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Circular economy in practice: The influence of second-hand stores on used electronics consumption in Japan and Germany

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HIGHLIGHTS

- German consumers reportedly bought 5x more used EEE than Japanese consumers over the past five years.
- Japanese prefer physical stores; Germans favor online platforms for second-hand EEE purchases.
- Store availability significantly predicts purchase intention, especially in Germany.
- Perceived risks/benefits are key psychological drivers of second-hand purchase intention in both countries.
- Combining attitudinal factors with infrastructural context offers a novel framework for understanding circular consumption.

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ABSTRACT

This study examines consumer purchase intention for second-hand electrical and electronic equipment in Japan and Germany, focusing on attitudinal drivers in addition to the accessibility of physical stores. Two web-based surveys (n = 600 and n = 866) collected data on consumer perceptions and the proximity of second-hand retailers. Regression analyses show that perceived benefits and risks significantly correlate with purchase intention, with notable differences between the two countries. The availability of physical second-hand stores plays a key role, while expected benefits of physical shopping environments had limited impact. German consumers were found to purchase second-hand electronic equipment at a significantly higher rate compared to their Japanese counterparts. The study contributes to circular economy research by combining subjective perceptions with reported infrastructural data, offering a more integrated model of reuse behavior. Findings have practical implications for policy and retail, highlighting the importance of local accessibility and consumer trust. While grounded in high-income contexts, the methodological approach can inform future research in emerging economies and other product domains.

1. Introduction

Achieving sustainable consumption and production patterns is critical for realizing the United Nations Sustainable Development Goals (SDGs), particularly Goal 12, which emphasizes responsible consumption and production. Reuse, a cornerstone of the circular economy, has been identified as a vital strategy for achieving these objectives. Defined as "the repeated use of a product or component for its intended purpose without significant modification" (Ellen MacArthur Foundation, 2021), reuse extends product lifetimes and mitigates environmental impacts associated with the production and disposal of new goods. For instance, Moon (2024) reported significant carbon savings—approximately 67 %—from the reuse of textiles via online platforms. Clemm et al. (2023) estimated that the second-hand smartphone market in the Unites States results in 27 % reduced new production and 25 % savings in carbon emissions. These findings underscore the environmental benefits of reuse, despite the potential for rebound effects, such as increased consumption due to lower costs of used products (Thomas, 2003; Cooper

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and Gutowski, 2017).

While physical second-hand marketplaces have long facilitated the reuse of products like textiles and automobiles, other product categories, such as electrical and electronic equipment (EEE), lack comparable infrastructure. EEE reuse is particularly significant due to the high environmental and resource costs associated with their production (Baldé et al., 2017). However, the second-hand EEE market remains underdeveloped in many regions, with online shops and second-hand online market platforms often dominating the trade. While online shopping offers distinct advantages, including convenience, extensive product availability, and ease of price comparison (Manohar et al., 2023), physical stores provide critical benefits for second-hand markets, such as the ability to inspect products firsthand, receive personalized assistance, and immediately acquire goods. These factors are particularly critical for pre-owned items, where trust and product condition are paramount (Abdulla et al., 2024).

Japan and Germany present contrasting cases for exploring the role of physical stores in EEE reuse in the context of high-income countries. Japan boasts a well-developed network of franchise businesses specializing in second-hand goods, including EEE, with over 4000 stores nationwide (locationsmart, 2023). Prominent chains like HardOff, BookOff, and 2nd Street provide recognizable and trusted channels for purchasing pre-owned electronics. In contrast, Germany lacks comparable franchise networks for used EEE, with trade largely occurring through online channels such as re-commerce companies, which boast increasing revenue and market share (Koutsou-Wehling, 2024). This disparity raises questions about how the availability of physical stores influences consumer engagement with reuse and purchase intentions for used EEE.

Despite the global significance of EEE reuse for advancing the circular economy, the impact of physical stores remains understudied. To the best of the authors' knowledge, no prior research has systematically examined the effects of physical store availability on EEE reuse behavior. This study aims to address this gap by investigating consumer engagement with second-hand EEE in Japan and Germany, complemented with consumer-reported data on second-hand market infrastructure location, thereby integrating subjective perceptions with more objective context.

Through online surveys, we explore the following research questions.

1. Do consumers prefer online or offline channels for purchasing used EEE?
2. What is the influence of physical store availability on consumer intentions to engage with EEE second-hand markets?
3. What are differences in how physical and online channels affect various demographics and EEE categories, such as consumer electronics and household appliances?

The paper is structured as follows: Section 2 grounds the study in the context of theoretical background and methodological landscape. Section 3 outlines the hypotheses, section 4 explains the methods, section 5 presents the results, section 6 discusses the findings, and section 6 provides conclusions and outlook.

This study contributes to circular economy research by integrating attitudinal modeling with location-based infrastructural indicators, offering a more holistic understanding of consumer participation in reuse behavior. While this study focuses on consumer behavior rather than environmental outcomes, understanding purchase patterns is essential for realizing the environmental benefits of reuse.

2. Literature

2.1. Theoretical background

Research into second-hand consumption draws from theories of planned behavior (Ajzen, 1991), value-belief-norm theory (Stern et al., 1999), and behavioral economics, particularly as they relate to risk aversion and utility maximization. Studies have shown that consumer purchase intention (PI) for reused products is influenced by perceived benefits (e.g., cost savings, avoided environmental impact), perceived risks (e.g., product quality, hygiene concerns), and social norms (Güngördü Belbağ and Belbağ, 2024; Zhang and Luo, 2021). In addition, trust—whether in the product, seller, or platform—has emerged as a critical variable across product categories and sales channels (Guiot and Roux, 2010).

Attitudinal drivers are frequently assessed using psychometric constructs and analyzed through regression techniques, making structured surveys a widely adopted method in consumer behavior research (Quoquab et al., 2019; Webb et al., 2017). Regression models allow researchers to disentangle the relative influence of risk, benefit, and contextual factors on PI. The approach aligns with consumer behavior literature that seeks to explain intention as a function of individual, environmental, and product-level attributes (Matsumoto et al., 2018; Chun et al., 2022).

2.2. Methodological landscape

Quantitative studies on reuse behavior commonly employ survey-based approaches due to their ability to capture subjective perceptions and attitudes and relate them to individual behaviors or preferences. For example, recent studies have used structured surveys and structural equation modeling to analyze the factors influencing consumer willingness to pay for circular products, including refurbished electronics (Fu et al., 2023), as well as consumer behavior toward the reuse of electrical and electronic equipment (Banaszkiewicz et al., 2024).

Despite methodological consistency, gaps remain regarding how different retail environments (e.g., online vs. physical stores) shape risk perception and trust. Studies like Abdulla et al. (2024) suggest that physical inspection opportunities can significantly reduce perceived risk and increase purchase confidence, yet few studies examine this empirically in the context of EEE.

2.3. Geographical focus

Japan and Germany offer a useful comparative context for examining reuse behaviors, including in relation to electrical and electronic equipment (EEE). While both countries are high-income, technologically advanced nations with aging populations, there are of course cultural, economic, and infrastructural differences – not least the availability of physical stores as outlined in the introduction section.

In the past, Japanese consumers have been characterized as less knowledgeable about circular products, associating them with low benefits and higher risk, especially concerning quality, which can inhibit second-hand consumption (Matsumoto et al., 2016). However, Japan also boasts a robust franchise infrastructure of second-hand stores, offering high visibility and perceived reliability. In contrast, while Germany lacks such infrastructure, the reuse market is supported by regulatory frameworks that enforce minimum warranty periods and consumer rights (Clemm et al., 2021). Cross-cultural studies show that consumer trust and uncertainty avoidance vary significantly across national contexts, shaping willingness to buy used goods—whether clothing, electronics, or even food—through differences in perceived risk and cultural norms (Xu et al., 2014; Schroeder et al., 2007).

This study contributes to the literature by examining how the availability of physical stores influences reuse behavior in these two settings, addressing a notable gap. While past research has focused largely on online retail channels or generalized reuse behavior, few have explicitly assessed the role of infrastructure access—despite its theorized relevance in behavioral economics and consumer trust formation.

3. Hypotheses

To address the research questions, this study employs regression analysis on survey data, following methodologies from Matsumoto et al. (2018) and Chun et al. (2022), to evaluate the impact of several factors on consumer purchase intention for used products. Two established hypotheses from prior studies are adopted, which have already been well-tested and reported on, alongside two novel hypotheses tailored for this study.

Previous research highlights that perceived benefits, such as cost savings and environmental advantages, positively influence PI for second-hand products. Conversely, perceived risks, including concerns over safety, quality, and repair costs, negatively affect PI (Mugge et al., 2017; Matsumoto et al., 2018; Chun et al., 2022). These insights inform the following hypotheses.

H1. Perceived benefits of buying used EEE positively influence consumer PI for used EEE.

H2. Perceived risks of buying used EEE negatively influence consumer PI for used EEE.

Building on this foundation, this study proposes hypotheses related to the availability of physical stores and their unique advantages, such as allowing consumers to inspect products in person and consult with sales staff. We hypothesize that the presence of physical stores within consumers' accessible environments, particularly in Japanese cities, where second-hand franchises are widespread, positively influences their intention to purchase used electrical and electronic equipment (EEE). This is supported in part by Abdulla et al. (2024), who found that physical exposure to remanufactured product markets can enhance consumer acceptance.

H3. The availability of physical second-hand stores trading EEE positively influences consumer PI for used EEE.

Besides the mere availability and accessibility, the consumer propensity to value potential benefits of physical stores, including the ability to inspect products, interact with staff, and take possession of purchased items immediately, is hypothesized to impact consumer PI for used EEE. This is in part supported by data reporting the leading reasons for Japanese consumers to make purchases at physical stores, being the ability to inspect products before purchase (about 77 %) and taking ownership immediately after the purchase (Statista Research Department, 2025).

H4. The perceived benefits of physical stores positively influence consumer PI for used EEE.

Fig. 1 presents the hypothesized model.

4. Survey

4.1. Data collection and analysis

A first, web-based survey was conducted in fall 2023 to explore consumer perceptions and preferences for second-hand EEE in Japan and Germany. It included questions on purchase experiences, purchase intention for used EEE, and question items related to the hypotheses: perceived risks, perceived benefits, availability of physical stores, and benefits of shopping at physical stores. The sample size for each country was 300, with equal representation across six age groups. A full list of the questions is provided in Annex I of the supplementary materials.

A second survey, conducted in spring 2024, gathered data on the number, names, and proximity of physical shops trading used EEE to respondent's homes. This spatially contextualized variable provided a more objective assessment of store availability while mitigating regional bias. Respondents included 462 in Japan and 404 in Germany. The questions are provided in Annex II of the supplementary materials. Table 1 summarizes the respondents' demographics, including living areas and income distributions.

While the two surveys were conducted at different points in time and sampled different individuals, we do not expect this to negatively impact the results. The constructs measured in the first survey (attitudes, preferences, intentions) are relatively stable over short timeframes, and no major policy, economic, or market developments relevant to second-hand EEE occurred between the two waves. Additionally, store availability as measured in the second survey, is unlikely to have changed substantially within the six-month interval. Therefore, the time gap between both surveys is not expected to introduce systematic bias into our findings. A limitation of this approach is that individual-level attitudes cannot be directly linked to individual-level store access, as different samples were used. However, both samples were demographically representative, allowing population-level insights.

Factor analysis using SPSS (version 28) identified underlying constructs with high internal consistency (Cronbach's alpha): Purchase Intention (PI, $\alpha = 0.93$), Availability of Stores (A/A, $\alpha = 0.91$), Perceived Benefits (PB, $\alpha = 0.89$), Perceived Risks (PR, $\alpha = 0.91$), and Store Benefits (PBPS, $\alpha = 0.77$). AMOS version 28 confirmed the discriminant validity of constructs following Fornell and Larcker's (1981) criteria. Ordinary Least Squares (OLS) regression was used to analyze the relationship between predictors (PB, PR, A/A, PBPS) and PI, with significance set at $\alpha = 0.05$.

4.2. Dependent variable

The dependent variable, Purchase Intention (PI), measures consumers' intention to buy second-hand EEE, including consumer

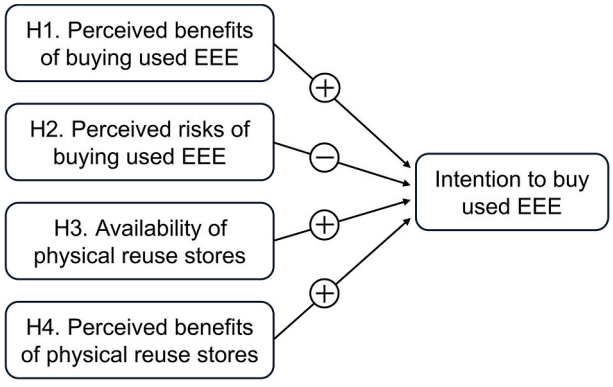

Fig. 1. Hypothesized model. The expected positive and negative influence of the independent variables on the dependent variable (purchase intention) are indicated with a + or - icon.

Table 1
Respondents' living area and income distribution.

Variable	First survey		Second survey	
Country	JP	DE	JP	DE
Living area				
Big city center	69	58	106	92
Big city suburbs	59	49	79	59
Provincial city	99	115	156	172
Countryside	73	78	119	81
Household income				
Highest quartile	20	26	27	41
Higher quartile	34	60	51	92
Lower quartile	95	98	138	130
Lowest quartile	151	116	246	141

electronics (e.g., smartphones), small household appliances (SHA, e.g., microwaves), and large household appliances (LHA, e.g., refrigerators). Items were rated on a 7-point Likert scale (1 = "strongly disagree" to 7 = "strongly agree"), covering personal purchase intentions and willingness to encourage others to buy used EEE.

4.3. Independent variables

Independent variables include Availability of Stores (A/A), Perceived Benefits (PB), Perceived Risks (PR), and Perceived Store Benefits (PBPS). The specific questions used to measure these constructs are included in Annex I of the supplementary materials. All variables were measured on a 7-point Likert scale.

- PB: Includes price consciousness and environmental benefits, such as resource savings and reduced emissions.
- PR: Encompasses concerns about safety, quality, repair costs, and time investment.
- A/A: Measures awareness and accessibility of second-hand stores compared to new EEE stores.
- PBPS: Reflects benefits of physical stores, such as firsthand inspection, staff support, and immediate ownership.

5. Results

5.1. Descriptive analysis

The survey results highlight distinct preferences and experiences between Japanese and German respondents regarding second-hand EEE. Japanese respondents favored physical stores (56 %), whereas German respondents preferred online shops (29 %). Purchasing directly from previous owners was more common among Germans (17 %) than Japanese respondents (3 %) as is shown in Table 2 and Fig. 2 (Panel A).

More than twice of the German respondents reported to have purchased used EEE before (54 %) compared to Japanese respondents (25 %), with Germans buying approximately five times more used EEE per capita (1.28 per person on average) in the last five years (Fig. 2, Panel B). Across both countries, pre-owned consumer electronics were purchased at twice the rate of household appliances. Purchase intention for second-hand EEE was higher among Germans (normalized PI: .42) than Japanese respondents (.30).

Gender differences emerged, with Japanese female respondents reporting lower purchase intention (.27) compared to Japanese males (.34). German respondents showed minimal gender differences (male: .41; female: .40) (Fig. 2, Panel C). Among the reasons cited, reluctance to use pre-owned products (27 %), hygiene concerns (23 %), and reliability issues (17 %) ranked highest among female Japanese respondents.

Contrary to expectations, the availability and accessibility of physical stores trading used EEE was rated higher in Germany (.44) than Japan (.35). More German respondents (62.6 %) reported knowing shops in their area compared to Japanese respondents (50.6 %), although Japanese respondents identified more shops per capita on average (1.90) than Germans (1.68). Shops were perceived to be more accessible in Germany, with 91 % of respondents describing them as nearby and easy to reach, compared to 78 % in Japan. Average travel distances and times were similar: 6.0 km and 12 min in Germany and 5.6 km and 13 min in Japan.

Respondents also listed shop names in their area. In Japan, 57 % of named shops belonged to franchise businesses such as 2nd Street, Hard Off, and Book Off, while in Germany, franchises comprised just 16 %. MediaMarkt and Saturn were frequently mentioned but are primarily known for selling new rather than used EEE, casting doubt on their relevance. In fact, the authors confirmed with both franchises that second-hand EEE were not sold in physical stores at the time of the survey. Removing those responses, the average number of shops trading used EEE known to the German respondents was reduced to 1.54, or about 19 % below the Japanese average (Fig. 2, Panel D). This indicates a difference in the perception of A/A between Japan and Germany, where Japanese know a higher number of stores but reported a lower perceived A/A.

Differences in preference by age groups were more pronounced in the Japanese context, where respondents aged 50 and above accounted for 56 % of those preferring physical stores, compared to 44 % among those aged 20–49 (Fig. 2, Panel F).

5.2. Regression analysis

The results of the regression analysis for Japan and Germany are summarized in Table 3 and in Fig. 2 (Panel E).

The regression analysis for Japan reveals that the model explains 42 % of the variance in the intention to buy used electrical and electronic equipment (EEE) ($R^2 = .42$, F-statistic = 30.06, $p < 0.01$). Among the predictor variables, perceived benefits (PB) had a significant positive effect on purchase intention ($\beta = .17$, $t = 4.12$, $p < 0.01$), indicating that consumers who perceive greater benefits in buying used EEE are more likely to make such purchases. Conversely, perceived risk (PR) negatively influenced purchase intention ($\beta = -.12$, $t = -2.53$, $p < 0.05$), suggesting that higher perceived risks deter consumers from buying used EEE.

The availability of physical stores (A/A) emerged as the strongest predictor ($\beta = .40$, $t = 8.66$, $p < 0.01$), implying that consumers in Japan highly value the ability to purchase used EEE from a physical retail location. However, the benefits of physical stores (PBPS) did not significantly impact purchase intention ($\beta = -.01$, $t = -.26$, p = n.s.), indicating that while store availability matters, the specific advantages of physical stores may not be a key driver of purchasing behavior.

Among demographic factors, gender had a small but significant negative effect ($\beta = -.23$, $t = -2.02$, $p < 0.05$), meaning that male consumers were slightly more likely to buy used EEE than female consumers. Age and income did not significantly affect purchase intention.

The regression model for Germany explained 36 % of the variance in purchase intention ($R^2 = .36$, F-statistic = 23.58, $p < 0.01$). Similar to Japan, perceived benefits (PB) significantly increased purchase

Table 2
Preferences and shopping experience.

Aspect	Japan	Germany
Previous experience buying used EEE		
Any channel	25 %	54 %
Online shop	16 %	33 %
Physical store	14 %	18 %
Previous owner	11 %	37 %
Preferred channel to buy used EEE		
Online shop	18 %	29 %
Physical store	56 %	22 %
Previous owner	3 %	17 %
No preference	23 %	32 %

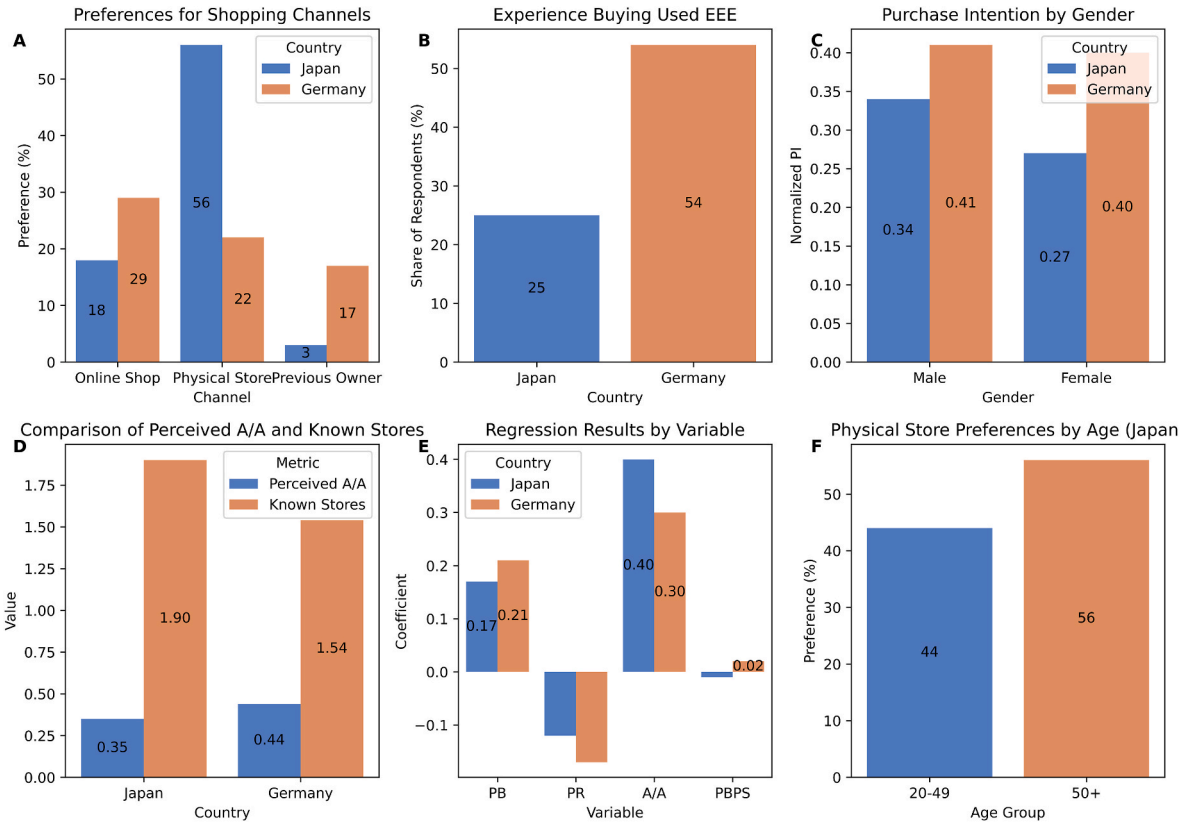

Fig. 2. Overview of Key Findings on Second-Hand EEE Consumer Behavior and Preferences. Panel A: Preferences for shopping channels in Japan and Germany, showing contrasting preferences for physical stores versus online platforms. **Panel B:** Share of respondents with prior experience buying used EEE, showing Germans' higher affinity. **Panel C:** Purchase intention for second-hand EEE by gender, highlighting higher normalized scores among males and minimal gender differences in Germany. **Panel D:** Comparison of perceived availability and accessibility (A/A) and the actual number of known physical stores trading used EEE per respondent in Germany and Japan, indicating regional differences in perceptions. **Panel E:** Regression results summarizing the influence of perceived benefits, risks, accessibility, and store benefits on purchase intention across both countries. **Panel F:** Age-based preferences in Japan, showing older generations' stronger inclination toward physical stores.

intention ($\beta = .21$, $t = 4.42$, $p < 0.01$), confirming that German consumers who recognize the advantages of buying used EEE are more inclined to make such purchases. Perceived risk (PR) also negatively influenced purchase intention ($\beta = -.17$, $t = -3.20$, $p < 0.01$), reinforcing the idea that risk perception serves as a barrier to adoption.

The availability of physical stores (A/A) had a strong positive effect ($\beta = .30$, $t = 6.71$, $p < 0.01$), similar to Japan, indicating that store accessibility is an important consideration for German consumers. However, unlike Japan, the benefits of physical stores (PBPS) showed a positive but non-significant effect ($\beta = .09$, $t = 1.64$, $p =$ n.s.), suggesting that while store presence is valued, the specific advantages of physical stores are not a major determinant of purchase intention.

Among demographic variables, age had a significant negative impact ($\beta = -.15$, $t = -3.32$, $p < 0.01$), suggesting that younger consumers are more likely to buy used EEE than older ones. Gender and income did not show significant effects on purchase intention.

These findings affirm H1 (positive correlation between PB and PI), H2 (negative association between PR and PI), and H3 (positive link between A/A and PI). However, H4 (positive relationship between PBPS and PI) was not supported.

Table 3
Results of regression for Japan and Germany.

Variable	Japan			Germany		
	Coefficient	Std Errors	t-value	Coefficient	Std Errors	t-value
Intercept	1.94	.390	4.99[b]	1.88	.49	3.85[b]
Gender	−.23	.112	−2.02[a]	.05	.15	.30
Age	−.05	.030	−1.64	−.15	.05	−3.32[b]
Income	−.06	.030	−1.84	−.04	.04	−1.05
PB	.17	.040	4.12[b]	.21	.05	4.42[b]
PR	−.12	.050	−2.53[a]	−.17	.05	−3.20[b]
A/A	.40	.050	8.66[b]	.30	.04	6.71[b]
PBPS	−.01	.047	−.26	.09	.06	1.64
Model Summary	$R^2 = .42$ F-statistic = 30.06[b]			$R^2 = .36$ F-statistic = 23.58[b]		

[a] sig. < .05.
[b] sig. < .01.

6. Discussion

6.1. Research questions

This section discusses findings related to the three research questions (RQ) based on the survey and regression results.

For RQ1, the survey revealed that Japanese respondents predominantly prefer physical stores for purchasing used EEE (56 %), whereas Germans favor online shops (29 %). This aligns with the higher availability of physical stores in Japan. Interestingly, Japanese consumers also prefer physical stores for new EEE (50 %) over online options (25 %), hinting at a general preference for offline shopping, whereas Germans exhibit the opposite preference, favoring online shopping for new EEE (43 %) over physical stores (35 %). Assuming that indeed Japan has a higher availability of physical stores, this is in line with previous research reporting that higher availability of retail stores in the vicinity of consumers lowers their likelihood of purchasing second-hand good via online platforms (Hinojo et al., 2022). Differences between Japanese and German consumers may further be explained with cultural factors or market conditions, such as online return and warranty policies being relatively less appealing in Japan compared to Germany (Clemm et al., 2021).

For RQ2, the regression analysis identified store availability and accessibility as significant factors influencing purchase intention in both countries. This underscores the need to make second-hand electronics widely accessible through physical and online channels. Businesses could expand their physical store presence, enhance online shopping experiences, and improve consumer awareness of second-hand options. These findings align with Abdulla et al. (2024), who advocate for integrating physical channels to market remanufactured products, potentially broadening market reach. However, the perceived benefits of physical stores showed no significant impact on PI, suggesting that while physical stores play a role, the considered factors (firsthand inspection of products, staff availability, immediacy of purchase) exert a weaker than expected influence. This is in contrast to expectations, given that the reported leading reasons for purchasing at physical stores among Japanese consumers were congruent with questions in our survey, being inspecting products before purchase and taking ownership immediately after the purchase (Statista Research Department, 2025). This paradox, where store availability matters but specific store benefits don't, suggests availability may signal market legitimacy and product normalization rather than providing functional advantages. This challenges transaction cost theories that emphasize inspection and immediacy benefits. Pertaining to RQ3, demographic differences between Japan and Germany also provide important strategic insights. In Japan, gender played a role, with men more likely to purchase used EEE than women, suggesting that trust-building measures targeting female consumers may be beneficial. In Germany, younger consumers exhibited a greater willingness to buy used EEE, indicating that marketing efforts should focus on younger demographics through digital campaigns, sustainability messaging, and trade-in programs. Notably, higher age groups (50 years and above) among Japanese respondents displayed a more pronounced preference for physical stores, indicating that older generations may currently engage more with the circular economy through physical channels. These findings are well aligned with previous research reporting older consumers to be less likely to use online platforms to buy second-hand goods (Hinojo et al., 2022). Further, being female was reported to have a significant negative effect on participation in online second-hand markets in the literature (Hinojo et al., 2022).

6.2. Further insights

Beyond the research questions, the data reveals additional insights. Only 25 % of Japanese respondents reported having purchased used EEE, compared to 54 % of German respondents. Several factors may explain this disparity. Matsumoto et al. (2016) found that Japanese consumers were less likely to buy remanufactured car parts due to limited knowledge, and cultural traits, such as low tolerance for ambiguity (Hofstede, 1980; Schroeder et al., 2007), may contribute to a general aversion toward used products.

Warranty periods also differ significantly between the countries. Clemm et al. (2021) reported that warranties on used EEE in Germany can extend up to 3 years, exceeding the statutory 2-year minimum. In contrast, Japanese shops typically offer warranties of only 30 days to 6 months. These extended warranties in Germany likely reduce perceived risks associated with purchasing used EEE. However, this data pertains to online shops, with no comparable information available for physical stores.

Regarding gender differences, previous studies (Chahal, 2013) suggest that men are more inclined to purchase second-hand electronic products and cars, whereas women are more likely to buy second-hand books, clothes, and accessories. This pattern was observed in our findings, with men displaying a greater intention to purchase second-hand electronics compared to women.

6.3. Recommendations

The analysis provides actionable insights for businesses and policymakers in Japan and Germany. Enhancing the perceived benefits of buying second-hand EEE, improving store availability, and addressing perceived risks are key strategies to boost consumer adoption. Understanding age-related preferences can further inform targeted marketing efforts, contributing to sustainable consumption practices with potential environmental implications.

First, the positive relationship between perceived benefits and purchase intention highlights the need to emphasize the advantages of second-hand EEE. Messaging strategies could consider promoting environmental benefits, such as extending product lifecycles, reducing e-waste, and conserving resources. Second, addressing perceived risks is essential to building consumer confidence. Risk mitigation strategies include quality assurance, warranties, and transparent product information. Policymakers can support these efforts by establishing regulations and standards to ensure safety and reliability. Third, improving store availability and accessibility may be key. Businesses could consider expanding physical store networks, enhancing online shopping platforms, and ensuring awareness of second-hand EEE options. Collaborations with retailers and e-commerce platforms can further increase visibility and accessibility. Fourth, while the benefits of physical stores showed no significant relationship with PI, physical stores still play a relevant role. Businesses could complement their physical presence with strong online channels, reflecting the growing importance of e-commerce. Finally, recognizing age differences is vital. Younger consumers show higher PI for used EEE, suggesting that businesses should engage them through social media, online platforms, and sustainability-focused messaging. Tailoring campaigns to older demographics, who prefer physical stores, remains equally important. Policymakers and businesses should consider collaborating to promote second-hand EEE adoption by incentivizing eco-friendly practices, supporting consumer education, and establishing quality standards to foster a sustainable consumption environment.

Another recommendation is to promote cross-cultural knowledge exchange: Germany's success in second-hand EEE adoption, particularly through online channels, could serve as a case study for Japan, while Japan's franchise-based physical store model could inspire similar initiatives in Germany. Policymakers could encourage bilateral knowledge-sharing programs to disseminate best practices. Further, with gender differences influencing purchase behavior, businesses should develop marketing strategies that address specific concerns. For instance, campaigns targeting female consumers could emphasize product hygiene, quality assurance, and extended warranties to overcome barriers to second-hand EEE adoption.

6.4. Limitations

Although factors such as perceived benefits, risks, and store availability significantly correlate with purchase intention, the modest R-squared values suggest that additional predictors may contribute to consumer decision-making. For instance, government incentives and warranty provisions, known to affect consumer behavior, were not extensively analyzed in this study. Other potential influences, such as brand trust (Güngördü Belbağ and Belbağ, 2024), also warrant further exploration. Moreover, cultural perceptions of second-hand goods, as noted by Xu et al. (2014), may play a critical role in shaping consumer preferences. Future research should consider these nuances to better capture the complexity of decision-making processes across diverse populations.

While Japan and Germany provide valuable contrasts in consumer culture, reuse infrastructure, and environmental attitudes, both are high-income, industrialized countries with relatively mature second-hand markets. This limits the direct generalizability of our findings to low- and middle-income countries, where infrastructure, regulatory frameworks, and cultural perceptions of reuse may differ significantly. Expanding the analysis to a broader range of cultural, economic, and regulatory contexts could provide a more comprehensive understanding of global consumer attitudes and behaviors, as well as the role of physical infrastructure, helping refine strategies for promoting second-hand EEE consumption worldwide.

7. Conclusions and outlook

This study examined consumer purchase intention for second-hand electrical and electronic equipment in Japan and Germany, integrating attitudinal constructs with location-based infrastructure data. The findings reveal significant cross-national differences in reuse behavior and the critical role of physical store availability in shaping consumer engagement with circular economy practices.

7.1. Theoretical contributions

This research advances circular economy literature in three distinct ways. First, it extends the Theory of Planned Behavior (Ajzen, 1991) by demonstrating that infrastructure availability functions as a distinct behavioral determinant beyond attitudes and subjective norms, with standardized coefficients ($\beta = .40$ for Japan, $\beta = .30$ for Germany) exceeding those of traditional constructs. This challenges existing consumer behavior models that treat infrastructure as contextual background rather than an active behavioral driver.

Second, the study introduces a novel methodological approach by integrating consumer-reported store location data with subjective perceptions, addressing a knowledge gap regarding the role of physical infrastructure in second-hand markets. This dual-data approach revealed a paradox: while Japanese respondents knew more stores (1.90 vs 1.54), they perceived lower availability than Germans, highlighting the importance of combining objective and subjective measures.

Third, our findings challenge assumptions about physical store benefits. Despite literature suggesting that product inspection and immediate ownership drive physical store preferences (Abdulla et al., 2024), these benefits showed no significant relationship with purchase intention. This indicates that store presence matters more than specific store advantages, suggesting that accessibility rather than functionality drives reuse behavior.

7.2. Managerial and policy implications

The five-fold difference in per capita EEE purchases between Germany (1.28) and Japan (.25) underscores substantial untapped potential in the Japanese market. For practitioners, three evidence-based strategies emerge:

For retailers: In Japan, expand physical store networks in urban areas where 50+ age groups show strong preference for offline channels (56 % preference rate). In Germany, strengthen online presence while maintaining physical touchpoints for product categories requiring trust-building. Both markets require enhanced warranty provisions: While Germany offers longer warranties (up to 3 years vs Japan's 30 days to 6 months), our data shows German consumers remain more sensitive to perceived risk ($\beta = -.17$ vs $-.12$), suggesting warranty extensions alone may not fully address risk concerns. Additional trust-building measures beyond warranties may be needed.

For policymakers: The strong influence of store availability (explaining up to 40 % of variance) justifies infrastructure investment in second-hand retail. Specific interventions include: (1) zoning regulations favoring second-hand stores in urban centers, (2) tax incentives for franchise expansion in underserved areas, and (3) standardized quality certification systems to address the gender gap in Japan (PI difference of .07 between genders).

For marketing strategies: Target communications should differ by country, emphasizing convenience and warranty protection in Germany (where online dominates) versus quality assurance and brand trust in Japan (where franchise recognition is high). Address gender-specific barriers through targeted campaigns, particularly for Japanese women who cite hygiene (23 %) and reliability concerns (17 %).

7.3. Limitations and future research

While the model explains substantial variance ($R^2 = .42$ for Japan, .36 for Germany), unmeasured factors such as social influence and product-specific attributes warrant investigation. The focus on high-income countries limits generalizability to emerging economies where informal reuse markets may be more dominant. Future research should examine causal relationships through experimental designs and extend the framework to other circular economy domains beyond EEE.

7.4. Concluding remarks

This study demonstrates that promoting reuse behavior requires more than changing consumer attitudes; it demands strategic infrastructure development and context-specific interventions. The integration of location data with behavioral modeling offers a replicable framework for understanding circular economy participation across diverse markets. As countries strive toward SDG 12 ("Ensure sustainable consumption and production patterns") targets, our findings underscore that physical infrastructure remains a critical, yet often overlooked, enabler of sustainable consumption transitions.

CRediT authorship contribution statement

Christian Clemm: Writing – review & editing, Writing – original draft, Visualization, Methodology, Investigation, Data curation, Conceptualization. **Mitsutaka Matsumoto:** Writing – review & editing, Methodology, Data curation, Conceptualization. **Kenichiro Chinen:** Writing – original draft, Formal analysis, Data curation. **Yoon-Young Chun:** Writing – review & editing, Conceptualization. **Media Romadona:** Writing – review & editing.

Declaration of generative AI and AI-assisted technologies in the writing process

During the preparation of this work, the author(s) used OpenAI's ChatGPT to make linguistic improvements. After using this tool or service, the author(s) reviewed and edited the content as needed and take full responsibility for the content of the publication.

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Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.jclepro.2025.146717.

Data availability

The collected survey data has not been specified for publication. Survey respondents were not informed that raw survey data would be published.

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