

THE IMPACT OF INCENTIVES AND IOT INTEGRATION ON YOUNG CONSUMERS' ADOPTION OF PAY-PER-WASH SERVICES: A BEHAVIORAL ANALYSIS

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Abstract. This study explores pay-per-wash (PPW) services, focusing on young consumers drawing from a dataset of 457 responses collected from Germany and the Czech Republic. Utilizing gender and living conditions as segmentation criteria, the research uncovers both shared and distinct preferences among this demographic. Key findings highlight a universal appeal for Internet of Things (IoT)-enabled features, as well as the significance of both monetary and non-monetary incentives in driving PPW service adoption. Notably, females demonstrate a stronger preference for timely operations, complimentary detergents, and eco-friendly solutions. However, while providing valuable insights, the research acknowledges limitations, such as potential segmentation oversights and an exclusive focus on a specific age bracket. Moreover, the study validates three hypotheses regarding the positive impact of IoT features, optimized washing settings, and sustainable behavior on young consumers' inclination toward the PPW model. By offering a roadmap for PPW services, the research emphasizes the importance of adopting a balanced marketing approach that considers both universal and gender-specific preferences.

Keywords: consumer behavior, consumer decision-making, IoT integration, technology adoption.

JEL Classification: M31, M310, O33

1. Introduction

The escalating impacts of climate change have deeply permeated our daily lives, manifesting in heatwaves, environmental catastrophes, and disease outbreaks catalyzed by these shifts (Haines & Patz, 2004). Beyond these immediate concerns, there looms an impending economic upheaval due to the adverse consequences of climate change (Tol, 2009). Consequently, a discernible shift towards more sustainable consumer behavior has emerged in response to this urgent global challenge.

This transition is underscored by a study conducted by Deloitte (2021) in the UK, which revealed a growing inclination towards sustainable lifestyles among consumers. A significant 61% of respondents curtailed their use of single-use plastics over the past year, with 49% opting for seasonal products and 45% favoring locally produced

goods. The resonance of sustainability is further echoed in the prioritization of waste reduction (44%), circular practices (43%), and carbon footprint reduction (43%) among consumers' considerations (Deloitte, 2021). Germany's Federal Environment Agency (2020) confirms this trend, reporting that 65% of respondents regard climate protection as pivotal, particularly among the youth aged 14 to 22 (74%).

This evolving consumer landscape compels corporations to align their offerings with sustainable values. Indeed, Banerjee et al. (2003) contend that integrating sustainability into business practices not only enhances a company's image and customer satisfaction but also confers competitive advantage and long-term financial benefits (Cantele & Zardini, 2018).

Sustainable practices hold significance for the washing industry, a major contributor to the carbon

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footprint in clothing lifecycles (Muthu, 2020). Washing involves water, energy, and chemicals, accounting for up to 80% of a garment's carbon footprint (Muthu, 2020). The emergence of the pay-per-use [PPU] model aligns with the sharing economy, centralizing repair and re-utilization, thereby reducing waste (Cherry & Pidgeon, 2018).

The potential of pay-per-use services, particularly in the context of washing machines, is bolstered by the escalating share of service industries in global GDP, a trend supplanting traditional industrial sectors (Deloitte, 2018). This shift is exemplified by the remarkable growth of the car-sharing market over the past decade (Shaheen et al., 2018).

In light of these trends, targeting young consumers holds promise for pay-per-wash services. These demographic conducts laundry more frequently (Carlsson-Kanyama et al., 2005) and is confronted with the choice of purchasing washing machines upon establishing their households. Furthermore, Millennials are drawn to ethical corporate practices and corporate social responsibility [CSR], influencing their choice of employers (Klimkiewicz & Oltra, 2017).

The convergence of climate consciousness, sustainable behavior, and market dynamics accentuates the opportunity for businesses to cater to young consumers through sustainable services. This study aims to identify compelling incentives that drive the adoption of pay-per-wash services among the youth. The findings will enable companies to tailor their services to align with consumer preferences, thereby enhancing customer satisfaction and overall economic performance. Additionally, such endeavors contribute to bolstering a company's appeal as an employer, a pivotal advantage in the competitive talent landscape.

The prevalence of washing machines, along with their conventional ownership models, poses a distinctive obstacle when transitioning to service-oriented frameworks (Leahy & Lyons, 2010). Consequently, understanding how the integration of IoT can drive the adoption of online marketing strategies becomes essential. This study aims to address these inquiries by exploring the subsequent research objectives:

- How can IoT-driven incentives be optimally utilized to facilitate the adoption of pay-per-wash services among young consumers?
- What effective strategies can be implemented to encourage young consumers to transition from conventional ownership of washing machines to embracing pay-per-wash services facilitated by IoT technology?

The study's theoretical contribution lies in its exploration of the interplay between technological incentives and consumer behavior. By focusing on IoT-driven features and optimized settings as incentives, the research extends the existing body of knowledge on how innovative approaches can shape sustainable consumption

choices. The investigation aims to shed light on the nuanced relationship between these incentives and young consumers' propensity to adopt PPU services (Smith & Noble, 2014). This nuanced understanding could potentially inform the development of future business models and policies aimed at promoting sustainable behavior.

The structure of the paper covers the Literature Review. It examines existing research on sustainability and consumer behavior, the dynamics of pay-per-use [PPU] services, the integration of Internet of Things [IoT] technology in these services, and the role of various incentives in influencing consumer behavior. These discussions set the theoretical backdrop against which the study's hypotheses are developed. In the Methodology section, the article describes a quantitative research design using structured questionnaires to collect data from young consumers in Germany and the Czech Republic. The analytical strategy involves descriptive statistics, clustering, and discriminant analysis to identify patterns and preferences in the adoption of PPW services. The Data Analysis section presents the results, providing insights into consumer preferences and behaviors, and evaluating the effectiveness of different types of incentives in promoting PPW services. Finally, the Discussion and Conclusion summarize the findings, discussing their implications for businesses targeting young consumers with PPW services. This section reassesses the hypotheses based on the analysis and offers strategic recommendations for market penetration and growth.

The inclusion of a cross-country analysis between the Czech Republic and Germany is motivated by the need to recognize the influence of cultural, economic, and contextual factors on consumer behavior. Both countries have distinct socioeconomic landscapes, consumer preferences, and levels of technological adoption. Comparing these two contexts provides a broader perspective on the generalizability of findings and helps identify potential variations in the impact of incentives on consumer behavior. Moreover, cross-country analysis allows for the identification of best practices and lessons that can be adapted across different regions, enhancing the practical applicability of the research outcomes.

In our recent exploration into the rapidly evolving domain of pay-per-wash [PPW] services, we aimed to discern the preferences and behaviors of young consumers. The study unearthed some critical insights, revealing both universal and gender-specific preferences among users. Predominantly urban participants showed distinct clustering based on gender, with each group having its unique set of preferences. While certain features like remote control capabilities and energy efficiency appealed across the board, others, like timeliness and eco-friendliness, held varying degrees of importance based on gender. This preliminary understanding underscores the need for a nuanced approach in offering and marketing PPW services, paving the way for our detailed analysis that follows.

2. Literature Review

2.1. Sustainability and Consumer Behaviour

Concern for the climate is a prevailing subject in today's society, and sustainability has become a buzzword for most companies and consumers. Essentially, sustainability was defined as not living at the expense of future generations in the present time (Hauff, 1987). This concept of generational justice is also a crucial factor in today's understanding of sustainability. In 2015, the United Nations Summit on Sustainable Development adopted the 17 Sustainable Development Goals in New York, representing a new concept of sustainable development. The summit's primary focus was to improve the general standard of living, enhance social amenities such as schools and hospitals, and foster economic stability among countries (Nunes et al., 2016).

As these goals illustrate, sustainability has multiple facets. The three-pillar model of economic, ecological, and social capital, known as a comprehensive approach for politics and companies toward more sustainable practices (Kleine, 2009), encompasses areas of action for implementing sustainability strategies and serves to categorize various requirements (Barbier, 1987). However, the three-pillar model's intention to attribute equal rank and weight to each pillar is under critical examination within the scientific community. Logically, assigning the same status to the economy, society, and nature is incomprehensible. Consequently, the three-pillar model is often referred to as the "weak sustainability" model. To embrace a "strong sustainability" model, the emphasis should be on ecology (IHK, 2015). Rogall (2012) introduced the concept of "strong sustainability," emphasizing the acknowledgment of the finite nature and its limits, directing the focus towards conserving natural resources rather than optimizing their consumption. In this perspective, the economy functions as a subsystem within the overarching ecological system (Rogall, 2012). Acknowledging nature's finite nature, it logically follows that no subsystem within a finite system can grow infinitely (Jackson, 2017). Therefore, the environment's preservation holds significant importance.

Progress in addressing environmental issues relies on ecologically conscious consumer behavior. Such behavior is defined as the extent to which a consumer prefers purchasing or consuming items manufactured under ecological or green production standards (Brochado et al., 2017). Ecological standards encompass a wide array of indicators for measuring ecological sustainability: emission impacts, resource consumption, pollution, and conservation of natural habitats (Joung et al., 2013).

Nowadays, there is a global push for sustainable development using ethical methods (Davidavičienė et al., 2024). For example, the study of Riaz et al. (2022) validates how cognitive and affective experiences significantly influence customer satisfaction and repurchase intentions within food delivery applications, suggesting that situational factors like distance and time availability play a moderating role.

The positive attitudes of young consumers toward sustainable consumption are not consistently translated into their actual behaviors (Bernardes et al., 2019). This gap presents an avenue for businesses to bridge by creating opportunities for more sustainable consumption practices (Joshi et al., 2019). Adapting business strategies to these consumer insights can lead to more effective promotion of sustainable practices and products, ensuring that environmental concerns are addressed in ways that resonate with consumers' values. The fusion of sustainable practices between companies and consumers yields heightened customer satisfaction, ultimately elevating a company's financial performance. Thus, there exists a compelling need to explore how young consumers can be steered toward ecologically conscious washing behaviors facilitated by pay-per-wash services that offer environmental and economic benefits (Tukker, 2004). However, consumers often fail to exhibit ecologically conscious behavior even if they express intentions of environmentally responsible actions earlier. This discrepancy between perceived motivations for sustainable engagement and actual behavior is termed the "value-action gap" (Fishbein & Ajzen, 1975). Numerous scholars have researched ways to bridge this gap. It's essential to note that the value-action gap cannot be closed merely by providing more information to participants; instead, policies and opportunities for more conscientious behavior need to be integrated into consumers' everyday contexts (Blake, 1999). The study of Pop et al. (2022) proves that there is a potential for more sustainable behavior. Thus, the authors argue that understanding this gap is critical for effectively promoting sustainable products and services. By exploring the specific factors that influence young consumers' decisions, businesses can develop targeted strategies that not only promote sustainability but also resonate deeply with this demographic's values and lifestyle choices.

2.2. Pay-Per-Use [PPU] Services

According to Baines et al. (2007), the adoption of a business strategy centered around a Product Service System [PSS] establishes a value proposition that prioritizes the needs of end-users over the product itself. This orientation facilitates the design of a need-fulfillment system with significantly reduced environmental and social impacts, as indicated by Mont (2002). PSS embodies a symbiotic relationship between products and services, encapsulating a competitive strategy focused on services, environmental sustainability, and differentiation from competitors who emphasize lower-priced offerings (Baines et al., 2007). The findings of the study (Alhalalmeh et al., 2022) validate the substantial influence of perceived value on customer trust and purchasing behaviors. The authors discuss how this strategic focus not only enhances customer loyalty but also positions companies as leaders in sustainability, aligning their operations with global sustainability goals.

In the current global landscape, sustainable production and consumption have emerged as paramount challenges. To address these environmental concerns, various approaches such as cleaner production, cleaner technology, waste minimization, recycling, eco-design, and design for sustainability have been developed over the past decades. Nonetheless, to propel the transformation of current production and consumption patterns, the introduction of a novel strategy is imperative (Mont, 2002). The argument put forth is that transitioning to a service-dominant logic could be the key to achieving these goals, suggesting a shift that may redefine value creation in industrial sectors.

As per Baines and Lightfoot (2013), the adoption of pay-per-use services offers product-oriented businesses a strategic avenue to address challenges related to commoditization and diminishing profitability. This approach serves as a novel source of competitive advantage. The distinction between manufacturing and service industries has often been clear-cut. Yet, the manner in which manufactured products reach end-users or the level of direct engagement with end-users tends to be considered separately. However, manufacturers can leverage services to underpin their competitive strategies, merging production with service provision for enhanced value (Windahl & Lakemond, 2006).

Oliva and Kallenberg (2003) posit that the introduction of the pay-per-use strategy challenges established business models concerning product sales, spare parts, and support services. While enterprises increasingly recognize the merits of integrated solutions, a comprehensive understanding of integrating products and services, encompassing associated challenges, scope of service offerings, and factors influencing decisions about product-service amalgamation, remains limited (Windahl & Lakemond, 2006).

Under the pay-per-use model, corporations maintain ownership and accountability for products and services, while customers remunerate for on-demand utilization. This model finds favor among clients as it allows tailored payment for utilized services, often accompanied by elevated service quality due to manufacturers' vested interest in providing enduring products (Weinhardt et al., 2009).

Although pay-per-use is not a new concept, it has long been employed by utility companies to monitor usage. The emergence of IoT technology has substantially simplified, and amplified accessibility, and heightened precision in tracking product consumption. Consequently, pay-per-use has become a viable avenue for companies previously hindered by technological limitations (Windahl & Lakemond, 2010). It underscores that IoT not only simplifies usage tracking but also opens up new avenues for customer engagement and service customization, thereby enhancing the overall value proposition offered to consumers.

Helander et al. (2007) share a congruent perspective, emphasizing that manufacturers are now enabling clients'

access to desired goods through Pay-Per-Use [PPU] services. In lieu of outright purchases, businesses enable customers to remunerate solely for the actual utilization of the product. Notably, quantification of product usage can encompass diverse metrics such as operating hours, as demonstrated by Rolls-Royce's "power-by-the-hour" approach, or distance traveled, as exemplified by Michelin's pay-per-kilometer solution.

The realm of PPU services intertwines closely with the concepts of substitutional services, outcome-based services, and result-oriented professional services. Each of these concepts addresses comparable client needs as other services, allowing for potential interchangeability. In this instance, PPU services substitute outright product purchases. This transition signifies a shift from product acquisition to payment based on the extent of product utilization (Tukker, 2004).

Under the PPU model, manufacturers assume full responsibility for all requisite service operations to ensure seamless product use. This includes aspects such as product and spare part maintenance, repair, and replacement as required (Helander & Möller, 2007; Lay et al., 2010). Analogous to substituting services, PPU implies a paradigm where clients engage with services instead of procuring products concurrently (Cusumano et al., 2015). Furthermore, outcome-based services pivot toward achieving specific objectives. Here, customers invest in the outcomes stemming from product utilization, as opposed to the products themselves (Ng & Nudurupati, 2010).

2.3. Internet of Things (IoT) and PPU

Digital technology advancements are well-documented drivers of change in business structures and pricing tactics across almost all industries (Lerch & Gotsch, 2015; Smith, 2013). The convergence of IoT with other disruptive information and communication technologies, machine learning, and increasingly pervasive sensors has the potential to transform businesses by enabling the connectivity of physical commodities, among other things (Brynjolfsson & McAfee, 2014). When combined, these technologies enable manufacturers to collect and evaluate data regarding the location and manner in which machines are utilized, consequently leading to the identification of pertinent usage indicators. Subsequently, various business models based on the transmission and assessment of data originating from or pertaining to physical objects have emerged (Dijkman et al., 2015; Heinis, et al., 2017). Thus, the integration of such technologies not only streamlines operations but also provides unprecedented insights into consumer behaviors and machine efficiency, paving the way for more informed business decisions.

Pay-Per-Use [PPU] services have emerged as a significant pricing mechanism with potential benefits across multiple dimensions. Fishburn & Odlyzko (1999) and Baines & Lightfoot (2013) concur in their assessment of PPU services as advanced offerings capable of

yielding new competitive advantages. By incentivizing rational consumption patterns, PPU services contribute to the formulation of product designs that optimize resource utilization during operation (Bocken et al., 2014). These services offer a distinctive competitive edge when customers transition from product purchases to usage-based charges, a paradigm shift that translates low life-cycle costs into competitive usage fees (Cusumano et al., 2015). More notably, PPU services facilitate the remanufacturing process by streamlining the recovery of used products, surpassing the efficacy of traditional sales approaches (Sundin & Bras, 2005).

From a marketing perspective, the integration of Internet of Things [IoT] technology in PPU services unlocks remarkable opportunities. IoT-enabled devices gather real-time data on usage patterns, allowing providers to deliver value-added features that can be prominently marketed. The data-driven insights from IoT can also facilitate dynamic adjustments to product positioning in the market. As customer needs evolve, IoT-informed adaptations can refine offerings to align more closely with market demands, enhancing both consumer satisfaction and product competitiveness (Veile, 2023). This data-driven refinement process enhances the strategic positioning of PPU services and bolsters their resonance in an ever-evolving market landscape. Therefore, this adaptive capability could significantly influence the sustainability and growth of businesses, enabling them to respond swiftly to changing market dynamics and consumer preferences.

Businesses use PPU services as a means of increasing market share, particularly when product markets mature (Cusumano et al., 2015). PPU services assist businesses in growing demand by targeting client categories with insufficient product usage to justify purchasing the products. In such cases, businesses utilize PPU services, resulting in the product being sold multiple times within its economic lifecycle (Östlin et al., 2009).

PPU services reduce barriers to product utilization for clients whose tastes are still in flux. Apart from these prospects, businesses must contend with the risk that amortizing product expenses via PPU revenues take longer than selling the goods directly. Additionally, unpredictability regarding maintenance expenses can jeopardize the profitability of PPU services (Cusumano et al., 2015).

Similar to PPU, pay-per-wash is also a type of payment mechanism in which the user pays for the product's use, which in this case is the laundry service as and when needed rather than purchasing it. In other words, customers pay for the service of a washing machine only when they use it.

2.4. Incentives in Behaviour Change and Performance Improvement

Goetz (2010) asserts that incentives extend beyond mere monetary benefits, encompassing motivators and rewards in a broader context. Incentives encompass various forms, products, or services that individuals deem

valuable. Monetary and non-monetary incentives are frequently distinguished in the literature, sparking debates on their effectiveness. Economic studies delve into incentives' impact on effort supply, making them a central focus (Erkal et al., 2018). Thus, the nuanced understanding of these incentives can lead to more effective organizational strategies, particularly in enhancing employee motivation and performance.

Lefebvre & Stenger (2020) highlight how inherent social dilemmas in public and environmental economics hinder states' efforts to enhance policy effectiveness. Balancing self-interest and collective welfare results in challenges like free-riding, undermining initiatives such as biodiversity conservation. Incentive programs boost individual contributions and overall well-being but are often resource-intensive and temporary due to political or budget constraints (Lefebvre & Stenger, 2020). This challenge aligns with Goetz's viewpoint, where government initiatives face hurdles in driving behavioral change. Consequently, global organizations seek innovative approaches to promoting eco-friendly behaviors (Goetz, 2010). The discussion here turns on the critical need for sustainable incentive schemes that not only promote environmental stewardship but also align with broader economic objectives, thereby avoiding the pitfalls of short-term policymaking.

Regarding motivation and performance increase, the use of monetary incentives is recommended for individuals who consider accounting information (Bonner & Sprinkle, 2002). Monetary incentives impact behavior through cognitive exertion encouraging more thought in tasks (Read, 2005). In the literature, experiments focus on the effectiveness of non-monetary incentives, showing that they significantly affect performance compared to monetary incentives. Sittenthaler & Mohnen (2022) find that performance-unrelated incentives, like gifts, positively correlate with performance, leading to a 25% increase in candidates' performance. Lacetera & Macis (2012) reveal a negative correlation between cash and blood donation, as payment doesn't induce altruistic motives. Jeffrey (2009) demonstrates the motivational power of non-cash incentives, with participants performing better with hedonic non-cash incentives in a word game experiment. Kelly et al. (2017) suggests a relationship between non-monetary incentives and favorable outcomes over time. They find that non-monetary incentives led to improved performance in a tournament after initial losses (Kelly et al., 2017). Authors argue that these findings underline the complexity of human motivation and the varying impacts of different types of incentives, suggesting that a one-size-fits-all approach to incentive design may be less effective.

In the realm of incentives, challenges include legal restrictions, linking performance to corresponding incentives, unnecessarily rewarding good behavior, rewarding equivalent effort across different businesses, creating negative inducements, addressing public perceptions, and managing funding (Goetz, 2010).

3. Methodology

Pay-per-wash [PPW] services allow customers to pay a fixed amount per load or item of clothing rather than paying for the entire service or a monthly subscription. PPW services are popular among customers who seek convenience, flexibility, and cost-effectiveness for their garment care needs (Grand View Research, 2020). Based on the literature review, it can be inferred that the integration of Internet of Things (IoT) technology or optimization strategies within the pay-per-use [PPU] framework for laundry services holds substantial potential as a significant incentive to attract young consumers. In response to this insight, the current study formulated three hypotheses:

H1: IoT features such as remote control and programmable operation time have an attractive effect on young consumers, stimulating their adoption of the pay-per-wash system;

H2: Optimized washing settings act as motivators, driving young consumers toward the pay-per-wash model;

H3: The utilization of pay-per-wash services fosters sustainable washing behavior, eventually leading to a reduction in guilt among young consumers.

The investigation seeks to comprehensively address the research question, “How can younger generations be inclined towards pay-per-wash services through the integration of incentives?” and is augmented by two sub-questions:

(a) “Which non-monetary incentives do younger generations prefer?”;

(b) “Which monetary incentives do younger generations prefer?”

The exploration of both monetary and non-monetary incentives is intended to provide a holistic understanding of the drivers influencing the young consumer’s behavior towards pay-per-wash services. This examination aligns with the growing emphasis on environmental concerns and sustainable consumption patterns.

The data collection methodology employed structured questionnaires as the primary instrument, designed to ensure comparability and repeatability of the results across different demographic segments. The sampling strategy was purposive, targeting individuals aged 16 to 35 who had used pay-per-wash services within the last six months, ensuring the relevance and immediacy of the feedback. Closed-ended questions, as well as questions using a Likert scale ranging from 1 to 5, were utilized to gather responses. This ensured standardized and efficient data acquisition. Respondents were recruited through online platforms and social media channels associated with lifestyle and consumer behavior, broadening the scope of input while maintaining a focus on the target demographic. The questionnaire was organized into three sections:

(a) gathering general respondent information;

(b) exploring customer motivations and perceptions regarding pay-per-wash services;

(c) soliciting insights into the incentives provided by organizations to foster loyalty towards their services.

Additionally, to ensure the validity of the data, each questionnaire included screening questions to verify the respondents’ familiarity and recent interactions with pay-per-wash services.

To ensure data quality, a comprehensive data cleaning process was executed. This process encompassed eligibility assessment, accuracy verification, consistency validation, and completeness assessment. To address potential analysis bias, a cross-continental collaboration was established, drawing upon the expertise of an international project team with diverse geographical backgrounds.

The data analysis employed descriptive statistics, clustering, and discriminant analysis to decipher the insights from the gathered responses. Descriptive statistics provided an initial understanding of the central tendencies and variability within our data set, offering a straightforward depiction of user demographics and their respective responses. All computations and data processing were performed using the R software, a robust platform renowned for its statistical capabilities and flexibility. This choice of software ensured the reliability and precision of the analysis, further reinforcing the integrity of our research findings.

4. Data Analysis

4.1. Descriptive statistics

From the sample data of 457 participants, the majority of young consumers of pay-per-wash services are male (50.3%, $N = 230$) and female (49.7%, $N = 216$), with a small percentage identifying as diverse (2.4%, $N = 11$) as is shown in Figure 1. This indicates that pay-per-wash services appeal nearly equally to both males and females, suggesting potential for targeted marketing campaigns for these demographics. Additionally, there is room for improvement in reaching out to a more diverse customer base.

The target cohort for this study consisted of young consumers of pay-per-wash services. Participants’ ages

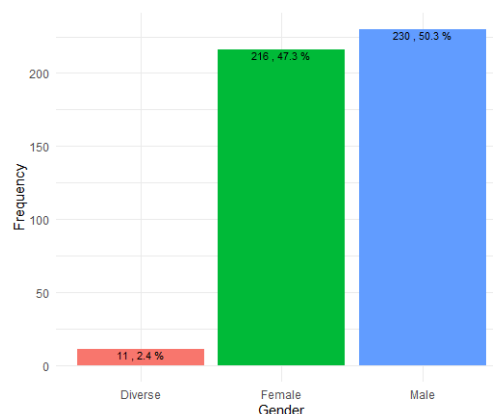


Figure 1. Respondents’ Gender (Source: authors’ calculation using R software)

ranged from 16 to 35, with a mean [M] of 21.7 and a standard deviation [SD] of 2.92. This cohort of young adults is particularly intriguing for study because pay-per-wash [PPW] services tend to appeal to those with busy lifestyles, limited budgets, or lack of access to laundry facilities. The focus on this age group is strategic, reflecting the growing trend of tech-savviness and environmental consciousness among young adults. The majority of the consumers are from Germany, accounting for 60.8% (N = 278), compared to only 39.2% (N = 179) from the Czech Republic.

When asked how many times they wash laundry per month, 64.6% (N = 295) reported washing 1-4 times, 22.8% (N = 104) reported 5-10 times, and 12.7% (N = 58) reported 10+ times, as shown in Figure 2.

Most users own an apartment (41.6%, N = 190), with other cohorts (Family household, Washing in the salon, and Friends' place) below 15% (Figure 3). This distribution suggests a significant opportunity for targeted marketing in residential areas, particularly apartment complexes, where the density of potential users might

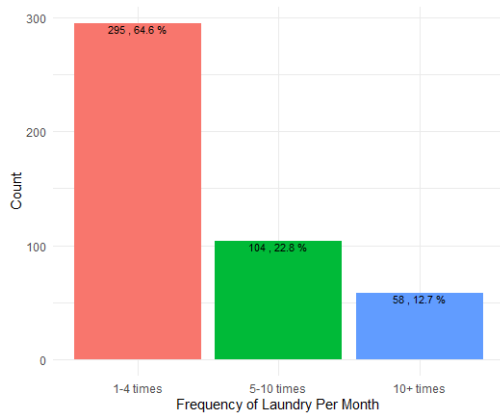


Figure 2. Frequency of Laundry per month (Source: authors' calculation using R software)

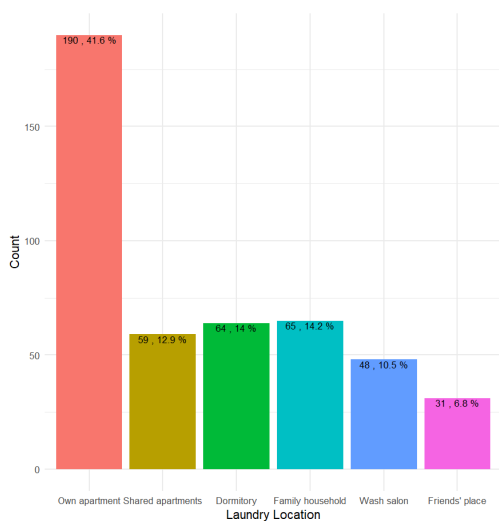


Figure 3. Laundry Location (Source: authors' calculation using R software)

be higher. Regarding cost awareness, 97.2% (N = 444) of the customers know how much they pay for each wash.

Features that might incentivize young consumers to adopt the pay-per-wash system were evaluated. Each feature, whether related to importance, comfortability, motivation, or preference, was rated on a 5-point Likert scale. All the scaled items scored above the midpoint of 2.5, indicating that these attributes highly resonate with young customers. This high level of engagement with the features tested indicates a robust market potential for enhanced PPW services tailored to these preferences. The most compelling incentives likely to entice young consumers to try the pay-per-wash service include the Motivation for Remote Control (M = 4.15, SD = 0.808), motivation to reduce waste (M = 4.13, SD = 0.809), and offering complimentary sustainable detergent for every wash (M = 4.03, SD = 0.823). The significant appeal of remote-control features and sustainability incentives suggests that modern consumers prioritize convenience and environmental considerations, which should inform the strategic positioning of PPW services. The descriptive statistics for these features are summarized in Table 2.

Table 1. Descriptive Statistics of Key Incentives for Young Consumers Adopting Pay-per-Wash Services

Variable	N	Min	Max	Mean	SD
Familiarity to IoT	457	1	5	3.43	1.050
Washing Machine Preference	457	1	5	3.46	0.886
Comfort Choosing Settings	457	1	5	3.93	1.060
Motivation for Service-Selected Settings	457	1	5	3.93	1.060
Importance of Timed Operation	457	1	5	3.96	1.060
Likelihood to Try with Discount	457	2	5	3.44	0.935
Likelihood to Try with Complimentary Detergent	457	1	5	4.03	0.823
Motivation for Remote Control	457	1	5	4.15	0.808
Motivation for Waste Reduction	457	1	5	4.13	0.809
Motivation for Tree Planting	457	1	5	3.98	1.030
Impact on Guilty Feelings	457	1	5	3.91	1.070
Motivation for Energy Efficiency	457	1	5	4.45	0.763

4.2. Clustering and Discriminant Analysis

The sample is diverse in terms of gender, age, and location, underscoring the potential of unique preferences among the participants. Recognizing these preferences—whether they pertain to discounts, promotions, convenience, flexibility, or cost-effectiveness—can guide the development of targeted marketing campaigns or specialized devices to cater to each cohort. These findings underline the necessity for PPW providers to employ

data-driven marketing strategies that address specific consumer needs and preferences, enhancing service personalization and customer satisfaction.

To gain insights into the sampled customers' preferences, needs, and expectations, this study employed both clustering and linear discriminant analysis. These analyses aimed to help tailor the PPW services more effectively.

Cluster analysis classifies consumers based on incentives related to PPW adoption, considering factors like their perceived importance, comfortability, motivation, and preference. The Duda-Hart stopping rule was employed to determine the optimal number of clusters. A cluster that presents a high Duda value and a low pseudo-T2 value is considered preferable (Table 2). This optimal clustering approach facilitates the efficient targeting of marketing efforts by identifying distinct consumer segments with homogeneous characteristics. In this study, the ideal number was identified as two clusters (Duda = 0.9085; pseudo-T2 = 29.822). Linear Discriminant Analysis is utilized to predict a customer's cluster membership based on certain socioeconomic and demographic attributes, such as gender, age, country of birth, and machine preference.

Table 2. Determination of the optimal number of clusters based on the Duda-Hart stopping

Number of clusters	2	3	4	5	6	7	8
Duda values	0.9085	0.8418	0.9156	0.8459	0.8550	0.8101	0.8932
pseudo-T2	29.8220	29.5112	21.2911	15.6714	17.8059	14.7681	14.8334

4.3. Segmentation analysis

The results indicate that the participants can be categorized into two distinct clusters. Cluster 1 comprises 297 subjects (65.0%), while Cluster 2 consists of 160 subjects (35.0%). The group means for each of the attributes, age, and preferred washing machine are summarized in Table 3. The detailed segmentation allows for an in-depth understanding of consumer behavior, facilitating the development of tailored strategies that resonate with specific groups. This targeted approach is crucial for enhancing user engagement and fostering brand loyalty among diverse consumer bases.

The results indicate that both cohorts are of similar age, are mostly aware of washing costs, and share the same washing machine preferences. Cluster 1, however, has significantly higher average scores in eight of the attributes, which include the importance of timed operation, likelihood to try with complimentary detergent, motivation for tree planting, and the impact on guilty feelings, compared to Cluster 2. These differences suggest that Cluster 1 may have a higher sensitivity to environmental and ethical marketing, which could be leveraged in targeted promotional strategies. Interestingly, both clusters demonstrate a similar familiarity with IoT and exhibit comparable interest

Table 3. Segmentation Analysis by Continuous Attributes

Characteristic	Cluster 1, N = 297	Cluster 2, N = 160
Age (years)*	22 (3.0)	22 (2.7)
Aware of Wash Cost	291 (98%)	153 (96%)
Familiarity to IoT	3.43 (1.06)	3.43 (1.04)
Washing Machine Preference*	3.46 (0.91)	3.46 (0.85)
Comfort Choosing Settings	3.97 (1.02)	3.84 (1.12)
Motivation for Service-Selected Settings	3.90 (1.00)	3.99 (1.17)
Importance of Timed Operation	4.44 (0.69)	3.06 (1.06)
Likelihood to Try with Discount	3.51 (0.93)	3.31 (0.92)
Likelihood to Try with Complimentary Detergent	4.07 (0.83)	3.97 (0.80)
Motivation for Remote Control	4.21 (0.79)	4.04 (0.82)
Motivation for Waste Reduction	4.16 (0.79)	4.07 (0.84)
Motivation for Tree Planting	4.49 (0.59)	3.03 (0.99)
Impact on Guilty Feelings	4.21 (0.87)	3.35 (1.18)
Motivation for Energy Efficiency	4.46 (0.77)	4.44 (0.76)

Note: n (%); *: Not included as input attributes in clustering

levels in discounts, motivation for remote control, motivation for waste reduction, and motivation for energy efficiency.

In terms of demographic distinctions, the study segmented the clusters by various covariates. The data shows that the majority of subjects in Cluster 1 are female (50%), while in Cluster 2, males dominate at 56%. Additionally, individuals in Cluster 1 tend to wash more frequently than those in Cluster 2. A significant portion of participants from both clusters' own apartments, with Germany being the predominant country of residence. This demographic information is crucial for understanding the distinct behaviors and preferences within each cluster, helping marketers to fine-tune their strategies according to gender differences and washing frequency. The detailed breakdown is shown in Table 4. The analysis of these demographics provides actionable insights for businesses aiming to optimize their service offerings and marketing messages to better match the lifestyle and values of their target audience.

In general, pay-per-wash [PPW] washing machines offer greater convenience, cost-effectiveness, and environmental benefits. These services allow users to pay only for what they use, leading to potential cost savings and waste reduction. The absence of ownership costs—like purchase, maintenance, or repair—further underscores the financial benefits, making PPW particularly appealing to younger generations who may be navigating financial constraints.

Beyond cost considerations, PPW machines contribute to environmental sustainability. Their use typically leads to lower consumption of water, energy, and detergent. These machines often feature energy-efficient

Table 4. Segmentation Analysis by Categorical Attributes

Characteristic	Cluster 1, n = 297	Cluster 2, n = 160
Gender		
Diverse	8 (2.7%)	3 (1.9%)
Female	149 (50%)	67 (42%)
Male	140 (47%)	90 (56%)
Country		
CZ	120 (40%)	59 (37%)
DE	177 (60%)	101 (63%)
Frequency of Laundry		
1-4 times	200 (67%)	95 (59%)
5-10 times	63 (21%)	41 (26%)
10+ times	34 (11%)	24 (15%)
Laundry Location		
Own apartment	121 (41%)	69 (43%)
Shared apartments	41 (14%)	18 (11%)
Dormitory	43 (14%)	21 (13%)
Family household	40 (13%)	25 (16%)
Wash salon	31 (10%)	17 (11%)
Friends' place	21 (7.1%)	10 (6.3%)

Note: n (%)

designs and have auto-adjust functions that optimize both water and energy use.

Considering these advantages, one might speculate that females could be more inclined towards PPW machines than males. This inclination might stem from a greater appreciation for timeliness, convenience, cost-effectiveness, and environmental consciousness. However, this is a generalization and may not hold true across all individual cases.

4.4. Canonical LDA

Linear Discriminant Analysis [LDA] was employed to forecast cluster membership based on variables such as Gender, Age, Country, Frequency of Laundry, Laundry Location, Awareness of Wash Cost, and Washing Machine Preference. The specifics of the fitted model can be found in Table 5.

The classifier's performance metrics are detailed in Table 6. Of the 297 observations in cluster 1, the LDA fitting accurately identified 288 as belonging to cluster 1, while mistakenly categorizing 9 as part of cluster 2. Overall, the model's predictive accuracy stands at 0.650, denoting a reasonably good performance.

Utilizing the LDA model that has been fitted, we analyzed hypothetical data for three individuals as detailed in Table 7. Based on the model's assessment, individual 1 was classified into clusters 2 and 3, while individuals 2 and 3 were classified into cluster 1. This model can be instrumental in discerning individual preferences, thereby allowing for tailored recommendations.

Table 5. Regression Coefficients of Linear Disclaimant Mode Predicting a Customer into Two Clusters Based on Socio-Economic and Demographic Attributes

Variable	LD1
Gender: Female	0.7144
Gender: Male	1.6825
Age	-0.1246
Country: DE	0.4631
\`Frequency of Laundry: 5-10 times	1.0975
\`Frequency of Laundry: 10+ times	1.3329
\`Laundry Location: Shared apartments	-0.8976
\`Laundry Location: Dormitory	-0.5083
\`Laundry Location: Family household	0.1747
\`Laundry Location: Wash salon	-0.1370
\`Laundry Location: Friends' place	-0.5983
\`Aware of Wash Cost: No	3.1272
\`Washing Machine Preference	0.0273

Table 6. Confusion Matrix Based on Linear Discriminant Analysis Predicting Customer Cluster

		Linear Discriminant Analysis [Prediction]	
		Cluster 1	Cluster 2
Clustering [Actual]	Cluster 1	288	9
	Cluster 2	154	6

Note: The proportion of correct prediction = 0.6499

Table 7. Linear Discriminant Analysis Predicting Customer Cluster Using Hypothetical Subjects

Gender	Age	Country	Frequency of Laundry	Laundry Location	Aware of Wash Cost	Washing Machine Preference	Prediction
Female	27	DE	1-4 times	Family household	No	1	cluster2
Female	27	CZ	5-10 times	Family household	Yes	4	cluster1
Male	35	DE	10+ times	Friends' place	Yes	5	cluster1

5. Conclusions and recommendation

Recent research has delved into understanding young consumers' preferences and behaviors toward pay-per-wash [PPW] services, revealing pivotal market dynamics and addressing specific hypotheses. Hypothesis suggesting that IoT features like remote control and programmable operation time act as compelling motivators, found strong resonance, especially among the younger demographic. This study introduces a novel insight into the role of situational factors as moderators in the relationship between service satisfaction and consumer loyalty,

a relatively unexplored area within the context of PPW services. Additionally, it sheds light on the nuanced variations in gender-specific preferences, highlighting women's prioritization of timeliness, free detergent offers, and eco-friendly solutions more than men. The convenience of remotely controlling the wash cycle is an important benefit for potential pay-per-wash users. The data also aligned with another hypothesis showcasing that optimized washing settings are attractive levers for young consumers exploring the PPW model. Therefore, the study introduces an insight into the role of situational factors as moderators in the relationship between service satisfaction and consumer loyalty, a relatively unexplored area within the context of PPW services. However, a gap in awareness about the sustainable benefits of PPW services was evident, prompting a reevaluation of the third hypothesis, which postulated that the adoption of PPW would drive sustainable washing behaviors and mitigate guilt feelings. The study found that monetary incentives also play a role. A significant portion of those in shared or personal living spaces expressed willingness to allow automatic washing program selection if it resulted in discounts.

In answering the complementary sub-questions, it emerged that universally appealing features such as IoT capabilities and discounts are powerful motivators. Nonetheless, with gender-based nuances, such as females' pronounced preference for timely wash cycles and sustainable offerings, PPW services have a unique opportunity to tailor marketing strategies. By leveraging these insights, businesses can foster connections and appeal to a diverse young consumer base, optimizing market reach. By highlighting these gender-specific preferences and situational factors, this study contributes to a deeper understanding of consumer behavior within the PPW sector, offering insights that can inform targeted marketing efforts and product development initiatives.

In the short term, the focus should be on younger consumers, especially those in their apartments or dormitories. Tapping into their values, companies should emphasize the convenience of IoT-enabled features. Additionally, aligning with the broader sustainability trend, initiatives like planting a tree after a certain number of washes could serve as an attractive incentive. As for longer-term strategies, companies shouldn't limit themselves to a niche segment. As the pay-per-wash model gains acceptance, it's essential to widen the net, targeting those in shared apartments or family homes. Comprehensive marketing campaigns underscoring the sustainability and cost benefits of pay-per-wash could be pivotal in driving wider adoption.

In summation, while challenges like high initial marketing costs exist, the pay-per-wash model holds significant promise. By uncovering gender-specific preferences and situational factors that influence consumer behavior, this study provides valuable insights that can inform strategic decision-making in marketing and product development, contributing to the scientific novelty and value of research results. With the right strategies, companies

can tap into a burgeoning market eager for sustainable, convenient, and cost-effective washing solutions.

The study found that the choice of washing machine operating time is significantly linked to living conditions. For those in shared or individual apartments, dormitories, or even family homes, the ability to select operating times is crucial. This feature seems to offer flexibility and convenience, a valued attribute for this segment. When it comes to the age factor, younger individuals (aged 17–31) seem less attached to the idea of owning washing machines compared to their older counterparts (32–36 years). This divergence in preference suggests that younger demographics might be more open to alternative models of accessing washing services. The acceptance of pay-per-wash services is not the same across life situations. Those who live in separate apartments or dorms appear to be more receptive, while those who live in family homes or shared apartments are more resilient.

The study's segmentation revealed two distinct consumer clusters. Intriguingly, gender emerged as a significant differentiator. Cluster 1 predominantly comprised women, while men were the majority in Cluster 2. Despite the identified distinctions, both clusters exhibited a consistent attraction towards offerings like discounts, remote control functions, and energy efficiency incentives. However, digging deeper into gender-specific preferences, women seemed to prioritize timeliness, free detergent offers, and eco-friendly solutions more than men.

While the study sheds light on young consumers' preferences regarding pay-per-wash [PPW] services, there are inherent limitations. The segmentation primarily based on gender and living conditions might not account for all the nuanced variations within this demographic. Additionally, the focus on a specific age bracket might exclude insights from other potential user groups who could also be inclined toward PPW services. The emphasis on IoT features, though validated by the data, might overshadow other non-technological motivators that weren't adequately explored. Lastly, while the study identified a gap in sustainability awareness, the extent to which this could influence the long-term adoption of PPW services remains ambiguous. The future initiatives could include educational campaigns highlighting the environmental benefits of PPW services, promoting initiatives such as reduced water and energy consumption, and emphasizing the positive impact of waste reduction and eco-friendly detergent options.

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