not only manufacturing costs, but also waste production. This has brought positive benefits to both the environment and the economy [16]. PSS is a set of product-based services, which blurs the boundary between traditional product and service sectors, and combines the life cycle of both producers and products [26]. Maeda believes that by introducing the concept of life cycle assessment (LCA) into PSS and assessing the benefits of PSS through life cycle, it can develop a diverse range of service delivery methods, and thus improve the effectiveness of industrial PSS. Currently, LCA is mostly applied to products, mainly to explore and quantify the impact of products on the environment in each stage of their life cycle [27]. In recent years, in response to the requirements of environmental protection, it was required in many countries that the design of industrial products should include disassembly and recycling considerations. The aim was to reduce the costs of products in their life cycle through design innovation. Therefore, in recent years, many researchers have been involved in studies such as design for environment, design for recyclability, design for life-cycle, design for assembly and dis-assembly and design for assembly and dis-assembly [28–34]. These studies were collectively called design for X (DFX) [35,36]. DFX was a design process that considered not only the functional and performance requirements of a product, but also the engineering factors related to the entire life cycle of the product, even extending to the environment and ecology, during the process of product development and system design. The idea was undoubtedly to simulate the problems that may occur in the product life cycle and to develop ways to improve them in advance, thus reducing the impact of the product on the environment, during the R&D stage when the product has a high degree of design freedom. Therefore, all product developers should realize that considering the full life cycle of a product as early as possible in the design process will help improve the competitiveness of the product [12].

As the digital environment goes more and more mature, leverage digital technology to link industries has become a competitive advantage for enterprises. However, the digitization of enterprises is no longer focusing on the improvement of their hardware and software. Many companies have already leveraged technology to help internal management, which tries to improve their organizational performance and provide customers with a better consumer experience. Digital transformation creates business value by using modes and techniques of modern technology, and transmission of the internet. Digital transformation relies on cross-departmental integration, which can occur in processes such as corporate processes, talent acquisition, and product development, and meanwhile affects various organizations within the enterprise. Paschou et al. classified the digital competences into four categories: (a) data analysis and management, (b) digital content creation, (c) soft skills, and (d) innovation appetite. It can support firms in defining which skills are necessary to support complex transformation. Moreover, they are either useful for determining

the needs of training/reskills employees, as well as the mechanisms for recruiting new talents [37]. Digital technologies can, on the one hand, be applied to enable or enhance PSS business models, or on the other hand, to improve PSS design. In light of this, enterprises must rethink their business models and find data and data insights to create new and sustainable revenue. This will require new ways of pooling people, data, and processes to continuously create more value as they become a new digital enterprise [38]. Thus, this study used a PSS to examine elderly persons' attitudes toward AD rental and the key factors influencing their decision to rent such devices.

2.2. Attitude toward AD Use

Attitudes toward AD refer to users' perception and opinion of AD as well as their predicted behaviors toward and tendency to use the devices. From a socio-psychological perspective, attitude is a key factor affecting the use of ADs and in predicting future use. Studies have highlighted that most users have a positive user attitude toward ADs [39,40].

Roelands et al., for example, suggested a positive correlation between self-perceived health condition (need to use ADs or not) and attitude toward AD use. The more aware users are of their need for ADs, the more positive is their attitude, and this affects willingness to use the devices. In addition, the degree of users' need for ADs correlates with their perceived importance of ADs. However, Taiwan's AD industry is lagging in development and faces insufficient consumer awareness. Elderly persons may lack information sources and thus, have a limited understanding of ADs. Attitude toward AD can be affected by psychological, social, and cultural factors and influences willingness to purchase and satisfaction with AD [41,42]. Adopting a PSS, this study examined the elderly population's attitude toward AD rental, analyzed users' positive and negative feedback, and discussed resultant behaviors.

2.3. Assistive Device Rental

There is a growing demand for medical equipment worldwide in response to aging populations and the increasing prevalence of cancer and other chronic diseases [43]. Taiwan's expected status as a super-aged society by 2025 is likely to generate significant demand for ADs, specifically AD technology and services. ADs and related services are both indispensable and complementary to each other. The efficacy of ADs can only be optimized through a comprehensive AD service [44]. Taiwan's Assistive Devices Center recycles used ADs after thorough disinfection, cleaning, and sterilization. Users can rent ADs, and financially challenged individuals can avail of the devices free of cost. In addition, it offers services such as AD assessment, maintenance, and consultation. A survey examining the intention of elderly persons and those with permanent or temporary disabilities in Taiwan highlighted that consumers' AD purchase is often influenced by cultural factors. Factors contributing to consumer prejudice against AD rental are as follows. First are economic concerns, wherein consumers may prefer select ADs or free alternatives. Second is filial piety, that is, relatives of elderly members prefer better and new ADs. Third is time concerns, as ADs are often not available immediately and thus, may be purchased at a higher price in an emergency. Finally are preconceived notions that rented ADs are unhygienic or are not thoroughly disinfected as well as superstitions associated with previous users passing away [6]. Sung et al. revealed that AD users considered the following factors when purchasing a wheelchair (listed in order of importance): function, safety, and comfort [45]. Chen highlighted that wheelchair users valued safety and durability [46]. According to Tu et al., depending on an elderly person's lifestyle, the perceptual factors of functionality, satisfaction, safety, and comfort influence AD selection [47]. However, AD rental companies are yet to establish a credible disinfection process when compared to other rental items such as automobiles and mechanical equipment, and this is because of the weak law enforcement by the Taiwanese government. Thus, user benefits of the AD rental model remain less evident [5].

Nowadays, many developed countries are facing the problem of sub-replacement fertility, and the average life expectancy of humans is increasing with the advancement of medical technology and the growing awareness of health preservation among the general public. Evidently, countries worldwide will face the problem of insufficient manpower for elderly care in the future, and there is a dire need for the power of assistive technology to help solve the dilemma [3]. Relevant studies have revealed that when a person with disabilities is still conscious and capable of action, using the remaining autonomy to use assistive devices to aid in activities of daily living can enhance the individual's functional independence and reduce the burden of caregiving [48]. Thus, it is clear that assistive devices are extremely helpful in maintaining the daily life of the disabled; the use of assistive devices can replace lost functions, enhance convenience and safety in caregiving, and reduce the burden on caregivers. The use of assistive devices is bound to become a trend in elderly care, but purchasing assistive devices is often a heavy burden for the average family, and most families do not have the energy to follow up on the disposal of assistive devices that are no longer adequate for use at home. The abandonment of those that are still functional leads to a waste of social resources. The recycling and leasing services of assistive devices can meet the needs of the disabled for short-term use of assistive devices and the elderly who need to change the type of assistive devices frequently in response to changes in their conditions. The services are in line not only with the trend of global environmental protection, but also with the concept of "servicizing" [6]. Servicizing was essentially the design of a PSS that builds on existing products to develop, design, and expand services [49]. In order to develop sustainable products and achieve the goal of a sustainable enterprise, enterprises can replace the products per se with services through the PSS concept, which includes both physical products and intangible services [7]. The concept covers the entire product life cycle and organizational considerations. On the premise of satisfying consumers' needs, it promotes environmental design of products by reducing the total production volume, improves resource efficiency, and reduces energy and resource consumption and waste generation by reusing and remanufacturing products and materials or parts, thereby achieving the goal of dematerialization [50–52], reducing the economic, environmental, and social impacts of products (including services) at all stages of their life cycle, and moving toward global sustainable development. Based on this, we take the dematerialization of PSS as the starting point, and by virtue of tangible products and intangible services mentioned by Tukker, identify the position of the assistive device leasing industry, to facilitate the development of a suitable policy for the elderly community to rent assistive devices [12]. According to Mont, the concept of dematerialization was to reduce the material flows in the production and consumption of products with a lower environmental burden to reduce the economic, environmental, and social impact of products (including services) at all stages of their life cycle, and to move toward sustainable development [10]. Dematerialization does not mean that the product will disappear, but that the product will be the main touch point of the service to create an impressive PSS. The most important aspect of resource integration and optimization throughout the system was the development and design of the entire service procedure of the product. With the growth of the service economy, the trend of users' needs has gradually started to change from possession to usage and value perception, which was also the condition for business transformation [49]. Based on this, we take the dematerialization of PSS as the starting point, and by virtue of tangible products and intangible services mentioned by Tukker, identify the position of the assistive device leasing industry, to facilitate the development of a suitable policy for the elderly community to rent assistive devices [20].

3. Research Methodology

This study referenced domestic and international literature, expert interviews, and the Quebec User Evaluation of Satisfaction with assistive Technology (QUEST 2.0) [53]. Content validity and applicability was then performed by experts. An analysis model was constructed to assess elderly persons' attitudes toward AD rental.

3.1. Study Design and Sampling Method

This study employed a random sampling method. A questionnaire-based survey was conducted on 129 elderly persons who were 65 years and above and financially independent. The survey aimed to understand their attitude toward AD rental and key factors influencing related decisions. The questionnaire was developed on the basis of a literature review. Content validity and applicability were determined by experts.

3.2. Research Instruments and Assessment of Validity and Reliability

Data were referenced from the extant literature and expert interviews to develop the "elderly persons' attitude toward AD rental" scale and the "key factor influencing AD rentals" scale (Tables 1 and 2) to ensure the items are in line with the definition of the scales' dimensions. The questionnaire is divided into three parts. The first part reports participants' basic information and current status of AD use. The second part documents elderly persons' attitude toward AD rental on a five-point Likert scale, where 1 denotes "strongly disagree" and 5 is "strongly agree." A higher score represents a more positive attitude, whereas a lower one indicates a more negative one. The final part also uses a five-point Likert scale (1 is "strongly disagree" and 5 is "strongly agree") to examine for key features prioritized by the elderly when renting ADs. A higher score suggests greater importance assigned to a given attribute of a rented AD, while a lower score denotes less importance. The researchers distributed hard copies of the questionnaire and explained each item and the purpose of the survey considering the elderly's general lack of proficiency with electronic devices and other possible reading and comprehension issues. The response rate was 100% with a total of 129 valid responses.

The questionnaire items were revised by experts to ensure the use of appropriate items. In addition, participants were sampled prior to the survey. Thus, the questionnaire used in this study met the content validity requirements. A pilot test was conducted on 30 elderly persons who met the research criteria to determine the reliability of the questionnaire. The scales and each item were analyzed as per the corrected item-total correlation. The preliminary Cronbach's α was 0.891, and the final Cronbach's α was 0.908. Cronbach's α for the remaining 12 items in the "elderly person's attitude toward AD rental" scale was 0.679. Cronbach's α for the "key attributes of rented ADs" scale was 0.936, and the number of items was reduced from 24 to 19. According to Hair et al., the minimum acceptable Cronbach's α value ranges between 0.6 and 0.7 [54].

3.3. Research Process

The study was conducted in two parts, a pilot and final test. First, a literature review and expert revisions were performed to finalize the questionnaire items. The sample size was estimated on the basis of the pilot test results. Subsequently, data from the final test were analyzed. The study examined the elderly population's attitude toward AD rental via a PSS and factors influencing their rental decision. The findings highlight a strategy to promote an AD rental model for the elderly.

Table 1. Assessment items for elderly persons' attitude toward AD rental.

Item
1. I will rent a high-quality and high-priced AD.
2. I may switch to an AD depending on the progression of my disease.
3. Rented ADs offer a wider variety.
4. I may get an AD that fits my requirement and will choose to rent one.
5. The purchased AD is a waste when no longer needed.
6. AD rentals by a company/physical store provide a sense of security.
7. I would rent an AD from a place that offers services across the country.
8. I find the maintenance of the rented AD convenient.
9. I think is it inexpensive to purchase an AD.
10. I want to use a brand-new AD.
11. The rented AD lacks the sense of being one's personal possession.
12. The rented AD is not clean enough.

Table 2. Items for key features of rented AD prioritized by elderly users.

Dimension	Item
Price	1. Is the rented AD subsidized by the government? 2. Is the price of the rented high or low? 3. Does the rented AD belong to a renowned brand?
Sensory	4. What is the size of the rented AD? 5. Is the rented AD trending in the market? 6. What is the product weight of the rented AD? 7. What are the materials used in the rented AD? 8. What is the color of the rented AD? 9. What are the design features of the rented AD?
Practicability	10. Is the rented AD easy to use? 11. Is the rented AD adjustable? 12. Is the rented AD durable? 13. What are the economic benefits of the rented AD? 14. Is the rented AD is comfortable to use? 15. Is the rented AD safe and sturdy?
Service	16. Does the rental company offer home delivery services? 17. Does the company offer efficient maintenance services? 18. Does the company offer follow-up services? 19. What are the other professional services provided?

4. Analysis of Results

4.1. Data Analysis

This study used the IBM SPSS Statistics 25 for statistical analysis. Descriptive statistics, including frequency, percentage, mean, and standard deviation, were used to examine the demographic variables and current status of AD use. An independent sample *t*-test and one-way ANOVA were conducted on the demographic variables, attitude toward AD rental, and key features of rented ADs. A Scheffé post hoc comparison was performed if the analysis results achieved the predetermined significance. A logistic regression analysis was conducted to examine key factors influencing the elderly population's willingness to rent ADs.

4.2. Results

4.2.1. Demographic Variables and Current Status of AD Use

The study is based on 129 participants, of whom 61 are male (47.3%) and 68 are female (52.7%). Most participants were 65–70 years old (50.4%) and reported an educational level lower than middle school (50.3%). Further, 95.3% were married, 28.7% were employed or retired, 65.9% earned a monthly income of TWD 20,000 or less, and 44.2% lived in central Taiwan. The survey posed three questions on participants' previous AD experience to examine their willingness to rent the device in the future. Items include type of AD used, sources of AD, and satisfaction with AD. A total of 101 participants (78.3%) reported they would rent an AD in the future. The majority or 81.4% (105 people) stated they had never used ADs. Among those who did, 59.5% utilized them for personal mobility. About 30.6% obtained ADs through self-purchases. Most previous AD users (58.3%) were satisfied with their experience.

4.2.2. Attitude toward AD Rental

The AD rental attitude scale comprises 12 questions and reported a mean of 3.54 and SD of 0.403. The item "I may switch to an AD depending on the progression of my disease" had the highest score (M = 4.18, SD = 0.655), followed by "I find the maintenance of the rented AD convenient" (M = 4.08, SD = 0.746). These findings indicate a fairly positive participant attitude toward AD rental.

4.2.3. Key Features of AD Rentals

The scale for key features of rented ADs has 19 items. The price, sensory, practicability, and service dimensions in the scale reported means of 3.99 (SD = 0.681), 3.69 (SD = 0.654), 4.1 (SD = 0.706), and 4.23 (SD = 0.665), respectively. Among these, "home delivery of rented AD" under the service dimension received the highest score with a mean of 4.26 (SD = 0.763), followed by "rented AD is subsidized by the government" under the price dimension with a mean of 4.24 (SD = 0.778). This suggests that participants attach significant importance to these features when renting ADs.

4.2.4. Differences between Demographic Variables and Attitudes toward AD Rental

The independent sample *t*-test suggested that attitudes toward rented ADs significantly differed depending on the elderly persons' marital status (t = −2.576, p = 0.011). Compared with their unmarried counterpart (M = 3.13, SD = 0.556), married participants (M = 3.56, SD = 0.387) showed a higher acceptance of AD rentals. In addition, attitude toward AD rental significantly differed depending on intention to rent ADs in the future (t = 3.090, p = 0.002). Elderly persons who considered renting ADs in the future (M = 3.59, SD = 0.363) have higher AD rental acceptance than those who did not (M = 3.34, SD = 0.476) (Table 3). The F-values for all variables did not reach the significant level of α = 0.05 (Table 4), indicating that attitudes toward AD rental did not significantly differ by variables such as age, education level, occupation, monthly income, and residential area.

Table 3. The independent sample *t*-test between demographic variables and attitudes toward AD rental.

Item		n	M ± SD	t
Gender	male	61	3.55 ± 0.378	0.323
	women	68	3.53 ± 0.426	
Marital status	married	6	3.13 ± 0.556	−2.576 **
	unmarried	122	3.56 ± 0.387	
Current status of AD use	yes	24	3.57 ± 0.452	0.366
	no	105	3.53 ± 0.393	
Rent ADs in the future.	willingness	101	3.59 ± 0.363	3.090 **
	unwilling	28	3.34 ± 0.456	

** *Significant at 1% level.*

Table 4. The ANOVA of variance between demographic variables and attitudes toward AD rental.

Item	df	SS	MS	F
Age	4	0.594	0.149	0.914
Education level	3	0.277	0.092	0.564
Occupation	11	0.544	0.049	0.286
Monthly income	4	0.362	0.091	0.550
Education level	2	0.164	0.082	0.500

4.2.5. Difference between Demographic Variables and Key Features of AD Rental

The price dimension of the scale for key features of AD rental (t = −2.256, p = 0.026) was analyzed using an independent sample *t*-test. The results significantly differed by marital status. Key attributes of rented ADs were assigned greater importance by married participants (M = 4.02, SD = 0.664) than their unmarried counterparts (M = 3.39, SD = 0.828). Findings for the sensory dimension (t = 3.451, p = 0.001) significantly varied by intention to rent ADs in the future. Participants who intended to rent ADs in the future (M = 3.79, SD = 0.653) attached greater value to the sensory dimension of rented ADs compared with those who did not (M = 3.33, SD = 0.524). Intention to rent ADs in the future also had a significantly varying impact on the sensory dimension (t = 5.039, p = 0.000). Compared with those who did not intend to rent ADs in the future (M = 3.56, SD = 0.736), participants

with an intention to do so (M = 4.26, SD = 0.621) assigned greater value to the sensory dimension. Intention to rent ADs in the future also significantly differed for the service dimension (t = 3.104, $p = 0.002$). Participants who intended to rent ADs in the future (M = 4.32, SD = 0.621) attached more importance to the service dimension of the rented ADs compared with those who did not (M = 3.89, SD = 0.718). See Table 5 for the results. Table 6 summarizes the results of the one-way ANOVA. The findings for the price dimension as a key feature of rented ADs significantly vary by participants' occupation (F = 2.102, $p = 0.025$). For the sensory dimension, the impact significantly differs by age (F = 2.537, $p = 0.043$) and area of residence (F = 3.506, $p = 0.033$). The study shows similar findings for the sensory dimension depending on age and area of residence. Schefft's post hoc comparison (Table 7) showed that participants employed in the retail industry attached greater importance to the price dimension compared with those who were unemployed/retired or in traditional, financial, design, military, public, teaching, electronics, housekeeping, service, manufacturing, medical, or other sectors. Elderly participants living in the northern region assigned greater value to the sensory dimension than did those from the central region.

Table 5. The independent sample *t*-test between demographic variables and key features of AD rental.

Dimension	Item		n	M ± SD	t
Price	Gender	male	61	4.00 ± 0.664	0.203
		women	68	3.98 ± 0.701	
	Marital status	married	6	3.39 ± 0.828	−2.256 *
		unmarried	122	4.02 ± 0.664	
	Current status of AD use	yes	24	4.03 ± 0.573	0.323
		no	105	3.98 ± 0.706	
	Rent ADs in the future.	willingness	101	4.09 ± 0.628	3.240
		unwilling	28	3.63 ± 0.755	
Sensory	Gender	male	61	3.73 ± 0.709	0.517
		women	68	3.65 ± 0.605	
	Marital status	married	6	3.47 ± 0.414	−0.833
		unmarried	122	3.70 ± 0.663	
	Current status of AD use	yes	24	3.67 ± 0.553	0.135
		no	105	3.69 ± 0.678	
	Rent ADs in the future.	willingness	101	3.79 ± 0.653	3.451 ***
		unwilling	28	3.33 ± 0.524	
Practicability	Gender	male	61	4.13 ± 0.766	0.719
		women	68	4.08 ± 0.652	
	Marital status	married	6	4.06 ± 0.712	−0.174
		unmarried	122	4.11 ± 0.708	
	Current status of AD use	yes	24	4.15 ± 0.643	0.316
		no	105	4.10 ± 0.722	
	Rent ADs in the future.	willingness	101	4.26 ± 0.621	5.039 ***
		unwilling	28	3.56 ± 0.736	
Service	Gender	male	61	4.23 ± 0.702	0.912
		women	68	4.22 ± 0.634	
	Marital status	married	6	4.33 ± 0.817	0.401
		unmarried	122	4.22 ± 0.660	
	Current status of AD use	yes	24	4.06 ± 0.677	−1.346
		no	105	4.26 ± 0.660	
	Rent ADs in the future.	willingness	101	4.32 ± 0.621	3.104 **
		unwilling	28	3.89 ± 0.718	

*, **, *** *Significant at 5, 1, and 0.1% levels, respectively.*

Table 6. The ANOVA of variance between demographic variables and key features of AD rental.

Dimension	Item	df	SS	MS	F
Price	Age	4	3.169	0.792	1.746
	Education level	3	0.514	0.171	0.364
	Occupation	11	9.805	0.891	2.102 *
	Monthly income	4	2.290	0.572	1.242
	Residential area	2	1.301	0.650	1.410
Sensory	Age	4	4.146	1.037	2.537 *
	Education level	3	0.808	0.269	0.623
	Occupation	11	4.929	0.448	1.051
	Monthly income	4	0.649	0.162	0.371
	Residential area	2	2.890	1.445	3.506 *
Practicability	Age	4	1.449	0.362	0.721
	Education level	3	2.618	0.873	1.784
	Occupation	11	3.871	0.352	0.687
	Monthly income	4	1.873	0.468	0.938
	Residential area	2	2.585	1.293	2.661
Service	Age	4	0.369	0.092	0.204
	Education level	3	1.606	0.535	1.218
	Occupation	11	3.770	0.343	0.760
	Monthly income	4	1.646	0.411	0.929
	Residential area	2	1.283	0.642	1.463

** Significant at 5% levels, respectively.*

Table 7. The Schefft's post hoc comparison of variance between demographic variables and key features of AD rental.

Dimension		Item	n	M ± SD	Scheffé's Post Hoc Comparison
Price	Occupation	1. military, public, teaching	15	4.22 ± 0.430	10 > 8 > 3 > 7 > 1 > 5 > 11 > 9 > 4 > 6 > 2 > 12
		2. electronics	2	3.00 ± 0.000	
		3. financial	1	4.33	
		4. service	9	3.67 ± 0.624	
		5. medical	1	4.00	
		6. manufacturing	4	3.67 ± 0.609	
		7. design	1	4.33	
		8. traditional	18	4.37 ± 0.656	
		9. housekeeping	35	3.86 ± 0.701	
		10. retail industry	5	4.47 ± 0.447	
		11. unemployed/retired	37	3.94 ± 0.706	
		12. other sectors	1	3.00	
Sensory	Age	1. aged 65–70	65	3.68 ± 0.594	n.s
		2. aged 71–75	35	3.48 ± 0.614	
		3. aged 76–80	14	4.01 ± 0.681	
		4. aged 81–85	12	4.00 ± 0.775	
		5. aged 85 and over	3	3.67 ± 01.154	
	Residential area	1. northern region	44	3.88 ± 0.766	1 > 2
		2. central region	57	3.54 ± 0.585	
		3. southern region	28	3.71 ± 0.529	

n.s: The Schefft's post hoc comparison of Schefft's method showed results a non-significant difference.

4.3. Empirical Analysis

This study examined elderly persons' behavior toward renting ADs using SPSS software and a logistic regression analysis. The following subsections detail the results.

4.3.1. Correlation Analysis on Experimental Variables

A logistic regression analysis was conducted to examine for variables affecting behaviors toward AD rental. Prior to the analysis, Pearson's correlation coefficient was used to avoid high collinearity among input variables, which affects model variance and in turn, lowers predictability. Variables with a value greater than 0.8 were considered highly correlated. One variable was deleted to prevent a high degree of collinearity in the logistic regression [55]. The analysis revealed a correlation of less than 0.8 for the price, sensory, practicability, and service dimensions. Thus, a logistic regression analysis was conducted to further determine factors influencing attitude toward AD rentals (Table 8).

Table 8. The correlation analysis on experimental variables of willingness to rent ADs.

	Price	**Sensory**	**Practicability**	**Service**
Price		0.736 **	0.428 **	0.487 **
Sensory	0.736 **		0.506 **	0.485 **
Practicability	0.428 **	0.506 **		0.715 **
Service	0.487 **	0.485 **	0.715 **	

** *Significant at 1% level, respectively.*

4.3.2. Significance Test of Logistic Regression Model

This study used statistical software SPSS 25 and logistic regression to analyze the data. Lower log likelihood and greater Cox and Snell's R^2 indicate greater goodness of fit for the logistic regression model [54]. Table 9 shows that Cox and Snell's R^2 is 0.181 and Nagelkerke's R^2 is 0.279. Both values are greater than the threshold (R^2 = 0.15), suggesting that the model has significant explanatory power. χ^2 reached significance in the logistic regression analysis, which means at least one independent variable can predict the dependent variable. However, the results of the Hosmer–Lemeshow test do not reach statistical significance, indicating that the model has adequate goodness of fit [54]. The results reported a p-value of 0.405 ($p > 0.05$). Thus, the model had acceptable goodness of fit. A better way to determine goodness of fit using logistic regression is to use both of the above-mentioned methods [19]. Accuracy was estimated at 83.7% using four predictor variables and by setting the split value to 0.500. The differential analysis reported a prediction accuracy rate at more than 25%. The higher the accuracy, the better the goodness of fit of the constructed logistic regression model and the greater the impact of the predictor variable on the criterion variable [55].

Table 9. List of logistic regression model.

−2 Log Likelihood	**Cox and Snell's R^2**	**Nagelkerke's R^2**
109.213	0.181	0.279
	Hosmer–Lemeshow test	
χ^2	df	significant
8.295	8	0.405

4.3.3. Determining Variables for AD Rental Behaviors

This study examined the research variables under the four dimensions of price, sensory, practicability, and service, as well as the variables of willingness to rent ADs. Table 10 presents the estimates and statistical significance of the variables for AD rental behaviors. The variable effect on willingness to rent ADs was determined by a positive or negative sign associated with the parameter estimate. Variables under the practicability dimension significantly influenced participants' willingness to rent ADs. The dimension reported negative parameter estimates. Thus, elderly persons who assign less importance to practicability aspects are more likely to rent an AD, where those who attach greater importance to practicability aspects are more likely to purchase one.

Table 10. Results of the logistics regression model of key features of AD rental dimensions and the variables of willingness to rent ADs.

Key Features of AD Rental Dimensions	B	S.E.	Wald	d.f.	Sig	Exp(B)
Price	−0.435	0.498	0.764	1	0.382	0.647
sensory	−0.466	0.596	0.612	1	0.434	0.627
practicability	−1.473	0.482	9.320	1	0.002	0.229
service	0.308	0.504	0.374	1	0.541	1.361

Note: S.E. = standard error; X^2 = 25.761 significant at the 0.1% level.

5. Discussion

As discussed in the introduction, a PSS is a sustainable business model that aims at lessening the harmful unsustainable effects of consumption. PSS is for the company to deliver a function rather than a product to its customers by emphasizing the use and functions of the product, rather than owning the product. The main focus is not on the tangible product, but rather on the customer experience and the function the product provides [56–58]. One of the basic elements of PSS is to change the original consumption habits of suppliers or consumers through leasing. Based on leasing, their habits are changed from purchase to lease, and the originally sold products are converted into services. Consumers can only use the functions brought by products, while the ownership of products remains with suppliers. In this way, suppliers can effectively provide services and control waste recycling. Therefore, PSS also motivates suppliers to develop more durable, recyclable, and valuable industrial materials as well as less fragile products. Consequently, it reduces not only the manufacturing cost for enterprises, but also the amount of waste produced, thus bringing positive effects to both the environment and the economy [59].

The results of the study revealed that most users have a positive user attitude toward ADs. Furthermore, Roelands et al., for example, suggested a positive correlation between self-perceived health condition (need to use ADs or not) and attitude toward AD use. The more aware users are of their need for ADs, the more positive is their attitude, and this affects their willingness to use the devices [39,40]. This study used a PSS to examine elderly persons' attitude toward AD rental and the key factors influencing their decision to rent such devices. The results indicated the logistic regression revealed the practicability variables in the scale for key features of rented ADs significantly influenced elderly persons' willingness to rent ADs. The estimated variable was negative, indicating that the more the participants valued practicability, the less likely they were to rent ADs. In other words, it can be speculated that those who prioritize practicability will purchase their own ADs given their preferences of adjustability, durability, safety, stability, ease of use, and wider variety of functions. This example illustrates a particular form of PSS that is popular within the literature. The type of use-oriented PSS: selling the use or availability of a product that is not owned by the customer (e.g., AD rental). In this case, the company is motivated to create a PSS to maximize the use of the product needed to meet demand and to extend the life of the product and the materials used to produce it [60–62]. The type of PSS solution satisfies customer needs through a combination of products and services that are systemized to deliver the desired utility or function [59].

6. Conclusions and Recommendations

6.1. Conclusions

This study used a PSS to examine elderly persons' attitudes toward AD rental and the key factors influencing their decision to rent such devices. First, the logistic regression revealed the practicability variables in the scale for key features of rented ADs significantly influenced elderly persons' willingness to rent ADs. The estimated variable was negative, indicating that the more the participants valued practicability, the less likely they were to rent ADs. In other words, it can be speculated that those who prioritize practicability will purchase their own ADs given their preferences of adjustability, durability, safety, stability,

ease of use, and wider variety of functions. Second, the literature review revealed that PSS is a feasible approach to implement AD rentals in Taiwan. This could complement government subsidies for long-term care to assist the financially disadvantaged. However, the concept of AD rentals is yet to gain popularity among the elderly population, and no policy promotes rentals via PSS. Thus, despite the commendable maintenance services, Taiwan's AD rental industry is likely to face slow growth [63]. Therefore, PSS also motivates suppliers to develop more durable, recyclable, and valuable industrial materials as well as less fragile products. Consequently, it reduces not only the manufacturing cost for enterprises, but also the amount of waste produced, thus bringing positive effects to both the environment and the economy [64].

Since consumers using a PSS do not own the product but rather buy the service it provides, the service provider needs to take more responsibility. Moreover, there is a lack of awareness about the economic benefits of AD rentals and trust in companies' disinfection process among the elderly population. In addition to lacking trust in the cleanliness of ADs, elderly persons are also uncomfortable with the notion of using reused devices. Government support is needed to promote information about AD rentals and to support thorough cleaning and disinfection processes. Further, excessive cleaning and disinfection could damage the surface material of existing ADs. The discoloration or worn-out condition of the devices further diminishes users' confidence. Given the relatively small size of Taiwan's AD rental market and insufficient public awareness, it is impossible for AD rental companies alone to create a sustainable AD rental service. Nevertheless, there is potential to promote AD rentals in the future. The present study has positively impacted certain elderly persons' acceptance of the AD rental system in Taiwan. AD rental policies that promote awareness building can help increase demand. In addition, private services will help the elderly population switch devices on the basis of the progression of their disease, which, in turn, could contribute to the development of the industry and increase employment opportunities.

6.2. Suggestions for Future Research

This study examined elderly persons' attitudes toward AD rentals via a PSS and the key factors influencing their willingness to rent AD. In addition, it offers strategies to promote AD rentals. However, the research focused on the concept of AD rentals and does not specify types of ADs, which may have affected participant responses. Thus, future research could provide actual rental equipment or refer to the types of AD offered by other countries. The study also focused on elderly persons' aged 65 years and above. While it examined demographic variables, it did not explore differences within the elderly population. Moreover, there are numerous factors that affect elderly persons' decision to rent ADs. Thus, researchers could classify the elderly population on the basis of their lifestyle or by analyzing all dimensions of a given variable. This will allow for a more comprehensive analysis of different elderly groups and could aid the development of the AD rental industry and the formulation of AD rental policies.

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