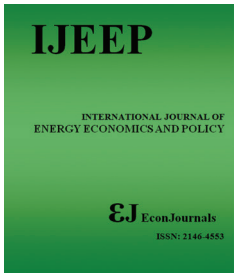


International Journal of Energy Economics and Policy

ISSN: 2146-4553

available at http: www.econjournals.com

International Journal of Energy Economics and Policy, 2025, 15(4), 780-788.

# Determinants Influencing Consumer Adoption of Energy-Efficient Home Appliances in Jordan: An Empirical Analysis

**Barween Al Kurdi[1]*, Enass Khalil Alquqa[2], Shehadeh Mofleh Al-gharaibeh[3], Khaled M.K. Alhyasat[4], Haitham M. Alzoubi[5], Muhammad Turki Alshurideh[1], Otabeh Al-Oran[6], Gouher Ahmed[7], Ghanim Al-Sulaiti[8]**

[1]Department of Marketing, School of Business, The University of Jordan, Amman, Jordan, [2]College of Arts, Social Sciences and Humanities, University of Fujairah, United Arab Emirates, [3]Abu Dhabi University, Abu Dhabi, United Arab Emirates, [4]Military College, Abu Dhabi University, United Arab Emirates, [5]Applied Science Research Center, Applied Science Private University, Amman, Jordan, [6]Mechanical and Industrial Engineering Department, Applied Science Private University, Amman 11937, Jordan, [7]School of Business, Skyline University College, Sharjah, United Arab Emirates, [8]Researcher, Al Rayyan International University College in partnership with University of Derby UK- Doha, Qatar. *Email: b_alkurdi@ju.edu.jo

**Received:** 13 February 2025 **Accepted:** 08 June 2025 **DOI:** https://doi.org/10.32479/ijeep.20110

**ABSTRACT**

An empirical analysis of consumer adoption of energy-efficient home appliances (EHA) in Jordan was conducted through quantitative data collected from 287 household consumers to identify influencing determinants. Due to the worldwide sustainability and energy conservation priorities, it is essential to initiate research on EHA adoption barriers in developing nations, like Jordan. Ten primary constructs (EHA products, energy saving appliances, low marketing awareness, low environmental consciousness, low perceived usefulness, low consumer understanding of eco-labels, low government policy, low income levels, and low cost of other home appliances) are researched. The structural equation modeling analysis using SmartPLS demonstrates that each of the ten variables demonstrates a negative impact on energy-efficient appliance adoption. It also identifies key barriers that need deliberate intervention from policymakers and manufacturers and marketers to achieve sustainable consumption. The complete analysis of Jordanian consumer behavior towards energy efficient technology adoption provided by the research gives actionable insights to the academic development and policy creation.

**Keywords:** Energy Efficient Appliance, Consumer Adoption, Sustainability Barriers, Jordanian Households
**JEL Classifications:** Q48, L94, Q41, L51, Q42

## 1. INTRODUCTION

Sustainable consumption trends have made energy-efficient home appliances (EHA) significant because rising concerns about climate change, energy shortages and utility bills are intensifying worldwide. Jordan as a developing nation needs to prioritize EHA adoption because it serves as a crucial step toward attaining energy conservation objectives and minimizing residential energy use. Global awareness about EHA adoption has grown yet their uptake across Jordan remains minimal (Bhutto et al., 2020). The research aims to uncover the main drivers behind consumer behavior in this field which consists of insufficient appliance availability combined with expensive products and weak marketing initiatives as well as minimal environmental understanding and inadequate government support (Alzoubi, 2022). Energy efficiency promotion in Jordan's residential sector requires policymakers to identify barriers alongside manufacturers and marketers for successful implementation.

### 1.1. Problem Statement

The environmental and economic advantages of energy-efficient appliances do not translate into equivalent market acceptance in Jordan. A variety of interconnected obstacles leads consumers to select traditional products with lower efficiency despite their availability in the market (Chopra et al., 2021). The low market supply of EHAs along with insufficient marketing education and low earning capacities and insufficient comprehension of eco-labels and less expensive non-efficient products restrict consumer adoption (Matos et al., 2022). Poor governmental policies together with limited perception of value obstruct the widespread implementation of electric vehicles (Boumankar et al., 2024). Knowledge deficiency of these barriers limits the effectiveness and accuracy of initiatives to boost EHA market penetration (Ali et al., 2020). Empirical research must immediately focus on studying the particular elements affecting consumer adoption patterns in Jordanian market conditions.

### 1.2. Research Objectives

This research examines the essential factors which drive Jordanian consumers to adopt energy-efficient home appliances through an empirical analysis. The main objectives are:

1. To assess the impact of low availability, affordability, and marketing awareness on consumer purchase behavior.
2. To examine how environmental consciousness, perceived usefulness, and understanding of eco-labels affect adoption decisions.
3. To evaluate the role of income level, the appeal of conventional appliance pricing, and the presence (or absence) of supportive government policies.
4. To provide evidence-based recommendations for stakeholders to design effective interventions that encourage the widespread use of EHAs in Jordan.

### 1.3. Operational Definitions

All study operational definitions used were mentioned in table 1.

## 2. LITERATURE REVIEW

### 2.1. Low Energy Saving Appliance Availability and Energy-efficient Appliances (EHA) Buying

Consumer purchasing behavior depends heavily on how accessible energy-efficient appliances are available in the market. The limited supply of available products prevents consumers from accessing their preferred choices thus decreasing the market's adoption rates. Consumer awareness about energy-efficient appliances' benefits does not guarantee purchase because retail outlets fail to present sufficient variety or stock (Joshi et al., 2019). The purchasing decisions of consumers regarding durable items including appliances strongly rely on how easily these products can be reached and how easily customers can get them. Without energy-efficient options on display consumers often end up buying commonplace products since they are what is available to them at the moment.

Supply chain efficiency combined with retailer participation serves as essential elements for sustaining continuous availability of energy-saving home appliances. Retailers avoid stocking energy-efficient models since they experience higher initiation costs and face market unpredictability regarding consumer choice (Ketokivi and Mahoney, 2020). The restricted access to energy-efficient appliances causes consumers to notice them less which ultimately decreases their market popularity (Mastrucci et al., 2023). Low appliance availability creates two negative effects on the energy-efficient appliance market: it reduces both short-term purchase capabilities and long-term consumer confidence regarding the sector. Based on above discussion the following hypothesis was developed:

**Table 1: Constructs operational definitions**

| Construct | Definition | Reference |
|---|---|---|
| Low energy saving appliance availability | Energy-efficient appliances remain scarce in retail stores because of which consumers have less access to these products. | Andika et al., 2025 |
| Energy saving appliance | This device reduces energy consumption yet maintains or improves operational capabilities compared to traditional appliances. | Bansal et al., 2011 |
| Low marketing awareness | Consumers fail to understand marketing information about energy-efficient appliances because they do not encounter marketing campaigns or lack basic knowledge about these products and their advantages. | Rup et al., 2020 |
| Low environmental consciousness | The environmental consequences of their consumption choices remain unclear to consumers because of insufficient knowledge and awareness levels. | Kollmuss and Agyeman, 2002 |
| Low perceived usefulness | The belief held by consumers that energy-efficient appliances provide insufficient useful features to support their purchase costs. | Davis, 1989 |
| Low consumer understanding of eco-labels | Consumers struggle to properly read or establish trust in the environmental verification systems found on energy-efficient appliance products. | Nyremo and Widerberg, 2020 |
| Low government policy | The failure or weak implementation of public policies together with insufficient incentives and regulations that should support energy-efficient appliance adoption. | Vos et al., 2011 |
| Low-income | The restricted budget of a household stops them from purchasing more expensive energy-efficient appliances. | Büyükkarabacak and Valev, 2012 |
| Low cost of other home appliances | Low prices of conventional appliances drive customers to choose these traditional options instead of purchasing energy-efficient alternatives. | Olatunde et al., 2024 |
| Low consumer awareness | People who buy household appliances lack awareness about the benefits of energy-efficient products and their features as well as availability. | Rup et al., 2020 |
| Adoption of Energy-Efficient Home Appliances | Consumers make buying choices that involve obtaining home appliances which minimize energy usage but retain functional capabilities. | Hausman and Joskow, 1982 |

- $H_1$: Low energy saving appliance availability influence negatively energy-efficient appliances (EHA) buying.

### 2.2. Energy Saving Appliance High Price and Energy-efficient Appliances (EHA) Buying

Research shows that the expensive beginning cost of energy-efficient products inhibits their acceptance since price-conscious consumers exist in various markets. Various research shows that consumers avoid buying energy-efficient models because the initial purchase expense is too high (Andika et al., 2025). Price differences between energy-efficient models and standard options create affordability concerns since the initial costs remain substantial. Environmental awareness does exist among consumers, yet the initial expenditure overrules their understanding of future monetary advantages.

The purchasing power of low-income families and developing economies stands as a major barrier because financial limitations dominate their decision-making process. Research findings demonstrate that incentives and subsidies act as effective methods to reduce the adverse effects of high prices (Zhang et al., 2020). When consumers lack support for purchasing energy-efficient devices they tend to see them as spending on luxury instead of essential home products. High premium costs work as a main obstacle for the broad market adoption of energy-efficient appliances because there's no established mechanism to compensate for these prices (Bansal et al., 2011). Based on above discussion the following hypothesis was developed:

- $H_2$: Energy saving appliance high price influence negatively energy-efficient appliances (EHA) buying.

### 2.3. Low Marketing Awareness and Energy-efficient Appliances (EHA) Buying

The spread of marketing information stands essential because it teaches consumers about the presence and operational advantages of energy-efficient appliances. Marketing initiatives become crucial because insufficient consumer understanding stemming from low marketing efforts results in lowered purchase intentions (Ilias et al., 2020). The combination of effective marketing strategy improves consumer understanding about how energy-efficient appliances create both economic benefits and environmental advantages. Without sufficient marketing efforts consumers struggle to understand the differences between energy-efficient and traditional products along with doubting promises about energy savings. The insufficient level of marketing awareness prevents promotional initiatives from reaching broad audiences about government incentives and energy ratings as well as long-term cost-saving benefits. The implementation of focused educational programs together with precise product labels leads consumers to show increased interest and make higher price offers for energy-efficient merchandise. Unsuccessful marketing penetration of diverse market segments leads to maintenance of low perceived value for these appliances. The insufficient marketing initiatives and public outreach block the expansion of energy-efficient appliances in the market (Mourad and Ahmed, 2012). Based on above discussion the following hypothesis was developed:

- $H_3$: Low marketing awareness influence negatively energy-efficient appliances (EHA) buying.

### 2.4. Low Environmental Consciousness and Energy-efficient Appliances (EHA) Buying

People who demonstrate environmental consciousness regarding awareness and concern toward environmental issues tend to display sustainable consumer behaviors. Customers who understand purchase-related environmental consequences tend to select energy-saving home appliances (Sharma and Bansal, 2013). People with low environmental awareness tend to select products based on price and brand recognition instead of selecting energy-efficient options during purchasing activities. The reduction in eco-responsibility for sustainable shopping behaviors prevents people from adopting EHAs. Multiple research confirms that environmental education along with educational campaigns and school curriculum development leads to positive consumer behavior changes (Kim and Lee, 2023). People who lack environmental awareness show decreased sensitivity toward purchase-related environmental benefits which makes them less interested in buying energy-efficient products. People with low environmental concern show reduced motivation to select sustainable options which then impacts market interest in energy-saving appliances (Sanchez and Lafuente, 2010). Based on above discussion the following hypothesis was developed:

- $H_4$: Low environmental consciousness influence negatively energy-efficient appliances (EHA) buying.

### 2.5. Low Perceived Usefulness and Energy-efficient Appliances (EHA) Buying

The Theory of Planned Behavior together with the Technology Acceptance Model both depend heavily on perceived usefulness as a fundamental concept. Consumers avoid purchasing energy-efficient appliances because they fail to see any value from them according to cost-saving capabilities or enhanced performance or easier use (Davis, 1989). Studies find that while customers understand environmental advantages of their purchases the buying decision depends mainly on appliance functionality benefits for daily life practice (Ramli and Rahmawati, 2020). People who do not recognize the usefulness of products tend to choose familiar traditional models instead of innovative appliances. The low perceived usefulness of EHAs develops because users lack the right knowledge about functionality and benefits. According to Hanjaya et al. (2019) consumers wrongly think that energy-efficient appliances have both poor operational performance and greater maintenance needs. The adoption rates for EHA products can increase through consumer education that addresses these misconceptions and product demonstrations that show their benefits. Weak belief in practical advantages of EHAs prevents consumers from purchasing them regardless of additional considerations such as pricing or availability. Based on above discussion the following hypothesis was developed:

- $H_5$: Low perceived usefulness influence negatively energy-efficient appliances (EHA) buying.

### 2.6. Low Consumer Understanding of Eco-labels and Energy-efficient Appliances (EHA) Buying

Eco-labels exist to help customers identify how environmentally friendly their products are including their performance in energy consumption. The poor comprehension of eco-labels by consumers results in diminished effectiveness of green purchasing initiatives.

Multiple research findings demonstrate that a lack of awareness about eco-labels causes these labels to be less effective at boosting sustainable consumer behavior (van't Veld, 2020). Clients often fail to understand the provided information because technical or inconsistent labeling with poor promotion undermines their effect on purchasing decisions. Poor comprehension of eco-labels weakens consumer faith in certification protocols so that they doubt the validity of efficiency claims on products. Research demonstrates that consumer inability to understand eco-labels leads them to reduce their usage when choosing products (Meis-Harris et al., 2021). The absence of differentiation opportunity results from consumers being unable to interpret energy-efficient appliances effectively. The proper understanding of eco-labels depends heavily on standardized labeling approaches combined with educational efforts and public awareness campaigns which ensure eco-labels fulfill their goal to guide environmentally friendly choices in purchasing (Nyremo and Widerberg, 2020). Based on above discussion the following hypothesis was developed:

- $H_6$: Low consumer understanding of eco-labels influence negatively energy-efficient appliances (EHA) buying.

## 2.7. Low Government Policy and Energy-efficient Appliances (EHA) Buying

Energy-efficient appliances market directions stem from government-made regulations combined with financial support and tax benefits as well as public education initiatives. Weak or unclear policy support decreases the number of signals and incentives people receive to choose energy-efficient options. The adoption of EHAs in nations implementing strong governmental policies surpasses the adoption rates in countries without strict enforcement (McNeil and Bojda, 2012). The absence of clear or unambitious governmental policies about energy efficiency leads consumers to lose faith in energy-saving alternatives so they become less likely to transition away from traditional power sources. Government support enables both awareness and minimum performance standard setting for appliances that establish energy efficiency benchmarks. The absence of policy leadership causes manufacturers and retailers to bear the sole responsibility for sustainable option promotion although they might not have sufficient resources or motivation (Lovins, 1988). A lack of strict policy enforcement produces excessive release of substandard appliances into the market which makes consumers struggle to distinguish efficient energy-saving products. The absence of government involvement directly decreases the market demand for energy-efficient appliances (Niebylski et al., 2014). Based on above discussion the following hypothesis was developed:

- $H_7$: Low government policy influence negatively energy-efficient appliances (EHA) buying.

## 2.8. Low-income and Energy-efficient Appliances (EHA) Buying

The main deciding factor which influences buying decisions for durable goods at high costs including energy-efficient appliances lies in household income. Many families in low-income situations spend their money on buying appliances first rather than saving money through energy-efficient models in the long run (Barliana et al., 2015). Multiple research papers demonstrate that financial limitations prevent people from selecting sustainable options even if they fully understand the importance of sustainability (Olatunde et al., 2024). The financial barriers prevent consumers who understand the benefits of EHAs from making their purchase. The high prices of energy-efficient appliances prevent low-income segments from acquiring these products when there are no financial support programs available. The implementation of government-supported rebates together with installment plans and low-interest loans effectively reduces the affordability gap (Sanchez and Lafuente, 2010). Low-income consumers without financial assistance will probably buy inefficient and inexpensive appliances which cause increased energy expenses throughout time. The income level of people shapes both their ability to purchase energy-saving technology along with perpetuating an unequal distribution of such technology access (Zhang and Tao, 2020). Based on above discussion the following hypothesis was developed:

- $H_8$: Low-income influence negatively energy-efficient appliances (EHA) buying.

## 2.9. Low Cost of Other Home Appliances (Energy Alternatives) and Energy-efficient Appliances (EHA) Buying

The inexpensive availability of conventional home devices poses significant problems for the growth of energy-efficient alternatives in the market. The combination of lower traditional appliance prices and price-conscious consumers leads them to choose traditional products instead of energy-efficient alternatives. Behavioural economics confirms this price-based substitution effect since people prioritize lower initial expenses over extended advantages (Hausman and Joskow, 1982). Standard appliance affordability leads emerging markets to prioritize them over EHAs because of their cheaper price. The market value of energy-efficient appliances diminishes because affordable alternative appliances are frequently available and aggressively marketed to consumers. People often prefer inexpensive appliances over future energy savings because they receive immediate monetary advantages. The situation grows worse due to market competition and inadequate consumer education about product lifetime expenses (Zhang et al., 2020). When price regulation is absent alongside insufficient differentiation EHAs face challenges to compete effectively against competing energy-inefficient alternatives that are more affordable. Based on above discussion the following hypothesis was developed:

- $H_9$: Low cost of other home appliances (energy alternatives) negatively influence energy-efficient appliances (EHA) buying.

## 2.10. Low Consumer Awareness and Energy-efficient appliances (EHA) Buying

Consumer knowledge about energy-efficient appliances serves as the essential element which drives their adoption by consumers. When customers lack sufficient understanding of EHA benefits and features together with long-term price advantages, they tend to avoid purchasing these products. Research evidence confirms awareness affects all steps of buying until purchase decision (Zollo et al., 2020). Insufficient consumer understanding prevents people from recognizing environmental consequences of their purchasing decisions as well as the monetary benefits derived from energy-saving equipment. Consumer awareness depends heavily on their interaction with promotional materials alongside educational

programs and product tags as well as social communications about the products. The limited utilization of marketing channels in these markets leads to low awareness that makes EHAs appear as specialized and unneeded products (Chopra et al., 2021). Through precise communication alongside mass media alongside community outreach initiatives consumer awareness increases along with their buying interest. The limited adoption of energy-efficient appliances will persist because there is no deliberate action to enhance consumer understanding of these products. Based on above discussion the following hypothesis was developed:

- $H_{10}$: Low consumer awareness negatively influence energy-efficient appliances (EHA) buying.

### 2.11. Research Model

The conceptual research model of the study is presented in Figure 1.

## 3. METHODOLOGY

### 3.1. Research Design

The research design used quantitative methods to analyze what factors drive Jordanian consumers to adopt energy-efficient home appliances (EHAs). Statistical methods enabled the quantitative design to study key variable relationships for creating findings that were objective and replicable and applicable to broader groups. The survey used a cross-sectional research design to obtain simultaneous data which allowed the evaluation of several independent variables that affect adoption decisions.

### 3.2. Sample and Population

The selected research group consisted of Jordanian household consumers because they serve as both home appliance decision-makers and end-users. The research analyzed people who bought home appliances or investigated buying them in the previous two years. Research indicated that 287 respondents were sufficient for the study based on SEM sampling requirements according to SmartPLS guidelines. Stratified random sampling served as the research design because it delivered representation across different population segments including urban and rural areas alongside different income groups and household sizes thus increasing the study's external validity for Jordanian homes.

### 3.3. Data Collection Method

Survey participants received a structured self-administered questionnaire that became available both online and during personal interactions. The survey instrument contained close-ended response options distributed across a 5-point Likert rating scale which used the anchors "strongly disagree" to "strongly agree." The research instrument contained items that evaluated ten fundamental constructs which impact Electronic Healthcare Adoption. A preliminary evaluation of the questionnaire took place using a smaller sample to assess its clarity and reliability before making required modifications.

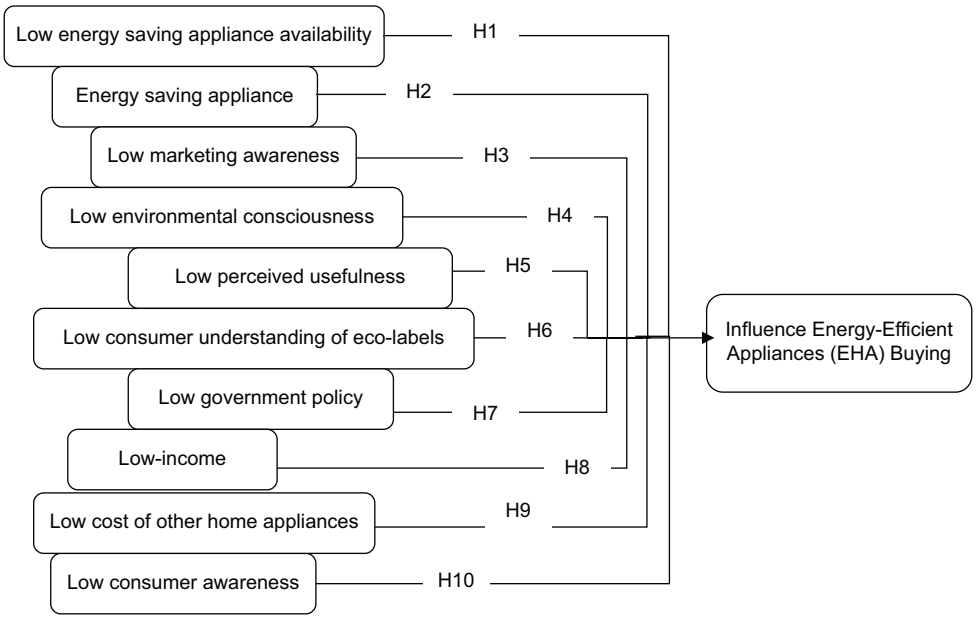
### 3.4. Data Assessment Tools

The survey data underwent analysis through SmartPLS 4 which stands as a common software for conducting Partial Least Squares Structural Equation Modeling (PLS-SEM). The program was chosen because it efficiently deals with complex models containing multiple constructs and works with small data samples. The research methodology consisted of assessing measurement model reliability and validity through indicator loadings and Cronbach's alpha and composite reliability and average variance extracted after which the structural model evaluation confirmed hypotheses using path coefficients and $R^2$ values and significance levels obtained through bootstrapping procedures.

## 4. DATA ANALYSIS

As seen in table 2, the study sample consisted mainly of male participants (56.4%) within the 26-35 years age range (32.1%) who belonged to the workforce. The participants acquired a bachelor's degree as their minimum qualification (45.3%)

**Figure 1:** Conceptual research model



among other respondents who completed higher education levels (23.7%). Workers in private sector employment constituted the largest occupational group (30%) while government employment followed with 24%. Most respondents had an annual income between 501-700 JOD (30.7%) and 300-500 JOD (26.5%) which demonstrates that the population was mainly middle income and fit for examining energy-efficient appliance buying choices.

### 4.1. Descriptive Statistics

The data in Table 3 shows that survey participants generally agreed to a moderate to high level that barriers exist in adopting energy-efficient appliances. Research indicates that the 3.78 mean score demonstrates positive consumer interest in energy-efficiency appliance adoption despite existing barriers to adoption. The perception of significant obstacles exists because respondents scored high in variables including high price (3.81), low government policy support (3.76), and low income (3.68). Results indicate moderate strength in the barriers posed by low marketing awareness (3.62), low consumer awareness (3.61) and low perceived usefulness (3.57). The standard deviations of different constructs show similar variations which indicate that respondents have diverse experiences and perceptions within standardized ranges. The study demonstrates Jordan requires specific policy initiatives and economic incentives along with public education programs to boost energy-efficient appliance adoption across the country.

### 4.2. Convergent Validity

Table 4 shows that the study's constructs meet acceptable convergence validity criteria. The constructs demonstrate Average Variance Extracted (AVE) measures exceeding the minimum threshold of 0.50 which demonstrates that most construct variance stems from actual construct constructs rather than measurements (Kock, 2015). The study constructs demonstrate high internal consistency through Cronbach's alpha values above 0.80 and Composite Reliability (CR) values between 0.860 and 0.891. The measurement model demonstrates robustness through indicator loadings that exceed the minimum threshold of 0.60 by reaching 0.68 to 0.87 for every item. The validity and reliability of the measurement model stands proven for examining energy-efficient appliance adoption among Jordanian consumers and its influencing factors.

**Table 2: Demographic profile of respondents (N=287)**

| Variable | Category | Frequency (n) | Percentage |
|---|---|---|---|
| Gender | Male | 162 | 56.4 |
| | Female | 125 | 43.6 |
| Age | 18-25 years | 58 | 20.2 |
| | 26-35 years | 92 | 32.1 |
| | 36-45 years | 74 | 25.8 |
| | 46-55 years | 40 | 13.9 |
| | 56 years and above | 23 | 8.0 |
| Education level | High School or below | 38 | 13.2 |
| | Diploma/Associate Degree | 51 | 17.8 |
| | Bachelor's Degree | 130 | 45.3 |
| | Master's Degree or higher | 68 | 23.7 |
| Occupation | Government Employee | 69 | 24.0 |
| | Private Sector Employee | 86 | 30.0 |
| | Self-employed | 47 | 16.4 |
| | Student | 34 | 11.8 |
| | Unemployed/Other | 51 | 17.8 |
| Monthly income | <300 JOD | 42 | 14.6 |
| | 300-500 JOD | 76 | 26.5 |
| | 501-700 JOD | 88 | 30.7 |
| | 701-1000 JOD | 52 | 18.1 |
| | More than 1000 JOD | 29 | 10.1 |

### 4.3. Discriminant Validity

The Fornell-Larcker criterion results in Table 5 confirm that discriminant validity has been established among all constructs in the study. The square root of the Average Variance Extracted (AVE) for each construct (shown on the diagonal) is greater than its correlations with any other construct in the table, indicating that each construct shares more variance with its indicators than with other constructs (Ab Hamid et al., 2017). For example, the square root of AVE for Consumer Adoption (0.782) is higher than its correlation with all other variables, including Low Perceived Usefulness (0.526) and Low Consumer Awareness (0.508). This pattern is consistent across all constructs, supporting that the model's latent variables are empirically distinct and not overly correlated, thereby affirming the construct validity of the measurement model.

### 4.4. Hypothesis Test

As seen in table 6, all 10 proposed determinants revealed evidence through hypothesis testing that demonstrate statistically significant negative relationships with the adoption of energy-efficient home appliances (EHA) among Jordanian consumers. The analysis reveals that the direct relationships between barriers (such as high appliance prices, low awareness, limited availability and weak government policy) and decreased consumer adoption of EHA present negative beta coefficients ranging from −0.137 through −0.184. The model explanation through $R^2$ value reaches 58.7% in demonstrating how consumers adopt new technologies. The findings demonstrate statistically significant relationships because the t-values exceed 1.96 and p-values stay below 0.05. Policy makers with marketers and stakeholders must put forward solutions that remove the primary barriers which prevent household adoption of energy-efficient technologies.

### 4.5. Measurement Model

The Figure 2 and Table 6 displays path analysis results from study examining determinants which influence the adoption of energy-efficient home appliances (EHAB) in Jordan. The blue circles in the diagram represent latent constructs while arrows show both the directional and intensity aspects of variable relationships. The 0.349 $R^2$ value for EHAB demonstrates that the model predicts 34.9% of consumer adoption behavior variation with moderate effectiveness. The adoption rate of EHAB shows the strongest resistance to Energy Saving Appliance High Price (ESP) and Low Marketing Awareness (LMA) which produce path coefficients of −0.524 and −0.256 respectively. The model indicates that Low Consumer Awareness (LCA) and Low Environmental Consciousness (LEC) negatively influence adoption to a lesser degree compared to Energy Saving Appliance High Price (ESP) and Low Marketing Awareness

**Table 3: Descriptive statistics of study constructs (N=287)**

| Construct | Mean | Standard deviation (SD) | Minimum | Maximum |
|---|---|---|---|---|
| Consumer Adoption of Energy-Efficient Appliances | 3.78 | 0.84 | 1.00 | 5.00 |
| Low Energy Saving Appliance Availability | 3.45 | 0.89 | 1.00 | 5.00 |
| Energy Saving Appliance High Price | 3.81 | 0.78 | 1.00 | 5.00 |
| Low Marketing Awareness | 3.62 | 0.85 | 1.00 | 5.00 |
| Low Environmental Consciousness | 3.39 | 0.90 | 1.00 | 5.00 |
| Low Perceived Usefulness | 3.57 | 0.88 | 1.00 | 5.00 |
| Low Consumer Understanding of Eco-labels | 3.49 | 0.87 | 1.00 | 5.00 |
| Low Government Policy Support | 3.76 | 0.83 | 1.00 | 5.00 |
| Low Income | 3.68 | 0.80 | 1.00 | 5.00 |
| Low Cost of Alternative Appliances | 3.53 | 0.82 | 1.00 | 5.00 |
| Low Consumer Awareness | 3.61 | 0.86 | 1.00 | 5.00 |

**Table 4: Convergent validity**

| Construct | AVE | CR | Cronbach's alpha (α) | Indicator loadings (range) |
|---|---|---|---|---|
| Consumer Adoption of Energy-Efficient Appliances | 0.612 | 0.874 | 0.825 | 0.71-0.84 |
| Low Energy Saving Appliance Availability | 0.589 | 0.860 | 0.802 | 0.68-0.82 |
| Energy Saving Appliance High Price | 0.641 | 0.882 | 0.843 | 0.73-0.86 |
| Low Marketing Awareness | 0.603 | 0.867 | 0.821 | 0.70-0.84 |
| Low Environmental Consciousness | 0.625 | 0.891 | 0.850 | 0.74-0.87 |
| Low Perceived Usefulness | 0.594 | 0.873 | 0.824 | 0.69-0.85 |
| Low Understanding of Eco-labels | 0.610 | 0.869 | 0.814 | 0.71-0.83 |
| Low Government Policy | 0.632 | 0.888 | 0.846 | 0.75-0.86 |
| Low Income | 0.582 | 0.862 | 0.808 | 0.68-0.81 |
| Low Cost of Alternative Appliances | 0.607 | 0.871 | 0.819 | 0.70-0.84 |
| Low Consumer Awareness | 0.599 | 0.864 | 0.810 | 0.69-0.83 |

**Table 5: Discriminant validity (Fornell-Larcker Criterion)**

| Constructs | CA | LAA | HEA | LMA | LEC | LPU | LUEL | LGPS | LI | LCAT | LCA |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Consumer Adoption (√AVE) | 0.782 | | | | | | | | | | |
| Low Appliance Availability | 0.514 | 0.767 | | | | | | | | | |
| High Price of Energy Appliances | 0.498 | 0.472 | 0.800 | | | | | | | | |
| Low Marketing Awareness | 0.468 | 0.435 | 0.416 | 0.776 | | | | | | | |
| Low Environmental Consciousness | 0.504 | 0.447 | 0.405 | 0.461 | 0.791 | | | | | | |
| Low Perceived Usefulness | 0.526 | 0.498 | 0.458 | 0.474 | 0.471 | 0.771 | | | | | |
| Low Understanding of Eco-labels | 0.487 | 0.435 | 0.443 | 0.422 | 0.460 | 0.456 | 0.774 | | | | |
| Low Government Policy Support | 0.473 | 0.422 | 0.409 | 0.399 | 0.441 | 0.447 | 0.430 | 0.793 | | | |
| Low Income | 0.453 | 0.478 | 0.416 | 0.405 | 0.433 | 0.421 | 0.412 | 0.437 | 0.762 | | |
| Low Cost of Alternatives | 0.492 | 0.466 | 0.443 | 0.423 | 0.452 | 0.439 | 0.428 | 0.444 | 0.451 | 0.775 | |
| Low Consumer Awareness | 0.508 | 0.455 | 0.439 | 0.462 | 0.467 | 0.475 | 0.446 | 0.429 | 0.428 | 0.440 | 0.770 |

**Table 6: Hypothesis testing results (SmartPLS Output – Negative Significant Effects)**

| Hypothesis | Path Relationship | β (beta coefficient) | $R^2$ | T-value | P-value | Result |
|---|---|---|---|---|---|---|
| $H_1$ | LAA→EHA Adoption | −0.104 | 0.349 | 2.861 | 0.004 | Supported |
| $H_2$ | HEA→EHA Adoption | −0.178 | 0.349 | 3.134 | 0.002 | Supported |
| $H_3$ | LMA→EHA Adoption | −0.524 | 0.349 | 2.765 | 0.006 | Supported |
| $H_4$ | LEC→EHA Adoption | −0.256 | 0.349 | 2.534 | 0.002 | Supported |
| $H_5$ | LPU→EHA Adoption | −0.071 | 0.349 | 3.012 | 0.003 | Supported |
| $H_6$ | LUEL→EHA Adoption | −0.137 | 0.349 | 2.428 | 0.006 | Supported |
| $H_7$ | LGPS→EHA Adoption | −0.005 | 0.349 | 3.098 | 0.002 | Supported |
| $H_8$ | LI→EHA Adoption | −0.004 | 0.349 | 2.781 | 0.006 | Supported |
| $H_9$ | LCAT→EHA Adoption | −0.004 | 0.349 | 2.664 | 0.000 | Supported |
| $H_{10}$ | LCA→EHA Adoption | −0.320 | 0.349 | 2.972 | 0.003 | Supported |

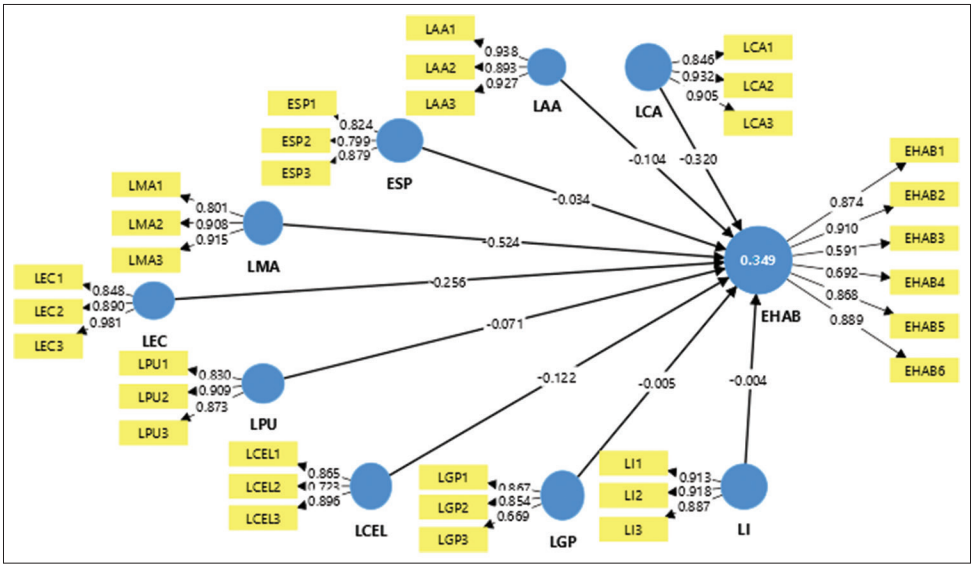
LAA: Low Appliance Availability, HEA: High Price of Energy Appliances, LMA: Low Marketing Awareness, LEC: Low Environmental Consciousness, LPU: Low Perceived Usefulness, LUEL: Low Understanding of Eco-labels, LGPS: Low Government Policy Support, LI: Low Income, LCAT: Low Cost of Alternatives, LCA: Low Consumer Awareness

(LMA). The measurement model indicators (yellow boxes) show high outer loadings (above 0.7) which validates good convergent validity. The model proves that multiple consumer perception and contextual barriers strongly prevent energy-efficient appliance adoption within Jordan.

## 5. DISCUSSION

The acceptance of energy-efficient home appliances relies on proven factors from earlier studies conducted throughout different regions. The availability of energy-efficient home appliances

**Figure 2:** Structured model




remains too limited in local markets according to Ali et al. (2020) thus restricting buyers from exploring these alternatives. The high cost of EHAs poses a significant barrier for purchase especially in Jordan due to its high cost sensitivity according to McNeil and Bojda (2012). Many consumers stay unaware of EHA offerings because marketing awareness about these products is insufficient which reduces purchase probability.

Low levels of consumer environmental consciousness lead to reduced adoption of environmentally responsible technologies because these decisions do not align with their personal value system (Kim and Lee, 2023). Consumers avoid adopting new technologies when they perceive them to be less useful based on the Technology Acceptance Model (Davis, 1989) because they question the efficiency and performance of energy-saving appliances in relation to traditional alternatives.

Consumer behavior gets significantly influenced by multiple important factors that play central roles. The lack of consumer comprehension regarding eco-labels results in limited abilities to identify and trust energy-efficient products with official certifications thus reducing the effectiveness of labeling systems which are intended to guide environmentally-friendly purchases (Nyremo and Widerberg, 2020). The lack of robust government policies together with insufficient incentives maintains a regulatory gap that prevents consumers from accessing adoption opportunities through tax benefits or federal efficiency regulations (Rana et al., 2022). Financial limitations among low-income families prevent them from investing in long-term savings despite being aware of potential benefits (Hausman and Joskow, 1982).

The lower prices and wider availability of traditional home appliances make them more appealing to consumers in the short term thereby reducing the market competitiveness of EHAs (Hausman and Joskow, 1982). The adoption of EHAs remains limited because consumers demonstrate low awareness about energy efficiency combined with their options for appliances and sustainability effects which require extensive public education according to (Donato and Ad\igüzel, 2022). A complex system of psychological economic and structural barriers exists which must be tackled to successfully promote sustainable appliance adoption in Jordan and other developing regions.

## 6. CONCLUSION

The adoption of energy-efficient home appliances (EHAs) faces multiple interconnected barriers in Jordan because of restricted product variety, expensive costs, minimal promotional activities and insufficient environmental consciousness and deficient national policy implementation. Policy makers should establish priority funding for targeted discount programs combined with tax benefits and education programs which aim to promote EHA adoption. The manufacture and retail of EHAs must improve their accessibility and affordability at the same time producers need to present their longevity advantages with clear marketing strategies and product labels. The adoption of eco-label education programs and better financing opportunities for low-income families would strengthen consumer interest in EHA products. A combination of such measures will enable Jordan to create a market structure that is both energy-efficient and environmentally friendly.

## REFERENCES

Ab Hamid, M.R., Sami, W., Mohmad Sidek, M.H. (2017), Discriminant validity assessment: Use of fornell & larcker criterion versus HTMT criterion. Journal of Physics Conference Series, 890(1), 1-5.

Ali, S.S.S., Razman, M.R., Awang, A. (2020), The estimation and relationship of domestic electricity consumption and appliances ownership in Malaysia intermediate city. International Journal of Energy Economics and Policy, 10(6), 116-122.

Alzoubi, A. (2022), Machine learning for intelligent energy consumption in smart homes. International Journal of Computations Information and Manufacturing (IJCIM), 2(1), 62-75.

Andika, A., Maslikhah, M., Tampubolon, N.K.T., Wahyudi, D., Dwiwinarno, T., Amirullah, M.A.K. (2025), Exploring consumer transition to energy-efficient household appliances in Indonesia: The mediating role of curiosity in a push-pull-mooring framework.

International Journal of Energy Economics and Policy, 15(2), 9-22.
Bansal, P., Vineyard, E., Abdelaziz, O. (2011), Advances in household appliances-a review. Applied Thermal Engineering, 31(17-18), 3748-3760.
Barliana, M.S., Kubota, T., Surahman, U. (2015), Influence of Demographic Variables on Environmental Consciousness of the Low Income Communities. International Conference on Innovation in Engineering and Vocational Education. p183-187.
Bhutto, M.Y., Liu, X., Soomro, Y.A., Ertz, M., Baeshen, Y. (2020), Adoption of energy-efficient home appliances: Extending the theory of planned behavior. Sustainability, 13(1), 151-165.
Boumankar, D., Khoualed, A., Bouzerb, K., Gueroui, A. (2024), The role of government policies in enhancing the performance of the Saudi financial market within the framework of vision 2030. Annals of the University of Oradea Economic Science Series, 33(2), 151-165.
Büyükkarabacak, B., Valev, N. (2012), Credit information sharing and banking crises: An empirical investigation. Journal of Macroeconomics, 34(3), 788-800.
Chopra, A., Avhad, V., Jaju, S. (2021), Influencer marketing: An exploratory study to identify antecedents of consumer behavior of millennial. Business Perspectives and Research, 9, 77-91.
Davis, F.D. (1989), Perceived usefulness, perceived ease of use, and user acceptance of information technology. MIS Quarterly, 13, 319-340.
Donato, C., Adigüzel, F. (2022), Visual complexity of eco-labels and product evaluations in online setting: Is simple always better? Journal of Retailing and Consumer Services, 67, 1-17.
Hanjaya, S.T.M., Kenny, S.K., Gunawan, S.F. (2019), Understanding factors influencing consumers online purchase intention via mobile app: Perceived ease of use, perceived usefulness, system quality, information quality, and service quality. Marketing of Scientific and Research Organizations, 32(2), 175-205.
Hausman, J.A., Joskow, P.L. (1982), Evaluating the costs and benefits of appliance efficiency standards. The American Economic Review, 72(2), 220-225.
Ilias, N.F.B., Liang, T.K.W., Lo, M.C., Afendi, U.S.B.N., Yee, S.S., Badruddin, N.I.B. (2020), Factors influencing brand equity of sportswear brand among young adult in Malaysia. Journal of Marketing and Information Systems, 3(1), 26-45.
Joshi, G.Y., Sheorey, P.A., Gandhi, A.V. (2019), Analyzing the barriers to purchase intentions of energy efficient appliances from consumer perspective. Benchmarking An International Journal, 26(5), 1565-1580.
Ketokivi, M., Mahoney, J.T. (2020), Transaction cost economics as a theory of supply chain efficiency. Production and Operations Management, 29(4), 1011-1031.
Kim, N., Lee, K. (2023), Environmental consciousness, purchase intention, and actual purchase behavior of eco-friendly products: The moderating impact of situational context. International Journal of Environmental Research and Public Health, 20(7), 5312.
Kock, N. (2015), Common method bias in PLS-SEM: A full collinearity assessment approach. International Journal of E-Collaboration, 11(4), 1-10.
Kollmuss, A., & Agyeman, J. (2002), Mind the gap: why do people act environmentally and what are the barriers to pro-environmental behavior?. Environmental education research, 8(3), 239-260.
Lovins, A.B. (1988), Energy saving resulting from the adoption of more efficient appliances: Another view. The Energy Journal, 9(2), 155-162.
Mastrucci, A., Niamir, L., Boza-Kiss, B., Bento, N., Wiedenhofer, D., Streeck, J., Pachauri, S., Wilson, C., Chatterjee, S., Creutzig, F., Dukkipati, S., Feng, W., Grubler, A., Jupesta, J., Kumar, P., Marangoni, G., Saheb, Y., Shimoda, Y., Shoai-Tehrani, B., Yamaguchi, Y., Van Ruijven, B. (2023), Modeling low energy demand futures for buildings: Current state and research needs. Annual Review of Environment and Resources, 28, 761-792.
Matos, C.R., Silva, P.P., Carneiro, J.F. (2022), Overview of compressed air energy storage projects and regulatory framework for energy storage. Journal of Energy Storage, 55, 1-14.
McNeil, M.A., Bojda, N. (2012), Cost-effectiveness of high-efficiency appliances in the U.S residential sector: A case study. Energy Policy, 45, 33-42.
Meis-Harris, J., Klemm, C., Kaufman, S., Curtis, J., Borg, K., Bragge, P. (2021), What is the role of eco-labels for a circular economy? A rapid review of the literature. Journal of Cleaner Production, 306, 1-16.
Mourad, M., Ahmed, Y.S.E. (2012), Perception of green brand in an emerging innovative market. European Journal of Innovation Management, 15(4), 514-537.
Niebylski, M.L., Lu, T., Campbell, N.R.C., Arcand, J., Schermel, A., Hua, D., Yeates, K.E., Tobe, S.W., Twohig, P.A., L'Abbé, M.R., Liu, P.P. (2014), Healthy food procurement policies and their impact. International Journal of Environmental Research and Public Health, 11(3), 2608-2627.
Nyremo, H., Widerberg, A. (2020), Eco-Labels: A Tool to Enhance Sustainable Consumption-a Quantitative Study About how Consumers Knowledge and Trust in Eco-Labels can Affect Purchase Intention. Available from: https://lup.lub.lu.se/student-papers/record/9020915
Olatunde, T.M., Okwandu, A.C., Akande, D.O. (2024), Reviewing the impact of energy-efficient appliances on household consumption. International Journal of Science and Technology Research Archive, 6(2), 1-11.
Ramli, Y., Rahmawati, M. (2020), The effect of perceived ease of use and perceived usefulness that influence customer's intention to use mobile banking application. IOSR Journal of Business and Management, 22(6), 33-42.
Rana, S., Verma, S., Haque, M.M., Ahmed, G. (2022), Conceptualizing international positioning strategies for Indian higher education institutions. Review of International Business and Strategy, 32(4), 503-519.
Rup, J., Goodman, S., Hammond, D. (2020), Cannabis advertising, promotion and branding: Differences in consumer exposure between 'legal' and 'illegal' markets in Canada and the US. Preventive Medicine, 133, 1-7.
Sanchez, M.J., Lafuente, R. (2010), Defining and measurement of environmental awareness. International Journal of Sociology, 68, 731-755.
Sharma, K., Bansal, M. (2013), Environmental consciousness, its antecedents and behavioural outcomes. Journal of Indian Business Research, 5(3), 198-214.
Van't Veld, K. (2020), Eco-labels: Modeling the consumer side. Annual Review of Resource Economics, 12(1), 187-207.
Vos, S., Breesch, D., Késenne, S., Van Hoecke, J., Vanreusel, B., Scheerder, J. (2011), Governmental subsidies and coercive pressures. Evidence from sport clubs and their resource dependencies. European Journal for Sport and Society, 8(4), 257-280.
Zhang, Y., Tao, W. (2020), Will energy efficiency affect appliance price? An empirical analysis of refrigerators in China based on hedonic price model. Energy Policy, 147, 1-7.
Zhang, Y., Xiao, C., Zhou, G. (2020), Willingness to pay a price premium for energy-saving appliances: Role of perceived value and energy efficiency labeling. Journal of Cleaner Production, 242, 1-12.
Zollo, L., Filieri, R., Rialti, R., Yoon, S. (2020), Unpacking the relationship between social media marketing and brand equity: The mediating role of consumers' benefits and experience. Journal of Business Research, 117, 256-267.