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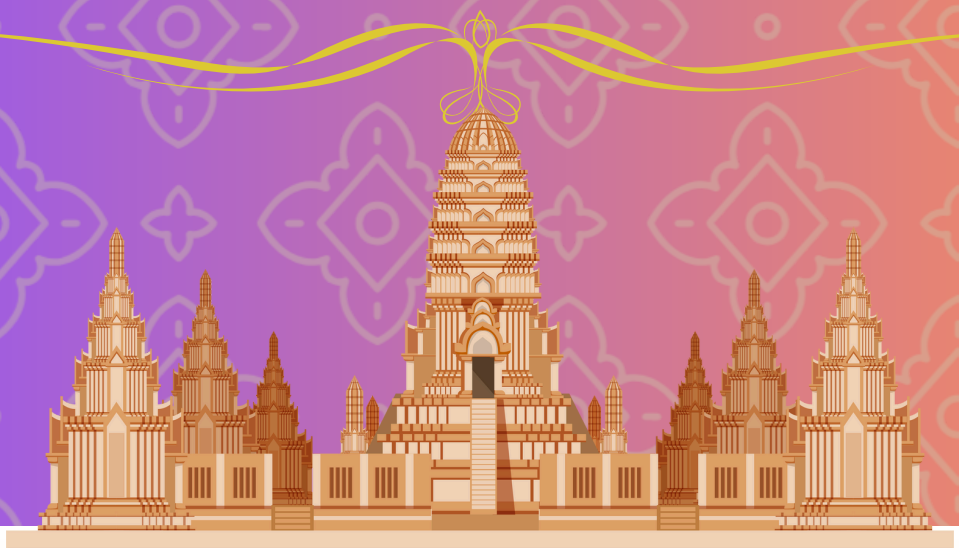

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Digital Marketing Skills in the Digital Economy: A Review Article

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ABSTRACT

Objective: This review article delves into the critical importance of digital marketing skills in the digital economy, highlighting their role in driving business growth and competitiveness.

Methods: This study adopted a systematic approach. The qualitative research method utilised in this review comprises four key stages: research design, data collection, data analysis, and report writing. Content analysis was employed as the primary data analysis method.

Results: As the workplace becomes more technology-driven, digital skills are essential for success. While specialised skills like programming are emphasised, foundational digital skills—using digital tools across different tasks—are equally important.

Conclusions: Concerns about the impact of technology on the nature of work are widespread. As many jobs now demand essential digital skills, there is a growing need for targeted digital training, particularly for adult learners and workers displaced from their previous occupations. Training and education providers must develop programs that equip job seekers and employees with fundamental digital literacy to thrive in the evolving workforce.

Keywords: *Digital Marketing, Skills, Digital Economy*

INTRODUCTION

The digital economy is viewed as a new establishment for the formation and development of many industries, including banking, retail trade, transportation, electricity, education, health care, and many others. The digital economy, which is heavily dependent on information technology (IT) and data, is evolving and is a critical driver of innovation. It also appears to be a new market. The digital economy's opportunities and challenges are essential to the economic systems of many countries (Borremans et al., 2018; Limna et al., 2023). Furthermore, recent advances in new technologies, particularly in information and communication technologies (ICTs), have resulted in significant changes in the social and economic fields. Because of ICTs, new business models, such as sharing economy and circular economy, and new funding methods in managerial projects, such as crowdfunding, have emerged as alternatives to solving existing problems (Polanco-Diges & Debasa, 2020; Santarius et al., 2023). Digital technologies have drastically altered the organisational and marketing environments. Whether this is an opportunity or a challenge for small and medium-sized businesses depends on how they approach it strategically. Organisations that are guided by a combination of market, learning, and entrepreneurial orientations, in particular, are well-positioned to capitalise on the opportunities presented by digital technologies because they adopt attitudes and behaviours that support the generation and use of market insight, proactive innovation, and openness to new ideas (Quinton et al., 2018).

Over the last decade, businesses of all sizes have digitised their operations and processes. Many industries, including hospitality, food and beverage, as well as education, are already leveraging digital technologies such as artificial intelligence (AI) and big data to improve workflow and supply chain efficiency. As a result, in order to stand out from the crowd, today's job seekers must have specialised skills (Gómez-Poyato et al., 2022; Limna et al., 2021). The nature of the skills that jobs require has changed as a result of the digitization of work. Because jobs are becoming more technological in nature, digital skills are becoming increasingly important for workers to thrive in the modern workplace. Even jobs that have traditionally not required technology are increasingly requiring it. Much emphasis is placed on specialised digital skills such as programming and IT work, but less specialised (or foundational) digital skills — the ability to use digital tools to complete tasks in a variety of settings — are also worthy of consideration given their importance in almost all aspects of work (Hecker & Loprest, 2019). Hence, studying digital marketing skills in the digital economy is critical. This review article contributes to the understanding of their significance by examining how these skills drive business growth and competitiveness in the digital landscape. It highlights the essential role of digital marketing in enhancing brand presence, optimising marketing strategies, and leveraging data analytics to engage consumers effectively. The article also addresses the need for continuous upskilling to keep pace with evolving digital trends and technologies. By providing insights into the strategic impact of digital marketing skills, this review may serve as a valuable resource for business owners, managers, educators, policymakers, and other stakeholders, aiming to harness the potential of digital marketing in the modern economy.

LITERATURE REVIEW

Digital marketing is a collection of internet-based techniques for persuading users to buy a product or service. The use of digital media to promote a brand in a timely, personal, and relevant manner is also referred to as digital marketing. Furthermore, in the digital marketing environment, the use of data sciences, which facilitate decision-making and the extraction of actionable insights and knowledge from large datasets, has increased dramatically over the last decade (Napawut et al., 2022). The significance of digital skills for workers extends beyond rising workplace demand. Digital skills are increasingly being used in elementary and secondary school classrooms, for banking and shopping, interactions with the government, entertainment, social connection, and a variety of other purposes. Digital skills are becoming increasingly important in job search and skill development (Hecker & Loprest, 2019).

Digital marketing encompasses various facets, including engaging with individuals, discerning their preferences, and delivering content in the most effective manner. Rather than merely prompting the audience to purchase a product or service, digital marketers aim to cultivate a relationship that encourages voluntary consumer engagement. Acquiring advanced digital marketing skills is vital for individuals seeking to enhance their expertise and prepare for the job market. Key digital marketing skills include social media marketing, content marketing, and other relevant areas, all of which contribute to a comprehensive digital marketing strategy (Bala & Verma, 2018; Charlesworth, 2018; Chaffey & Smith, 2022).

The use of social media has grown significantly in recent years. The proliferation of social media platforms has altered the dynamics of the electronic marketplace by establishing social networks of consumers, opinion leaders, and subject matter experts. Consumers are increasingly using social media to identify products, gather information about products, evaluate products, and make product purchases (Mason et al., 2021). Moreover, content marketing is the process of creating and disseminating information that is relevant and valuable to customers. It is an ongoing dialogue between brands and customers. Content marketing is a fundamental strategy that entails creating and distributing content on websites and social media platforms such as videos, blogs, white papers in pdf format, and website articles. A content marketing strategy aims to create content that will reach the target market (Napawut et al., 2022; Siripipatthanakul et al., 2022). Furthermore, email marketing is a type of communication that uses electronic mail to deliver messages to individuals or groups. Email marketing entails sending advertisements, company requests or donations, and other messages in order to increase trust, loyalty, and brand awareness. Email marketing is a low-cost, highly responsive tool for promoting and building customer interactions. It is the most effective type of electronic marketing (Astoriano et al., 2022).

Kovács and Zarándné (2022) explore the personal skills demanded by employers for graduate and junior positions in digital marketing. The study reviews academic literature on transferable soft skills relevant to the digital marketing sector and examines job requirements for roles such as junior digital marketing manager, social media manager, and digital marketing assistant. The research is based on a content analysis of 5,548 job advertisements collected over a month in February 2021 from the top five job websites in Hungary. Using a

classification framework, the study categorises 31 frequently mentioned soft and hard skills into five main categories and analyses these with quantitative methods. The findings reveal that while hard skills remain predominant in job advertisements, there is a growing emphasis on soft skills. The study also highlights the importance of foreign language and software knowledge in job ads and investigates the differences in soft skill requirements between foreign and multinational companies. The study's results offer insights into what employers prioritise when hiring for graduate and junior roles in digital marketing and provide valuable implications for both academic research and practical applications. The findings contribute to a comprehensive understanding of essential digital marketing employability skills.

There have been significant developments in communications and marketing in the digital era in terms of new communication channels. Hence, companies are now attempting to use digital marketing channels to provide appropriate services to customers in order to increase their level of satisfaction. Ghotbifar et al. (2017) identify and evaluate factors influencing the digital marketing skill gap. Operational strategic factors and environmental factors both had a direct and positive impact on the development of digital marketing skill gaps. Environmental factors such as social and cultural circumstances, religion, technology, and the economy had a more proactive impact on the digital marketing skills gap.

Yoga et al. (2019) examine the adoption of IT in digital marketing by small and medium-sized enterprises (SMEs) in Bali, specifically focusing on travel agents and ticketing services. The study reveals that while these companies utilise websites, social media, and email for marketing communications, these tools primarily serve as supplementary elements rather than central components of their sales strategies. Email remains the primary communication tool, especially in business-to-business interactions, as many companies have partners outside Bali. While the use of digital marketing is often driven by the demands of the digital era, the companies demonstrate limited expertise in effectively harnessing its potential. Key features, such as social media algorithms and paid promotions, are largely unexplored. Furthermore, the study highlights the lack of engagement with Big Data, which could provide crucial insights into consumer profiles and behaviour, essential for optimising marketing strategies. An interesting finding is that alongside traditional competitors, such as other travel agents and online travel agencies, tour guides pose a significant, often overlooked competitive threat. As the first point of contact for tourists, tour guides often establish direct communication with guests, sometimes bypassing travel agents altogether. This trend underscores the importance of an effective marketing strategy and the potential role of Big Data in preventing further market erosion for offline travel agents.

Furthermore, Jardim (2021) describes entrepreneurial skills in light of the current globalisation and digital transformation phenomena. The findings pointed to a three-part entrepreneurial skill model — being open to novelty, creating solutions to emerging problems, and communicating effectively — that integrates the following skills: creativity and innovation, the spirit of initiative, self-efficacy and resilience, strategic planning and evaluation, problem resolution and decision-making, transformational leadership, clear and visual communication, teamwork and networking, and digital communication.

RESEARCH METHODOLOGY

A systematic review represents a comprehensive and rigorous approach to evaluating the latest evidence, employing unbiased, repeatable research methods to ensure reliability. This process involves methodical data analysis to derive meaningful insights from large datasets, assessing the efficacy of various elements and identifying gaps in knowledge that warrant further investigation. To conduct a systematic review effectively, it is essential to follow established procedures. This includes reviewing existing systematic reviews for guidance, familiarising oneself with relevant terminology, and distinguishing between different types of systematic reviews (Kraus et al., 2024; Phuangsuwan & Rakpathum, 2024).

The qualitative research method utilised in this review comprises four key stages: research design, data collection, data analysis, and report writing. Content analysis, a versatile technique for qualitative systematic reviews, is employed to systematically and objectively describe phenomena and derive valid conclusions from verbal, visual, or written data (Limna & Kraiwanit, 2022; Limna, 2023; Phuangsuwan et al., 2024). Consequently, this review article utilised qualitative content analysis to achieve its research objectives.

RESULTS AND DISCUSSIONS

Digital marketing skills have become essential in today's rapidly evolving digital economy. The study emphasises a range of crucial competencies, including social media marketing, content creation, email campaigns, and data analytics. Social media skills are particularly critical, given the platforms' growing influence in shaping consumer behaviour and market dynamics. Content marketing emerges as a fundamental strategy, requiring the ability to craft and distribute valuable, engaging material across various formats. While email marketing remains a cost-effective tool for building customer relationships, the increasing importance of data sciences in marketing decisions underscores the need for analytical skills. The study also notes the rising significance of personal branding and foundational digital literacy. Strategic planning and the capacity to integrate diverse digital marketing tools are emphasised as key competencies. Perhaps most importantly, the study stresses adaptability and continuous learning as critical skills, given the fast-paced changes in digital technologies. This comprehensive skill set, combining both specialised and broad digital competencies, is becoming increasingly crucial across various roles in the digital marketplace, highlighting the need for ongoing professional development in the field of digital marketing.

Figure 1. Digital Strategy (Team Pepper, 2021)

According to Team Pepper (2021), digital marketing leverages electronic devices to deliver promotional content and track its effectiveness throughout the customer journey, utilising methods such as online videos, display ads, search engine marketing, and sponsored social media advertising. It has revolutionised how businesses, particularly small and mid-sized ones, reach their target audiences by offering high ROI opportunities through strategies like Pay Per Click (PPC) campaigns and Search Engine Optimization (SEO). With nearly 60% of the global population online, digital marketing is now the most effective way to engage with customers. Key strategies for successful digital marketing include maintaining an active social media presence, collecting and utilising customer feedback, thinking creatively to stand out, implementing gamification, and providing live updates during events. Integrating mobile and social marketing platforms enhances user experience, while focusing on user-generated content and consistent blogging can strengthen brand authority. By adopting these techniques, businesses can improve client relationships, boost brand recognition, and achieve a competitive edge in the digital marketplace.

The rapid integration of technology into the workplace has fundamentally transformed the nature of work, emphasising the need for both specialised and foundational digital skills. While specialised skills, such as programming and advanced IT expertise, are crucial for certain roles, foundational digital skills are increasingly essential across all job sectors. These skills involve the effective use of digital tools for a variety of tasks, enabling employees to perform their duties efficiently and adapt to technological changes.

The study's findings align with previous research. Tabuena et al. (2022) indicated that digital marketing has surpassed traditional marketing. Internet advertisements are becoming more prevalent. Firms' perceptions of the value of digital marketing can be classified. To meet client needs via digital marketing channels, an integrated approach is required. To succeed in this new market, businesses must first understand their customers' lifestyles. Despite a lack of funds to upgrade technology and harness internet development, digital marketing has evolved into an internet advertising platform for small business owners. Digital marketers are becoming more interested in social media advertising. Because of the potential market share gains that social media marketing could provide for internet marketers, social advertising spending is expected to increase in the coming years. Happonen et al. (2022) revealed that growth-oriented companies seek applicants with a strong personal brand image because they see it as a predictor of future success. Moreover, during the orientation process, companies should support new applicants' skills, particularly social media branding, because it will help them align with the company's brand vision. Gómez-Poyato et al. (2022) concluded that training in digital skills must be included in university training plans, just as the pandemic was a catalyst for widespread use of ICTs. The findings emphasise the importance of improving digital competence and skill training for future generations of social workers, who, despite being digital natives, will need to know how to use ICTs in their social work.

CONCLUSIONS

As technological advancements increasingly influence the modern workplace, digital skills have become crucial for professional success. While specialised skills like programming receive significant attention, foundational digital skills—such as effectively using digital tools across various tasks—are equally important. The growing concerns about technology's impact on job roles underscore the need for targeted digital training, especially for adult learners and individuals displaced from their previous occupations. Training and education providers must develop comprehensive programs to impart essential digital literacy, enabling both job seekers and current employees to thrive in the evolving digital landscape. Future research should expand beyond this systematic review to include methodologies like questionnaires or interviews to capture a broader range of perspectives and insights.

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An Assessment of Public Satisfaction with Municipal Waste Collection Taxation: A Qualitative Case Study of Khlong Phon Subdistrict Municipality in Krabi, Thailand

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ABSTRACT

Objective: This study assesses public satisfaction with the municipal waste collection taxation system in Khlong Phon Subdistrict Municipality, Krabi Province, Thailand. It explores factors shaping residents' perceptions, experiences, and attitudes toward the system.

Methods: In this qualitative case study, data were collected through in-depth interviews involving a purposive sample of residents, community leaders, and municipal staff. Content analysis was employed to identify recurring themes and patterns related to public satisfaction.

Results: The study' s findings identified three key themes: fairness and equity, efficiency of services, and transparency. While most found the tax rate fair, larger families and businesses noted inequity. Residents praised service reliability but highlighted lapses in remote areas and expressed dissatisfaction with unclear tax revenue allocation.

Conclusions: The findings highlight the need for tailored taxation, improved logistics, and transparent communication to boost public trust and cooperation. Addressing these factors can improve satisfaction, resource allocation, sustainable waste management, and beyond. Additionally, the study provides actionable insights for policymakers in Krabi and similar municipalities, emphasising the role of community engagement in effective governance.

Keywords: *Municipal Waste Taxation, Public Satisfaction, Qualitative Case Study, Khlong*

INTRODUCTION

Municipal waste is a prevalent and socially impactful form of waste, originating from the daily activities of individuals and households. While waste is produced in all societies, urban areas tend to generate far larger quantities due to their denser populations and higher consumption rates. This results in a significant increase in waste production in cities compared to rural regions. The management of municipal waste in urban settings is a complex and resource-intensive task, requiring considerable financial investment, time, and effort for its collection and disposal. Municipal waste typically includes both solid and liquid components, each posing distinct challenges in terms of treatment, recycling, and proper disposal (JeyaSundar et al., 2020). The efficient management of municipal waste is a critical component of urban governance, influencing public health, environmental sustainability, and the overall quality of life for residents (Mesjasz-Lech, 2014; Wong, 2023). In Thailand, municipalities are responsible for ensuring the proper collection, disposal, and recycling of waste. To fund these essential services, many municipalities implement waste collection taxation systems. These systems are designed to provide a stable source of revenue, ensuring the continuity and effectiveness of waste management services. However, the success of these systems is not solely dependent on their design and execution but also on the level of public satisfaction (Babel et al., 2020; Incharoen et al., 2022; Pharino, 2017; Saiebsri et al., 2023).

Public satisfaction with waste collection taxation systems is essential for encouraging citizen compliance and cooperation with local authorities. When residents view the taxation system as fair, efficient, and responsive to their needs, they are more likely to support and follow the policies set forth. Conversely, dissatisfaction can lead to non-compliance, revenue generation challenges, and strained relations between the public and local government. Understanding the factors that influence public satisfaction with these taxation systems is, therefore, vital for ensuring the effective implementation and long-term sustainability of waste management services (Abas et al., 2021; Collins & Kim, 2009; Larbi-Tettey, 2018; Mohammed & Tangl, 2023; Nogueira et al., 2024; Puche-Regaliza et al., 2021).

Khlong Phon Subdistrict Municipality, located in Krabi Province, serves as a notable example of a community striving to balance waste management needs with the expectations of its residents. While waste collection services are essential for public health and environmental sustainability, there has been limited research on the public's perception of waste collection taxation in small municipalities like Khlong Phon. This qualitative case study aims to assess public satisfaction with the municipal waste collection taxation system in Khlong Phon, exploring the factors that shape residents' perceptions, experiences, and attitudes toward the

system. The findings of this study are expected to contribute to a deeper understanding of public satisfaction with waste collection taxation, offering practical lessons for local government authorities in Krabi and similar municipalities across Thailand. By evaluating the current system, this research aims to highlight broader implications for public policy and municipal governance, particularly in regions with limited resources where community engagement is critical for the successful implementation of public services.

Research Objective

This study explores public satisfaction with Khlong Phon's municipal waste collection taxation system, focusing on the factors shaping residents' perceptions and experiences.

LITERATURE REVIEW

Public satisfaction with municipal services, especially waste collection and management, has increasingly drawn attention in urban governance research. Effective waste management is essential for safeguarding public health, ensuring environmental sustainability, and enhancing the quality of life within communities. Public perception and satisfaction are critical to the success of these systems, as they directly impact citizen compliance and support for the taxation policies that fund waste management services. Positive public sentiment can lead to higher cooperation with local authorities, while dissatisfaction may hinder the effectiveness of waste management efforts, posing challenges to policy implementation and sustainability.

Municipal Waste Collection and Taxation

Municipal waste collection and taxation are critical components of urban management, addressing environmental sustainability, public health, and economic efficiency. Local governments typically oversee waste collection services, often relying on both public and private entities to execute waste removal, sorting, and recycling processes. Funding for these services generally stems from taxation, where municipalities impose waste collection fees on residents and businesses, either directly as part of local property taxes or as separate service charges. The structure and rates of waste collection taxes can vary significantly, influenced by factors such as population density, waste production levels, and the municipality's environmental policies. Progressive tax models, where larger waste producers or higher-income areas pay proportionally more, aim to ensure fairness while incentivizing waste reduction. However, tax-based waste collection systems also face challenges, including administrative complexity, resistance to rate increases, and enforcement difficulties. Effective waste collection and taxation policies balance operational costs with sustainable practices, promoting community-wide participation in waste minimization while securing the necessary resources to maintain a clean and healthy urban environment (Chowdhary et al., 2023; Doussoulin & Colther, 2022; Oladejo et al., 2024; Silva & Almeida, 2024; Siritorn, 2017).

Public Satisfaction and Dissatisfaction in Municipal Service

Public satisfaction and dissatisfaction with municipal services reflect residents' perceptions of service quality, accessibility, and responsiveness to community needs. Satisfaction tends to be high when services, such as waste collection, water supply, public safety, and infrastructure maintenance, are delivered efficiently, reliably, and transparently. When residents experience timely service responses, clear communication, and accountability, they are more likely to feel a sense of trust in local authorities. Additionally, services that demonstrate attentiveness to public input and adapt to specific community requirements often achieve higher satisfaction levels, as residents feel that their needs and opinions are valued. On the other hand, dissatisfaction arises when municipal services are inconsistent, poorly managed, or when residents encounter bureaucratic obstacles that delay problem resolution. Limited budgets, staffing constraints, and outdated technologies can further hinder service quality, amplifying dissatisfaction, especially in densely populated or economically disadvantaged areas. Addressing both satisfaction and dissatisfaction requires municipalities to adopt a proactive approach, leveraging feedback, investing in service improvements, and fostering transparency to strengthen public trust and engagement in local governance (Andriotis, 2002; Chowalit et al., 2024; Nogueira et al., 2024; OECD, 2023; Romero-Subia et al., 2022).

Related Research

Krajčírová et al. (2018) identified waste management as one of the most pressing environmental challenges, focusing on a case study of the municipal waste fee system in a

selected municipality in the Nitra region of Slovakia. In accordance with the Act on Local Taxes and Local Fees, municipalities levy fees for municipal and minor construction waste, with rates set by binding local regulations. These fees contribute to municipal tax revenue, with rates for legal entities and entrepreneurs based on waste volume and collection frequency, while non-entrepreneurs are charged a lump sum. The study highlighted that Slovakia's waste recovery rate is among the lowest in the European Union (EU), with landfilling remaining the primary method of disposal. In the reviewed municipality, 35% of total waste was recovered in 2016. The authors recommend increasing municipal waste and construction waste fees to address the high volume of generated and landfilled waste, promoting more sustainable waste management practices.

Incharoen et al. (2022) examined municipal waste management practices at the source in Trang Province, focusing on 10 municipalities and involving 90 key informants, including municipal workers, health network leaders, and residents. Data collection employed a mixed-methods approach, utilising checklists and questionnaires for quantitative data and in-depth interviews and focus group discussions for qualitative insights. Quantitative findings revealed that 77.33% of waste reduction efforts utilised the 3Rs principle (reduce, reuse, recycle), while only 5.56%

involved product and container design to minimise waste. Supervisors or waste collectors conducted 70% of waste management inspections. The most prevalent issue identified was illegal dumping in boundary areas (90%), while common management challenges included insufficient waste smear warning signs and reliance on social measures or community regulations (50%). These findings underscore the importance of targeted strategies to enhance waste management efficiency and community compliance.

Puche-Regaliza et al. (2021) investigated the factors influencing public satisfaction with the urban solid waste collection services in Burgos, Spain, using Structural Equation Modelling (SEM) based on the SERVQUAL model dimensions. The study identified that Assurance and Responsiveness significantly and positively impact public satisfaction, whereas Reliability, Empathy, and Tangibility show no significant effects. Key indicators contributing to Assurance include pavement and walkway cleanliness, while the frequency of organic and selective waste collection drives Responsiveness. The findings suggest that enhancing satisfaction requires increasing the frequency of cleanliness and waste collection, which involves balancing cost, pollution, and service quality. Despite these challenges, 84.37% of citizens reported satisfaction with the service. The study emphasises the importance of targeted investments and strategies to improve service efficiency and quality while considering environmental and sustainability implications.

Abas et al. (2021) examined the public's willingness to pay (WTP) for improved solid waste management services in rural areas of Kelantan, Malaysia, where local authorities currently use a fixed-rate waste charging method due to its low administrative cost. However, this method has proven ineffective and led to environmental concerns. The study involved 911 respondents from three districts: Jeli, Kuala Krai, and Gua Musang. While approximately 75% of participants expressed satisfaction with existing waste management services, nearly 62% indicated a willingness to pay more for better services, with an estimated mean WTP of RM12.05 per household. A logistic regression analysis revealed that satisfaction with current services significantly influenced WTP, along with socio-economic factors such as education level, type of housing, occupation, and household income. The findings provide valuable insights into rural residents' attitudes toward waste management and their readiness to support enhanced services financially.

Zhang et al. (2024) highlighted the challenges of municipal solid waste (MSW) management in developing countries across Asia and Africa, where rapid urbanisation has led to a significant increase in waste generation. Ineffective policy implementation and monitoring, constrained land and financial resources, and unorganised public behaviour have hindered progress, often resulting in inefficient and unsustainable waste management practices. Drawing on insights from 170 academic papers spanning 2013 to 2023, the review suggests moving beyond a sole focus on recycling to adopt solutions such as waste sorting at the source, landfill optimization,

thermal treatment, and leveraging waste as a resource. Key barriers include socio-economic disparities, infrastructural inadequacies, and cultural factors. The study emphasises integrating waste management into a circular economy framework by enhancing citizen participation in waste reduction and recycling initiatives and securing international financial support to improve local systems.

RESEARCH METHODOLOGY

This study adopted a qualitative case study approach to explore public satisfaction with the municipal waste collection taxation system in Khlong Phon Municipality. The methodology was designed to provide an in-depth understanding of the factors shaping residents' perceptions, experiences, and attitudes toward the system.

Research Design

A case study methodology was selected to focus on the unique context of Khlong Phon Municipality, allowing for a detailed examination of the specific social, cultural, and administrative dynamics influencing public satisfaction. The qualitative nature of the study enables the collection of rich, descriptive data, essential for capturing the complexity of residents' views and experiences (Agius, 2013; Sonsuphap et al., 2024).

Data Collection

To gather rich and meaningful data, this study relied on in-depth interviews. Semi-structured interviews were conducted with a purposive sample of 12 Khlong Phon residents and local stakeholders. This method allowed participants to share their perspectives, experiences, and concerns regarding the taxation system. The interview protocols are designed to address key aspects of the taxation system, including its fairness, efficiency, transparency, and alignment with community needs. Open-ended questions encourage participants to express their opinions freely, ensuring the collection of diverse viewpoints.

Sampling Strategy

Purposive sampling is commonly used in qualitative research with the goal of gaining detailed information about a specific phenomenon or population (Limna & Kraiwanit, 2022; Limna et al., 2024; Nyimbili & Nyimbili, 2024). In this study, purposive sampling was employed to select participants who were knowledgeable about or directly affected by the municipal waste collection taxation system, including residents from diverse demographic and socio-economic backgrounds, as well as community leaders and representatives. This approach ensured a wide range of perspectives, thereby enhancing the finding's validity.

Data Analysis

Content analysis is a qualitative method that describes and quantifies specific phenomena by making valid inferences from verbal, visual, or written data in a systematic and objective manner (Limna & Kraiwanit, 2022). The study utilised content analysis as the primary method for analysing qualitative data collected through in-depth interviews and focus group discussions. Content analysis enables the systematic examination of verbal and textual data, allowing the identification of recurring themes, patterns, and categories relevant to public satisfaction with the municipal waste collection taxation system.

RESULTS

The findings of this qualitative study provided valuable insights into the factors influencing public satisfaction with the municipal waste collection taxation system in Khlong Phon Subdistrict Municipality. Through in-depth interviews, several key themes emerged that highlight residents' perceptions, experiences, and attitudes toward the system.

Perceived Fairness and Equity

Residents expressed diverse perspectives regarding the fairness of the current taxation system. Many participants acknowledged the tax rate as reasonable for average households and appreciated the municipality's efforts to maintain consistent waste management services. However, a significant portion of respondents, particularly those from larger households or small business owners, voiced concerns about the system's perceived inequity. They argued that the tax structure fails to account for the actual volume of waste generated, placing a disproportionate financial burden on higher waste producers. This feedback highlights the need for a more tailored taxation model that aligns with individual waste output. Implementing such an approach could promote a greater sense of equity among community members and ensure a fairer distribution of responsibilities across different demographic and economic segments. This adjustment would not only address concerns of fairness but also encourage sustainable waste management practices through incentivizing waste reduction.

> *"For a family like mine, I think the tax rate is fair. It is manageable, and I appreciate that the municipality keeps waste collection consistent. At least we see where the money is going"* (Personal Communication).

> *"It is not fair for bigger families. We generate more waste, but the tax does not account for that. We are paying the same as smaller households, even though we are using the service more. The tax should consider how much waste a household or business produces. If you generate more waste, you pay more. That would feel fairer to everyone"* (Personal Communication).

> *"I run a small food stall, and the waste we produce is much higher than a household. Yet, I pay the same tax as a family of four. The system doesn't feel equitable, and it is a burden for businesses like mine"* (Personal Communication).

> *"Yes, as long as it is transparent. People need to understand why they're paying what they're paying and see the benefits clearly"* (Personal Communication).

Efficiency and Reliability of Waste Collection Services

Based on the interviews, the reliability of waste collection services was identified as a key determinant of residents' satisfaction. While many participants praised the municipality for maintaining a regular waste collection schedule, some highlighted occasional delays or lapses, particularly in remote areas. Such inconsistencies were perceived as inconveniences that undermined confidence in the system. Additionally, residents emphasised the importance of more effective management of waste overflow during peak periods and holidays. They suggested that improvements in logistical planning, such as increased frequency of collections or additional resources during high-demand times, could significantly enhance the reliability of services and overall satisfaction with the waste management system.

> *"I think the service is good. They stick to the schedule most of the time. It is reassuring to know the waste will be collected regularly"* (Personal Communication).

> *"In the remote area, for us in the outskirts, it's hit or miss. Sometimes, they're on time, but there are delays, especially during bad weather or holidays. It's frustrating because the trash piles up, and there's no backup plan"* (Personal Communication).

> *"The bins overflow quickly during festivals or weekends. It's not just an eyesore; it's a health concern. Adding more resources or increasing collection frequency during busy times would make a big difference. It would show that the municipality is proactive about solving these issues."* (Personal Communication).

Transparency and Communication

Referring to the interviews, transparency and effective communication emerged as critical factors in building trust in the taxation system. Many residents expressed frustration over the lack of clear information about how tax revenues are allocated and the tangible benefits they provide. This lack of clarity left participants feeling disconnected from the decision-making process and uncertain about the system's fairness and efficiency. To address these concerns, residents recommended that local authorities offer detailed breakdowns of fund allocation, specifically highlighting improvements in waste management. Moreover, they also emphasised the importance of enhanced communication strategies, such as regular community updates,

public forums, and accessible reports, to foster trust and encourage greater public cooperation. These measures could bridge the gap between residents and policymakers, ensuring a more transparent and inclusive approach to municipal governance.

> *"It would help if they showed a breakdown of how the funds are spent. For example, how much of it goes into waste management or other services. That way, we'd feel more connected to the process"* (Personal Communication).

> *"They could do a lot more in terms of communication. Public forums, regular updates—anything to keep us in the loop"* (Personal Communication).

> *"If they were more transparent, it would build trust. We'd feel like we're part of the decision-making process, not just passive participants"* (Personal Communication).

DISCUSSION

The findings of this study highlight the complex interplay between perceived fairness, service efficiency, and transparency in shaping public satisfaction with the municipal waste collection taxation system in Khlong Phon Municipality. The theme of perceived fairness and equity underscores the critical role that taxation structures play in fostering public acceptance. Many residents expressed concerns about the flat-rate tax system, which they felt disproportionately burdened larger households and small businesses. This aligns with broader literature emphasising the need for progressive and volume-based taxation systems that better reflect waste generation levels (Abas et al., 2021). Implementing such a model could address equity concerns while incentivizing waste reduction behaviours among residents.

The theme of efficiency and reliability of waste collection services underscores the operational challenges municipalities face, particularly in ensuring consistent service delivery to all areas. While many residents appreciated the regular collection schedule, reports of occasional lapses highlight the importance of continuous service improvement. Similar studies, such as Zhang et al. (2024), have emphasised the logistical challenges of waste management in rapidly urbanising regions, suggesting that targeted investments in infrastructure and workforce capacity could enhance reliability and address resident concerns.

Finally, the theme of transparency and communication reveals the significant role of trust and engagement in public satisfaction. The lack of clear communication about tax allocation and service improvements fosters a sense of disconnect between residents and municipal authorities. This finding is consistent with Puche-Regaliza et al. (2021), who noted that transparent communication and citizen engagement are key drivers of satisfaction with urban waste management systems. Introducing community forums, detailed expenditure reports, and

regular updates could strengthen public trust and cooperation, ensuring that the taxation system is perceived not only as necessary but also as beneficial to the community.

CONCLUSION

This study provides valuable insights into the factors influencing public satisfaction with the municipal waste collection taxation system in Khlong Phon Subdistrict Municipality. The findings suggest that addressing issues of fairness, improving the reliability of waste collection services, and enhancing transparency and communication are essential to fostering greater public satisfaction and cooperation. By adopting a more tailored taxation approach, municipal authorities could address equity concerns and align tax rates with waste generation levels. Simultaneously, investments in logistical planning and infrastructure could improve service reliability, particularly in underserved areas. Finally, fostering transparency through regular updates and public engagement initiatives could bridge the trust gap between residents and authorities, ensuring that the taxation system is not only effective but also widely supported. These conclusions offer practical lessons for policymakers not only in Krabi, but also other similar municipalities across Thailand, highlighting the need for a more community-centred approach to waste management governance.

Future research should explore the feasibility of implementing usage-based taxation models and investigate innovative waste management strategies that leverage community participation. Such efforts will ensure that waste management systems remain effective and resilient in the face of evolving environmental, social, and economic challenges.

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CONFLICT OF INTEREST

There are no conflicts of interest regarding the publication of this research.

AUTHOR CONTRIBUTIONS

Conceptualisation – K.K. and R.N.; Methodology – K.K. and R.N.; Investigation – K.K., P.T., and R.N.; Software – K.K., P.T., and R.N.; Validation – K.K., P.T., and R.N.; Writing – K.K., P.T., and R.N.; Resources – K.K., P.T., and R.N.; Supervision – K.K.

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Systematic Literature Review on Recommender Systems in E-Commerce: Emerging Techniques, Popular Algorithms, and Key Challenges

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ABSTRACT

Objective: This study examines advancements in recommender systems (RS) within e-commerce, focusing on emerging techniques, popular algorithms, and key challenges. Through a systematic literature review (SLR), 26 studies published between 2019 and 2024 were analyzed using PRISMA guidelines. Findings reveal that graph neural networks (GNNs) and hybrid models, integrating traditional and AI-driven methodologies, improve personalization and scalability. However, challenges like algorithmic bias and real-time computational demands persist. Future research should emphasize scalable algorithms and fairness-aware systems to ensure equitable recommendations and optimize economic impact.

Methods: The review tracks the evolution of RS from traditional methods, such as collaborative filtering, to modern approaches incorporating deep learning, GNNs, and hybrid models. We advance the state of the art of recommendation systems in terms of recommendation accuracy, scalability, and personalization, and solve cold start problems and data sparsity challenges. The study follows PRISMA guidelines, and the relevant studies published between 2019 and 2024 were synthesized by purposive sampling of 26 articles. Performance metrics, including precision, recall, and F1-score, were employed to assess system effectiveness, with quality assessments emphasizing methodological rigor.

Results: Deep learning and GNNs have great potential in improving RS capabilities, but their deployment in real time applications is limited by high computational requirements for accuracy improvement and sparse data handling.

Conclusions and Recommendations: Combining matrix factorization and neural networks, hybrid models emerge as promising solutions. Nonetheless, scalability, algorithmic bias, and fairness remain significant barriers, necessitating optimizing trust-aware systems and bias mitigation techniques for large-scale environments. Future work includes scaling up hybrid models, incorporating fairness mechanisms to establish equity in recommendation results, and studying the economic effects of RS on the behaviour and commercial outcomes of users.

Keywords: *Recommender systems, e-commerce, deep learning, graph neural networks, SLR*

INTRODUCTION

Recommender systems (RS) are pivotal in e-commerce, enabling personalized suggestions that improve user engagement and drive revenue. Techniques have evolved from traditional collaborative filtering to advanced models like deep learning and graph neural networks (GNNs), which address challenges such as cold-start and data sparsity while enhancing recommendation accuracy and scalability (Wang et al., 2024; Geng et al., 2023). Recommender systems (RS) have become a cornerstone in the digital transformation of e-commerce, significantly enhancing user experience by providing personalized product and service suggestions. For example, these systems are used by major platforms like Amazon and Netflix that use them to enhance engagement and boost sales by recommending things based on individual user's preferences (Sharma et al., 2021). With the quantity of available information in e-commerce increasing, the need for efficient, accurate and scalable recommendation algorithms has become more critical than ever (Salunke & Nichite, 2022).

The development of recommender systems has evolved considerably, moving from traditional methods such as collaborative filtering and content-based filtering to more advanced techniques, including deep learning, GNNs, and hybrid models (Fathinezhad et al., 2023). In the past few years, recent innovations like context aware models (Livne et al., 2020) and reinforcement learning improved the adaptability of RS to user accounts so that it can personalize the recommendation but improve its accuracy. Innovation in these areas has been able to address long standing problems such as cold-start issues and data sparsity that often impair the quality of recommendation (Salunke & Nichite, 2022). Modern recommender systems can incorporate multimodal data, including text, images, and real-time interactions, resulting in more dynamic and personalized user experiences (Chen, 2021).

However, there are still many key issues to address. Above all, scalability has been a major issue because applications are handling heavy data that must be processed in real time in large scale e-commerce platforms (Singh, 2018). The fairness and algorithmic bias of recommender systems is also of critical importance, since recommender systems need to design equitability across various user groups (Wan et al., 2023). Techniques like collaborative filtering systems have also encountered privacy concerns and privacy preserving techniques such as differential privacy examined to protect user data (Herbert et al., 2021). However, federated learning, a promising privacy preserving technique, is still in its infancy when applied to real world e-commerce deployments (Li et al., 2023).

The rapid advancement of artificial intelligence and machine learning technologies presents opportunities and challenges for future recommender systems in e-commerce. This review discusses the latest techniques, algorithms and challenges in the field, and highlights gaps in the current literature and potential future research areas.

Research Objective (RO)

The main goal of this research is to discover and evaluate recent research in recommender systems (RS) in e-commerce. In particular, the research seeks to explore the latest methods, including deep learning, graph neural networks (GNNs) and combined models, and evaluate their effects on enhancing the recommendation accuracy and scalability. This study also attempts to identify key challenges, including scalability, cold start issues, bias, and fairness, and suggest solutions. Additionally, the research will explore how these advancements affect the personalization of recommendations and their economic effect on user behavior and commercial outcomes on e-commerce platforms.

Research Questions (RQ)

In this dissertation, we explore recent advancements as well as long standing challenges in recommender systems (RS) operating in the online e-commerce domain.

To guide the investigation, the following research questions are posed:

- **RQ1**: What are the emerging techniques in recommender systems between 2019 and 2024, particularly in the context of e-commerce platforms?
- **RQ2**: Which algorithms have become most popular in developing recommender systems for e-commerce over the past five years?
- **RQ3**: What key challenges do recommender systems in e-commerce currently face, including scalability, cold-start issues, algorithmic bias, and fairness, and how are these challenges being addressed?

The answers to these research questions guide the systematic analysis of state of the art techniques, popular algorithms and solutions for the main obstacles in e-commerce recommender systems.

LITERATURE REVIEW

Recommender systems (RS) have been playing an important role in e-commerce by providing personalized shopping experience and optimizing consumer engagement. Using user preferences, purchase history and contextual data, these systems significantly enhance the efficiency of e-commerce platforms (Salunke & Nichite, 2022; Sharma et al., 2021). Traditional collaborative filtering has rapidly evolved into more advanced, AI driven methodologies (Gao et al., 2023). In this section, we examine the status of e-commerce using RS, new techniques that are being explored, popular algorithms that are widely used, and chronic problems that prevent RS to be more adopted.

Recommender Systems in E-Commerce

The importance of recommender systems is to help tailor product recommendations to specific users to increase user satisfaction and revenue growth (Chen, 2021). Collaborative filtering and content based filtering are early methods of RS that built the base of modern RS by matching user preferences with similar patterns found in datasets (Zhang et al., 2021). However, these systems suffer from scalability and sparsity issues, especially in large scale e-commerce environments (Singh, 2018). Nowadays, advanced approaches have been employed that combine multimodal data including text, image, user interaction and provide more dynamic and context aware recommendations (Livne et al., 2022).

Emerging Techniques

The rise of AI technologies has introduced several cutting-edge techniques that address limitations of traditional RS:

- Graph Neural Networks (GNNs): Graph Neural Networks (GNNs) can leverage graph structures to model complex user item interactions, and can therefore address high order interactions. For example, LightGCN has shown great improvement on recommendation tasks by simplifying aggregation processes (Gao et al., 2023).

- Attention Mechanisms: Attention based models like the Neural Attentive Recommender (NAR) (Chen et al., 2021) dynamically rank a user's interactions and strengthen session based recommendations.

- Federated Learning: Instead, this technique trains models across distributed datasets without sharing sensitive information, which is why it fits well for large scale ecommerce platforms (Li et al., 2023).

However, real world implementations suffer from the high computational costs of these approaches, and there are challenges for integrating these approaches into legacy systems.

Popular Algorithms

Recommender systems in e-commerce frequently rely on robust algorithms to deliver accurate results:

• Matrix Factorization (MF): As it turns out, MF remains a cornerstone algorithm, simple and efficient. Incremental trust-aware MF, (Eslami & Ghaderi, 2022) present enhanced variations including solutions to cold start issues and scalability constraints.

• Deep Learning Models: We find that Autoencoders and Convolutional Neural Networks (CNNs) are well adapted as they are able to identify complex user item relationships and latent features (Sharma and Mishra, 2024).

• Hybrid Models: With the introduction of sentiment analysis or reinforcement learning, collaborative and content based filtering is combined to produce hybrid systems that substantially boost recommendation accuracy and increase user satisfaction (Huang, 2022).

Nevertheless, these methods generally necessitate a great deal of available datasets and the state of the art computing capabilities, which hinder the small e-commerce platforms.

Key Challenges

Several critical challenges continue to hinder the scalability and effectiveness of RS in e-commerce:

• Scalability: As e-commerce platforms grow, RS will have a massive volume of data to process in real time. Federated learning and distributed computing are some newly emerging techniques to solve this problem (Li et al., 2023).

• Bias and Fairness: However, most often, algorithmic biases result in unfair recommendations which give an undue advantage to some user groups. As means to address these issues, fairness aware algorithms and explainability techniques are grabbing attention (Wang & Yao, 2024).

• Cold Start and Sparsity: The cold start problem still needs to be addressed since new users and items have no history. The solutions are incremental learning and context aware techniques (Zhao et al., 2021).

• Economic and Ethical Concerns: It's a very delicate balance between equitable recommendations and maximizing economic benefits. In addition, future RS research must be concerned with ethical issues, including transparency, and the trust of its users (Sharma et al., 2021).

RESEARCH METHODOLOGY

This systematic literature review (SLR) followed PRISMA guidelines to ensure a transparent and rigorous selection process (Page et al., 2021). Data were sourced from ACM Digital Library, IEEE Xplore, and SpringerLink, covering studies published between 2019 and 2024. Using purposive sampling, the inclusion criteria targeted empirical evaluations of

recommender systems focusing on AI-driven techniques, scalability, and fairness. Exclusion criteria eliminated studies without empirical validation or outside the e-commerce domain. Of the 2,584 studies initially identified, 26 were included after rigorous screening (Higgins et al., 2019). This review focuses on emerging techniques *(e.g., deep learning, graph neural networks), popular algorithms* (e.g., deep learning, graph neural networks), popular algorithms (e.g., collaborative filtering, hybrid models), and key challenges (e.g., scalability, cold-start, fairness) in recommender systems within the e-commerce domain (Fathinezhad et al., 2023). A comprehensive flow diagram representing each step of the SLR process was created, with particular emphasis on strategies to address these challenges (Page et al., 2021). As illustrated in Fig. 1, the PRISMA flow diagram details the number of studies identified, screened, excluded, and included at each stage, visually representing the rigorous selection process (Page et al., 2021; Higgins et al., 2019). The review protocol was collaboratively developed by researchers specializing in recommender systems and e-commerce technologies. The guiding research question for this SLR was: "What are the emerging techniques, popular algorithms, and key challenges in recommender systems for e-commerce?" The review also aimed to identify gaps in the existing literature and propose future research directions (Salunke & Nichite, 2022; Fayyaz et al., 2020).

Research Framework

A combined approach using the PICO and SPIDER frameworks was adopted to address the research questions posed in this review systematically. These frameworks ensure a comprehensive analysis of emerging techniques and the persistent challenges in recommender systems (RS) within e-commerce. The PICO framework is applied to RQ1 and RQ2, comparing traditional and emerging algorithms. The components include Population (P): e-commerce platforms using recommender systems; Intervention (I): emerging algorithms such as deep learning, graph neural networks (GNNs), reinforcement learning, and hybrid models; Comparison (C): traditional algorithms like collaborative filtering and content-based filtering; Outcome (O): improvements in performance, scalability, recommendation accuracy, and real-time adaptability (Fayyaz et al., 2020).

The SPIDER framework addresses key challenges in RQ3 related to modern recommender systems. Its components are Sample (S): studies on e-commerce recommender systems; Phenomenon of Interest (PI): challenges such as scalability, cold-start problems, bias, and fairness; Design (D): empirical studies, systematic reviews, and comparative analyses; Evaluation (E): effectiveness of solutions addressing these challenges; and Research Type (R): qualitative and quantitative studies (Hasan & Khatwal, 2023). This review combines the PICO and SPIDER frameworks to capture the algorithm advancements and the ongoing challenges e-commerce recommender systems face. This approach provides insights into how modern algorithms enhance recommendation performance, mitigate bias, and handle scalability challenges in large-scale environments (Roy & Dutta, 2022; Fayyaz et al., 2020).

Preliminary Research and Idea Validation

To ensure the originality and relevance of this SLR, a preliminary search was conducted across five key databases: ACM Digital Library, IEEE Xplore, Elsevier's ScienceDirect, SpringerLink, and Wiley Online. This research aimed to identify existing reviews and confirm that no systematic literature review on hybrid filtering and AI-driven techniques in recommender systems for e-commerce has been published. Key search terms included

"recommender systems," "e-commerce," "hybrid filtering," and AI techniques such as "deep learning," "graph neural networks (GNNs)," and "reinforcement learning," combined with terms like "systematic review" and "survey" (Page et al., 2021; Higgins et al., 2019). The initial search revealed no direct overlap with existing reviews. While some studies addressed hybrid filtering, they primarily focused on traditional techniques, such as collaborative filtering and content-based filtering, with limited exploration of modern AI techniques like GNNs and reinforcement learning (Salunke & Nichite, 2022).

This presents an opportunity to explore AI-driven hybrid filtering in e-commerce recommender systems, addressing gaps not covered by existing literature. Three main gaps were identified: (1) Scalability: Few studies discuss scalability in hybrid systems, particularly in real-time applications for large-scale e-commerce platforms. (2) Fairness and Bias: Limited research addresses fairness and bias mitigation in AI-driven recommender systems, essential for ensuring equitable recommendations across diverse user groups. (3) Explainability: A significant gap exists in explainable AI for hybrid recommender systems, which is crucial for building trust and transparency in recommendations (Fathinezhad et al., 2023; Tawfik et al., 2019). These gaps underscore the need for a comprehensive SLR that explores AI-driven techniques in hybrid filtering for e-commerce, contributing to scalability, fairness, and explainability advancements.

Inclusion and Exclusion Criteria

The inclusion criteria for this Systematic Literature Review (SLR) focus on studies published between 2019 and 2024 that directly address recommender systems (RS) within e-commerce platforms, such as retail, media streaming, fashion, and travel. Only peer-reviewed studies using modern methodologies, such as deep learning, hybrid filtering, graph neural networks (GNNs), and reinforcement learning, are included—particularly those validated on large-scale datasets like Amazon and Netflix (Salunke & Nichite, 2022). Empirical studies with performance evaluations using metrics such as precision and recall are prioritized (Higgins et al., 2019). Exclusion criteria include research focused on non-e-commerce domains (e.g., healthcare, education) unless applicable to e-commerce. Those studies using traditional collaborative or content based filtering without AI driven enhancements or without empirical validation are also excluded. Further, abstract only papers, editorials, theses, or studies with no full text access are excluded, to ensure methodological rigor (Tawfik et al., 2019). The use of these criteria guarantees that this review covers the most recent advances in the domain of recommender systems and emphasizes major challenges including scalability, cold start and bias mitigation (Huang, 2022).

Search Strategy

A comprehensive search strategy was applied to capture relevant studies on recommender systems in e-commerce. The search covered key databases, including ACM Digital Library, IEEE Xplore, Elsevier's ScienceDirect, SpringerLink, and Wiley Online (Page et al., 2021; Higgins et al., 2019). Keywords included "recommender systems," "deep learning," "hybrid filtering," and "e-commerce," combined with Boolean operators to ensure coverage of key topics such as algorithms, scalability, fairness, and empirical validation (Salunke & Nichite, 2022). In addition, Zotero was used for reference management, ensuring deduplication and proper export for further screening. The search terms spanned key concepts and domains, such as "collaborative filtering," "context-aware recommendations," and datasets like

Amazon, Netflix, and MovieLens (Huang, 2022). The papers selected were published between 2019 and 2024; however, non-peer-reviewed articles, non-English publications, and studies unrelated to e-commerce were excluded to maintain relevance and quality (Tawfik et al., 2019). Trial searches were conducted to refine the terms and ensure comprehensive coverage of significant articles.

Search Databases, Import Results to a Library, and Export to Google Sheets

To ensure comprehensive coverage of studies on recommender systems in e-commerce, search queries were tailored to five key databases: ACM Digital Library, IEEE Xplore, Elsevier's ScienceDirect, SpringerLink, and Wiley Online. These databases were selected based on their relevance to AI-driven recommender systems and e-commerce platforms (Page et al., 2021; Higgins et al., 2019). Search queries were structured around the PICO and SPIDER frameworks, focusing on emerging techniques, popular algorithms, and key challenges from 2019 to 2024. The queries were customized for each database to cover all three RQs. The following search queries were used across various academic databases to address the relevant research questions. In the ACM Digital Library, the queries were:

- RQ1: "recommender systems" AND "e-commerce" AND "deep learning" AND "2019-2024"
- RQ2: "popular algorithms" AND "recommender systems" AND "e-commerce" AND "collaborative filtering"
- RQ3: "recommender systems" AND "e-commerce" AND ("scalability" OR "bias") AND "challenges"

In IEEE Xplore, the query used was: "recommender systems" AND "e-commerce" AND ("emerging techniques" OR "neural networks") AND "2019-2024." In Elsevier's ScienceDirect, the query was: "recommender systems" AND "e-commerce" AND "reinforcement learning" AND "2019-2024." Lastly, SpringerLink and Wiley Online Library followed similar query structures, ensuring comprehensive coverage of all research questions while addressing specific challenges and advancements in the field. Once search results were retrieved, Zotero was used for reference management, utilizing its duplicate-removal function to ensure unique records by comparing titles, authors, publication years, and journals (Tawfik et al., 2019). Cleaned records were then exported to Google Sheets, where key information such as authors, publication year, DOI, and abstracts were stored for further analysis. The initial search retrieved 2,588 studies, refined by applying additional filters and keyword variations, focusing on studies relevant to AI algorithms, large-scale datasets, and e-commerce applications (Huang, 2022).

Title and Abstract Screening

To find articles to review, we only viewed the titles of articles retrieved with our Inclusion Criteria, Exclusion Criteria, and Keywords for Inclusion and Exclusion based on PICO (Page et al., 2021) and SPIDER (Higgins et al., 2019) framework for each RQ. To minimize the number of irrelevant articles included, and that only the most relevant studies were included for further review. After the title screening, the following was to abstract screening, the same principles apply. Two researchers perform the screening with our team. Cochrane guidance

advises two reviewers for this step but with two researchers we are able to fully examine each article (Higgins et al., 2019). Suppose there are differences in opinions or uncertainties about including a particular article. In that case, we adopt an inclusive approach until the lead researcher or Principal Investigator (PI) reviews the decisions and makes a final determination through discussion and consensus. For transparency, all excluded records are assigned clear reasons for exclusion (Tawfik et al., 2019).

Full-Text Downloading and Screening

My Athens access to our institution was used to obtain full-text articles. Eligibility for inclusion was measured against Inclusion and Exclusion criteria for inclusion and exclusion generated out of the PICO and SPIDER frameworks, for each Research Question (RQ) (Higgins et al., 2019). If articles we didn't have access to through the databases, we requested the full text from the authors using ResearchGate or accessed the journal archive as appropriate (Page et al., 2021). To verify that the texts fulfilled eligibility criteria, two researchers separately reviewed the full texts. Where there was disagreement, discussion resolved any disagreements and all eliminated articles were recorded with reasons for analysis to ensure transparency in the analysis (Tawfik et al., 2019).

Manual Search

To minimize bias and ensure comprehensive coverage, we extended our search using manual methods to capture studies that may have been missed in the initial search. This included reviewing reference lists from included studies and performing citation tracking using Research Rabbit's "Connection" feature, which helped track articles citing the included studies and identify "related" articles (Page et al., 2021). These manual strategies specifically addressed our Research Questions (RQs). As with electronic searches, two researchers independently reviewed articles, using the Inclusion Criteria and Exclusion Criteria (Higgins et al., 2019). The results of the manual search were compiled and compared to resolve discrepancies through discussion. Other articles were recorded before they were integrated into the dataset overall (Tawfik et al., 2019).

Data Extraction and Quality Assessment

Data related to Research Questions (RQs) were systematically extracted from selected studies, covering various aspects of recommender systems in e-commerce. A data extraction form was used to collect information on study characteristics (e.g., authors, publication year), AI techniques (e.g., neural networks, collaborative filtering), and performance metrics (e.g., accuracy, precision, F1-score) (Hao et al., 2023).

- RQ1 (Emerging Techniques): Focused on emerging methods such as graph neural networks (GNNs) and hybrid models (Javaji & Sarode, 2023).
- RQ2 (Popular Algorithms): Concentrated on algorithms like collaborative filtering, matrix factorization, and deep learning (Lara-Cabrera et al., 2020).
- RQ3 (Key Challenges): Addressed scalability, cold-start problems, and bias (Li et al., 2021).

The quantitative and qualitative data were extracted and organized. The effectiveness of the systems was measured by means of performance metrics such as precision, recall and F1-score (Jannach et al., 2016). Google Sheets and Python scripts facilitated data management, converting the extracted quantitative data into CSV files for analysis (Loper et al., 2024). Quality assessment was conducted using tools aligned with the PICO/SPIDER framework to ensure consistency and relevance (Higgins et al., 2019). Studies were evaluated based on their design, prioritizing experimental studies for RQ1 and RQ2 and qualitative studies for RQ3 (Page et al., 2021). Performance metrics were central to the evaluation. Data quality was further verified by assessing dataset relevance (e.g., Amazon and MovieLens), with peer-reviewed studies prioritized to maintain high academic standards (Chin et al., 2022). Each study was rated using predefined criteria:

- **High-quality**: Fully met criteria, demonstrating intense methodological rigor.
- **Moderate-quality**: Met most criteria but had some limitations.
- **Low-quality**: Failed to meet key criteria.

Data Collection and Sampling Technique

Two researchers independently conducted the quality assessments to ensure consistency, resolving discrepancies through discussion. Based on the evaluations, 11 studies were rated as high-quality, 12 as moderate-quality, and three as low-quality, ensuring consistency in the synthesis (Page et al., 2021).

RESULTS

This review synthesized data from studies addressing emerging techniques, popular algorithms, and key challenges in recommender systems (RS) within e-commerce. The synthesis aimed to ensure comparability across different Research Questions (RQs) and to provide a comprehensive understanding of the advancements and challenges in the field.

RQ1 (Emerging Techniques): Deep learning techniques and GNNs have emerged as pivotal in improving personalization and scalability in recommender systems. For instance, GNNs, such as LightGCN, reduce computational complexity while enhancing accuracy in sparse datasets by up to 25% (Gao et al., 2023). Similarly, hybrid approaches integrating matrix factorization with neural networks achieved a 15–20% improvement in recommendation accuracy compared to traditional methods (Li et al., 2021).

RQ2 (Popular Algorithms): Matrix factorization remains a foundational algorithm for collaborative filtering. Its integration with deep learning autoencoders has proven effective for sparse data scenarios, achieving higher precision and recall rates (Sharma & Mishra, 2024). CNNs, when combined with matrix factorization, offer scalable solutions that enhance both computational efficiency and recommendation accuracy (Li et al., 2021).

RQ3 (Key Challenges): In large-scale e-commerce platforms, scalability and cold-start issues remain key challenges. Incremental learning models have shown promise in addressing these barriers by dynamically adapting to new data, although further validation in real-world settings is needed (Zhao et al., 2021). Trust-aware systems and fairness mechanisms have

improved equitable recommendations by 10–15%, but their optimization for dynamic, large-scale environments remains an area of active research (Wang & Yao, 2024).
To ensure the robustness of this review, a rigorous process of screening and selecting studies was undertaken, guided by PRISMA guidelines. Figure 1 illustrates the number of studies identified, screened, excluded, and included at each stage. Of the 2,584 studies initially identified, 26 were included after detailed screening, with 11 classified as high quality and 12 as moderate quality. Three low-quality studies were excluded to maintain methodological rigor (Page et al., 2021).

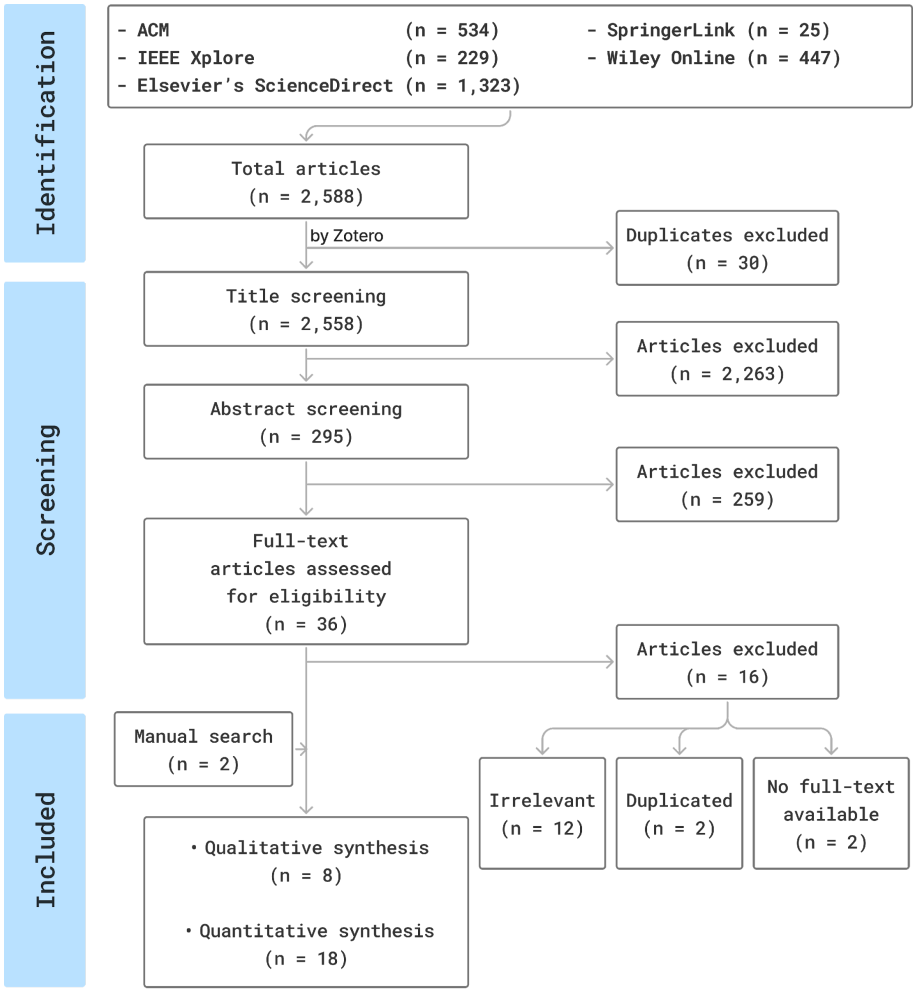

Figure 1. Number of papers of each stage using the Prisma Method

The synthesis comprised 11 high-quality and 12 moderate-quality studies, while three low-quality studies were excluded from upholding the rigor of the review (Page et al., 2021). As illustrated in Figure 1, which details the screening and selection process, the review adhered to a rigorous methodological approach. This figure visually represents the number of studies identified, screened, excluded, and included at each stage of the review process in alignment with PRISMA guidelines.

It then conducts qualitative synthesis of eight studies, using thematic analysis and conceptual frameworks to explore underlying patterns and to derive insights. However, 18 studies were synthesized quantitatively, testing statistical evaluations based on precision, recall, and F1 score to evaluate the accuracy of recommendation systems (Thomas & Harden, 2023). By combining qualitative and quantitative methods, it is in line with traditional systematic review standards (Hong et al., 2018), and strengthens the reliability of the findings.

DISCUSSION AND CRITICAL ANALYSIS

The findings emphasize significant advancements in AI-driven recommender systems, mainly through applying deep learning and graph neural networks (GNNs). These techniques enable systems to handle complex data, leading to more personalized and scalable recommendations. However, Zhang et al. (2021) and Gao et al. (2023) highlighted that these methods demand substantial computational resources, limiting their practicality for real-time, large-scale e-commerce applications. The cold-start problem remains a critical challenge. Hybrid models and Deep LSTM approaches, as suggested by Zhao et al. (2021), show promise in capturing user interactions, but their performance relies heavily on external datasets. Trust-aware and fairness-focused systems offer solutions to bias, but further optimization for real-world applications is necessary (Wang & Yao, 2024).

Albeit important to users' trust and satisfaction, algorithmic bias and fairness have not been sufficiently studied. Fairness metrics should also, in future studies, be integrated into evaluation frameworks in order to ensure fairness across different user groups. Also, the demand for the ethical transparency and explainability of the systems driven by AI grows more and more crucial in the work of Wang & Yao (2024), where the goal is to build up trust in algorithmic decision making. The recent studies also suggest that further exploring the economic impact of RS as well as user personalization may also help make future research more relevant (Li et al., 2022).

CONCLUSIONS AND RECOMMENDATION FOR FUTURE RESEARCH

This review highlights the transformative role of deep learning and GNNs in enhancing the accuracy and scalability of recommender systems, significantly improving personalization. However, challenges such as cold-start problems, computational efficiency, and scalability remain barriers to large-scale, real-time e-commerce implementation. While matrix factorization continues to provide solid solutions, hybrid models yield more promising results when integrated with neural networks (Li et al., 2021). Addressing bias and fairness remains critical, and trust-aware systems, like those proposed by Wang & Yao (2024), offer potential solutions; however, they must be optimized for real-time scalability and broader application across diverse user groups. Furthermore, RS have turned out to be vital apparatuses in e business as it gives customized shopping background as well as boost client commitment. Early RS was built on traditional methods such as collaborative filtering and content based filtering which suffered from the same challenges as scalability and data sparsity. Especially in large scale platforms with the varied user base and the vast product catalog, these constraints were evident. RS addresses these issues using modern data (text, images and behavioral interactions) to provide real time, dynamic recommendations in real time. RS has become an indispensable part in the e-commerce industry that greatly has improved user satisfaction and increased business performance (Chen, 2021; Sharma et al., 2021).

Current work in RS is now moving away from the use of early RS methods, and instead, focuses on integrating state of the art techniques to compensate for their limitations. LightGCN, a GNN, has shown the potential to suck high-order relations between users and items, contributing to nearly 25% improvement on recommendation accuracy and a big decrease of computational burden (Gao et al., 2023). A privacy preserving way of collaborative model training over multiple distributed datasets is federated learning. The large scale e-commerce platforms that emphasize data privacy have found this method to have been particularly beneficial (Li et al., 2023). For instance, attention based models such as Neural Attentive Recommender (NAR) utilize dynamic user interaction prioritization to improve the session based recommendation precision (Chen et al., 2021).

At the heart of any RS are algorithms that change to suit the needs of modern e-commerce platforms. One of the most fundamental algorithms for collaborative filtering, matrix factorization has been modified with deep learning to have utility in dealing with the problem of data sparsity and cold start (Eslami & Ghaderi, 2022). Autoencoders and convolutional neural networks (CNNs) are deep learning models widely used to uncover latent relationship of user and item, that provide robust solutions for large scale applications (Sharma & Mishra, 2024). With hybrid models that combine collaborative and content based filtering and reinforcement learning or sentiment analysis, both user satisfaction and recommendation accuracy were greatly improved, indicating possibilities for practical use (Huang, 2022).

However, there are still numerous challenges. Processing a large amount of data and meeting this requirement in real time is very challenging from this point of view because RS is a very demanding system in which scalability is one of the persistent issues. Federated learning and distributed computing could be potential solutions; their optimization towards real world applications is an ongoing research area, however (Zhao et al., 2021). In addition, important obstacles for algorithmic bias and fairness remain, making it crucial that we have fairness aware systems to support equitable outcomes for all user groups (Wang & Yao, 2024). In addition, the cold start problem, especially for new users and items, still thwarts RS performance. To overcome these limitations, incremental learning and context-aware models are coming to be deemed as promising approaches, but their reliability in different learning settings is still to be validated (Zhao et al., 2021).

Additional future research would focus on enhancing scalability towards real-time applications, including optimizing hybrid models and trust-aware systems that cover a huge amount of data. By doing so, we can integrate fairness and bias mitigation mechanisms into recommendation algorithms ensuring equitable outcomes for all users. Finally, we explore the user personalization and economic impact of AI-driven recommendations in e-commerce to gain meaningful insights beyond technical gains in recommender systems and how they impact user behaviour and commerce. Enhancing the explainability of AI models will be crucial for building user trust and understanding of recommendation outcomes. Addressing these gaps will enable future research to balance technical performance with ethical responsibility, resulting in more inclusive and scalable solutions for e-commerce platforms.

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Factors Influencing the Decision to Choose Cryptocurrencies Among Generation Y in Thailand

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ABSTRACT

Objective: This study investigates the determinant factors influencing cryptocurrency investment decisions among Generation Y in Thailand.

Methods: This study employed quantitative methodology. Data were collected through structured questionnaires from 599 respondents, 412 of whom were Generation Y (born 1981-1996). Multiple linear regression analysis with the Stepwise method revealed seven significant factors affecting investment decisions: cryptocurrency attitude favorability, risk tolerance threshold, ownership privacy, tax exemption policy for unrealized gains, transaction processing speed, decentralized system architecture, and mining reward mechanisms.

Results: The model demonstrated explanatory power with the R^2 value of 0.527 and a correlation coefficient of 0.535, indicating these factors collectively account for 52.7% of the variance in cryptocurrency investment decisions.

Conclusion and Recommendations: The findings contribute to understanding digital asset investment behavior among Generation Y and provide practical implications for investment advisors, financial institutions, and policymakers in developing targeted strategies for this demographic. This research offers valuable insights for stakeholders in the cryptocurrency ecosystem, particularly those focused on Thailand's emerging digital asset market.

Keywords: *Cryptocurrency investment, Generation Y, Investment decision factors, Digital assets*

INTRODUCTION

Digital technology has fundamentally transformed various aspects of human life, particularly in financial transactions and investment paradigms. Cryptocurrencies have emerged as a revolutionary force in the financial sector, offering distinctive advantages such as enhanced security, expedited transactions, and reduced costs without traditional financial intermediaries. In Thailand, the cryptocurrency market has witnessed substantial growth, primarily driven by increasing recognition of its potential for generating long-term financial returns.

Generation Y, individuals born between 1981 and 1996, exhibit unique characteristics predisposing them to cryptocurrency investments. These include technological proficiency, sophisticated information access capabilities, and extensive experience with digital transactions. These distinctive attributes position them as primary adopters of cryptocurrency investments compared to other generational groups.

A comprehensive review of existing literature, encompassing 20 domestic and international sources, has identified multiple factors influencing cryptocurrency investment decisions. The Cybersecurity Measures (Alauthman et al., 2024) establish fundamental security protocols within blockchain technology to mitigate potential cyberattack vulnerabilities. The Decentralized System (Chary et al., 2022) facilitates autonomous operation without centralized authority, enhancing system transparency and security. The Consensus Mechanism (Alzahrani & Daim, 2019) implements systematic validation protocols, while Smart Contracts (Li & He, 2020) enable automated transaction execution under predetermined conditions. The Low Energy Consumption and Environmental Friendliness (Mauri et al., 2018) addresses ecological sustainability through optimized mining processes. The Listing on Trading Platforms and never-delisted status demonstrates sustained market viability, while Popularity and Positive Social Perception (Anandhabalaji & Babu, 2024) influence market dynamics through community engagement. The Clear Coin Supply (Dumrongsombut et al., 2021) establishes transparent circulation parameters that ensure confidential asset management, complemented by Privacy in Ownership (Praipaisankit, 2021). Furthermore, the History of High Returns (Chary et al., 2022) provides empirical performance metrics supported by the Mining Rewards System (Gazali et al., 2018) that incentivizes network participation. In addition, the High Market Value Ranking (Dumrongsombut et al., 2021) indicates substantial market capitalization, while High Trustworthiness (Praipaisankit, 2021) establishes credibility among stakeholders. Moreover, Legal Compliance (Praipaisankit, 2021) ensures regulatory adherence, augmented by High Transaction Speed (Dumrongsombut et al., 2021) and Low Transaction Fees (Dumrongsombut et al., 2021) that optimize operational efficiency. The Unlimited Transaction Capability (Handoko et al., 2023) enables unrestricted trading activity, while the Acceptable Risk Level (Handayani et al., 2023) maintains balanced investment profiles. The Tax-Exempt Profit Policy, if Not Sold, provides fiscal advantages, and a Positive Attitude Toward Cryptocurrencies (Waghmare et al., 2022) promotes widespread market acceptance.

The significance of understanding these investment determinants extends beyond academic interest. As cryptocurrency markets evolve, particularly in emerging economies like Thailand, comprehending the factors that drive investment decisions becomes vital for stakeholders. Financial institutions require this knowledge to develop appropriate investment products, while policymakers need it to formulate effective regulatory frameworks. Potential investors can benefit from understanding these factors to make more informed investment decisions.

Research Objective

This study examines how these factors influence cryptocurrency investment decisions among Generation Y in Thailand. By focusing on this technologically adept demographic in an emerging market context, the research seeks to contribute to the growing body of knowledge regarding cryptocurrency adoption and investment behavior. The findings are expected to provide valuable insights for investment strategists, financial advisors, and regulatory bodies in developing targeted approaches for the evolving digital asset landscape.

LITERATURE REVIEW

This study investigates the determinant factors influencing cryptocurrency investment decisions among Generation Y in Thailand. The researcher has compiled relevant concepts, theories, and research to form the following conceptual framework.

Cryptocurrency

Cryptocurrency is a new form of currency developed on blockchain technology, designed to operate without intermediaries such as banks or financial institutions to validate transactions. This technology enables secure and transparent transactions by recording data in a distributed ledger widely accepted in the finance, banking, and services sectors. The blockchain ledger is immutable, as each transaction is recorded as a block linked in a chain, allowing all network users to verify transactions. This decentralized, tamper-resistant system ensures data integrity and prevents unauthorized changes (Alauthman M et al., 2024)

Investment in Cryptocurrency

Investing in cryptocurrency involves holding digital assets that are highly volatile yet offer substantial return potential. Related research identifies key factors influencing cryptocurrency investment decisions, including data security, privacy, growing global market demand, and high-return opportunities. Studies indicate that most investors prioritize blockchain's transparency and security, as this technology mitigates theft and fraud risks. Easy access through online platforms and lower transaction fees also appeal to investors, particularly those seeking intermediary-free investment and freedom in asset management.

Related Research

Cryptocurrencies have emerged as transformative financial instruments rooted in decentralization, driven by blockchain technology that facilitates secure and direct transactions without intermediaries. As studied by (Song et al., 2024), this evolution is marked by innovations in blockchain models, where Bitcoin uses Proof of Work (PoW) to validate transactions through computational effort, while Ethereum has transitioned to the energy-efficient Proof of Stake (PoS) model. These advancements underscore the industry's goal of balancing decentralization with sustainable technological practices. Solana, a blockchain system, takes a unique approach by implementing high-performance validation methods to support large transaction volumes, addressing scalability and enhancing transaction efficiency across decentralized platforms.

Cryptocurrency investments have attracted diverse investors seeking high returns, though often accompanied by significant risks and volatility. Research by (Handoko et al., 2023) on investor behaviors reveals that decision-making is heavily influenced by heuristic biases such as availability and overconfidence biases. These biases can lead investors to make quick but sometimes irrational investment decisions, amplifying risk in a volatile market. The availability and representativeness biases significantly impact decision-making, leading investors to rely on past information or patterns in markets without complete evaluation, which in the cryptocurrency market often results in large fluctuations and the potential for substantial losses

While cryptocurrencies continue to grow as investment options, their environmental impact, especially from PoW systems, poses ongoing challenges. As (BİLİRER et al., 2024) highlight, Bitcoin's high energy consumption and associated CO2 emissions have raised global environmental concerns. Ethereum's transition to PoS has reduced its carbon footprint, offering a promising direction for future blockchain developments aimed at sustainability. The relationship between cryptocurrency prices and environmental impact remains complex, with calls for regulatory measures to mitigate adverse effects. These interconnected studies underscore the need for balance between advancing decentralized finance, addressing cognitive biases in investment, and ensuring environmental sustainability in the evolving landscape of digital assets

This study delves into the determinants of individuals' intentions to Choose Cryptocurrencies Among Generation Y in Thailand, with twenty factors according to a review from previous articles. Figure 1 provides a visual representation of the study's conceptual framework.

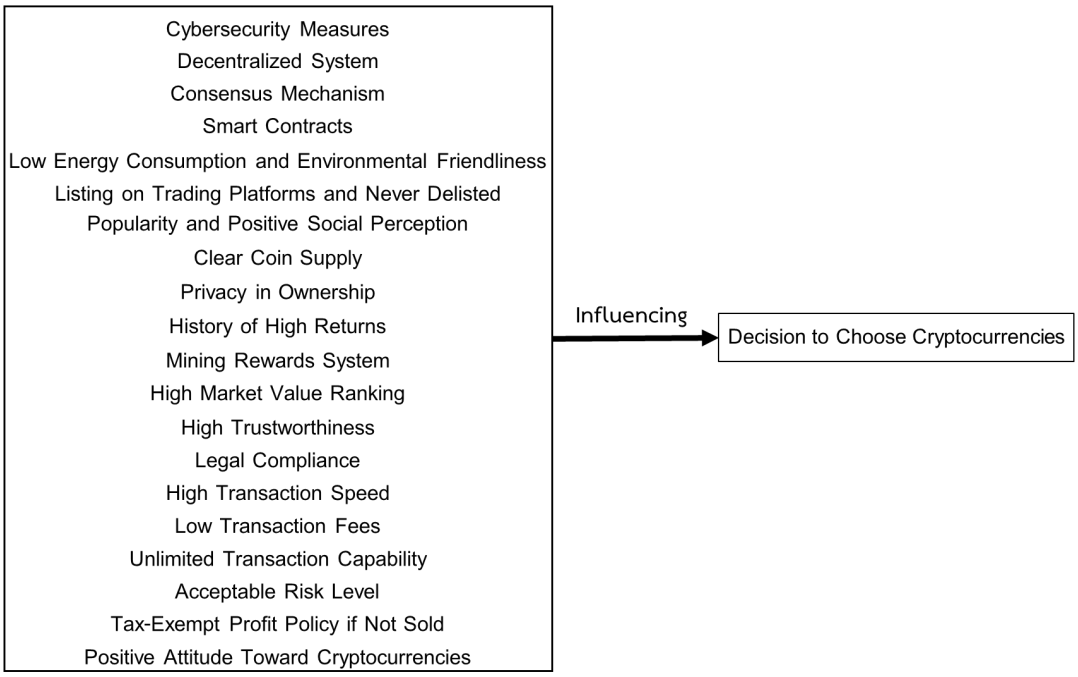

Figure 1. Conceptual Framework

The potential factors affecting the decision to choose cryptocurrencies in this study include Cybersecurity Measures, Decentralized System, Consensus Mechanism, Smart Contracts, Low Energy Consumption/Environmental Friendliness, Listing on Trading Platforms/Never Delisted, Popularity/Positive Social Perception, Clear Coin Supply, Privacy in Ownership, History of High Returns, Mining Rewards System, High Market Value Ranking, High Trustworthiness, Legal Compliance, High Transaction Speed, Low Transaction Fees, Unlimited Transaction Capability, Acceptable Risk Level, Tax-Exempt Profit Policy if Not Sold and Positive Attitude Toward Cryptocurrencies.

RESEARCH METHODOLOGY

This study employed a quantitative approach, utilizing a five-point Likert scale questionnaire to assess the factors influencing cryptocurrency investment decisions among Generation Y in Thailand. The questionnaire was distributed online via Google Forms, employing convenience sampling across social media communities such as Facebook and Line. The target population comprised Thai nationals belonging to Generation Y. The required sample size was determined using Taro Yamane's formula, necessitating a minimum of 400 respondents. Prior to full-scale distribution, the questionnaire underwent pre-testing with 30 respondents, in line with established recommendations (Damrong et al., 2022). Reliability was assessed using Cronbach's alpha coefficient to evaluate internal consistency. The Cronbach's alpha value of 0.937 indicated a high level of reliability among the factors, suggesting that the questionnaire items effectively measured the underlying constructs influencing cryptocurrency investment decisions. To analyze the data, multiple linear regression analysis was conducted using the Stepwise method.

RESULTS AND DISCUSSIONS

In this study, 599 participants from Thailand completed the online survey. After screening, 412 respondents were confirmed to be from Generation Y. The data collected from these participants were analyzed in detail to fulfill the research objectives. As shown in Table 1, the coefficient of determination (R^2) shows the proportion of variance in the decision-making process that can be explained by the factors included in each model. The analysis reveals that the model has the highest R^2 value of 0.535, which explains 53.5% of the variance in choosing cryptocurrencies.

Table 1. Model Summary

R	R^2	Adjusted R^2	Std. Error of the Estimate
0.731[g]	0.535	0.527	0.521

	Unstandardized B	Coefficients Std. Error	Standardized Coefficients Beta	t	Sig.
(Constant)	0.294	0.214		1.375	0.170
X20	0.484	0.050	0.439	9.653	0.000***
X18	0.181	0.051	0.164	3.561	0.000***
X9	0.088	0.048	0.083	1.844	0.066
X19	0.143	0.053	0.128	2.687	0.008**
X14	-0.136	0.043	-0.128	-3.134	0.002**
X2	0.101	0.037	0.108	2.709	0.007**
X11	0.068	0.026	0.100	2.654	0.008**

**Significant value at $p<0.01$ and ***Significant value at $p<0.001$

According to Table 1, the significant factors affecting decisions to choose cryptocurrencies in this study are X20 (Attitude Toward Cryptocurrencies), X18 (Acceptable Risk Level), X19 (Tax-Exempt Profit Policy, if Not Sold), X14 (Legal Compliance), X2 (Decentralized System), and X11 (Mining Rewards System).

The statistical analysis conducted in this study provides a comprehensive understanding of the factors influencing the decision to choose cryptocurrencies among Generation Y in Thailand. Among the tested factors, although the model exhibited the highest coefficient of determination (R^2). This study analyzed the factors influencing the decision to choose cryptocurrencies among Generation Y in Thailand. Previous research has explored factors influencing the decision to adopt digital currencies in Thailand, with some focusing broadly on all generations (Damrong et al., 2022) or specifically on Bitcoin adoption among Generation Z (Praipaisankit, 2021). This study narrows the scope by concentrating on Generation Y, based on the idea that this group possesses both technological knowledge and substantial financial resources, making them the most capable of adopting digital currencies. We are using a quantitative research approach. Data was collected from 412 respondents through a reliable online questionnaire. The Stepwise regression analysis identified seven models, with Model 7 chosen as the most appropriate model because it had an R^2 value of 0.535.

The model included six key factors influencing the decision-making process, such as Positive Attitude Toward Cryptocurrencies (X20): Personal attitudes significantly impact the choice to invest in cryptocurrencies; this factor has also been mentioned in previous research studies. Acceptable Risk Level (X18) refers to investors being more likely to choose cryptocurrencies if they can tolerate the associated risks. Privacy in Ownership (X9) refers to cryptocurrencies that ensure the privacy of holders is more appealing to investors, but it is rejected, so there is no effect in the prediction model. Tax-Exempt Profit Policy, if Not Sold (X19), refers to government policies that exempt unrealized profits from income tax and contribute to investment decisions. Legal Compliance (X14) refers to regulatory frameworks concerning cryptocurrency investment that affect investment decisions. However, legal compliance had a negative relationship, possibly reflecting the investors' skepticism toward stringent regulations. Decentralized System (X2) refers to the higher the level of decentralization in validating transactions, the more it influences investment decisions. Mining Rewards System (X11) refers to the higher the level of decentralization in validating transactions, the more it influences investment decisions.

Among these factors, a positive attitude toward cryptocurrencies was found to have the most substantial influence. At the same time, legal compliance showed a negative correlation, which may indicate the target group's perception of restrictive regulations. The findings provide valuable insights for developing marketing strategies, selecting cryptocurrencies for investment platforms, and formulating policies related to cryptocurrencies for this demographic in Thailand.

CONCLUSIONS

The purpose of this study was to examine the factors influencing Generation Y's decision to choose cryptocurrencies in Thailand. The Stepwise Multiple Regression Analysis results revealed several significant factors affecting cryptocurrency investment decisions: positive attitudes toward cryptocurrencies, acceptable risk levels, privacy in ownership, tax-exempt profit policies if not sold, high transaction speed, and a decentralized system. These factors collectively showed a correlation coefficient of 0.535 with the decision to invest in cryptocurrencies, accounting for 53.5% of the variance in investment decisions. The findings indicate that Generation Y in Thailand prioritizes security and privacy in investments and technological factors like transaction speed and decentralization. Six factors significantly impact confidence and decision-making regarding cryptocurrency investments. The six significant factors affecting decisions to choose cryptocurrencies in this study are X20; Attitude Toward Cryptocurrencies; X18; Acceptable Risk Level; X19; Tax-Exempt Profit Policy, if Not Sold; X14; Legal Compliance; X2; Decentralized System and X11; Mining Rewards System. The study's results can be a foundation for developing policies and marketing strategies to promote cryptocurrency investments among Generation Y. Furthermore. They can guide improvements in policies related to security and privacy to better meet the needs of investors in this demographic effectively.

LIMITATION AND RECOMMENDATION

This study has limitations regarding the sample group, which focuses exclusively on Generation Y in Thailand, and data collection via online questionnaires, which may not adequately represent other populations and pose potential issues with data accuracy. Furthermore, the high volatility of the cryptocurrency market may lead to findings that do not align with future trends. For future research, expanding the sample group, including the legal and economic contexts, exploring emerging technologies, such as decentralized finance (DeFi) and non-fungible token (NFT), and analyzing psychological factors and environmental impacts within the cryptocurrency market to obtain more comprehensive and insightful data.

DECLARATION

During the preparation of this work, the authors used AI, specifically ChatGPT, to check for spelling and grammar errors. After using this tool, the authors reviewed and edited the content as needed and took full responsibility for the publication's content.

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Electronic Word of Mouth (E-WOM) Affecting the Tourism Destination Choice

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ABSTRACT

Objective: This study aims to examine the impact of electronic word-of-mouth on tourists' destination choices. Electronic word-of-mouth (e-WOM) influences tourism choices, a topic that has been extensively discussed.

Methods: The research process was divided into four steps: 1) secondary data collection using document research, 2) observations, 3) data analysis, and 4) synthesis and proposition. Scholarly papers in the Scopus database, Web of Science (WOS), and Google Scholar were selected using purposive sampling based on related topics and keywords from 2021 to 2025.

Results: The results reveal that electronic word-of-mouth determines visitors' choice of tourism destinations and their experiences as tourists.

Conclusions: The proliferation of the Internet has given rise to a novel form of word-of-mouth (WOM), known as electronic word-of-mouth (e-WOM), which is one of the most potent informal media among customers, enterprises, and the general public. There is pertinent literature assessing the influence of electronic word-of-mouth (e-WOM) over traditional word-of-mouth (WOM) in consumer behavior while elucidating the primary distinctions between the two recommendation types to enhance comprehension of their respective potentials.

Keywords: electronic word-of-mouth, e-WOM, decision, tourist, review

1. INTRODUCTION

The impact of electronic word of mouth (e-WOM) on consumer behavior in tourism and hospitality is a relatively understudied and under-researched area. E-WOM affects tourist behavior beyond what tourism and hospitality specialists. The evidence-based conceptual framework illustrates its multidimensional, cognitive, normative, and affective scope, providing a systematic tool to uncover understudied facets of this important phenomenon. It synthesizes the vast and fragmented literature on e-WOM. It presents a novel conceptual framework to demonstrate the diverse range of cognitive, affective, and normative factors that influence tourism and hospitality service choices (Pourfakhimi et al., 2020). The heritage image and travel intention emerged as significant mediators of tourist behavior among young visitors to World Heritage Sites. It demonstrates that electronic word-of-mouth substantially improves both cognitive and emotional impressions of a destination, consequently reinforcing its perceived heritage image. Psychological factors, including emotions, attitudes, and desires, influence the relationship between electronic word-of-mouth (e-WOM) and the inclination to travel. They integrate electronic word-of-mouth with heritage imagery, thus enhancing the current body of literature. The insights offer practical recommendations for place managers and marketers to attract young tourists by employing strategies that emphasize favorable online reviews and emotional engagement (Ahmed et al., 2025).

Electronic word-of-mouth (e-WOM) has become a crucial element in consumer decision-making, especially in the tourist sector. the essential features of e-WOM and analyze their effects on tourist purchase intentions, to determine whether these effects differ significantly between the two markets. There are significant impacts of electronic word-of-mouth on the tourism industry, offering essential insights for industry stakeholders seeking to leverage e-WOM in diverse cultural settings (Tran & Kumar, 2024). Contemporary tourists increasingly rely on online reviews to inform their trip decisions. Electronic word of mouth has a significant impact on the purchasing intentions of travelers who use online travel agencies. There is an influence of electronic word-of-mouth factors on travelers' intentions to purchase tourism services from online travel firms. According to Social Exchange Theory, the quantity, quality, legitimacy, and utility of electronic word of mouth are recognized as the four key determinants of purchase intentions for services provided by an online travel agency. Except for the quantity of information, the three other independent variables influencing e-WOM—information quality, information trustworthiness, and information usefulness—significantly impact visitors' service purchasing intentions. The present research findings offer significant, practical implications for online travel service providers, online service agents, and managers of various tourism platforms, suggesting that they formulate and execute strategies to manage online reviews across diverse platforms and elicit improved responses from travelers (Hossain et al., 2024).

Communication platforms are shifting from physical to digital environments. The Internet has fundamentally transformed the business landscape, enabling individuals to serve as "media" for collaboration and information sharing. Professionals have commenced utilizing electronic word of mouth (e-WOM) for consumer insights via text analytics, sentiment analysis, hashtag analytics, and various machine learning technologies. Given the increasing significance of the subject as a study domain, it is essential to delineate the research landscape (Verma & Yadav, 2021). Thus, e-WOM influences tourists' or customers' decisions or choices regarding tourism destinations.

1.1 Research Objective

This study examines how electronic word-of-mouth (e-WOM) influences the decision to become a tourist.

1.2 Research Question

How is electronic word-of-mouth (e-WOM) affecting a tourist's decision to travel to a destination?

2. LITERATURE REVIEW

2.1 Electronic Word-of-Mouth

Word-of-mouth (WOM) credibility in multi-communicator and receiver circumstances affects consumers. This includes scenarios where one person sends a message to another, who acts as an intermediary and sends it to the end consumer. The original message may be altered or misinterpreted, reducing the trustworthiness of the WOM review. This strengthens written comments and reviews, such as e-WOM, which reduces risk and boosts consumer confidence: fast distribution and easy access separate e-WOM from traditional WOM. Online media (e-WOM) is used by consumers for two purposes while seeking product or service information. Since they do not require a friend or family member to tell them what to eat, they can acquire the knowledge more quickly. Second, e-WOM can verify WOM reviews. Credibility and speed distinguish the two media, influencing consumer behavior (Huete-Alcocer, 2017).

Electronic word-of-mouth (e-WOM) emerged in the mid-1990s, coinciding with the Internet's impact on consumer behavior. Consumers sharing product and company information online, on social media, and via mobile devices is called e-WOM. Because consumers may easily start online

chats, e-WOM increases retransmission intentions. It also facilitates fast, worldwide information transfer. Academic research on e-WOM has been conducted in various fields, including advertising, marketing, communication, management, and internet commerce, as it significantly impacts consumer behavior. E-WOM influences sales, product evaluations, purchasing decisions, customer satisfaction, and loyalty, as well as consumer-brand relationships, according to decades of research. Consumers' e-WOM behavior is driven by social connection, economic incentives, care for other consumers, and approval utility. In addition, social relationship elements (e.g., social capital) and message source and features influence e-WOM behavior. It is essential that social media–based e-WOM and purchase intentions, influencers as a new source of e-WOM, the impact of e-WOM on corporate reputation and customer social responsibility (CSR), and cross-cultural differences in e-WOM (Chu, 2021).

2.2 Behavioral Intention and Choice Decisions

According to decision theory principles, it was determined that behavioral intentions in a choice scenario can be anticipated with greater precision by evaluating attitudes toward all behavioral alternatives, rather than solely focusing on the attitude toward a single option. Supporting the assumption derived from Fishbein's model, it was determined that behavioral intentions for individual actions, as well as for actions in dichotomous and multiple-choice contexts, were influenced not only by attitudes toward the actions but also by normative views regarding these behaviors (Ajzen & Fishbein, 1969).

There is a difference between choice and decision. Choice is linked to the realm of intended desires, values, and beliefs. Decision pertains to the realm of behavior, performance, and outcomes. Choices are associated with reasons, whereas decisions are linked to causes. Comprehending the distinction between the locus of choice and the moment of decision facilitates the recognition of someone's emotions, whether positive or negative, enabling them to make informed choices and sound, definitive conclusions. Visiting the chosen location initially might provide the confidence necessary to remain motivated and undertake audacious, transformative actions. Choice decisions are influenced by a variety of social, cultural, economic, and psychological factors (Tallman & Gray, 1990; Wei, 2025).

Thus, choices, decision-making, and choice decisions are based on principles of decision theory and behavioral intention. Some related factors include social, cultural, economic, and psychological factors, as well as emotions.

2.3 e-WOM and Tourism

It must generate effective success metrics comprehensible to all stakeholders in tourist locations. Alternative destinations must supplant the long-haul locations that are no longer accessible, and research should pivot towards management rather than exclusively luring guests. Long-haul destinations will experience a decline in market share, while destinations will shift their objectives towards stakeholder satisfaction, and modes of travel will transition to lower-emission alternatives. Options for destinations may diminish, ways of transportation may be restricted, and local tourism will likely become prevalent (Butler, 2025). Stakeholders in destination management and development can leverage electronic word-of-mouth (e-WOM) to enhance destination visibility and formulate strategies that promote favorable e-WOM regarding destinations (Vu Dinh et al., 2025).

Tourism encompasses travel for enjoyment and the commercial enterprise of facilitating and financing such travel. Tourism is the act of individuals traveling to and residing in locations outside their usual environment for a duration not exceeding one consecutive year, for leisure, business, or other purposes, and for a minimum of 24 hours, transcending the conventional view of tourism as solely related to vacation activities. Tourism may be categorized as domestic, occurring within the traveler's own country, or international. International tourism has both inbound and outbound effects on a nation's balance of payments. Thus, e-WOM influences destination decisions in tourism.

2.4 Online Reviews, Social Media Influencers, and e-WOM

Electronic Word-of-Mouth (e-WOM) denotes the dissemination of opinions, evaluations, and endorsements of items or services via online platforms. The para-social contact between consumers and influencers fosters a favorable disposition towards the influencer's recommended post. The cultivation of a good attitude towards the post leads to the formation of buy intention and engagement in electronic word-of-mouth (e-WOM). The analysis of relationships concerning experience products or services revealed that attitude homophily and the interactivity of influencers were the most significant factors among the antecedents (influencer credibility, attitude homophily, interactivity) in the development of para-social interaction. Consumers' levels of risk aversion moderate the relationship between attitude and purchase intention. Even for experience products perceived as inherently risky, consumers with low risk aversion were more inclined to make purchases based on the influencer's endorsement. In today's landscape, when firms heavily utilize influencer marketing, achieving the desired impact is contingent upon selecting the appropriate influencer. It is essential to ascertain the requirements that would motivate followers to purchase the product and generate favorable word-of-mouth communication, which are primary objectives of the influencer's posts (Ermeç, 2022).

E-commerce has had consistent growth since the mid-1990s, when internet access became increasingly widespread. Informational content is crucial in online purchase decisions. Prospective customers typically gather pertinent information and do a comparison prior to contemplating a purchase. Electronic word-of-mouth (e-WOM) is regarded as a credible source of information. Customer evaluations and influencer endorsements can be classified as electronic word-of-mouth (e-WOM). They signify customers' dissemination of experiences and assessments of a product or service to other prospective consumers. There is substantial evidence about the impact of electronic word-of-mouth on purchase intention. The influencer review positively influences purchase intention (Dwidienawati et al., 2020).

Therefore, electronic word-of-mouth (e-WOM) is considered a reliable source of information. Customer assessments and influencer endorsements can be categorized as electronic word-of-mouth (e-WOM). Customers' sharing of tourism experiences and evaluations of tourists' service with other potential destination decisions. Electronic word-of-mouth influence decision choices. The influencer's review favorably affects decisions. In contrast, negative reviews may inhibit their destination decisions.

2.5 Digital Marketing Content and e-WOM

Given that e-WOM is a valuable component of digital marketing for every firm, a deeper comprehension of its mechanisms will enable personnel to leverage this idea more effectively. Electronic word-of-mouth facilitates the establishment of relationships between individuals, firms, brands, and other consumers, resulting in advantages for both parties. It significantly influences a firm's performance (Akbari et al., 2022).

Digital content marketing and electronic word of mouth (E-WOM) positively affect customer purchase intentions. Appealing marketing content, such as on Instagram significantly influences buy intention, while individuals also seek recommendations through electronic word of mouth on the platform to bolster their purchasing decisions (Ratri et al., 2025).

The impact of electronic word-of-mouth on consumer purchasing intentions through a thorough examination of how digital marketing methods affect behavioral results. using platforms like Instagram and TikTok. Social media marketing significantly impacts purchase intention, both alone and concurrently, when integrated with e-WOM elements. Assess the efficacy of digital marketing and offer pragmatic insights to enhance brand loyalty and stimulate purchase conversions via strategic and engaging online methodologies (Pahlawan & Cahyono, 2025).

Thus, digital marketing content may influence e-WOM based on tourist experience and influence choice decisions in tourism.

3. METHODOLOGY

The qualitative research adopted by the researchers was based on the studies by Auttawechasakoon & Wiwasukh (2022, 2023). It was divided into four stages as follows:

3.1. Data Collection: The data collection was conducted through documentary research. The database was established to gather information in support of the study's objective, utilizing secondary data from scholarly publications, based on the Internet, and related research. The references used were from reputable academic resources like Scopus, Google Scholar, word of mouth, behavior, tourism, decisions, tourists in 2024, and backward below 10 years were the key search terms (Keywords) utilized in this context. The period from January 20, 2024, to March 20, 2024, is the secondary data collection period for phase 1.

3.2. Observation: A researcher observed tourist attractions to describe the factors that influence cultural tourism. During the visit, the researcher interpreted the qualitative data using Word Cloud and Grammarly to check grammar and validate the content, ensuring accuracy and avoiding plagiarism and artificial intelligence (AI) similarity.

3.3. Data Analysis: Information from the document was analyzed separately, and grouping techniques were employed content analysis the following criteria: 1) the year that the research was released through various media channels; 2) the type of research mentioned; 3) the subject that is relevant to current research; 4) the objectives that support current research; and 5) the research methods that are helpful to current research. 6) Content assessment.

3.4. Synthesis and Proposition: Research synthesis is based on the literature review. The researcher compiled a list of relevant research articles and conducted a systematic review of content information. Secondary data were analyzed from 2024 and earlier. The evaluation of primary data to propose stage factors was conducted between April 2 and June 5, 2024, in accordance with the research objective. Evaluative and contributing factors were considered.

4. RESULTS

4.1 Grammarly results shows the appropriate of grammar is about 95%, and 1% of plagiarism. Thus, this article is acceptable for its content validity and without ethical issues.

4.2 Conceptual Framework

The researcher presents the conceptual model by observation to propose the factors influencing the decision to be a tourist.

Electronic Word-of-Mouth Affecting the Decision to be a Tourist is shown in Figure 1.

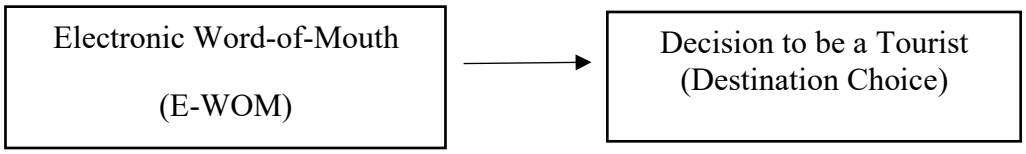

Figure 1. Electronic word-of-mouth (e-WOM) behavior that influences
The decision to be a tourist (destination choice).

4.3 Word Clouds

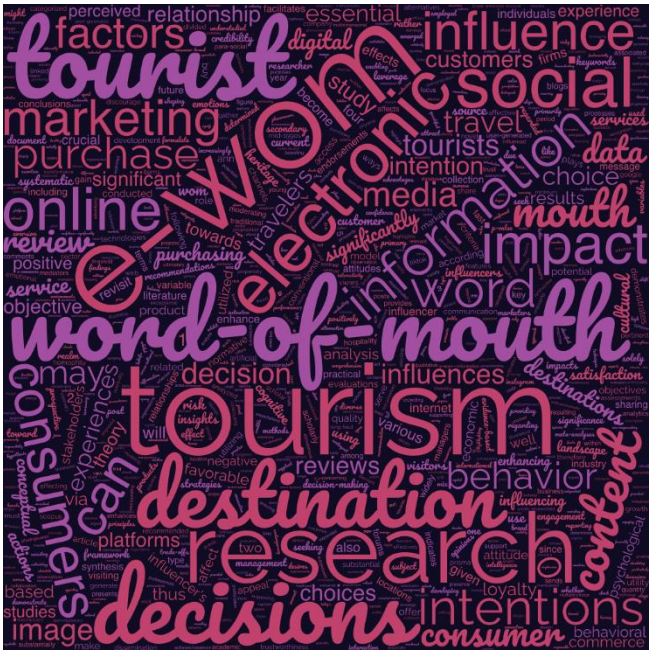

Figure 2. Word Clouds
https://www.wordclouds.com/

5 DISCUSSIONS

According to Tiong et al. (2025), electronic word-of-mouth has a significant influence on the relationship between the marketing mix and the tourist experience, particularly in terms of the likelihood of revisiting. An effectively implemented marketing mix, combined with favorable experiences, motivates travelers to share their experiences online, thereby enhancing their propensity to return. The moderating analysis indicates that the impact of e-WOM on revisit intentions is more pronounced for travelers pursuing personal satisfaction rather than transactional objectives. This study enhances consumer behavior theory by demonstrating how intrinsic motives intensify the effects of electronic word-of-mouth (e-WOM). It provides ways to enhance electronic word-of-mouth through tailored experiences, social media interaction, and innovative technologies such as artificial intelligence and augmented reality. Future studies should employ longitudinal designs to document the progression of tourist behavior and investigate the influence of social media influencers on platforms such as TikTok. The results highlight the significance of electronic word-of-mouth in influencing tourist behavior, providing actionable information for destination marketers to improve engagement and intentions to revisit.

Rahman et al. (2023) confirmed that tourism is integral to the economic landscape. Understanding the factors that influence tourist loyalty is crucial for sustainable development. The factors that influence tourist loyalty in the tourism sector, with a focus on destination image, service quality, electronic word of mouth, and tourist satisfaction. It highlights that an affirmative destination image and exceptional services positively influence tourist loyalty. Moreover, electronic word of mouth and visitor satisfaction serve as mediators in these connections, highlighting how favorable views and pleasure contribute to loyalty. Social media has a moderating effect on the dynamics of destination image, service quality, and tourist loyalty. It provides essential information for tourism stakeholders and destination marketers to refine their strategies. By enhancing its destination image, delivering exceptional services, and leveraging social media, Pakistan can attract and retain tourists, thereby promoting the growth and prosperity of its tourism industry. This study contributes to the existing literature and offers practical recommendations for enhancing tourism in developing countries.

Suwardono (2025) concluded that the User Generated Content variable is indicated to possess a positive correlation and a substantial impact on Purchasing Decisions. The P-value is positive and below the significance threshold of 0.05, specifically 0.016. These findings align with the aforementioned studies. It demonstrates that user-generated content can expand the market, enhance marketing appeal, and eventually affect purchasing decisions. The subsequent hypothesis posits that the Electronic Word of Mouth variable may also mitigate the impact of the User-Generated Content variable on Purchasing Decisions. This is because the P-value is positive and

below the significance threshold of 0.000. The results indicate that the Electronic Word of Mouth variable enhances the appeal of marketing, resulting in a more significant influence after moderation, quantified at 0.016.

Alnoor et al. (2024) demonstrate that electronic commerce platforms are now widely utilized as an alternative to traditional shopping, facilitated by Web 2.0 technologies. Due to a pro-technology bias, experts tend to focus more on adopting technology and less on the impact of e-WOM on customers' inclination to use social commerce. It addresses the gap by examining how e-WOM influences the intentions of both males and females, and how perceived crowding mediates this effect. This study employed dual-stage multi-group structural equation modeling and artificial neural networks (SEM-ANN). By incorporating both positive and negative aspects, as well as perceived crowding, we expanded e-WOM. Results show causal and non-compensatory links between constructs. SEM-supported variables are ANN model input neurons. The natural importance of the ANN approach indicates that individuals' social commerce intents are primarily focused on supporting the company, followed by essential functionalities. Technicalities and mistreatment more impact women. The ANN model predicts 97% of buyers' social commerce intents—the theoretical and practical consequences of boosting consumers' propensity to use social commerce channels.

Pham et al. (2025) demonstrated that electronic word-of-mouth (e-WOM) substantially influences tourist engagement (TE) and perceived value (PV), illuminating tourist motivation (MT), satisfaction (SA), and intention to revisit (RE). Significantly, trade-offs (TR) concerning monetary and non-monetary expenses adversely influence the relationship between PV and RE. This study emphasizes the mediating role of cognitive processes and the moderating effect of trade-offs in developing RE within the current situation.

It can be argued that several studies confirm the impact of e-WOM on tourists' decision-making choices.

6 CONCLUSIONS

E-WOM, which stands for electronic word of mouth, has a substantial impact on the decisions that travelers make on their destinations by molding their views, expectations, and decision-making processes. In contrast to the more conventional type of word-of-mouth communication, electronic word-of-mouth (E-WOM) is disseminated swiftly through various online platforms, including social media, travel blogs, review websites, and forums, where travelers share their experiences, thoughts, and feedback. The presence of positive evaluations and high ratings can increase the appeal of a destination by establishing trust and credibility, whilst the presence of negative comments might discourage future visitors. Since tourists frequently seek peer-generated

information to gain genuine insights, electronic word-of-mouth plays a crucial role in shaping a location's image, influencing itinerary design, and ultimately boosting tourism demand.

Electronic Word of Mouth (E-WOM) has a considerable impact on the selection of tourism destinations, as it provides potential tourists with access to information and opinions from previous visitors, which are often regarded as more objective. E-word-of-mouth (E-WOM) is composed of online reviews, social media posts, blogs, and forums. It is responsible for shaping the image of a location, influencing attitudes towards visiting, and ultimately driving travel intentions. Due to the intangible nature of tourism services, customers are highly reliant on referrals of this kind. This is because they are seeking to reduce the uncertainty and risk associated with their decisions. Negative word-of-mouth can discourage potential tourists from visiting a destination, while positive word-of-mouth can enhance the brand image of a destination, foster trust, and increase bookings. This highlights the significant role that word of mouth plays in the modern tourism marketing landscape.

7 RESEARCH IMPLICATIONS

In the realm of tourism, encompassing leisure and corporate travel, various digital components profoundly impact a tourist's experience:

7.1 Electronic Word-of-Mouth (E-WOM): This pertains to any affirmative or negative remarks made by prospective, current, or previous clients regarding a product or service (such as a holiday destination or hotel) that is disseminated to a wide audience through the internet. It constitutes online digital suggestions or critiques.

7.2 Online Reviews: A significant manifestation of electronic word-of-mouth (e-WOM), online reviews consist of user-generated evaluations and comments of tourism items or services, commonly located on platforms such as TripAdvisor, Google Reviews, or booking websites. They offer comprehensive feedback, evaluations, and frequently images, directly impacting prospective travelers.

7.3 Social Media Influencers: These individuals have cultivated a substantial following on social media platforms, and their thoughts and content are regarded as credible by their audience. In tourism, they present travel experiences, destinations, and services, serving as digital opinion leaders capable of inspiring and persuading their followers to visit specific locations.

7.4 Digital Marketing Content: This includes all types of content produced and disseminated via digital means to enhance tourism promotion. It encompasses captivating images and videos, blog

entries, destination manuals, targeted promotions, and interactive experiences, all intended to attract, inform, and convert prospective tourists.

7.5 Tourist Choice Decision: This refers to the procedure a tourist does when choosing a destination, lodging, activities, and other travel-related services. In the contemporary digital era, electronic word-of-mouth (e-WOM), online evaluations, social media influencers, and varied digital marketing content are essential in disseminating information, establishing trust, influencing perceptions, and eventually directing tourists in their decisions.

8 LIMITATIONS AND RECOMMENDATIONS

PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) is an evidence-based minimum set of criteria designed to assist scientific authors in reporting various systematic reviews and meta-analyses, primarily utilized to evaluate the advantages and disadvantages of healthcare interventions. The PRISMA method is a widely accepted systematic review, and it is recommended for use in further studies following the study by Siripipatthanakul & Phuangsuwan (2024).

This article is a review article that may not involve respondents. Therefore, it may not be very objective and requires further study, such as a questionnaire or interview survey, to gain a more in-depth insight for future research. Partial Least Squares Structural Equation Modeling (PLS-SEM) is recommended for testing the hypotheses with a mediator, following the study by Siripipatthanakul et al. (2025).

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