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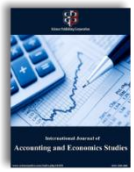

Emergence of Intelligent Systems in Consumer Products: Strategic Impacts and Opportunities in India

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Abstract

Artificial Intelligence (AI) is transforming consumer technology by embedding smart features into everyday products, revolutionizing markets and enhancing us-er experiences. This paper explores the adoption trends of three prominent AI-enabled product categories—smart locks, washing machines, and home assis-tants—within the Indian market. The study examines regional adoption patterns across urban, semi-urban, and rural areas, analyzing factors such as product pro-motion, customer demand, price affordability, infrastructure readiness, and after-sales service. Advanced classification algorithms, including Random Forest and Decision Trees, are used to pinpoint the key drivers behind market segmentation and regional preferences.

The findings reveal that urban areas lead in adoption rates due to well-established infrastructure, aggressive promotional strategies, and high customer demand. Semi-urban areas, while exhibiting moderate adoption, show promise as emerg-ing markets, whereas rural regions lag behind due to limited infrastructure and lower awareness levels. These insights highlight the need for businesses to de-velop region-specific strategies, such as customizing promotional efforts and im-proving accessibility and affordability, to maximize market penetration. Further-more, the research emphasizes the importance of after-sales service in building trust and sustaining growth. The study provides a roadmap for businesses to ef-fectively target diverse regional markets, leveraging AI technologies to meet evolving consumer needs.

Keywords: *Artificial Intelligence; Intelligent Systems; Consumer Segmentation; Regional Adoption; Random Forest; Consumer Technology.*

1. Introduction

The rapid proliferation of Artificial Intelligence (AI) in consumer products has brought about significant transformations in how businesses design, market, and deliver technologies. As Tasks performed solely by AI devices become more accessible, their adoption varies across regions, reflecting diverse socio-economic and infrastructural conditions. This study focuses on three pivotal categories: smart locks, AI-powered washing machines, and home assistants, which are shaping the landscape of home automation and smart living. India, with its vast and diverse demographic, offers a unique case for analyzing regional market dynamics. Urban areas, characterized by advanced infra-structure and higher purchasing power, often serve as early adopters. In contrast, semi-urban and rural regions represent emerging markets with distinct challenges, including affordability constraints and limited technological awareness. Understanding these adoption patterns is crucial for businesses aiming to penetrate diverse markets effectively.

The research employs a systematic approach, leveraging classification algorithms such as Random Forest and Decision Trees to explore the influence of critical parameters like product promotion, customer demand, price affordability, infrastructure, and after-sales service on regional adoption trends. By synthesizing data from leading Indian companies offering these products, this paper highlights key trends and provides a data-driven foundation for strategic business decisions. This comprehensive exploration not only advances academic discourse but also offers practical insights for businesses and policymakers navigating the AI directs or makes decisions to transform the consumer technology.

2. Literature review

Banerjee and Banerjee (2017) explore analytics adoption in India's emerging economy, identifying drivers like data infrastructure and competitive intensity, and barriers like fragmented data systems. Sector-specific trends in banking, FMCG, and manufacturing reveal analytics' potential and challenges. A framework linking competitive intensity, leadership, and data readiness is proposed. Key insights emphasize structured data and advocacy for effective analytics in emerging economies. Limitations include exploratory scope and limited participation. [1] Soni et al. (2019) analyze AI's transformative impact on businesses using a Neo-Schumpeterian framework, exploring

technological advancements and integration into business. Findings highlight AI's influence on customer interaction, sales, and skill sets, alongside ethical concerns like the "AI divide." The research stresses ethical considerations to ensure equitable access and prevent socio-economic disparities. [2] A study on International Market Segmentation (IMS) explores ethnic identity (EID) and cosmopolitanism (COS), showing their varied influence on consumer behavior across regions and products. Critiquing Levitt's homogenization thesis, it supports a "glocalized" marketing approach. The findings extend research on cultural dynamics in global markets. [3][4] Abrokwah-Larbi and Awuku-Larbi (2023) examine AI in marketing (AIM) for Ghanaian SMEs, identifying IoT, decision-making systems, VR/AR, and personalization as key determinants enhancing performance. Findings advocate AIM as a strategic resource for SMEs, transforming marketing and competitiveness in emerging economies. [5] Chingakham and Meitei study South Korean SMEs adopting AIM tools in India, highlighting improvements in targeting, retention, and efficiency. Tools like chatbots and predictive analytics boosted sales by up to 50%. Challenges include costs and data issues. AIM offers SMEs valuable marketing insights and enhanced strategies. [6] Patil, Rane, and Rane explore ChatGPT and generative AI adoption across finance, healthcare, and retail, showcasing applications like personalized services and product innovation. Challenges include data privacy and AI literacy. Strategies like transparency, upskilling, and collaboration address barriers, enhancing decision-making and engagement sustainably. [7] Bhagat et al. examine Functions primarily through AI customer segmentation, leveraging machine learning for hyper-personalized marketing and real-time adaptability. Ethical issues like data privacy are essential for responsible use. The study argues AI help streamline the operations and segmentation is vital for navigating evolving consumer preferences. [8] Dey and Banerjee analyze retail customer segmentation using K-means and RFM analysis, categorizing customers into six groups for tailored marketing strategies. Association Rule Mining enhances cross-selling opportunities. Challenges include data quality and business alignment. [9] Aggarwal highlights AI's role in online grocery shopping, improving personalization, inventory optimization, and segmentation for better customer experiences and efficiency. [10] Drs. Sabitha et al. explore AI-backed segmentation and personalization, focusing on machine learning and NLP to enhance marketing strategies. [11] Dutta et al. (2024) discuss AI-assisted e-marketing strategies and KPIs for electronics e-commerce innovation, highlighting demographic influences. [12] Basha (2023) examines AI's marketing integration, benefits, challenges, and ethical considerations. [13] Rane et al. (2024) highlight AI, ML, and DL's roles in reshaping strategies, decision-making, and innovation. [14] Doan et al. analyze Vietnamese electronics centers' branding strategies, focusing on differentiation and competitive advantage through market trends and customer engagement. [15] Dawar and Chattopadhyay critique multinational strategies in emerging markets, advocating localized approaches to address low incomes and labor dynamics, unlocking mass markets. [16] Dawar and Chattopadhyay propose strategies addressing low incomes and variability to enhance market penetration and profitability in emerging markets. [17] He et al. discuss challenges in globalizing Chinese home appliance brands, proposing industrial collaboration and technology-driven competitiveness. [18] Lin and Paleev analyze Xiaomi's innovative business model, emphasizing affordability, AIoT ecosystems, and partnerships for global growth, despite market challenges. [19] Talaat et al. propose DeepLimeSeg, a customer segmentation model combining deep learning and explainable AI, aiding precise, interpretable marketing decisions. [20] Sheth (2011) explores emerging markets' unique traits and their implications for marketing strategies, emphasizing inclusive and purpose-driven practices. [21]. Existing study examines emerging technologies driving FMCG efficiency, adoption, and competitiveness in underdeveloped markets using qualitative insights [22-25]. AI can enhance financial inclusion by overcoming traditional tech limits, but research on its optimal use remains limited and necessary [25-27]. Few studies analyze Industry 4.0 technologies' suitability across key SME functions, highlighting adoption trends, sustainability perceptions, and integration challenges [28].

3. Research methodology

This process involves collecting data from a business perspective, followed by preprocessing steps like data cleaning and reduction to ensure quality and relevance. The prepared dataset, often arbitrary, is used to create training sets for analysis. Classification algorithms such as Random Forest and Decision Tree are employed for modeling. The implementation leverages Python for coding and includes tools for generating graphs to visualize outcomes.

Here are some companies in India offering smart security locks along with their launch years:

1) Godrej Locks

Launch Year: 1897 (Godrej Group)

One of the oldest and most trusted lock manufacturers in India. They entered the smart lock segment with products like the Godrej Smart Lock, which integrates biometric, PIN, and RFID technology.

2) Ozone Overseas

Launch Year: 1999

Specializes in architectural hardware and security solutions, including a range of smart locks with features like fingerprint access, RFID cards, and app control.

3) Yale India (Assa Abloy Group)

Launch Year: 2012 (Indian market entry)

Offers high-end smart locks like the Yale Smart Door Lock, which supports biometric, keypad, and app-based entry.

4) Atomberg Technologies

Launch Year: 2012

Known for its innovative smart products, including smart locks and home automation systems.

5) Hafele India

Launch Year: 2001 (Indian market entry)

A subsidiary of the global Hafele Group, it offers premium smart locking solutions like Hafele EL9000 and Hafele Smart Door Locks.

6) OpenApp

Launch Year: 2015

An Indian startup specializing in smart locking systems for homes, businesses, and co-living spaces. OpenApp Smart Locks integrate with IoT platforms for remote access and monitoring.

7) EVE Home Automation (Smart Locks Division)

Launch Year: 2018

Focuses on providing affordable and user-friendly smart locks tailored for Indian customers.

Here's a list of companies in India offering washing machines with Artificial Intelligence (AI) features, along with their product launch years:

1) LG Electronics India

Product Launch Year: 2019
LG introduced AI-enabled washing machines with Direct Drive Technology and AI DD™. These models analyze the weight and fabric softness of clothes to optimize washing cycles.
2) Samsung India
Product Launch Year: 2020
Samsung's AI-powered washing machines, like the AI EcoBubble™ series, use artificial intelligence to suggest optimal wash cycles based on usage patterns and types of clothes. Features include auto detergent dispensing and smartphone integration via SmartThings.
3) Bosch India
Product Launch Year: 2021
Bosch launched AI-enabled washing machines under its Series 6 and 8. These models use i-DOS technology for precise detergent dosage and AI sensors for load and fabric type detection.
4) Whirlpool India
Product Launch Year: 2020
Whirlpool's IntelliFresh Pro and AI Control Front Load Washing Machines feature 6th Sense technology that adapts wash cycles based on load, fabric type, and soil level.
5) IFB Appliances
Product Launch Year: 2021
IFB's AI-facilitated washing machines are equipped with Intelligent Wash Programs that detect load and customize wash cycles. The Senator and Executive Plus series are prominent models.
6) Haier India
Product Launch Year: 2021
Haier introduced AI-capable models with Near Zero Pressure Technology and intelligent cycle customization to improve wash quality and water efficiency.
7) Panasonic India
Product Launch Year: 2020
Panasonic's AI washing machines come with StainMaster+ technology that intelligently adjusts water temperature and cycle intensity for different stains. Integration with the Miraie app enables smart control.
Here's a list of companies offering AI augmented Home Assistants in India along with their product launch years:
1) Google (Google India)
Product Launch Year: 2018
Product: Google Home and Nest Hub Series
Google's AI-powered home assistant utilizes Google Assistant to control smart devices, answer queries, and provide personalized services. The Nest Hub models also feature smart displays.
2) Amazon (Amazon Alexa India)
Product Launch Year: 2017
Product: Amazon Echo Series
Amazon launched its Alexa-enabled devices in India with regional language support, offering voice control over smart homes, music playback, and routine automation.
3) Apple (India)
Product Launch Year: 2021 (for full functionality in India)
Product: Apple HomePod mini
Apple's AI-powered HomePod mini uses Siri for smart home automation and sound optimization. It integrates seamlessly with the Apple ecosystem.
4) Xiaomi (Mi India)
Product Launch Year: 2019
Product: Mi Smart Speaker
Xiaomi's smart speaker is powered by Google Assistant, offering voice commands and integration with the Mi Home app for managing smart devices.
5) Bose (India)
Product Launch Year: 2020
Product: Bose Smart Speaker Series
Bose introduced AI-assisted smart speakers with Alexa and Google Assistant compatibility, focused on premium sound and smart home controls.
6) Lenovo (India)
Product Launch Year: 2019
Product: Lenovo Smart Clock and Smart Display
These devices feature Google Assistant for managing daily schedules, controlling smart home devices, and displaying visual information like weather and calendar.
7) Samsung (India)
Product Launch Year: 2021
Product: Samsung Galaxy Home Mini (India-specific rollout)
Samsung's AI assistant Bixby powers its smart home assistant, enabling control over Samsung and third-party smart devices.
8) Realme
Product Launch Year: 2020
Product: Realme Smart Speaker
This Google Assistant-powered device focuses on affordability and seamless integration with smart ecosystems.
9) Harman Kardon (India)
Product Launch Year: 2020
Product: Harman Kardon Citation Series
These premium AI-centric assistants support both Google Assistant and Alexa for a versatile smart home experience.

4. Result and discussion

The diagram [Fig. 4] highlights the integration of AI technologies into consumer products like smart locks, washing machines, and home assistants. Key enablers include biometric authentication, AI Direct Drive, and Natural Language Processing that enables computers to understand human language text., addressing security, efficiency, and user interaction. This reflects a shift towards consumer-centric innovation, offering strategic opportunities while addressing adoption challenges and privacy concerns.

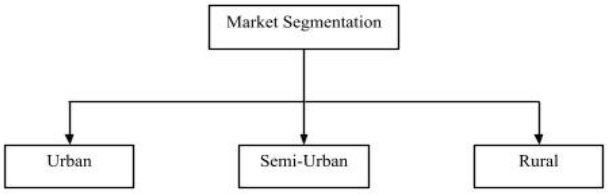

Fig. 1: Market Segmentation Based on Demographics.

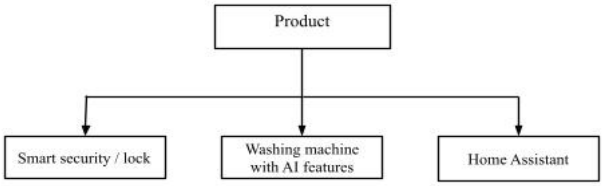

Fig. 2: Product Category that Mostly Used and AI assisted.

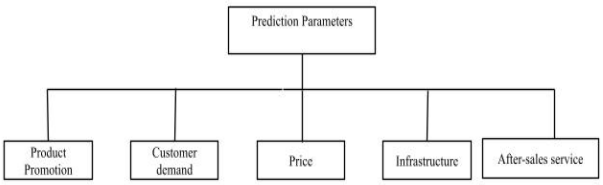

Fig. 3: Prediction Parameters-Strategy Decision.

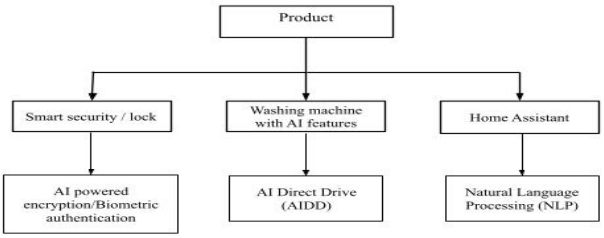

Fig. 4: AI Features Implementation (Described in Result Section).

4.1. Product: smart lock (retinal scan, biometric, password)

Model: Classification algorithm
Market Segment: Urban, Semi-Urban, Rural
Parameters: Product Promotion, Customer Demand, Price affordability, Infrastructure, After-sales Service.

Table 1: Parameter Matrix for Smart Lock

Parameter/Locality	Urban	Semi-Urban	Rural
Product Promotion	High	Moderate	Low
Customer Demand	High	Moderate	Low
Price Affordability	High	Moderate	Low
Infrastructure	High	Moderate	Low
After-sales Service	High	Moderate	Low

Responses: High, Moderate, Low.

Table 2: Primary Dataset for Smart Lock Collected from Survey

Region	**Product Promotion (1/0)**	**Customer Demand (1/0)**	**Price Affordability (1/0)**	**Infrastructure (1/0)**	**After-sales Service (1/0)**
Urban	1	1	1	1	1
Urban	1	1	1	1	1
Urban	1	1	1	1	1
Urban	1	1	1	1	1
Urban	1	1	1	1	1
Urban	1	1	1	1	1
Urban	1	1	1	1	1
Urban	1	1	1	1	1
Urban	1	1	1	1	1

Urban	1	1	0	1	1
Urban	1	1	0	1	1
Urban	1	1	1	1	1
Urban	1	1	1	1	1
Urban	1	1	0	1	1
Urban	1	1	1	1	1
Urban	1	1	1	1	1
Urban	1	1	1	1	1
Urban	1	1	1	1	1
Urban	1	1	1	1	1
Semi-Urban	1	1	1	1	1
Semi-Urban	1	1	1	1	1
Semi-Urban	0	1	1	1	1
Semi-Urban	1	1	1	1	1
Semi-Urban	1	1	1	1	1
Semi-Urban	0	0	1	0	1
Semi-Urban	1	1	1	1	0
Semi-Urban	0	0	0	0	0
Semi-Urban	1	0	1	1	0
Semi-Urban	0	1	0	0	1
Semi-Urban	1	1	1	1	0
Semi-Urban	0	0	0	0	0
Semi-Urban	1	0	0	0	1
Semi-Urban	1	1	1	1	1
Semi-Urban	0	0	0	0	0
Semi-Urban	1	1	0	0	0
Semi-Urban	1	0	1	1	1
Semi-Urban	0	1	1	1	1
Semi-Urban	1	1	0	1	1
Rural	1	1	1	1	1
Rural	0	0	1	0	0
Rural	0	0	1	0	0
Rural	1	1	1	1	1
Rural	0	0	0	0	0
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Rural	0	0	0	0	0
Rural	0	0	0	0	0
Rural	0	0	0	0	0
Rural	0	0	1	0	1
Rural	1	1	1	0	0
Rural	0	0	0	0	0
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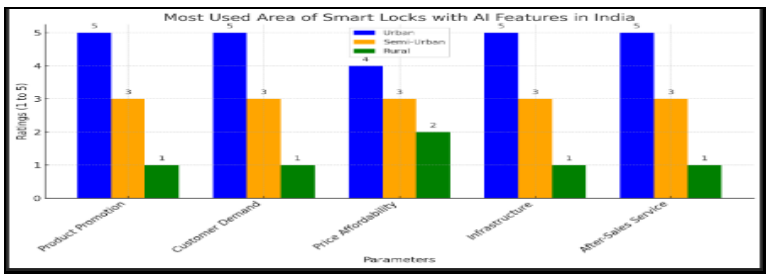

Fig. 5: Graph for Most Used Areas of Smart Locks with AI Features in India.

Summary:
Sample size: 60. Respondent demographics: urban, semiurban, rural. Sampling Strategy: Random data collection
Urban Areas rank highest across all parameters due to strong product promotion, high demand, affordability, infrastructure readiness, and service availability. [Refer Table 1.1, 1.2]
Rankings:
Urban Areas: Most Used
Semi-Urban Areas: Moderate Usage (Emerging Market)
Rural Areas: Minimal Usage

4.2. Product: washing machine with AI features

Model: Classification algorithm
Market Segment: Urban, Semi-Urban, Rural
Parameters: Product Promotion, Customer Demand, Price affordability, Infrastructure. After-sales Service

Table 2: Parameter Matrix for Washing Machine with AI Features

Parameter/Locality	Urban	Semi-Urban	Rural
Product Promotion	High	High	Moderate
Customer Demand	Moderate	Moderate	Low
Price Affordability	High	Moderate	Low
Infrastructure	High	Moderate	Low
After-sales Service	High	High	Low

Responses: High, Moderate, Low.

Table 3: Primary Dataset for Washing Machine Collected from Survey

Region	**Product Promotion (1/0)**	**Customer Demand (1/0)**	**Price Affordability (1/0)**	**Infrastructure (1/0)**	**After-sales Service (1/0)**
Urban	1	1	1	1	1
Urban	1	1	1	1	1
Urban	1	1	1	1	1
Urban	1	1	1	1	1
Urban	1	1	1	1	1
Urban	1	1	1	1	1
Urban	1	1	1	1	1
Urban	1	1	1	1	1
Urban	1	1	1	1	1
Urban	1	1	0	1	1
Urban	1	1	0	1	1
Urban	1	1	1	1	1
Urban	1	1	1	1	1
Urban	1	1	0	1	1
Urban	1	1	1	1	1
Urban	1	1	1	1	1
Urban	1	1	1	1	1
Urban	1	1	1	1	1
Urban	1	1	1	1	1
Semi-Urban	1	1	1	1	1
Semi-Urban	1	1	1	1	1
Semi-Urban	0	1	1	1	1
Semi-Urban	1	1	1	1	1
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Semi-Urban	1	0	0	0	1
Semi-Urban	1	1	1	1	1

Semi-Urban	0	0	0	0	0
Semi-Urban	1	1	0	0	0
Semi-Urban	1	0	1	1	1
Semi-Urban	0	1	1	1	1
Semi-Urban	1	1	0	1	1
Rural	1	1	1	1	1
Rural	0	0	1	0	0
Rural	0	0	1	0	0
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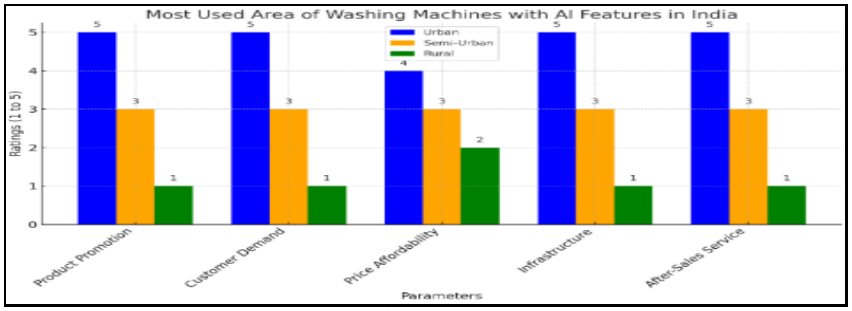

Fig. 6: Most Used Area of Washing Machines with AI Features in India.

Summary:
Sample size: 60. Respondent demographics: urban, semiurban, rural. Sampling Strategy: Random data collection
Urban Areas dominate in terms of adoption of AI-enabled washing machines due to effective promotion, strong demand, affordability, supporting infrastructure, and reliable service networks. [Refer Table 2.1, 2.2]
Rankings:
Urban Areas: Most Used
Semi-Urban Areas: Emerging Market with Moderate Use
Rural Areas: Minimal Usage

4.3. Product: home assistant

Model: Classification algorithm
Market Segment: Urban, Semi-Urban, Rural
Parameters: Product Promotion, Customer Demand. Price affordability. Infrastructure. After-sales Service

Table 4: Parameter Matrix for Home Assistants

Parameter/Locality	Urban	Semi-Urban	Rural
Product Promotion	High	Moderate	Low
Customer Demand	High	Low	Low
Price Affordability	Moderate	Moderate	Moderate
Infrastructure	High	Low	Low
After-sales Service	High	Moderate	Low

Responses: High, Moderate, Low.

Table 5: Primary Dataset for Home Assistants Collected from Survey

Region	Product Promotion (1/0)	Customer Demand (1/0)	Price Affordability (1/0)	Infrastructure (1/0)	After-sales Service (1/0)
Urban	1	1	1	1	1
Urban	1	1	1	1	1
Urban	1	1	1	1	1
Urban	1	1	1	1	1
Urban	1	1	1	1	1
Urban	1	1	1	1	1
Urban	1	1	1	1	1
Urban	1	1	1	1	1
Urban	1	1	1	1	1
Urban	1	1	0	1	1
Urban	1	1	0	1	1
Urban	1	1	1	1	1
Urban	1	1	1	1	1
Urban	1	1	0	1	1
Urban	1	1	1	1	1
Urban	1	1	1	1	1
Urban	1	1	1	1	1
Urban	1	1	1	1	1
Semi-Urban	1	1	1	1	1
Semi-Urban	1	1	1	1	1
Semi-Urban	0	1	1	1	1
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Semi-Urban	1	1	0	1	1
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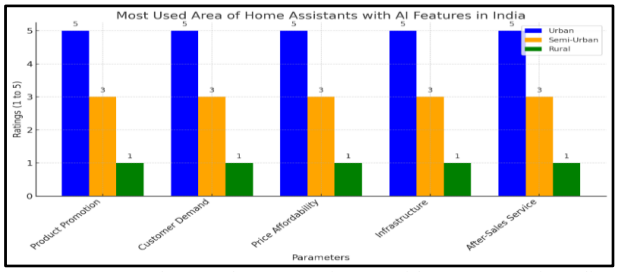

Fig. 7: Most Used Area of Home Assistants with AI Features in India.

Summary:
Sample size: 60. Respondent demographics: urban, semiurban, rural. Sampling Strategy: Random data collection
Urban Areas are the most used areas for AI-powered home assistants due to aggressive promotion, high customer demand, affordability for a larger demographic, supportive infrastructure, and accessible after-sales service. [Refer Table 3.1, 3.2]
Semi-Urban Areas are an emerging market with moderate adoption, primarily driven by budget models and growing awareness.
Rural Areas have minimal to no adoption due to affordability issues, poor infrastructure, and lack of awareness.
Rankings:
Urban Areas: Most Used
Semi-Urban Areas: Moderate Usage (Emerging Market)
Rural Areas: Minimal Usage

5. Implications

5.1. Product: smart lock (retinal scan, biometric, password)

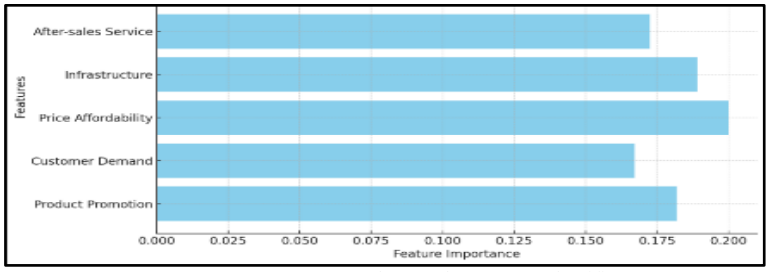

Fig. 8: Feature Importance by Random Forest Classifier.

Output - Features like Customer Demand or Price Affordability for smart locks might be more influential based on their weights.

5.2. Product: washing machine with AI features

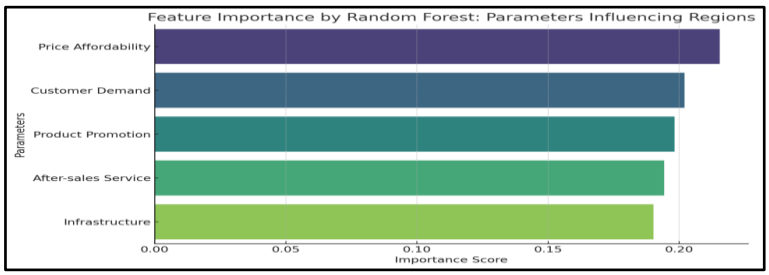

Fig. 9: Feature Importance by Random Forest: Parameters Influencing Regions.

Output - The bar chart ranks the parameters by their influence on predicting the region where the washing machine with AI features is most used. Parameters like Customer Demand and Infrastructure are likely to have higher importance.

5.3. Product: home assistant

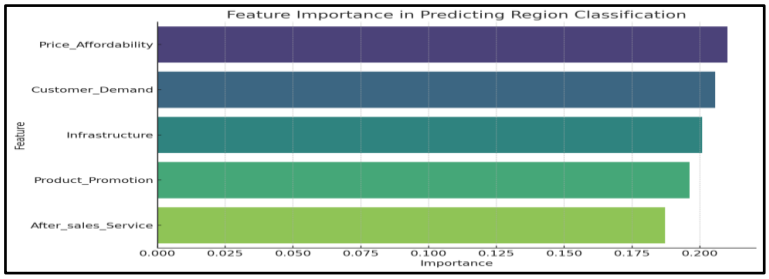

Fig. 10: Feature Importance in Predicting Region Classification.

Output - The bar chart highlights the relative importance of each feature for home assistants. Features like Customer Demand or Price Affordability may have stronger influences, as seen from their rankings in the chart.
There are 5 policy recommendations with official or proposed policy names related to AI adoption:
1) National AI Mission (India)
Focus: Incentives for AI adoption in industry.
Description: Provides funding and support for AI integration in key sectors like agriculture, healthcare, and education.
2) EU AI Act (European Union)
Focus: Ethical and privacy regulations for AI.
Description: Establishes legal requirements for high-risk AI applications, ensuring transparency, data protection, and accountability.
3) AI for All (India)
Focus: AI education and skill development.
Description: Promotes AI literacy and workforce training through public-private partnerships and educational reforms.
4) National AI Research Resource (USA)
Focus: Public-private innovation hubs.
Description: Supports shared AI research infrastructure to accelerate ethical innovation and collaboration between academia and industry.
5) Algorithmic Accountability Act (USA - proposed)
Focus: Mandatory impact assessments.
Description: Requires companies to evaluate and disclose the impacts of automated decision-making systems on fairness, privacy, and rights.

5.4. Ethical considerations in the Indian context

Smart locks and home assistants in India raise ethical concerns such as data privacy risks amid evolving laws (DPDP 2023), digital exclusion due to affordability and literacy gaps, algorithmic bias in voice recognition, lack of informed consent, and cybersecurity vulnerabilities. Stronger regulations, inclusive design, and consumer awareness are vital for responsible AI deployment in homes.

6. Future scope

The research highlights the interplay of socio-economic, infrastructural, and promotional factors driving the regional adoption of AI augmented consumer products in India. While urban areas lead due to robust infrastructure and demand, semi-urban and rural regions face barriers like affordability and limited access. Future studies could expand to additional products, explore temporal adoption dynamics, and assess the impact of emerging technologies like 5G and IoT. Comparative international analyses, consumer behavior studies, and policy impacts offer promising areas for deeper insights. Advanced machine learning models could further refine predictive analytics, enabling businesses to tailor strategies and address diverse regional challenges effectively.

7. Conclusion

This research analyzes AI integrated consumer product adoption in India, revealing disparities across urban, semi-urban, and rural markets due to infrastructure, affordability, and promotional variations. Urban areas dominate as lucrative markets, while semi-urban regions show growth potential, and rural areas face challenges. By combining machine learning and market analysis, the study offers a replicable framework for understanding technology adoption. The findings provide actionable insights for businesses to tailor strategies, optimize resources, and address market diversity, paving the way for adaptive approaches to drive AI controlled product adoption and economic growth across all societal segments.

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