Consumer Acceptance on the Usage of Reverse Vending Machine (RVM)

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Abstract

Plastic bottles are broadly used in Pakistan. Commonly, the plastic bottles are made up of polyethylene terephthalate (PET), a biodegradable material. Because of the non-availability of a powerful incentive scheme, these recyclable plastic bottles are often disposed of in landfills. This paper suggests a feasibility study of building acceptance in consumer to use reverse vending machine (RVM) in order to have a sustainable and green environment. The purpose of this research is to find out the impact of consumer acceptance (i.e. awareness, incentives, convenience and environmental consciousness) on the usage of reverse vending machine and moderating effect of brand endorsement on the usage of RVM. The study involves target audience of age group 18-50 who were gone through a survey questionnaire. Sample size taken was of 261 respondents and both the models of PLS SEM (measurement and structural) were used to carry out the analysis. The results showed that awareness and incentives do not impact consumer acceptance to the usage of RVM, but convenience and environmental consciousness have the strongest impact on our target audience. Besides that, our results derived that brand endorsement does not strengthen awareness and consumer acceptance on the usage of RVM. This study aims to create a better environmental practice in the city of lights. Government must actively install the RVMS in different locations with respect to the convenience of consumers in fostering environmental sustainability and community participation. Managers shall proactively include reverse vending machine integration into their organization's strategy as an essential part of corporate social responsibility (CSR).

Keywords: Consumer; RVM; Green Environment

Introduction

Pakistan lacks adequate recycling infrastructure to manage the growing plastic waste. Due to this, a large amount of plastic waste is disposed of in landfill sites, open dumps or even in the environment, resulting in pollution. Waste management in developing countries is a growing

issue. Karachi is one of the largest cities in Pakistan with a population of around 24 million people. According to statistics, around 12,000 tons of solid waste are generated in Karachi every day and 40% of which is generated on the streets of the city (Sabir et al., 2016). Due to a lack of local recycling systems, plastic bottles are often tossed into trash bins with other debris in Pakistan. They are separated into some by manual labor and sold to recycling plants. However, municipal authorities either burn or dump the majority of plastic waste, which increases air and land pollution. As a result, the nation needs organized methods, affordable fixes, and incentive-based strategies to collect plastic bottles and encourage people to recycle plastic (Zia et al., 2022). Reverse vending machines (RVM) are one of the methods of disposing of plastics efficiently (S.K. et al., 2019).

Issue our research will address

Our research is to create awareness in the people of Karachi to dispose plastic waste in a sustainable way rather than polluting the environment. The method we are focusing on this research is developing consumer acceptance regarding the concept of the usage of reverse vending machine (RVM). Reverse vending machines were introduced with the intention of reducing global plastic waste. The reverse vending machine (RVM) is an innovative approach created to collect plastic waste and consequently improve waste management. RVMs encourage people to properly dispose of plastic. The purpose of installing RVMs is to encourage sustainable and eco-friendly practices by giving value to plastic waste (Giardullo, 2019). This initiative would bring about environmental advantages by decreasing litter on the streets, preventing plastic waste from entering oceans and other bodies of water, and reducing the volume of waste sent to landfills. Establishing an effective plastic waste management system by adoption of reverse vending machines will lead to a reduction in the presence of plastic waste on the city streets but will also yield wide-ranging benefits for both society and the environment.

Type of research

The quantitative research method will be used to identify the consumer acceptance on the usage of reverse vending machine to discard the plastic bottle waste in an eco-friendly way. The questionnaire will be designed in a way that will cover 2 parts. 1st part consists of demographics related to the respondents that includes name, age, occupation, education, area, gender and marital status. 2nd part consists of the questions that are linked with the variables that have been finalized. These variables include dependent variable i.e. consumer acceptance on the usage of reverse vending machine & on all the independent variables i.e. awareness, incentives, convenience and environmental consciousness. Questions related to moderator variables, which is brand endorsement will also be included in the questionnaire (S.K. et al., 2019). Five points Likert scale will be used in the questionnaire to make it user friendly and less confusing to

respond. This will also save the time of the respondents and increase the participation rate as well (Konstantoglou et al., 2023).

The target respondents for our study would be the age group of 18 – 50 years of Karachi population (Konstantoglou et al., 2023). Data will be collected from different universities in Karachi that include students and faculty members. Employees of organizations and different industries will also be part of our data collection framework. Understanding of target audience and tailoring reverse vending machine adoption strategies in a similar way is essential. As the consumer acceptance to the technology may vary by demographic factors, including age, income and tech-savviness.

Research Objectives

The objective of this project is mainly to help collect plastic materials and hence, to boost recycling activities and to create awareness among the citizens of Karachi in collecting the plastic materials efficiently by using the reverse vending machines.

Research Questions

a) Does awareness have significant impact on consumer acceptance on the usage of reverse vending machine?

b) Does incentives have significant impact on consumer acceptance on the usage of reverse vending machine.

c) Does convenience have significant impact on consumer acceptance on the usage of reverse vending machine?

d) Does environmental consciousness have significant impact on consumer acceptance on the usage of reverse vending machine?

e) Does brand endorsement strengthen the relationship between awareness and consumer acceptance on the usage of reverse vending machine?

Outline of the study

This study seeks to investigate the effects of different independent variables on consumer acceptance on the usage of reverse vending machine. Depended variable for this study is consumer acceptance on the usage of reverse vending machine and independent variables are divided into four sub variables which are: awareness, incentives, convenience, and environmental consciousness. The research will be conducted in Karachi for the age group 18 to 50 years.

Literature Review

Consumer acceptance is the degree to which a consumer will use a firm innovation. Consumer behavior on the recycling is frequently studied in the western culture as well as developed countries. A reverse vending machine takes empty containers and returns money to help users promote recycling (Rahim & Khatib, 2021). Reverse vending machines (RVMS) can assist in the accomplishment of UN sustainable development goals (SDGS), especially for SDG 9 – industry , innovation and infrastructure , SDG 1 2 – responsible consumption and production, SDG 13 – climate action and SDG 14 – life below water (Jungthawan et al., 2023). Consumer acceptance on the usage of reverse vending machine mainly depends on the awareness of consumer, the offered incentives, its convenience to accessibility, user friendly outlook and its positive effect on the environment (Konstantoglou et al., 2023).However, field studies show that the reverse vending machine has not been widely used. Acceptance of using a high reverse vending machine requires ease of use and increased rewards (Nurfikri & Martono, 2023).

Understanding consumer attitudes towards circular economy practices and their influence on social acceptance is a crucial aspect to consider. If consumer is willing to protect the environment, then the acceptance of RVM is very important. By depositing plastic waste in RVM, consumer will protect the environment and can raise awareness through social networks, advertisement and word of mouth. In India, the first RVM was set in 2016. The plastic waste was provided to fiber manufacturing companies to make clothes or grocery bags. The benefits from using RVM were mostly described as being beneficial for the society by using charity and donations, rather than personal benefit (Amantayeva et al., 2021).

A reverse vending machine is an innovative technique to collect the plastic waste in a sustainable way because plastic debris, such as plastic bottles and plastic containers, is frequently discarded in landfills. The presence of used plastic bags and plastic bottles in the streets, gutters, and even sewers have a huge environmental risk. The amount of plastic created every day, and the use of such plastic products harms the environment and is a threat to the planet. Plastic consumption is excessive, and waste management of such is insufficient. The reverse vending machine (RVM) is intended to encourage waste management habits by rewarding depositors in the form of reward points for each item. Many countries have deployed RVM machines after learning about their benefits. If such devices are built, the massive volume of plastic bottles that are discarded in public spaces may be simply collected. The reverse vending machine (RVM) is like conventional vending machines, except it delivers rewards such as money or shopping vouchers in return for certain items recognized when placed into the machine (Mariya, 2020).

A study has been conducted in China on the behavior of universities students on the waste management and it has been found that the circular economy has a substantial effect on China's

future economic development. The research addressed the behavior of students on the waste recycling in the educational institutes and its positive impact on the circular economy. Implementation of smart vending machine will encourage the students and promote the concept of recycling (An & Liu, 2023). Environmental researcher found that the plastic waste management is a huge challenge but it has a significant impact on the overall environment. They proposed a concept of reverse vending machine as a suitable way out to mitigate the problem of pollution because of the plastic waste specifically plastic bottles used for packing mineral waters, soft drinks, beverages etc. Reverse vending machine is cheaper way to crush the plastic bottles into smaller pieces and make it economical in terms of energy consumption during final disposal process (Sambhi & Dahiya, 2020).

According to Yaddanapudi et al., (2023) design of reverse vending machine is contrasting to a vending machine which receives plastic bottles of water and beverages and convert it into small pieces of plastic waste. Currently the recycle rate in Malaysia is 10.5% which is very much less as compared to other industrialized countries but Malaysia has a goal to increase their rate of recycling by 22% and committed to become zero waste nation. A research has been done by (Rahim & Khatib, 2021) on the design and usage of reverse vending machine that covers the domain of shredding plastic bottles into small pieces, proper collection of polyethylene terephthalate (PET) waste, make it suitable to recycle waste through proper channels and give monetary rewards to the consumer who opt the option of reverse vending machine to dispose-off the PET bottles (Rahim & Khatib, 2021).

Hypotheses Testing

Awareness and consumer acceptance on the usage of RVM

Awareness of consumers is essential for the acceptance and usage of reverse vending machines because a socially aware and responsible individual contributes positively to the environment. The rising concern about awareness of waste generation and its outcomes has led to a range of studies being conducted which are focused at understanding factors that may enhance waste recycling behavior (Dempster et al., 2021). Brand endorsement and effective marketing will help consumers to understand the functionality and benefits of reverse vending machines. Roadshows can be arranged to provide awareness to use reverse vending machines. Increased awareness will lead to changes in consumer behavior.

H1: Awareness has a significant positive impact on consumer acceptance on the usage of RVM.

Incentives and consumer acceptance on the usage of RVM

Incentives refers to a thing that encourages and motivates someone to do something. The reverse vending machine will function by accepting plastic and providing monetary rewards as a

sign of appreciation. With the world's limited resources we must begin conserving them and putting a stop to waste. Collection of plastic waste can be encouraged through a reward system. A reverse vending machine is a concept or idea that promotes the practice of managing plastic waste. It is an idea of plastic waste management that includes a reward feature (Wong et al., 2019). A reverse vending machine is designed to accept used scrap, such as plastic bottles, and swap it for monetary rewards. People can be encouraged to dispose of their plastic bottles in the specified locations rather than elsewhere (Sambhi & Dahiya, 2020). In coming time, Reverse Vending Machine can be implement on subways, railway station, colleges, public places etc. According to Islam et al., (2019) reverse vending machine support in decreasing an exponential rise of plastic pollution. The plastic containers are placed at the machine's input. The system will then analyze plastic bottles using an array of sophisticated sensors. If the bottle is found to be made of plastic after the evaluation, the machine will offer feedback in the form of a reward, which will encourage the public to use it.

Reverse vending machines allow people to deposit plastic bottles. The end user usually receives shop credit or cumulative discounts from the machine. This is what distinguishes it as a "opposite" vending machine: instead of inserting cash and retrieving an item the customer inserts an item and extracts a monetary value (Kabir Ahmad et al., 2016). Offering incentives for the use of reverse vending machines will help its acceptance towards consumer. These incentives can be bonus points, coupons, discounts vouchers or donations to charity. Thus, it is significantly verified that incentives plays a vital role in our research. So, we made the following hypothesis:

H2: Incentives has a significant positive impact on consumer acceptance on the usage of RVM.

Convenience and consumer acceptance on the usage of RVM

Convenience denotes to the fact of something being easy to do. Convenience and comfort are equally major features in user choice. Consumers can easily attract towards the concept of reverse vending machine if the recycling is easy and can be incorporated into their daily routines. Accessibility of reverse vending machines should be easy and very well known to the consumer so they can reach out to the location without any hesitation as consumer evaluate the value proposition of reverse vending machine in comparison to their convenience. They assess whether the convenience, time savings, or any additional benefits (e.g. discounts, exclusive access) rationalize using the system. The location of the reverse vending machine plays an integral part in its utilization. As stated by (Rahim & Khatib, 2021),300 Millions PET bottles have been collected through 1200 RVM machines by TORMA Japan in a year. The concept of reverse vending machine is very popular in Japan and Norway mainly because of the selection of easily reachable location for the installation of machines. These locations include super markets where customer buy the plastic bottles and use reverse vending machine after product consumption instead of throw it

into garbage bins because of the cash or credit rewards given by the machine in return of every bottle disposal.

According to (S.K et al., 2019), willingness of the residents to use reverse vending machine will be increased if it is easily accessible to them specially for the women and married couple's convenience plays a crucial role in the adaption of the concept. It is suggested by (Balcers et al., 2019), the collection of plastic bottles or waste can be increased by giving facilities to the consumer as much as possible. Like placement of reverse vending machine in the parking area near the shops so the consumer can easily access to the machine while they are going back to the parking lot to pick their cars and heading out. This will also eliminate the hesitation of going inside the shop again just for to get the reward from reverse vending machine. Proximity in finding the reverse vending machine will help to implement the concept of circular economy in Thailand as the RVM takes PET bottles of different sizes and recycle it so that it can be re used in other product as well (Jungthawan et al., 2023).

A research has been led in India which exhibited that 89% of consumer will use reverse vending machine if they found it in their workplace, educational institutes and localities. Further breakdown of the survey highlighted the fact that out of 89% of the sample population, 43% of the users would prefer the reverse vending machines in the mall, 31% choose railways stations and 26% favours the presence of reverse vending machine in super markets (Jain et al., 2023). From the study of research, we concluded that the convenience is of utmost importance to consumer while using the RVM. Therefore, we hypothesized that:

H3: Convenience has a significant positive impact on consumer acceptance on the usage of RVM.

Environmental consciousness and consumer acceptance on the usage of RVM

Environmental consciousness refers to psychological aspects that define consumer propensity for eco-friendly behaviour. Making the transition to a greener lifestyle benefits the environment by lowering the quantity of pollutants that enters the air, water, and soil. Waste is generated in large quantities and dumped into the environment. In the majority of nations, waste management is still an essential component of every business, even though some garbage is recycled and repurposed. National or local regulations, which must be founded on rational grounds, primarily regulate the collection of post-consumer packaging materials. Over the past few decades, recycling of packaging materials has grown rapidly in a number of nations (Mnguni, 2021). Due to their greater performance, greater flexibility, ease of manufacture, and cheaper cost, plastics are gradually displacing traditional materials like metal, wood, and glass. PET, or polyethylene terephthalate, is a kind of plastic that is frequently used to create bottles for soft drinks, mineral water, ketchup, pickles, etc. By 2020, 72 million tonnes of PET are anticipated to be produced worldwide, up from 42 million tonnes in 2014 (Choudhary et al., 2019). Not only is

recycling the most effective approach to manage waste, but it also serves as a modern-day example of ecological sustainability. One strategy to lessen plastics' negative environmental effects and stop resource depletion is to recycle them (Abu Jadayil et al., 2022). Customers are becoming more and more concerned about the sustainability of the environment. The preservation and protection of the environment are major considerations for consumers. They are always looking for knowledge on how to use limited resources and recycle things (Hameed et al., 2019). Hence we conclude that environmental consciousness is a major factor for consumers and that brings the acceptance on the usage of RVM. Thus we post the following hypothesis:

H4: Environmental consciousness has a significant positive impact on consumer acceptance on the usage of RVM.

Moderating role of brand endorsement and consumer acceptance on the usage of RVM

An endorsement is a statement on social media that states support or approval of a specific product, brand, or service. Brand endorsement plays a pivotal role in raising awareness and fostering the adoption of reverse vending machines for recycling. Brands can actively participate in promoting plastic waste management through reverse vending machines. According to the article published in The Express Tribune in June,2022, PepsiCo's **'Saaf Suthra Shehar'** recycling program launched in Pakistan encouraged citizens to actively play a part in making their cities green and clean. Through the program, a free Aquafina refill is given to the citizen for every 10 used plastic bottles returned, thus incentivizing waste segregation. Brands have power, and their endorsements give customers confidence and motivate them to adopt new behaviours. This element of trust plays a crucial role in persuading people to use reverse vending machines as a practical and trustworthy plastic waste management technique. Some brands choose to installed reverse vending machines to emphasize their commitment to environmental responsibility. Validation of the concept of reverse vending machine from the brand will increase the awareness of the consumer and create positive motivation as well to adopt the unconventional recycling system. Endorsement will create emotional connections with consumer and leading to increased loyalty and advocacy.

Endorsement on the usage of reverse vending machine from a reputable brand will enhance the credibility and trustworthiness in the eyes of consumer. Consumers usually believe that a reliable brand wouldn't support a system unless they believe in its effectiveness. Japan and the firm collaborated to offer Reverse Vending Machines. The business benefits from its reputation as an eco-friendly establishment and uses it to its advantage (Nurfikri & Martono, 2023). Brand endorsement is a moderator in this research study and it has positive impact on awareness. Hence, we came up with the following hypothesis to test the moderating relationship between awareness and consumer acceptance on the usage of RVM that:

H5: Brand endorsement strengthen the relationship between awareness and consumer acceptance on the usage of RVM.

2.4 Hypothesized Model

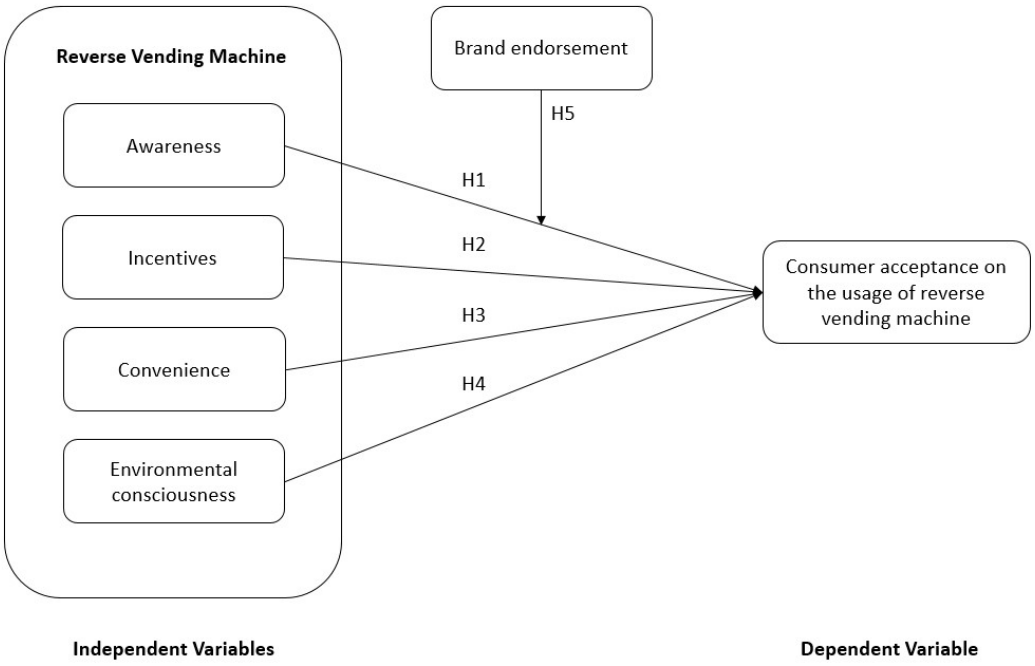

Figure 1: Hypothesized Model

Research Methods

For the purpose of research, nonprobability purposive sampling technique had been used to fill the questionnaire from the age group of 18 to 50. Data was collected from 261 respondents residing in Karachi and mainly focused on educational institutes & corporate sectors. Out of 261 respondents, 43% were females & 57% were male. The questionnaire comprises of two parts. The first part entails demographics of the respondents mainly gender, occupation and educational background. The second part involved questions that covered endogenous variable which is consumer acceptance on the usage of reverse vending machine and exogenous variables which are awareness, incentives, convenience and environmental consciousness to explore in detail the significance of each exogenous variables on endogenous variable. Moreover, in this study moderating variable is also included to check how the relationship of awareness and consumer acceptance is moderated by brand endorsement. Questions for exogenous variable awareness, incentives and convenience were adopted from the research of S.K. et al., (2019). Environmental

consciousness and queries of endogenous variable that is consumer acceptance on the usage of reverse vending machine were adopted from the study of (Jain et al., 2023).Questions of our moderator were designed from the study of the research paper (Jungthawan et al., 2023).

Table 1: Demographic Profile of the Respondents

Profile	Frequency	Percentage %
Gender		
Female	113	43
Male	148	57
Age (Years)		
18-25	95	36
26- 33	115	44
34-41	40	15
42 or above	11	4
Education		
Below Matric	2	1
Matric	1	0
Intermediate	16	6
Graduate	147	56
Post graduate	90	34
Ph.D or above	5	2

Results

Measurement Model

Indicator reliability

Measurement model assessment had been done by using PLS-SEM (J. F. H. Hair et al., 2018; Henseler et al., 2009; Sarstedt et al., 2019). Values of indicator reliability was measured by using factor loadings and all the values are between 0.663 to 0.9 as given in Table 1. Majority of the factor loading values of variables (awareness, incentive, convenience, environmental consciousness, brand endorsement and consumer acceptance on the usage of RVM) are above 0.708 which indicates good measure of latent factors (Collier, 2020; J. F. Hair et al., 2019).

Table 2: Indicator reliability

	Factor loading
AW01 <- Awareness	0.803

AW02 <- Awareness	0.816
AW03 <- Awareness	0.790
AW04 <- Awareness	0.720
AW05 <- Awareness	0.822
IN01 <- Incentives	0.750
IN02 <- Incentives	0.663
IN03 <- Incentives	0.721
IN04 <- Incentives	0.831
CN01 <- Convenience	0.709
CN02 <- Convenience	0.755
CN03 <- Convenience	0.840
CN04 <- Convenience	0.780
CN05 <- Convenience	0.711
E01 <- Environmental consciousness	0.900
EC02 <- Environmental consciousness	0.851
EC03 <- Environmental consciousness	0.871
EC04 <- Environmental consciousness	0.853
BE01 <- Brand endorsement	0.766
BE02 <- Brand endorsement	0.841
B0E3 <- Brand endorsement	0.833
BE04 <- Brand endorsement	0.762
CA01 <- Consumer acceptance on usage of RVM	0.833
CA02 <- Consumer acceptance on usage of RVM	0.890
CA03 <- Consumer acceptance on usage of RVM	0.884

Reliability and validity

Rrlibility of the construct is measured by Cronbach Alph and Rho and the threshold value for the both is 0.7 and below table shows that all the values of these are greater than the threshold value indictes model has achived construct reliability while AVE values indicates the convergent validity having threshold value greater than 0.4 and table sjows all value are significant.

Table 3: Validity and reliability analysis

Variables	Cronbach's alpha (α)	CR (rho_a)	CR (rho_c)	AVE
Awareness	0.809	0.792	0.841	0.537
Incentives	0.483	0.559	0.696	0.381
Convenience	0.694	0.717	0.801	0.45
Environmental consciousness	0.779	0.823	0.861	0.617
Brand endorsement	0.82	0.844	0.878	0.642
Consumer acceptance on usage of RVM	0.838	0.841	0.903	0.756

Discriminant validity

Moreover, discriminant validity was assessed using the Fornell-Larcker criterion and correlation and HTMT (Heterotrait-Monotrait) as mentioned in table 4 and 5 respectively. As per Fornell - Larcker criterion 1981, the square root of AVE in diagonals is the highest in rows and columns as compared with their correlation coefficient (Collier, 2020; J. F. Hair et al., 2019). Discriminant validity was further measured by using HTMT, which is more stringent criteria for assessing the validity. As per stated by (Watson et al., 1995) and (Kline, 2011); majority of the constructs has values less than 0.85 so discriminant validity has been established in the model.

Table 4: Fornell-Larcker Criterion and Correlation

	AW	BE	CA	CN	EC	IN
AW	**0.733**					
BE	0.142	**0.802**				
CA	0.308	0.503	**0.869**			
CN	0.236	0.424	0.684	**0.671**		
EC	0.356	0.439	0.734	0.653	**0.785**	
IN	0.252	0.222	0.424	0.415	0.452	**0.617**

Abbreviations: AW, Awareness; IN, Incentives; CN, Convenience; EC, Environmental consciousness; BE, Brand endorsement; CA, Consumer acceptance on usage of RVM

Table 5: Heterotrait-Monotrait (HTMT)

	AW	BE	CA	CN	EC	IN	BE x AW
AW	-						
BE	0.142	-					
CA	0.306	0.571	-				
CN	0.287	0.541	0.87	-			
EC	0.39	0.524	0.902	0.848	-		
IN	0.363	0.268	0.58	0.634	0.601	-	
BE x AW	0.308	0.124	0.368	0.207	0.357	0.199	-

Abbreviations: AW, Awareness; IN, Incentives; CN, Convenience; EC, Environmental consciousness; BE, Brand endorsement; CA, Consumer acceptance on usage of RVM

Structural Model

Hypotheses testing

As given in Table 7 of the hypothesis testing we see the measure used is called the p value and t value. The table shows that only hypothesis 3 and 4 are only accepted or supported by the results of this study because they have p value smaller than 0.05 and t value greater than 1.96 while other hypothesis don't meet significant threshold value for the both and p which are not supported. While the beta value for the each relationship shows its strength.

Table 6: Hypothesis Testing

Hypotheses	**Path**	**β**	**t statistics**	**Significance**	**Support**
H1	AW -> CA	0.018	0.4	0.345	No
H2	IN -> CA	0.078	1.455	0.073	No
H3	CN -> CA	0.302	4.053	0.000	Yes

H4	EC -> CA	0.378	4.472	0.000	Yes
H5	BE x AW -> CA	-0.093	4.724	0.042	No

Abbreviations: AW, Awareness; IN, Incentives; CN, Convenience; EC, Environmental consciousness; BE, Brand endorsement; CA, Consumer acceptance on usage of RVM

Table 7: Coefficient of determination

Discussions and Conclusion

The major finding of our research is that among four exogenous variables awareness and incentives have a strong relationship with consume acceptance on the usage of reverse vending machine, but they are not significant enough based on p and t values which is contrary to the research conducted in India. While convenience and environmental consciousness were found to be positively related to the usage of reverse vending machine which is consistent with the finding of previous research (S.K et al., 2019). The result of our studies did not align with the studies conducted by (Dempster et al., 2021). According to him consumer awareness is critical for the acceptability and use of reverse vending machines. It is contrary to the findings of our result since awareness had not established significant relation with consumer acceptance on the usage of reverse vending machine.

The finding of our study indicates that incentives did not encourage people to adopt the usage of reverse vending machine which is contrary to the previous research. The finding of our study seems to be inconsistent as per (Islam et al., 2019) that suggests reverse vending machine helps to reduce the exponential growth in plastic pollution and encourages the people to use it by giving monetary rewards. The finding of our study is consistent with (Balcers et al., 2019) who proposed that by providing convenience to consumers for the usage of reverse vending machine, the collection of plastic bottles or garbage may be enhanced. The findings of our study are primarily aligned with the previous study conducted by (Hameed et al., 2019) that people are increasingly worried about the environment's sustainability. Consumers place a high value on environmental preservation and protection. They are always seeking information on how to use limited resources and recycle items. It is interesting to note that the article published in The Express Tribune exhibited that awareness and consumer acceptance on the usage of reverse vending machine would be strengthened by brand endorsement which was acting as a moderator in our research. However, our test results showed that the brand endorsement did not strengthen the relationship between awareness and consumer acceptance on the usage of reverse vending machine.

Implications

This study fills several essential gaps in the literature. At first, we conducted research in Karachi, Pakistan. While most of the previous research was conducted in Germany, Norway, and the United States. The results of these researches conducted in developed countries may not be applicable in Asian countries where government regulations over plastic disposal are not efficient (S.K et al., 2019). The existing literature shows that reverse vending machine has the potential to greatly decrease litter, increase recycling, leading to a positive environmental impact by reducing landfill waste (Abu Jadayil et al., 2022). There are near to none research studies that includes environmental consciousness as a factor which impact the usage of reverse vending machine. Thus, environmental consciousness on reverse vending machine is another addition of this research to the existing literature. Brand endorsement may improve the credibility, visibility, and overall effectiveness of reverse vending machines as per the article published in The Express Tribune in June,2022. Reverse vending machines endorsed by well-known and trustworthy companies will more likely attract public attention and raise awareness about recycling activities. Thus, in our study we used brand endorsement as a moderator on the relationship between awareness and consumer acceptance on the usage of reverse vending machine. Managers shall proactively include reverse vending machine integration into their organization's strategy as an essential part of corporate social responsibility (CSR). Recognizing its strategic importance in fostering environmental sustainability and community participation is critical for long-term success. It may portray their firms as socially responsible entities by incorporating reverse vending machines into strategic planning, satisfying stakeholders' expectations, and improving the company image. This strategic alignment not only develops a responsible culture, but it also emphasizes a dedication to operational efficiency, eventually leading to a sustainable and resilient company model. The government should pass legislation regulating the use of reverse vending machine. Thus, they can be deployed in educational institutions, offices, or public venues where people go daily. When it is situated in areas where individuals are informed, awareness and engagement will make a difference. The adoption of RVMs might be part of the country's policy, in which the customer can receive reimbursements from stores if they recycle the plastic containers after usage. It creates compelling incentives for consumers to recycle. Policies and techniques such as the bottle bill and recycle refund systems can be legislated globally to encourage citizens to employ measures that will preserve our environment plastic-free.

Limitations

This study has certain limitations that may point to future research options. The data were collected from the 261 respondents residing in Karachi having age group from 18 to 50 years. However, it should be noted that they might not be the true representative of the population so

the findings derived from these respondents cannot be generalized. We feel that study with more representative samples is required to assess the generalizability of the findings. Geographic barriers exist in this research. Major analysis conducted in nations like Germany, Norway, and the United States have government regulations over plastic disposal and they are more efficient. As a result, the result's applicability to diverse geographies must be investigated (S.K et al., 2019).

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