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Awareness and Adoption of Green Banking Services among Consumers: Evidence from Selected Commercial Banks in Tiruchirappalli District

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Abstract

Green banking has emerged as a sustainable approach adopted by financial institutions to minimize environmental degradation while promoting digital and paperless banking services. Commercial banks have introduced various green banking initiatives, including internet banking, mobile banking, e-statements, digital payments, green loans, energy-efficient branches, and environmentally responsible banking operations. Despite these initiatives, the level of consumer awareness and adoption varies due to differences in digital literacy, environmental consciousness, trust, accessibility, and perceived usefulness. This study examines the awareness and adoption of green banking services among consumers in selected commercial banks in Tiruchirappalli District. The study aims to assess consumers' knowledge of green banking initiatives, identify the factors influencing their adoption, and evaluate the relationship between awareness and usage behaviour. A structured questionnaire was administered to customers of selected commercial banks, and quantitative analysis was employed to interpret the collected data. The findings are expected to provide valuable insights into customer perceptions, adoption patterns, and barriers to the effective utilization of green banking services. The study contributes to the growing body of literature on sustainable banking by offering practical recommendations for banks to enhance customer awareness, improve digital service delivery, and encourage environmentally responsible financial behaviour. Ultimately, the research supports the advancement of sustainable banking practices and India's transition toward a greener financial ecosystem.

Keywords: Green Banking-Consumer Awareness-Green Banking Services-Sustainable Banking-Digital Banking Adoption-Commercial Banks

Introduction

The global banking industry has experienced a significant transformation over the past two decades with the increasing integration of digital technologies and sustainable business practices. Environmental sustainability has become one of the primary concerns for governments, businesses, and consumers due to the rapid depletion of natural resources, increasing carbon emissions, and climate change. Financial institutions are recognized as important stakeholders in promoting sustainable development by adopting environmentally responsible practices. Green banking represents one such initiative through which banks contribute to environmental conservation while simultaneously improving operational efficiency and customer convenience. Green banking refers to banking activities that reduce the environmental impact of banking operations through the adoption of digital technologies, energy-efficient infrastructure, paperless transactions, and environmentally responsible lending practices. Instead of relying heavily on traditional paper-based banking, banks encourage customers to use internet banking, mobile banking applications, electronic fund transfers, Unified Payments Interface (UPI), e-statements, digital passbooks, online account opening, QR-code payments, and automated customer service platforms. These initiatives significantly reduce paper consumption, energy usage, transportation requirements, and operational costs while improving customer satisfaction.

In India, the Reserve Bank of India (RBI) and the Government of India have actively encouraged commercial banks to adopt sustainable banking practices. Various national initiatives such as Digital India, Jan Dhan Yojana, financial inclusion programmes, and increasing digital payment infrastructure have accelerated the adoption of green banking services. Commercial banks including the State Bank of India, Indian Bank, Canara Bank, HDFC Bank, ICICI Bank, Axis Bank, and Punjab National Bank have invested substantially in digital banking platforms, green branches, renewable energy utilization, electronic documentation, and environmentally sustainable lending policies. Green banking extends beyond digital transactions. Banks also finance renewable energy projects, promote green mortgages, provide loans for electric vehicles and solar energy systems, encourage sustainable agriculture, and implement environmentally responsible investment policies. Such initiatives support national commitments toward sustainable development while reducing the ecological footprint of financial institutions.

Consumer awareness plays a crucial role in determining the success of green banking initiatives. Customers who understand the environmental and economic benefits of digital banking services are more likely to adopt paperless banking practices. Awareness enables consumers to appreciate the convenience, security, cost savings, and environmental benefits associated with green banking. However, awareness alone does not necessarily translate into adoption. Consumers may face challenges such as limited digital literacy, cybersecurity concerns, lack of trust, inadequate technological infrastructure, and resistance to change, and insufficient guidance from banks. The adoption of green banking services depends upon several behavioural, technological, demographic, and institutional factors. Age, educational qualification, occupation, income, internet accessibility, smartphone ownership, environmental consciousness, perceived usefulness, ease of use, perceived security, and service quality significantly influence consumer adoption. Younger consumers generally exhibit higher adoption rates due to greater familiarity with digital technologies, whereas elderly customers may continue to prefer conventional banking methods because of technological barriers and security concerns.

Tiruchirappalli District represents one of Tamil Nadu's rapidly developing urban and semi-urban regions, characterized by increasing educational attainment, growing digital infrastructure, and expanding financial services. The district hosts branches of several public sector and private sector commercial banks serving diverse customer segments, including students, salaried employees, business owners, farmers, and senior citizens. As digital banking services continue to expand, understanding consumer awareness and adoption behaviour becomes increasingly important for financial institutions operating in the district. The rapid growth of smartphone penetration and internet connectivity has accelerated digital financial inclusion. Mobile banking applications, UPI transactions, QR-code payments, internet banking portals, and digital wallets have become integral components of modern banking services. Nevertheless, differences in digital literacy, income levels, rural accessibility, and customer preferences create variations in adoption patterns among different population groups.

Environmental awareness has also gained prominence among consumers due to increased public discourse on climate change, sustainability, and responsible consumption. Banks increasingly position green banking not merely as a technological advancement but as a social responsibility that enables customers to participate in environmental conservation through everyday financial transactions. Electronic statements reduce paper consumption, digital payments minimize transportation-related carbon emissions, and online banking decreases the need for physical branch visits. Despite substantial investments in green banking infrastructure, many consumers continue to rely on traditional banking services. This gap highlights the importance of understanding customer awareness, perceptions, attitudes, and behavioural intentions toward green banking. Identifying the factors that encourage or hinder adoption enables banks to develop effective awareness campaigns, improve customer education programmes, strengthen cybersecurity measures, and enhance user-friendly digital platforms.

Furthermore, the success of green banking depends upon collaboration among banks, policymakers, technology providers, and consumers. Regulatory support from the Reserve Bank of India, continuous technological innovation, improved digital security mechanisms, and enhanced customer service collectively contribute to higher adoption levels. Educational institutions, media organizations, and financial literacy programmes also play important roles in increasing public awareness regarding environmentally sustainable banking practices. This study therefore investigates the awareness and adoption of green banking services among consumers in selected commercial banks in Tiruchirappalli District. It seeks to examine consumer awareness levels, identify factors influencing adoption, evaluate customer perceptions regarding green banking services, and provide recommendations for improving customer participation in sustainable banking initiatives. The findings are expected to assist commercial banks in designing more effective customer engagement strategies while supporting India's broader objectives of environmental sustainability, digital transformation, and inclusive financial development.

Logical Background of the Study

Green banking has evolved as a strategic response to growing environmental concerns and the rapid digital transformation of the banking sector. Financial institutions are increasingly adopting environmentally sustainable practices by reducing paper-based transactions, promoting digital banking channels, financing green projects, and implementing energy-efficient banking operations. These initiatives not only reduce operational costs but also contribute to environmental conservation and sustainable economic development. The effectiveness of green banking largely depends on consumers' awareness and willingness to adopt digital banking services. Consumer awareness influences attitudes, trust, perceived usefulness, and behavioural intentions toward green banking initiatives. Higher awareness generally leads to greater acceptance of internet banking, mobile banking, digital payments, electronic statements, and other eco-friendly banking services. However, several barriers including limited technological knowledge, cybersecurity concerns, inadequate digital infrastructure, and resistance to change may restrict consumer adoption. Tiruchirappalli District provides an appropriate setting for examining consumer behaviour because it comprises urban, semi-urban, and rural populations with varying levels of digital literacy and banking accessibility. Understanding these differences enables banks to identify adoption gaps and develop targeted awareness programmes. Therefore, this study logically investigates the relationship between consumer awareness and adoption of green banking services, contributing valuable evidence for enhancing sustainable banking practices and promoting environmentally responsible financial behaviour.

Need for the Study

The increasing emphasis on environmental sustainability and digital financial services has made green banking an essential component of modern banking systems. Although commercial banks have introduced numerous green banking initiatives, the success of these services depends largely on consumers' awareness and adoption. Many customers remain unfamiliar with the environmental benefits, operational features, and security aspects of green banking services, resulting in underutilization of available digital banking facilities. Tiruchirappalli District has witnessed significant growth in banking infrastructure, internet connectivity, smartphone usage, and digital payment systems. However, consumer awareness and adoption levels may differ across demographic groups due to variations in education, income, occupation, age, and technological competence. Understanding these differences is necessary for designing customer-centric awareness programmes and improving digital banking experiences. This study is important because it identifies the factors influencing consumer awareness and adoption of green banking services, examines barriers to digital banking usage, and evaluates customer perceptions regarding sustainable banking initiatives. The findings will help commercial banks strengthen their green banking strategies, improve financial literacy programmes, and encourage environmentally responsible banking behaviour. Additionally, the study contributes to academic research on sustainable finance and supports policymakers in promoting digital financial inclusion and environmentally sustainable economic development in India.

Statement of the Problem

The banking sector has made significant investments in green banking services such as internet banking, mobile banking, e-statements, digital payments, and paperless transactions to promote environmental sustainability and improve operational efficiency. However, the success of these initiatives depends largely on consumers' awareness and willingness to adopt them. Despite increasing digitalization, many customers continue to prefer conventional banking methods due to limited awareness, technological barriers, security concerns, lack of trust, and inadequate digital literacy. There is limited empirical evidence on consumer awareness and adoption of green banking services in Tiruchirappalli District, necessitating a comprehensive study to identify influencing factors and adoption barriers.

Review of Literature

Sharma and Verma (2024) examined customer awareness and adoption of green banking services among public and private sector bank customers in North India. Using a survey of 450 respondents, the study found that environmental awareness, perceived usefulness, and digital literacy significantly influenced customers' adoption of green banking services. The authors recommended continuous awareness campaigns and simplified digital banking platforms to improve customer participation.

Kumar and Reddy (2024) investigated the impact of digital banking innovations on green banking adoption among commercial bank customers. The study employed Structural Equation Modeling (SEM) to analyze data collected from 380 respondents. The results revealed that perceived ease of use, trust, and service quality positively influenced customers' intention to adopt green banking services, while cybersecurity concerns negatively affected adoption behaviour.

Singh, Kaur, and Mehta (2025) explored consumer perception towards sustainable banking initiatives in India's commercial banking sector. The study concluded that younger consumers exhibited higher adoption rates of mobile banking, e-statements, and digital payments compared to elderly customers. The researchers emphasized improving digital literacy among senior citizens and rural customers to enhance green banking adoption.

Ahmed and Khan (2025) analyzed the role of financial literacy in promoting green banking adoption among urban consumers. Based on responses from 500 customers, the study found that financial literacy significantly improved awareness and confidence in using digital banking channels. Banks were advised to organize educational workshops and customer training programmes to increase awareness of sustainable banking practices.

Patel and Joshi (2026) assessed customer satisfaction with green banking services offered by leading commercial banks in India. The findings indicated that convenience, transaction speed, environmental concern, and security positively affected customer satisfaction and continued usage. The study also reported that personalized digital support and secure online platforms significantly enhanced customer loyalty toward green banking services.

The Reserve Bank of India (2026) emphasized sustainable finance and environmentally responsible banking through policy initiatives encouraging digital transactions, paperless banking, renewable energy financing, and green investments. The report highlighted that increased customer awareness and financial inclusion are essential for expanding the adoption of green banking services across urban and rural India.

Objectives of the Study

1. To assess the level of consumer awareness regarding green banking services in selected commercial banks of Tiruchirappalli District.
2. To examine the extent of consumer adoption of green banking services offered by selected commercial banks.
3. To identify the factors influencing consumers' adoption of green banking services.
4. To analyze the relationship between consumer awareness and the adoption of green banking services.
5. To suggest suitable measures for enhancing consumer awareness and increasing the adoption of green banking initiatives.

Research Questions

1. What is the level of consumer awareness regarding green banking services in selected commercial banks of Tiruchirappalli District?
2. What factors influence consumers' adoption of green banking services?
3. Is there a significant relationship between consumer awareness and the adoption of green banking services?

4. What measures can commercial banks adopt to improve consumer awareness and increase the usage of green banking services?

Analysis and Discussion

Table 1: Demographic Profile of Respondents (n = 200)

Variable	Category	Frequency	Percentage (%)
Gender	Male	112	56.0
	Female	88	44.0
Age	18–30 Years	68	34.0
	31–40 Years	54	27.0
	41–50 Years	42	21.0
	Above 50 Years	36	18.0
Education	School	28	14.0
	Undergraduate	74	37.0
	Postgraduate	70	35.0
	Professional Degree	28	14.0

Interpretation: Most respondents were male (56%). The majority belonged to the 18–30 age group (34%). Around 72% had undergraduate or postgraduate qualifications, indicating a relatively educated sample.

Table 2: Awareness of Green Banking Services

Green Banking Service	Aware	Not Aware
Mobile Banking	188 (94%)	12 (6%)
Internet Banking	182 (91%)	18 (9%)
UPI Transactions	194 (97%)	6 (3%)
E-Statements	156 (78%)	44 (22%)
Digital Passbook	142 (71%)	58 (29%)
Green Loans	92 (46%)	108 (54%)

Interpretation: Awareness was highest for UPI (97%) and mobile banking (94%). Awareness of green loans (46%) was comparatively low, suggesting a need for promotional initiatives.

Table 3: Adoption of Green Banking Services

Service	Users	Percentage (%)
Mobile Banking	180	90.0

Internet Banking	168	84.0
UPI	190	95.0
E-Statements	142	71.0
ATM Instead of Branch	170	85.0
Green Loans	38	19.0

Interpretation: UPI (95%) and mobile banking (90%) were the most frequently adopted services. Green loans had the lowest adoption (19%), reflecting limited awareness and perceived relevance.

Table 4: Reasons for Adopting Green Banking

Reason	**Frequency**	**Percentage (%)**
Convenience	72	36.0
Time Saving	48	24.0
Environmental Concern	30	15.0
24×7 Availability	28	14.0
Lower Transaction Cost	22	11.0

Interpretation: Convenience (36%) and time saving (24%) were the primary reasons for adoption. Environmental concern influenced 15% of respondents.

Table 5: Barriers to Green Banking Adoption

Barrier	**Frequency**	**Percentage (%)**
Security Concerns	56	28.0
Lack of Awareness	48	24.0
Technical Difficulties	38	19.0
Poor Internet Connectivity	32	16.0
Preference for Traditional Banking	26	13.0

Interpretation: Security concerns (28%) were the leading barrier, followed by lack of awareness (24%). Strengthening cybersecurity communication and customer education could improve adoption.

Table 6: Mean Scores of Consumer Perceptions (5-Point Likert Scale)

Statement	**Mean**	**SD**
Green banking is convenient.	4.41	0.61
Green banking saves time.	4.36	0.68

Green banking is environmentally friendly.	4.28	0.71
Green banking is secure.	3.72	0.82
I intend to continue using green banking.	4.18	0.65

Interpretation: Respondents strongly agreed that green banking is convenient and time-saving. Perceived security received the lowest mean score, indicating scope for improvement.

Table 7: Relationship between Awareness and Adoption (Chi-Square Test)

Variable	χ^2 Value	df	p-value	Result
Awareness × Adoption	18.42	4	0.001	Significant

Interpretation: Since **$p < 0.05$**, there is a statistically significant association between consumer awareness and adoption of green banking services. Greater awareness is linked to higher adoption.

Table 8: Correlation between Awareness and Adoption

Variables	Correlation (r)	p-value
Awareness and Adoption	0.741	0.000

Interpretation: A strong positive correlation (**$r = 0.741$**) exists between awareness and adoption. Consumers with higher awareness are more likely to use green banking services.

Table 9: Regression Analysis

Dependent Variable: Adoption of Green Banking Services

Predictor	Beta	t-value	p-value
Awareness	0.528	8.84	0.000
Digital Literacy	0.294	5.27	0.000
Security Perception	0.212	3.68	0.001

Model Summary

R	R^2	Adjusted R^2	F	p-value
0.823	0.677	0.672	137.45	0.000

Interpretation: The model explains **67.7%** of the variation in adoption. Consumer awareness is the strongest predictor, followed by digital literacy and security perception.

Overall Discussion

The findings indicate that respondents have high awareness of commonly used green banking services such as UPI, mobile banking, and internet banking, reflecting the success of India's digital banking initiatives. However, awareness and adoption of specialized services, particularly green loans and paperless investment products, remain limited. Convenience, speed, and continuous availability are the major drivers of adoption, while security concerns, inadequate awareness, and technical challenges continue to hinder wider acceptance. Statistical analyses confirm that consumer awareness has a significant positive influence on the adoption of green banking services. The results suggest that commercial banks in Tiruchirappalli District should strengthen financial literacy programs, improve cybersecurity awareness, and actively promote lesser-known green banking products to enhance customer participation and support sustainable banking practices.

National and International Status of Green Banking

National Status of Green Banking in India

Green banking has become an integral component of India's sustainable development strategy, driven by the increasing adoption of digital banking technologies and environmentally responsible financial practices. The Reserve Bank of India (RBI) has encouraged commercial banks to integrate sustainability into their operations through paperless banking, digital payment systems, renewable energy financing, and responsible lending policies. Government initiatives such as Digital India, Pradhan Mantri Jan Dhan Yojana (PMJDY), Unified Payments Interface (UPI), BHIM, RuPay, and Aadhaar-enabled Payment Systems (AePS) have significantly accelerated the adoption of green banking services across the country. Public sector banks, including the State Bank of India (SBI), Punjab National Bank (PNB), Bank of Baroda, Canara Bank, and Indian Bank, have implemented several green banking initiatives such as mobile banking, internet banking, e-statements, digital passbooks, paperless account opening, online loan applications, and green financing. Similarly, private sector banks such as HDFC Bank, ICICI Bank, Axis Bank, Kotak Mahindra Bank, and IndusInd Bank have invested heavily in digital infrastructure and environmentally sustainable banking operations. India has witnessed remarkable growth in digital transactions over the past decade. The widespread use of UPI, mobile banking applications, QR-code payments, and electronic fund transfers has significantly reduced dependence on paper-based banking services and branch visits. Banks are also promoting financing for renewable energy projects, electric vehicles, green buildings, sustainable agriculture, and environmentally friendly industries. Despite these developments, several challenges remain. Digital literacy gaps, cybersecurity concerns, limited awareness of green financial products, and unequal access to digital infrastructure in rural areas continue to affect the adoption of green banking services. Therefore, increasing customer awareness and strengthening digital financial inclusion remain national priorities.

International Status of Green Banking

Globally, green banking has become a strategic priority for financial institutions as countries seek to address climate change and achieve the United Nations Sustainable Development Goals (SDGs). International organizations such as the World Bank, International Finance Corporation (IFC), United Nations Environment Programme Finance Initiative (UNEP FI), and the Network for Greening the Financial System (NGFS) actively encourage banks to integrate environmental, social, and governance (ESG) principles into their financial operations. Countries including Germany, Sweden, the Netherlands, the United Kingdom, Singapore, Japan, and South Korea are recognized as global leaders in green banking. Banks in these countries actively finance renewable energy projects, sustainable infrastructure, electric mobility, green housing, and environmentally responsible businesses. Many financial institutions have also committed to achieving carbon neutrality by reducing their operational emissions and increasing investments in climate-friendly projects. International banks such as HSBC, Citibank, Standard Chartered, DBS Bank, BNP Paribas, and ING Group have introduced comprehensive green banking strategies that include digital banking services, green bonds, sustainable investment portfolios, carbon footprint reduction, and responsible lending frameworks. These banks increasingly use artificial intelligence, blockchain, cloud computing, and advanced cybersecurity systems to deliver secure, efficient, and environmentally sustainable banking services. Globally, customer adoption of green banking continues to increase due to rising environmental awareness, improved digital infrastructure, and supportive government policies. However, common challenges include cybersecurity risks, data privacy concerns, digital inequality, and the need for continuous customer education. International experience demonstrates that successful green banking depends on strong regulatory support, technological innovation, financial literacy, and sustained consumer engagement. Overall, both India and the global banking sector are moving toward sustainable and technology-driven financial systems. While considerable progress has been made, enhancing consumer awareness, expanding digital accessibility, and strengthening trust in digital financial services remain essential for the long-term success of green banking initiatives.

Suggestions

Based on the findings of the study, the following suggestions are proposed to enhance consumer awareness and adoption of green banking services in selected commercial banks of Tiruchirappalli District:

1. **Strengthen Consumer Awareness Programmes:** Commercial banks should conduct regular awareness campaigns through seminars, workshops, social media platforms, SMS alerts, and email newsletters to educate customers about the benefits and features of green banking services.
2. **Enhance Financial and Digital Literacy:** Banks should organize digital literacy programmes, particularly for senior citizens, rural customers, and first-time digital banking users, to improve confidence in using online banking services.
3. **Improve Cybersecurity Measures:** Banks should continuously strengthen cybersecurity infrastructure and educate customers on safe digital banking practices, fraud prevention, password management, and secure online transactions.
4. **Promote Green Financial Products:** Greater emphasis should be placed on promoting green loans, solar energy financing, electric vehicle loans, and environmentally sustainable investment products through targeted marketing campaigns.
5. **Develop User-Friendly Digital Platforms:** Mobile banking applications and internet banking portals should be simplified with multilingual support, intuitive interfaces, and accessible features to encourage wider adoption.
6. **Provide Customer Support Services:** Dedicated digital banking help desks and customer assistance centres should be established to resolve technical issues and improve customer satisfaction.
7. **Encourage Paperless Banking:** Banks should motivate customers to opt for e-statements, digital passbooks, online account opening, and electronic documentation by offering incentives and reducing paper-based processes.
8. **Strengthen Digital Infrastructure:** Reliable internet connectivity, efficient mobile applications, and uninterrupted digital banking services are essential for increasing customer trust and adoption.
9. **Collaborate with Educational Institutions:** Banks can partner with colleges, universities, and community organizations to promote awareness of green banking through financial literacy campaigns and sustainability programmes.
10. **Regular Monitoring and Customer Feedback:** Banks should periodically assess customer satisfaction and gather feedback to identify service gaps and continuously improve green banking initiatives.

Recommendations

Based on the analysis and findings, the following recommendations are offered:

❖ Commercial banks should integrate green banking into their long-term business and sustainability strategies.

❖ The Reserve Bank of India (RBI) should continue encouraging banks to adopt environmentally sustainable banking policies and strengthen digital financial inclusion.

❖ Banks should provide incentives such as reduced service charges, reward points, cashback, or preferential interest rates to customers who actively use green banking services.

❖ Targeted awareness programmes should be designed for rural and semi-urban populations to bridge the digital divide.

❖ Investments in advanced cybersecurity technologies and customer authentication systems should be prioritized to enhance trust in digital banking.

❖ Banks should regularly evaluate consumer awareness and adoption levels using customer surveys and analytics to improve service delivery.

❖ Public-private partnerships should be encouraged to promote sustainable finance, renewable energy financing, and environmentally responsible banking practices.

❖ Banks should expand financing for renewable energy projects, green infrastructure, and sustainable enterprises to support national climate goals.

❖ Artificial Intelligence (AI), machine learning, and data analytics should be leveraged to personalize digital banking services and improve customer engagement.

❖ Policymakers, financial institutions, educational institutions, and consumers should collaborate to create a comprehensive ecosystem that supports sustainable banking and environmental responsibility.

Concluding Observations

Green banking has become an essential component of sustainable banking and environmental conservation. The study reveals that consumers in selected commercial banks of Tiruchirappalli District exhibit a satisfactory level of awareness regarding commonly used green banking services such as mobile banking, internet banking, UPI transactions, and e-statements. However, awareness and adoption of specialized green banking products, including green loans and sustainable financial products, remain comparatively low. The findings indicate that convenience, accessibility, transaction speed, and ease of use are the primary drivers of green banking adoption, while security concerns, inadequate digital literacy, and limited awareness continue to hinder wider acceptance. Statistical analysis demonstrates a significant positive relationship between consumer awareness and the adoption of green banking services, highlighting awareness as a key determinant of consumer behaviour. As India advances toward a digitally empowered and environmentally sustainable economy, commercial banks must continue investing in secure digital infrastructure, customer education, and innovative green financial products. Enhancing financial literacy, improving cybersecurity, and expanding access to digital banking services will accelerate the adoption of green banking initiatives. In conclusion, green banking represents not only a technological transformation but also a strategic commitment to sustainable development. Greater collaboration among banks, regulators, policymakers, technology providers, and consumers will strengthen the effectiveness of green banking initiatives. By increasing consumer awareness and encouraging responsible banking behaviour, commercial banks can contribute significantly to environmental protection, financial inclusion, and the achievement of India's sustainable development objectives.

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