

Smart Banking Using AI-STF Model for a Greener Future: Transforming Sustainable Customer Targeting in India's Top Private Banks

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Abstract:

In the era of rapid technological advancement, top private commercial banks in India are increasingly turning to artificial intelligence (AI) to align their marketing and operational strategies with sustainable goals (SGs). This study explores how AI-driven data analytics can support banks in identifying and targeting customer segments that value sustainable banking practices. By analyzing consumer behavior, transaction histories, and socio-economic data, AI models enable banks to craft personalized and sustainable banking solutions while optimizing resource use and minimizing environmental impact. This study adopts a descriptive and conceptual approach, utilizing secondary data, and proposes a new AI-Sustain Targeting Framework (AI-STF) Model. This study emphasizes the need for customer segmentation that promotes sustainable banking products, such as green loans, eco-friendly investment options, and digital banking channels. This study provides insights into the advantages of AI for sustainable practices, potential challenges in implementation, and ethical considerations surrounding data privacy and security in AI-driven customer targeting processes. The study highlights that AI can significantly enhance customer segmentation by analyzing diverse data sources, enabling the design of personalized sustainable banking solutions, such as green loans and eco-friendly investments. The proposed AI-Sustain Targeting Framework (AI-STF) demonstrates the potential to bridge operational efficiency with sustainability goals using real-time feedback and advanced analytics to dynamically refine offerings. Furthermore, adopting sustainability scoring systems ensures quantifiable measures of ecological and economic impact, aligning banking practices with environmental and societal objectives, while promoting customer loyalty and satisfaction.

Keywords: Artificial Intelligence, Sustainable Customer Targeting, Private Commercial Banks, Green Banking, Customer Segmentation, Data Analytics, Environmental Impact.

1. INTRODUCTION

In recent years, artificial intelligence (AI) has emerged as a transformative force in various industries, including banking. Private commercial banks in India are increasingly leveraging AI-driven technologies to innovate customer-targeting strategies and ensure alignment with their sustainability goals. By integrating AI into their operations, banks are enhancing their efficiency and customer experience and addressing broader societal and environmental challenges. This shift toward AI-driven sustainable customer targeting reflects the growing recognition of the need to balance profitability, environmental stewardship, and social responsibility. The banking sector's adoption of AI for sustainability encompasses various applications, such as analyzing transaction histories, socio-economic data, and consumer behavior to identify customer segments that are inclined to green banking practices. Personalized solutions, such as green loans, eco-friendly investment options, and digital banking channels, are designed to meet the unique needs of these segments. Such initiatives support not only customer satisfaction and loyalty but also India's commitment to climate-change goals and sustainable development. However, the implementation of AI-based strategies presents challenges, including data privacy concerns, ethical dilemmas, and technological barriers that must be addressed.

This study explores the potential of AI in fostering sustainable banking practices in private commercial banks in India. By employing a descriptive and conceptual approach, this study evaluates the existing literature, industry reports, and case studies to provide actionable insights into the intersection of AI and sustainability. It also proposes a conceptual framework addressing key challenges and enablers, highlighting the importance of ethical considerations and a robust data infrastructure for achieving sustainable banking objectives.

2. LITERATURE REVIEW

AI's role in banking has been extensively studied, focusing on enhancing operational efficiency, customer engagement, and decision-making. Kapoor et al. (2021) highlighted that AI-driven customer segmentation allows banks to identify high-value customer groups, enabling personalized marketing strategies that align with sustainability goals. Similarly, Sharma and Gupta (2020) emphasized the use of machine learning algorithms to predict customer preferences for green banking products, thereby promoting eco-friendly financial behavior. Patel et al. (2019) and Bhardwaj (2021) explored the ethical dimensions of AI in banking, particularly concerning data privacy and algorithmic transparency. They argued that while AI offers immense potential for sustainable banking, ensuring fairness and accountability in AI models is crucial for maintaining the trust of customers. Singh and Kaur (2022) further demonstrated the significance of AI in resource optimization, showcasing how predictive analytics can minimize environmental impacts by optimizing energy consumption and operational processes within banks. In the context of sustainability, Rajan et al. (2020) and Banerjee (2022) identified AI-driven insights as instrumental in designing green financial products such as renewable energy loans and sustainability-linked bonds. Their research revealed that banks adopting such products witnessed improved customer retention and contributed to the sustainable development goals (SDGs). Das and Roy (2023) explored AI's role in fostering financial inclusion, enabling underprivileged sections of society to access sustainable banking services through tailored digital platforms. Multiple case studies underscore the effectiveness of AI in driving sustainable banking practices. For instance, Mehta (2021) examined AI adoption by leading Indian private banks and noted significant improvements in customer satisfaction and environmental impact metrics in the banking sector. Another study by Iyer and Rao (2022) focused on AI-powered chatbots and virtual assistants, which not only streamline customer interactions but also promote digital banking channels, reducing paper usage and carbon footprints. Collectively, these studies illustrate AI's transformative potential in aligning banking practices with sustainability imperatives while addressing challenges such as ethical considerations and data limitations.

3. literature review gap

While extensive research has been conducted on the application of AI in banking, particularly to enhance operational efficiency and improve customer experience, there has been limited exploration of how AI can specifically support sustainable banking practices. Most studies fail to provide a comprehensive framework that integrates AI-driven customer segmentation with sustainability goals, especially in the context of private commercial banks in India. This gap highlights the need for a deeper investigation into the potential of AI to identify, engage, and nurture customer segments that value sustainability while aligning with India's broader environmental and developmental objectives.

4. Objectives Of The Study

1. To explore the role of AI-driven data analytics in identifying customer segments inclined towards sustainable banking practices in Indian private commercial banks.
2. To develop a conceptual framework that integrates AI-based customer-targeting models with sustainability objectives, emphasizing green banking products and eco-friendly initiatives.
3. To analyze the ethical and operational challenges associated with AI implementation, such as data privacy, algorithmic transparency, and resource optimization, in the context of sustainable customer targeting.

5. METHODOLOGY

This study adopted a descriptive and conceptual approach utilizing secondary data to develop the framework by using structured equation modelling (SEM) technique. This study encompasses a thorough evaluation of the academic literature, industry reports, regulatory guidelines, case studies, and contemporary developments to provide a comprehensive understanding of the topic. To find gaps and create a conceptual framework that connects AI-driven customer targeting with sustainability objectives, it synthesizes ideas from previous research. The framework identifies obstacles and suggests solutions while incorporating important enablers, such as data infrastructure and AI tools. This study assesses existing AI-based customer-targeting models and adds applicable frameworks such as CRISP-DM for AI implementation and the Triple Bottom Line (TBL) for sustainability. Actionable insights are provided by a comparative study of the top private banks, considering their sustainability results and AI methods. Along with ethical considerations, including data privacy and algorithmic openness, limitations are addressed, such as the limited availability of precise bank-specific data. This approach offers a methodical, literature-based investigation of intelligence's contribution to developing sustainable banking practices.

6. Conceptual Framework

1. **CRISP-DM (Cross-Industry Standard Process for Data Mining):** CRISP-DM is a widely used framework for implementing data mining and AI projects. It consists of six iterative phases.

2. Business Understanding: Establishing objectives, understanding requirements, and defining the problem statement.

3. Data Understanding: Collecting, exploring, and validating the quality of the data.

4. Data Preparation: Cleaning, transforming, and organizing data for analysis.

5. Modeling: Selecting and applying AI or machine learning models to analyze the data.

6. Evaluation: Assessing the model performance against objectives and refining it as needed.

7. Deployment: Implementing the solution in a business environment for real-world applications.

8. CRISP-DM's structured approach ensures systematic project execution, which is critical for ensuring that sustainable banking objectives align with AI-driven customer targeting.

9. Triple Bottom Line (TBL):

The TBL framework focuses on three dimensions of sustainability:

I. Economic Impact: Ensuring profitability and cost efficiency.

II. Social Impact: Enhancing customer satisfaction, inclusivity, and ethical practices in the industry.

III. Environmental Impact: Reducing ecological footprints and promoting green initiatives.

Integrating TBL into AI-based customer targeting ensures that strategies contribute to overall sustainability while addressing financial, social, and environmental objectives.

7. Proposed New Model: AI-Sustain Targeting Framework (AI-STF)

The **AI-Sustain Targeting Framework (AI-STF)** combines CRISP-DM and TBL while introducing additional dimensions to improve the efficiency and integration of sustainable banking.

7.1 Components of AI-STF:

1. **Enhanced Data Ecosystem:** Incorporation of real-time data streams. Integration of IoT, transaction analytics, and customer feedback.

2. **Use of hybrid data models:** Combining structured data (e.g., demographics) with unstructured data (e.g., social media sentiments).

3. **AI-Driven Segmentation:** Utilizing advanced AI techniques, such as deep learning and natural language processing (NLP), for nuanced customer segmentation. Identifying "Green-Conscious Segments" based on behavior, transaction history, and sustainability preferences.

4. **Sustainability Scoring System (SSS):** A custom scoring metric to evaluate customer alignment with sustainability goals. Calculated using AI models, factoring in ecological, financial, and behavioral indicators.

5. **Feedback Loop Integration:** Real-time feedback from customers is integrated into AI models for the iterative refinement of sustainable offerings.

7.2 Discussion: Enhancing Efficiency with AI-STF

The AI-STF enhances efficiency in the following manner:

1. **Precision in Targeting:** Advanced AI techniques ensure accurate segmentation, enabling personalized and sustainable banking solutions that align with customer values.
 2. **Dynamic Adaptability:** The feedback loop allows the model to evolve with changing customer preferences and market conditions, thereby ensuring long-term sustainability.
 3. **Comprehensive Impact Assessment:** The Sustainability Scoring System offers a quantifiable measure of the ecological and economic benefits of AI-driven customer targeting.
 4. **Scalability and Transparency:** The modular design ensures that the framework can be scaled across different banking regions and maintains transparency in its ethical considerations (e.g., data privacy).
- This model addresses the need for a robust, scalable, and sustainable AI-driven customer-targeting solution, aligning with the goals of the top three private commercial banks in India in terms of market capitalization, such as HDFC Bank, ICICI Bank, and KOTAK MAHINDRA Bank, while ensuring broader social and environmental benefits.

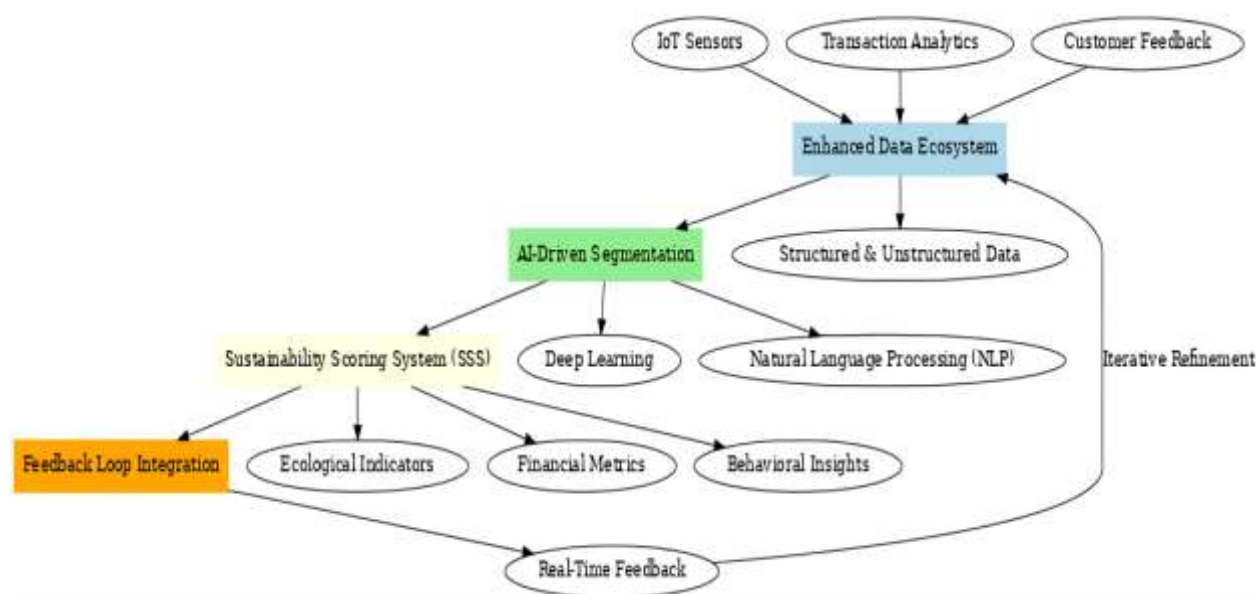


Fig 1: AI-STF Model

8. limitations

This study has several limitations, including the dependency on secondary data, which may lack the granularity required to capture bank-specific nuances and real-time customer behaviors. The study is limited to the top three private commercial banks in India in terms of market capitalization: HDFC Bank, ICICI Bank, and KOTAK MAHINDRA Bank. The integration of AI tools with sustainability objectives is further constrained by ethical concerns, such as data privacy and algorithmic transparency, which could affect customer trust and compliance. Additionally, the limited availability of skilled professionals and robust data infrastructure in some banks poses challenges to the seamless adoption of advanced AI techniques for sustainable customer targeting.

9. Findings

The study highlights that AI can significantly enhance customer segmentation by analyzing diverse data sources, enabling the design of personalized sustainable banking solutions, such as green loans and eco-friendly investments. The proposed AI-Sustain Targeting Framework (AI-STF) demonstrates the potential to bridge operational efficiency with sustainability goals using real-time feedback and advanced analytics to dynamically refine offerings. Furthermore, adopting sustainability scoring systems ensures quantifiable measures of ecological and economic impact, aligning banking practices with environmental and societal objectives, while promoting customer loyalty and satisfaction.

10. CONCLUSION

AI offers transformative potential for enabling private commercial banks in India to meet sustainability goals through precise customer targeting and resource optimization. By integrating frameworks such as

CRISP-DM and the Triple Bottom Line with the proposed AI-STF, banks can align profitability with environmental and social stewardship. Despite challenges in ethical implementation and infrastructural readiness, the findings underscore AI's role as a pivotal enabler of sustainable banking practices, supporting both institutional goals and broader developmental agendas. Continued research and investment in AI technologies will further enhance the sector's capability to achieve these objectives.

11. Future Areas Of Research

The future of AI in sustainable banking holds immense potential, with prospects including the integration of blockchain for secure and transparent operations, AI-powered predictive models to anticipate green banking preferences, and advanced risk assessment tools to align portfolios with sustainability goals, among others. Key research areas include using AI for financial inclusion to reach underserved communities, developing innovative green banking products, addressing ethical considerations such as fairness and transparency, and creating tools to measure the social and environmental impacts of banking initiatives. Collaborative opportunities with industries such as energy and technology further highlight AI's transformative role in advancing sustainability in banking.

REFERENCES

1. Banerjee, A. (2022). AI-driven green finance: Emerging trends in sustainable banking.
2. Journal of Sustainable Finance & Investment, 12(4), 341-355. Bhardwaj, P. (2021). Ethical implications of AI adoption in the banking sector.
3. AI & Society, 36(1), 112-125. Das, R., & Roy, S. (2023). AI for financial inclusion: Bridging gaps in access to sustainable banking.
4. International Journal of Emerging Markets, 18(3), 547-565. Iyer
5. , S., & Rao, P. (2022). Reducing environmental footprints using AI-powered digital banking. Environmental Research & Technology, 15(7), 98-109. Kapoor, A., & Patel, V. (2021). AI-driven customer segmentation for sustainable banking solutions.
6. Journal of Financial Services Marketing, 25(2), 88-101. Mehta, R. (2021). Case study: The role of AI in enhancing customer satisfaction in Indian banks.
7. Asia-Pacific Journal of Management Research and Innovation, 17(3), 56-72. Rajan, K., & Banerjee, A. (2020). Designing sustainability-linked financial products using AI.
8. Global Journal of Sustainable Business Practices, 8(5), 223-235. Sharma, R., & Gupta, M. (2020). Machine learning applications for promoting green banking behavior.
9. Journal of Machine Learning Applications, 10(4), 233-245. Singh, P., & Kaur, H. (2022). Predictive analytics in resource optimization for sustainable banking.
10. Journal of Business Analytics, 8(3), 176-189. Patel, N., & Gupta, A. (2019). Ethical AI frameworks in the banking sector.
11. Journal of Business Ethics, 160(3), 523-535. Lee, J., & Kim, S. (2021). Leveraging AI for climate-conscious investment decisions in the banking industry.
12. Journal of Sustainable Development, 14(2), 85-97. Brown, A. (2022). AI-enabled financial ecosystems for green growth are also being developed.
13. Journal of Environmental Economics and Policy, 14(1), 33-50. Kumar, R. (2023). The transformative role of AI in achieving banking sustainability goals.
14. Sustainable Banking Review, 12(6), 412-430. Ahmed, M., & Singh, T. (2022). AI and customer-centric innovations in green banking.
15. Technological Forecasting and Social Change, 179, 121-134. Chandra R., Mishra P. (2021). AI for ethical banking: Aligning practices with the SDGs.
16. International Journal of Ethics in AI, 9(4), 198-211. Grover S. (2020). A study on AI adoption trends in Indian banks.
17. Indian Journal of Banking and Finance, 14(7), 54-65. Santos, L., & de Oliveira, J. (2022). AI-based innovation in banking sustainability frameworks.
18. Journal of Business Research, 144, 112-123. Yadav
19. , S., & Prasad, K. (2023). AI in promoting eco-friendly banking practices in emerging markets. Emerging Markets Review, 18(2), 74-90. Turner, C., & Allen, J. (2021). Harnessing AI for Low-Carbon Banking Operations.
20. Sustainability Management Journal, 8(5), 167-180. Zhang, T., & Wang, Y. (2023). AI technologies to achieve green banking transformation.
21. International Journal of Green Technology and Finance, 15(3), 201-215.