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RICE Journal of Creative Entrepreneurship and Management (RJCM)
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About Us

RJCM is an international journal for academics and scholars at the higher education level to communicate and share their viewpoints and academic work with fellow professionals in the areas of creative entrepreneurship and management as practiced in their fields of specializations in social sciences. Currently, it is under the supervision of Thai-Journal Citation Index (TCI).

RJCM publishes three numbers per volume annually and welcomes contributors to submit their manuscript in January, May, and September of each year. We accept both academic and research papers in social sciences from contributors. The papers are double-blind reviewed by three independent reviewers in each volume and published online-plus-print thrice a year.

The length of the unformatted manuscript in WORD can be 15-25 pages in length including references. The contents of the manuscript should include (1) a title with the author's name, affiliate, email address and telephone contact, (2) an abstract of 150 words with 3-5 keywords, (3) an introduction, (4) a rationale and background of the study, (5) research objectives, (6) research methodology, (7) data collection procedure, (8) data analysis, (9) results and discussion, (10) research limitation (if any), (11) conclusion, (12) acknowledgement(s) (if any), (13) the author's biography of about 50-80 words, 14) references, and (15) an appendix or appendices (if any).

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Note from the Editors of *RJCM* Volume 6 Number 2

Dear *RJCM* Readers,

You are now with our second issue in Year 6 of *RICE Journal of Creative Entrepreneurship and Management* (*RJCM*). This issue contains six articles in the areas of hospitality management, consumer process satisfaction, digital educational management, and new messages design in digital communication.

In this issue, we have two papers on hospitality management: *"Mapping Research Agenda of Sustainable Restaurants: A Bibliometric Approach (2014-2024)"* (Article 1), and *"Enhancing Human Resource Competency in Service Industry: A Case Study of Dusit Thani Hua Hin Hotel's Online Instructional Media Initiative"* (Article 2). One paper reports consumer process satisfaction: *"The Influence of Product Assortment on Consumer Process Satisfaction"* (Article 3). Two papers deal with digital educational management: *"Factors of Digital Leadership for Basic Educational Administrators in Nonthaburi Province, Thailand"* (Article 4), and *"Organizational Strategic Factors Affecting the Success of AI Technology Implementation for Higher Education Institution Management in Bangkok"* (Article 5), followed by the last paper on new messages design in digital communication *"A New Messages Design for Communication in the Digital Age"* (Article 6). We also have an essay on sharing professional viewpoints on the issue of *College Students in Agriculture Need Knowledge Sharing for Professional Skills Development*. These papers report interesting findings and current issues in the areas under study.

Our paper contributors in the second issue of 2025 are researchers from seven higher education institutions in the central part of Thailand: (1) Ramkhamhaeng University, (2) The University of the Thai Chamber of Commerce, (3) Dusit Thani College, (4) Rajamangala University of Technology Rattanakosin, (5) Rajapruk University, (6) Shinawatra University, and (7) Advanced Future Talent Academy.

The editors hope that the research findings and current developments reported in these papers will be interesting to both researchers and practitioners in similar fields of study. The *RJCM* editorial team and the authors would appreciate our readers' comments about these articles, if possible. We always welcome contributions from those who may wish to be part of our *RJCM* network.

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Address from RICE Director

Nuttapong Jotikasthira, Ph.D.
Rattanakosin International College of Creative Entrepreneurship (RICE)
Rajamangala University of Technology Rattanakosin (RMUTR), Thailand

Dear *RJCM* Readers,

The current year 2025 has led us to encounter the high capacity of AI in helping students and scholars to think, write and produce academic work at different levels. We are also in need of a new definition of *plagiarism*—originally confined to copying human work. School teachers and university professors have to think urgently how they can convince their students and junior colleagues to use AI as an assistant, not as a master or a torch holder to show an easy path to them—ranging from handling assignments as required in the curriculum to delivering research proposals, final research reports, dissertations, or even the academic-rank qualifying papers. It is certain that scholars, educators, and practitioners rely more on AI as smart assistants to reach their targets in all fields of study and work. However, we cannot deny that professionals who rely on AI to execute their work need to discipline themselves for self-respect in using AI to help them produce documents or professional writing, and without shame claim the product of human counterfeit as their own.

Since the release of ChatGPT-4 in late 2023 and recently DeepSeek in early 2025, we have seen more pervasive effects of AI writing on the finished products of academic work that qualify for specific gains like a pass level, a degree, an award, a publication, and even qualifying work for academic ranking. At this point, we perhaps cannot jump to a conclusion that academic work with AI footprints should be classified as cybercrimes or fraud cases to reach the high level of the academic ladder. Our big concern, in fact, rests upon how we can reason with those who blindly rely on their AI assistant to do the work for them, to halt for self-esteem and particularly conscience in reminding themselves of how they can justify ownership of work that is not their brainchild. This might be too untimely to figure out possible solutions at this moment, simply because scholars, researchers, and educational practitioners would need time to experiment with possible strategies for learning development at the re-paradigm level. We can now only safeguard ourselves and our academic environment not to be too infested with human counterfeit effects as apparent in the finished writing products.

All of the above are my matters of concern for academic well-being of all stakeholders. Let me say again that I feel grateful to all the authors for contributing their work to our academic communities. Your academic/research papers within the framework of professional ethics in different fields of creative entrepreneurship and management certainly support the growth of *RJCM* and you as authors always have our journal team's appreciation along with you.

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Mapping Research Agenda of Sustainable Restaurants: A Bibliometric Approach (2014-2024)

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Abstract

This study maps the research landscape of sustainable restaurants from 2014 to 2024 through a bibliometric approach, analyzing publication trends, collaborative networks, and critical themes. Using 78 publications from the Web of Science, this study applies CiteSpace to visualize author, institutional, and country-level contributions. The analyzed results show a post-2020 surge in publications, reflecting increased academic and industry interest. Countries, such as Australia, China, and England emerge as significant contributors, along with institutions like Kyung Hee University in South Korea, highlighting global collaboration. Key themes include environmental impact, waste management, consumer behavior, and the role of technologies like Artificial Intelligence (AI) and blockchain in resource optimization. This study emphasizes accessible sustainability solutions, more robust policy frameworks, and the potential for interdisciplinary and cross-regional collaborations. The obtained findings offer valuable insights for academia and industry, supporting the integration of sustainability practices in response to evolving environmental and consumer needs.

Keywords: *Sustainable restaurants, environmental impact, waste management, resource optimization*

1. Introduction

Sustainability is about meeting today's needs without limiting future generations' ability to meet theirs and emphasizes responsible resource use across three pillars: environmental, economic, and social (Ranjbari et al., 2021). Environmentally, sustainability involves conserving resources and minimizing pollution; economically, it promotes growth that does not deplete resources; and socially, it fosters equity and well-being within communities (Zhou et al., 2024). By balancing these pillars, sustainability aims to create a resilient world where resources are preserved, economies are stable, and societies are inclusive, ensuring a healthy environment for future

generations. The development of sustainable restaurants is driven by the goal of reducing environmental impact while promoting social responsibility and long-term economic viability (Bui & Filimonau, 2021). Central to this pursuit is the adoption of resource-efficient practices, such as minimizing energy and water consumption, reducing food waste through recycling and composting, and sourcing locally produced organic ingredients to lower carbon footprints and support sustainable agriculture (Luttenberger, 2020).

Additionally, sustainable restaurants aim to foster social responsibility by offering fair wages to employees, supporting local communities, and engaging in ethical business practices (Mejia et al., 2022). Moreover, these establishments focus on promoting consumer health by providing nutritious, eco-friendly meal options, often emphasizing plant-based and organic foods. The overarching objective is to balance environmental stewardship with financial success, ensuring that the restaurant remains economically viable while aligning with the growing consumer demand for sustainability in the hospitality industry (Perrigot et al., 2021).

In recent years, green restaurants have become increasingly fashionable as various industries strive to achieve sustainability goals (Liu et al., 2020). Sustainable restaurants operate in ways that minimize their negative environmental impact while contributing to social and economic sustainability (Joshua et al., 2023). These establishments reduce waste, conserve energy, and source ingredients responsibly, often emphasizing local, organic, and seasonal foods to reduce the carbon footprint associated with transportation and industrial farming. In addition to careful menu planning, composting, and recycling, many sustainable restaurants invest in energy-efficient appliances and water-saving technologies to reduce resource consumption, further enhancing their environmental contributions (Agusdinata et al., 2024).

Beyond environmental considerations, sustainable restaurants also focus on ethical business practices. This includes ensuring fair labor conditions, supporting local farmers and suppliers, and engaging with the community to promote social well-being. The goal of a sustainable restaurant is to create a balance between profitability and responsibility, ensuring that its operations benefit both the environment and society while meeting the demands of environmentally-conscious consumers. This holistic approach, which extends beyond environmental concerns, contributes to social sustainability by promoting healthy eating, enhancing community well-being, and fostering greater awareness about food ethics and sustainability among consumers (Zeng & Botella-Carrubi, 2023).

Sustainable restaurants have become a focal point in both academic discourse and industry practice due to their pivotal role in promoting environmental stewardship, resource efficiency, and ethical consumption (Huang et al., 2023). They mitigate the environmental impact of the food service industry by adopting a wide range of eco-friendly practices, such as sourcing locally-grown, organic, and seasonal ingredients, reducing food waste through innovative waste management systems, and implementing energy-efficient technologies. Additionally, sustainable restaurants often prioritize fair trade and support local economies by partnering with nearby farmers and suppliers, creating a more resilient and localized food supply chain (Wentworth et al., 2023).

Sustainable restaurants address both environmental and social sustainability concerns, positioning sustainable restaurants as crucial contributors to the broader global effort to combat climate change and promote sustainability (Heydari, 2024).

The rise of sustainable restaurants is closely tied to global environmental challenges, particularly the urgency to address climate change, reduce greenhouse gas emissions, and conserve natural resources (Lucchi et al., 2024). In response to increasing consumer demand for environmentally responsible dining options, many restaurants have shifted toward sustainability, recognizing it as a necessary step toward long-term viability (Radnitz et al., 2023). This shift has sparked a growing body of academic research that investigates various dimensions of sustainability in the restaurant industry, including business models, consumer behavior, regulatory frameworks, and the economic viability of sustainable practices.

Academically, sustainable restaurants are explored through interdisciplinary lenses, encompassing environmental science, economics, sociology, and business management. Researchers have examined the financial implications of adopting sustainable practices, the challenges and opportunities in integrating sustainability into restaurant operations, and the role of consumer perceptions in influencing restaurant sustainability efforts (Suttikun & Mahasuweerachai, 2023). Moreover, the literature has expanded to assess the social and ethical implications of sustainability, particularly how restaurants can contribute to broader societal goals, such as reducing inequality and promoting public health (Ahmad et al., 2024). Comprehensive research on sustainable restaurants is crucial for guiding policy decisions, informing industry best practices, and fostering a culture of sustainability that meets current environmental, economic, and social needs without compromising the ability of future generations to do the same.

A bibliometric analysis of restaurant sustainability is beneficial for identifying key trends, influential research, and significant contributors in the field. It allows researchers to map the evolution of sustainability practices in the restaurant industry over time and highlight the most frequently cited studies, journals, and authors. Furthermore, this type of analysis can uncover gaps in the existing literature, guiding future research toward unexplored areas, such as the integration of new technologies, consumer behavior, and policy implications in sustainable dining. It also helps in understanding the collaborative networks between institutions and countries, shedding light on the global and interdisciplinary nature of sustainability research. Ultimately, a bibliometric analysis provides valuable insights into the progression of knowledge, informing both academic discourse and practical applications in restaurant sustainability.

Therefore, this study aims to construct a knowledge map of collaboration among authors, institutions, and countries in the field of sustainable restaurant research and illustrate co-occurrence networks, clustering, and burst analysis of keywords related to sustainable restaurants. These analyses serve to explore the primary research hotspots and forecast future research trends in sustainable restaurant development. By mapping the collaborative landscape and examining key themes, this research seeks to deepen the understanding of the evolving focus areas within sustainable restaurant studies, offering valuable insights for advancing sustainability practices in sustainable restaurants and identifying opportunities for future scholarly investigation.

Next, we conducted a literature review. The third part focuses on research methods and explains the process of data collection and analysis. The fourth part is the construction and explanation of the knowledge graph. Finally, the study was discussed and summarized.

2. Literature Review

Sustainable restaurants have gained considerable attention due to the sector's significant environmental impact (Di Pierro et al., 2023). Sustainability in restaurants encompasses efforts to minimize environmental degradation through practices, such as reducing waste, conserving energy and water, and adopting eco-friendly materials (Yong et al., 2024). While some businesses see sustainability as a tool for improving operational efficiency and branding, others perceive it as a moral obligation to reduce their ecological footprint (Opoku et al., 2023).

Green practices in restaurants are characterized by strategies that reduce the environmental burden of daily operations (Kanwal et al., 2024). These can range from optimizing resource usage—such as reducing water and energy consumption—to better waste management techniques, including food waste reduction and composting (Zhu et al., 2023). Restaurants also incorporate sustainable practices in their supply chains, such as sourcing locally grown organic produce and using biodegradable packaging materials (Jia et al., 2024).

Various factors influence the adoption of sustainable practices in the restaurant industry. These include growing consumer demand for eco-friendly options, regulatory pressures, and the pursuit of a green image that can enhance brand loyalty (Chung, 2020). Additionally, sustainable practices are often driven by internal organizational commitments, with restaurant owners and managers taking the lead in embedding sustainability into their core values (Tabrizi et al., 2023).

Despite the increasing adoption of green practices, many restaurants still face significant challenges in fully integrating sustainability into their operations. The high levels of consumption intrinsic to the hospitality sector, including overreliance on disposable materials and excessive resource use, pose hurdles to achieving genuine sustainability (Ribera Jemio et al., 2024). Moreover, sustainability efforts are often constrained by financial limitations, as many restaurants operate on thin profit margins, which can hinder investment in sustainable technologies and processes (Mejia et al., 2022). Implementing sustainable practices can lead to both operational and reputational benefits for restaurants. Studies have shown that restaurants with a solid green image tend to enjoy higher customer loyalty, which in turn enhances overall firm performance (Tosun et al., 2022). Additionally, energy-saving technologies and better waste management systems can result in significant cost savings over time (Chauhan et al., 2022).

The sustainability discourse in the restaurant industry also touches on social sustainability, particularly labor practices. Issues such as low wages, high staff turnover, and precarious employment conditions are prevalent in the industry and need to be addressed as part of a holistic approach to sustainability (Jain et al., 2024). Sustainable human resource management (HRM) practices, including fair wages and employment security, are essential for fostering a stable workforce that is committed to

sustainability goals (Rahi, 2023). Sustainable restaurant practices are becoming increasingly important as both environmental and social concerns grow in prominence. While many challenges remain, including financial constraints and ingrained unsustainable behaviors, the benefits of adopting green practices—both in terms of operational efficiency and customer loyalty—are clear (Hermundsdottir & Aspelund, 2022). The restaurant industry must continue to evolve by integrating sustainability into all facets of its operations, from supply chain management to HR practices.

In conclusion, a bibliometric analysis of sustainable restaurants is valuable for identifying research hotspots, trends, and gaps in this field. By systematically analyzing existing literature, researchers can uncover critical factors influencing the adoption of sustainability practices in restaurants, such as consumer demand, regulatory pressures, and the pursuit of brand loyalty. Additionally, bibliometric analysis helps assess the implementation of green practices across different countries or regions, highlighting global variations in sustainability challenges and solutions. By incorporating dimensions, such as supply chain management, energy efficiency, and human resource management, bibliometric analysis provides scholars and practitioners with a comprehensive knowledge base, fostering interdisciplinary collaboration and innovation and further advancing sustainability in the restaurant industry.

3. Research Method

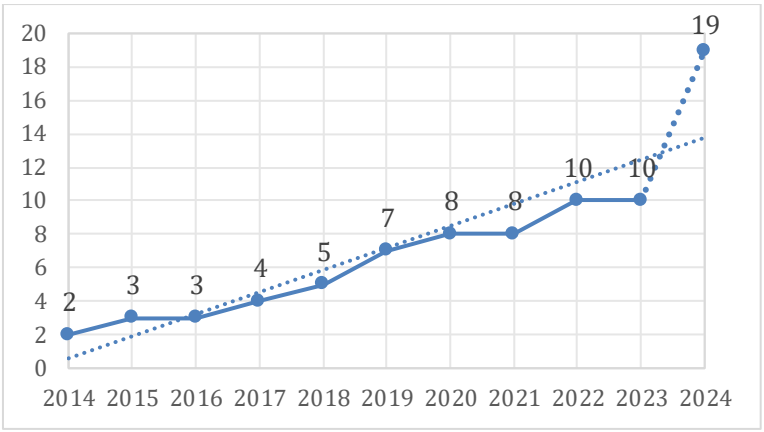
This study utilizes CiteSpace to conduct bibliometric analysis to investigate the development of sustainable restaurant research over the past decade (2014-2024). Bibliometric analysis is a quantitative approach that evaluates scientific publications, citations, and co-authorship patterns to identify key trends and influential contributions in a given field (Luo et al., 2022). Data were collected from the Web of Science, using search terms, such as "sustainable restaurants," "environmental management," and "green dining." TH= "Sustainable practices in the restaurant industry." The search was limited to peer-reviewed journal articles, conference papers, and review articles, excluding non-peer-reviewed sources. The final dataset included 78 relevant publications, providing a comprehensive foundation for analyzing the intellectual landscape of sustainable restaurant research.

4. Results

4.1 Publication Trend

The publication trend over the years shows significant growth, as shown in Figure 1, especially after 2020, when the number of contributing authors increased notably. In 2023, 10 authors published research on sustainable restaurants, and this number is projected to rise to 19 in 2024, suggests a rapidly expanding interest in the topic, likely driven by increasing global awareness of environmental sustainability and the restaurant industry's role in mitigating climate change. The sharp rise in publications in 2023 and 2024 reflects not only academic engagement but also the growing societal and industry pressures to adopt sustainable practices.

Figure 1: Publication Trend for Sustainable Restaurants



4.2. Authors' Cooperation Knowledge Maps

Table 1 provides an overview of the authors and their respective publication output in sustainable restaurant research between 2019 and 2024. Batat Wided stands out as the most prolific contributor, with three articles published in 2020 indicating significant engagement in this field during that period. Several other authors, including Wijesinghe Gayathri and Higgins-desbiolles Freya, both with two publications in 2019, and Choe Ja Young (Jacey), Hwang Jinsoo, and Filimonau Viachaslau, who each published two articles in 2020, highlight 2020 as a peak year for research activity, suggests that the topic of sustainability in the restaurant industry attracted considerable academic attention during this year, likely reflecting increased global interest in environmental sustainability.

In addition to these 2020 contributions, Wellton Lotte is noted for two publications in 2021, while Cho Meehee contributed two articles in 2023, demonstrating continued research momentum in this area. The table also features newer entries, such as Hughes Allison Felix with one article in 2022 and Cheng Ranis with an upcoming publication in 2024, indicating that the research on sustainable restaurants is ongoing and continues to evolve. Overall, the table highlights the concentration of academic activity in the early 2020s, with critical authors contributing consistently over this period, and signals that research in this field is still actively progressing.

Table 1: Recent Publications by Key Authors

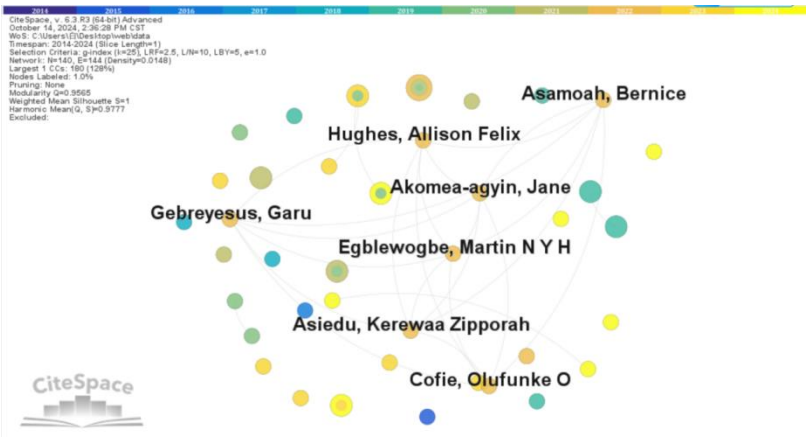
Article	Year	Author
3	2020	Batat, Wided
2	2019	Wijesinghe, Gayathri
2	2019	Higgins-desbiolles, Freya
2	2020	Choe, Ja Young (Jacey)
2	2021	Wellton, Lotte
2	2020	Hwang, Jinsoo
2	2020	Filimonau, Viachaslau
2	2023	Cho, Meehee
1	2024	Cheng, Ranis
1	2022	Hughes, Allison Felix

In analyzing the contributions of authors in the field of sustainable restaurants, the data reveals a clear distinction between core contributors and occasional participants. Batat, Wided stands out with three publications, positioning her as a central figure in the research landscape of sustainable restaurants. Other authors, such as Cho, Meehee, Filimonau, and Viachaslau, have contributed two publications, each indicating their consistent engagement with the topic. The majority of authors, however, have only one publication, suggesting either a one-time contribution or involvement in cross-disciplinary collaborations. On average, each author has contributed approximately 1.1 publications, highlighting a relatively dispersed pattern of research contributions without highly concentrated authorship.

In terms of collaboration intensity, most authors appear to work independently or in small teams, with relatively few instances of recurring collaborations between the same sets of authors. The absence of a dense collaboration network implies that the field is still emerging, with researchers likely coming from diverse disciplinary backgrounds, contributing to the broadening of perspectives in sustainable restaurant studies. However, the relatively low average number of publications per author (1.1) suggests that deeper collaborations and more prolific partnerships may develop as the field matures. The data also highlights critical publication years, such as 2020, where multiple authors published in the field, marking a peak in research activity. This surge may be attributed to a heightened global focus on sustainability in response to the U.N.'s Sustainable Development Goals (SDGs) and the food industry's critical role in addressing these challenges. The steady increase in publications leading up to 2024 demonstrates the growing recognition of sustainable restaurant research as an essential part of environmental studies, hospitality management, and consumer behavior research.

In conclusion, the author's collaboration knowledge map for sustainable restaurant research shows a field that is growing in both breadth and depth (see Figure 2). While still relatively dispersed in terms of collaborative intensity, the increasing number of contributors and publications indicates that this area is becoming more established within the academic community. Moving forward, fostering stronger cross-disciplinary and cross-regional collaborations could further enrich the research, driving innovation and practical solutions for sustainability in the restaurant industry.

Figure 2: Co-Authorship Network of Key Researchers' Studies (2014-2024)



4.3 Network Visualization of Sustainable Restaurant Agency Collaboration

Table 2 provides an overview of institutional contributions to a research network, as indicated by frequency, centrality, and year of contribution. Frequency reflects the number of times each institution has appeared in the dataset, with Griffith University and Kyung Hee University standing out for their higher frequencies (3 each), suggesting more substantial involvement in the research field. Institutions such as Bournemouth University, University of Lyon 2, and E.M. Normandie Business School also exhibit a frequency of 3, indicating consistent participation, though potentially with less influence given their lower centrality scores. Centrality measures an institution's prominence or influence within the research network, reflecting how well-connected it is to other institutions. Notably, Kyung Hee University (0.02) and Griffith University (0.01) exhibit higher centrality values, indicating that these institutions occupy more influential roles within the collaborative research network. In contrast, the remaining institutions have centrality scores of 0, suggesting their contributions, while present, are not as integrated into the broader research collaboration framework.

The year of contribution reveals that research activities from these institutions span from 2017 to 2023. While Griffith University is noted for its contributions in 2018, Kyung Hee University shows recent activity in 2023, highlighting its ongoing relevance in the research network. Other institutions, such as Bournemouth University and Sejong University, made significant contributions in 2020, which appears to be a peak year for research collaboration among several institutions. Overall, Table 2 highlights the central role of institutions, such as Griffith University and Kyung Hee University in sustainable research efforts while also illustrating the diverse international participation in this field, encompassing both highly influential universities and smaller institutions with more limited centrality in the network.

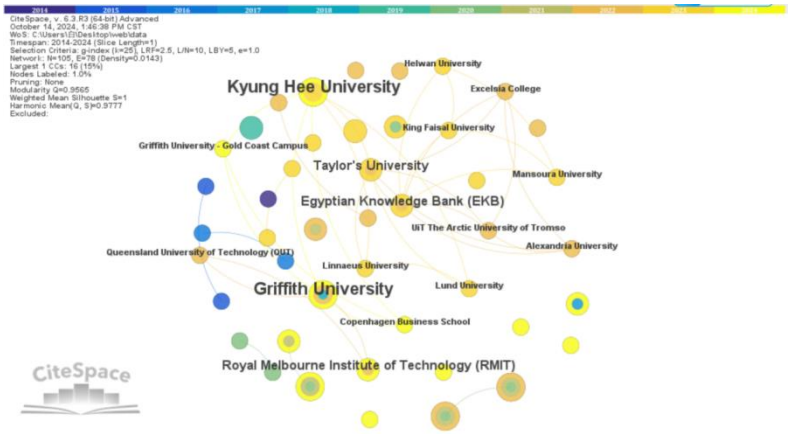
Table 2: Institutional Contributions to Recent Research

Frequency	Centrality	Year	Institution
3	0.01	2018	Griffith University
3	0	2020	Bournemouth University
3	0	2020	Univ Lyon 2
3	0	2020	E.M. Normandie Business Sch
3	0.02	2023	Kyung Hee University
2	0	2017	National Pingtung University Science & Technology
2	0	2021	Transylvania University of Brasov
2	0	2023	Ministry of Education & Science of Ukraine
2	0	2022	Royal Melbourne Institute of Technology (RMIT)
2	0	2020	Sejong University

Figure 3 network visualization provides a detailed representation of the institutional collaborations in sustainable tourism and hospitality research from 2014 to 2024. The size of each node reflects the prominence of an institution's research output, with larger nodes, such as Kyung Hee University, Griffith University, and the Royal Melbourne Institute of Technology (RMIT) indicating their significant contributions to this field. These institutions have played central roles in producing research and fostering international collaborations. The thickness of the connecting lines between nodes represents the strength of co-authorship relationships, with thicker lines denoting more frequent collaborations compared to thinner lines, which indicate less frequent collaborations. For instance, Griffith University and Queensland University of Technology (QUT) are well-connected, reflecting their active research partnerships. Similarly, Kyung Hee University exhibits strong connections with Taylor's University, Helwan University, and King Faisal University, indicating a broad and influential international research network.

The colors of the nodes, ranging from blue to yellow, indicate the periods during which institutions were most active in this research area. Blue and green nodes represent institutions that were active earlier in the timeline, such as Queensland University of Technology and Griffith University – Gold Coast Campus, which were critical contributors during 2014-2017. In contrast, yellow and orange nodes, including Kyung Hee University and RMIT, highlight institutions that have become more prominent in recent years (2021-2024). The network reveals significant international collaboration, with institutions like the Egyptian Knowledge Bank (EKB) and Taylor's University engaging in co-authorship relationships across diverse regions. Overall, this network demonstrates the global nature of sustainable tourism research, with long-standing institutions maintaining their influence while newer ones gain prominence, all contributing to the evolving research landscape in this critical field.

Figure 3: Sustainable Restaurant Institutional Cooperation Map



4.4 Analyzing Country-Level Contributions and Co-Authorship Trends

Table 3 provides insights into the research contributions of various countries, measured by quantity, centrality, and year. Australia and China lead with ten contributions each, reflecting their significant involvement in research output, followed closely by England (7) and South Korea (6). In terms of centrality, which indicates a country's influence within the research network, England (0.22), China (0.18), and Australia (0.15) show the highest levels, suggesting their pivotal roles in international research collaborations. South Korea (0.12) and Italy (0.09) also hold notable positions in the network, while countries like France, Sweden, Spain, and Thailand have a centrality of 0, indicating less integration into the global research collaboration framework despite their contributions.

The year column highlights peak research activities, with Australia and Brazil showing notable contributions in 2018, while China, England, South Korea, and France saw significant activity in 2020, marking it as a critical year for research collaboration. More recent contributions from Italy were recorded in 2023, reflecting its continued engagement in the research network. Overall, the data points to Australia, China, and England as central players in the research landscape, with South Korea and Italy contributing meaningfully. The diverse geographic spread of countries underscores the global nature of research in this field, with varying degrees of collaboration and influence across regions.

Table 3: Country Contributions to Research by Year and Centrality

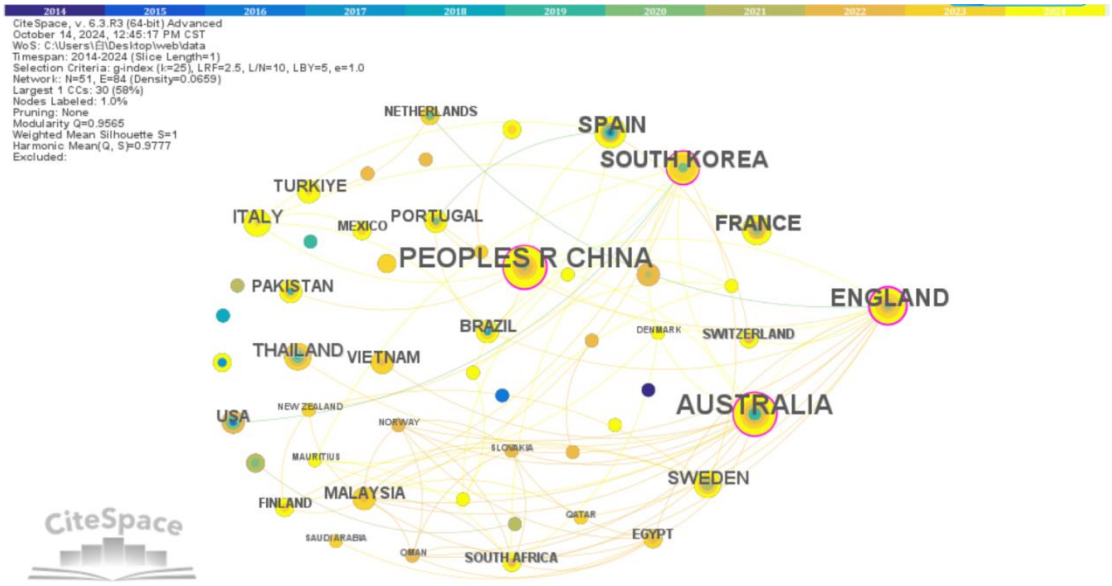
Quantity	Centrality	Year	Country
10	0.15	2018	Australia
10	0.18	2020	People's R China
7	0.22	2020	England

6	0.12	2020	South Korea
6	0.01	2015	Spain
5	0	2020	France
4	0.09	2023	Italy
4	0	2021	Sweden
4	0	2019	Thailand
3	0.03	2018	Brazil

Figure 4 provides a detailed visualization of the collaborative relationships between nations in sustainable tourism and hospitality research from 2014 to 2024. The size of each node represents the frequency of a country's research contributions, with larger nodes, such as China, Australia, England, and South Korea, indicating their prominent roles in driving research in this field. The thickness of the lines between nodes represents the strength of co-authorship, with thicker lines signifying more frequent collaborations. Strong connections, particularly between China, Australia, and England, suggest that these nations are central hubs in the global research network, fostering extensive international partnerships. Additionally, countries like Spain, France, and Thailand also demonstrate active involvement in international collaborations, reflecting the global nature of sustainable tourism research.

The color coding of the nodes indicates the temporal evolution of each country's research activity. Blue and green nodes, such as the USA and Pakistan, represent countries that were more active earlier in the timespan, while yellow and orange nodes, such as China, Australia, and England, reflect countries that have been more involved in recent years (2021-2024). The pink rings around certain nodes, including China, Australia, and England, highlight countries that have experienced significant bursts of research activity, indicating a surge in publications and collaborations in recent years. This surge points to increased research output and engagement from these countries. This growing involvement suggests an increasing focus on sustainability within these nations, making them critical contributors to the global research agenda. Overall, this network underscores the global collaboration patterns in sustainable tourism research, with significant research hubs leading the field and fostering widespread academic cooperation across multiple continents.

Figure 4: Global Collaboration Network in Sustainable Restaurant Research (2014-2024)



4.5 Keyword Co-occurrence Network

Table 4 presents an analysis of keywords in sustainable tourism and hospitality research based on frequency, centrality, and year, offering insights into the prominence, connectivity, and evolution of key themes. In terms of frequency, management (18 occurrences) is the most frequently cited keyword, highlighting its centrality in discussions on sustainable practices and strategies within the industry. Food waste (13 occurrences) also appears prominently, reflecting the sector's focus on reducing waste and improving resource efficiency, followed by behavior and industry (both with 11 occurrences), indicating a strong interest in consumer actions and the broader industrial context of sustainability. Keywords like tourism (10), restaurants (9), and green practices (7) suggest growing attention to specific applications of sustainability principles in these areas. Centrality measures the influence of keywords in connecting different research topics, with behavior (0.46) exhibiting the highest centrality, suggesting it plays a pivotal role in linking diverse areas of research, such as consumer behavior and environmental impact. Keywords like management (0.13), food waste (0.11), and impact (0.11) also show moderate centrality, indicating their importance in integrating multiple research strands.

In contrast, performance (0.02) and perceptions (0.03) are more isolated topics with lower centrality. The temporal analysis shows that food waste and performance gained prominence in 2014, reflecting early concerns with operational efficiency, while keywords like behavior (2018) and green practices (2019) emerged later, signaling a shift toward understanding consumer actions and sustainability adoption. More recently, restaurants (2022) have become a key area of focus, reflecting contemporary concerns about sustainability in the food service sector. Overall, the analysis demonstrates the evolving nature of research in this field, with early studies emphasizing operational efficiency, while recent years have seen a growing interest in

consumer behavior and specific sectoral applications of sustainability.

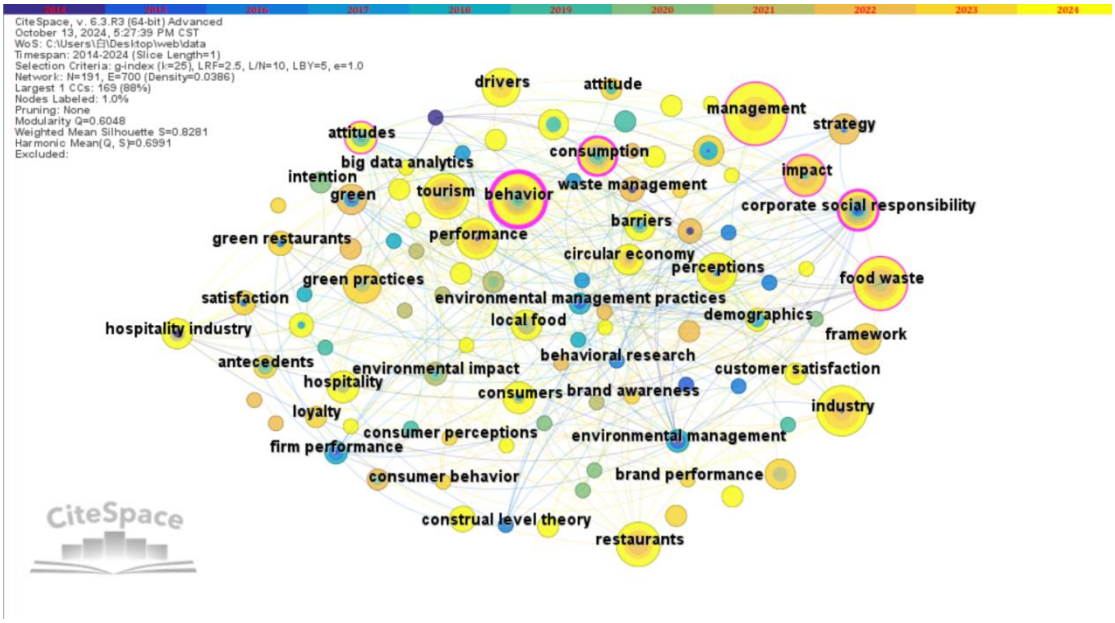
Table 4: Essential Research Keywords by Frequency and Centrality

Frequency	Centrality	Year	Keyword
18	0.13	2016	management
13	0.11	2014	food waste
11	0.05	2015	industry
11	0.46	2018	behavior
10	0.06	2017	tourism
9	0.09	2022	restaurants
8	0.03	2015	perceptions
8	0.11	2016	impact
8	0.02	2014	performance
7	0.07	2019	green practices

The keyword co-occurrence network illustrates the evolving research landscape in sustainable tourism and hospitality from 2014 to 2024 (see Figure 5). The size of the nodes in the network represents the frequency of each keyword's appearance in the literature, with larger nodes, such as tourism, behavior, corporate social responsibility (CSR), food waste, and the hospitality industry, indicating central themes in the field. These high-frequency keywords reveal the dominant areas of academic focus, particularly in understanding consumer behavior, corporate ethics, and sustainability practices. The connections (edges) between nodes reflect co-occurrence relationships, where thicker lines represent stronger associations between concepts. For example, behavior shows strong connections with tourism, CSR, and environmental management, suggesting its role as a crucial linking concept across various research areas. This interconnectedness highlights the multidisciplinary nature of sustainability research, where themes like consumer behavior, corporate responsibility, and environmental impacts are explored in relation to each other.

The color of the nodes represents the period when each keyword gained prominence, providing insight into the shifting focus of research over time. Earlier themes (2014-2018), represented by blue and green nodes, such as the hospitality industry and consumer behavior, indicate foundational areas of study. More recent topics (2021-2024), depicted by yellow and orange nodes, include emerging themes like big data analytics, waste management, and local food, pointing to the increasing importance of technology and sustainability in research. Furthermore, the pink rings around specific nodes denote burst keywords, which have seen a surge in academic attention during specific periods. Keywords, such as behavior, corporate social responsibility, and food waste indicate that these areas are growing in significance, reflecting current priorities in sustainability, corporate ethics, and waste reduction. Overall, the network reveals the central and emerging themes in sustainable tourism and hospitality, highlighting a field that is expanding from traditional topics into more data-driven and technologically innovative areas.

Figure 5: Keyword Co-occurrence Network in Sustainable Restaurant Research (2014-2024)



4.6 Critical Research Clusters and Keywords

Figure 6 illustrates the critical research clusters in sustainable tourism and hospitality from 2014 to 2024, depicting the co-occurrence relationships between various keywords in academic publications. The clusters are color-coded and numbered, highlighting distinct research themes.

The network analysis of sustainable tourism and hospitality research from 2014 to 2024 reveals several key clusters that underscore the interdisciplinary focus of the field. Cluster 0: Environmental Impact stands out as the most central, highlighting the critical importance of addressing the environmental consequences of tourism activities. This cluster emphasizes research on reducing the sector's ecological footprint, including efforts to mitigate biodiversity loss and carbon emissions. Similarly, Cluster 3 and Cluster 5 focus on operational practices within the hospitality sector, such as reducing waste, optimizing resource use, and enhancing organizational sustainability, thereby highlighting critical areas of improvement for sustainable practices in the industry. These clusters underscore the growing recognition of the need for improved resource management and corporate responsibility to ensure long-term environmental sustainability in tourism.

On the behavioral side, Cluster 2: Attitudes and Cluster 4: Cognitive Triggers explore how consumer attitudes and decision-making processes impact the adoption of sustainable tourism practices. These clusters investigate the psychological drivers, including values and beliefs, that influence tourists' sustainability choices. Expanding on this, Cluster 6: Cognitive Driver delves deeper into the motivations behind sustainable behaviors, exploring how preferences and identity shape consumer actions. Meanwhile, Cluster 8: Sustainable Tourism Measures focuses on the implementation of specific policies and practices that promote sustainability, reflecting newer research trends. Together, these clusters demonstrate a comprehensive approach to sustainability in tourism, where both operational strategies and consumer behavior play pivotal roles

in advancing sustainable practices in the industry.

Figure 6: Key Research Clusters in Sustainable Restaurant (2014-2024)

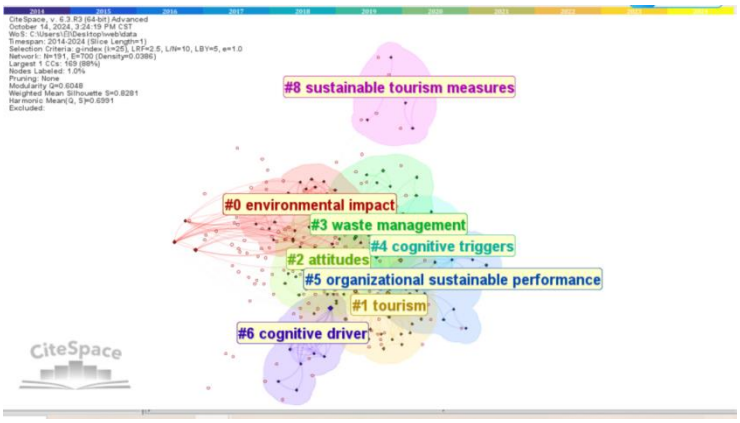


Table 5 provides an in-depth analysis of critical research clusters in sustainable tourism, hospitality, and restaurant management from 2016 to 2022, highlighting the evolving trends and focal points in academic studies. Early research, such as the 2016 cluster on sustainable holidays and ethical standards, laid the groundwork for integrating ethical principles into tourism practices. By 2020, the focus had shifted significantly toward environmental impact, food consumption, and sustainable food practices, particularly in full-service restaurants, reflects a growing awareness of environmental concerns, with keywords like green dining and holistic sustainability emphasizing comprehensive approaches to sustainability in the hospitality sector. Similarly, the 2019 cluster on waste management and circular practices highlights the industry's movement toward the circular economy, prioritizing resource management and waste reduction to meet global sustainability targets.

Corporate governance and organizational performance have also emerged as significant themes in sustainable tourism and hospitality research. In 2017, keywords such as corporate governance mechanisms, content analysis, and supply chain management suggest a focus on firm performance and the implementation of sustainable business practices. This trend underscores the importance of integrating sustainability into strategic decision-making and operational models to achieve long-term success. The 2021 cluster builds on this by exploring the role of big data analytics and online customer reviews in promoting sustainability. In particular, businesses are increasingly leveraging environmentally-framed reviews to understand consumer expectations and refine their sustainability efforts, especially in the context of sustainable restaurants and food service businesses.

Consumer behavior and psychology are also central to the development of sustainability in tourism and hospitality. The 2020 cluster on consumer attitudes, premium pricing, and satisfaction suggests that consumers' willingness to pay for sustainable options is influencing business strategies. Additionally, the 2019 cluster on behavioral intention and cognitive drivers highlights how experimental interventions are used to explore the factors that shape consumer decision-making in sustainable

environments, such as indoor innovative farm restaurants. These clusters reflect the growing focus on understanding consumer psychology and how it can drive sustainable behaviors. More recent research, such as the 2022 cluster on territorial differences and regional clusters, emphasizes the need for region-specific sustainability strategies in tourism, mainly through concepts like circular destination assessment. This regional focus signals the increasing recognition that sustainability requires context-specific solutions tailored to local environmental and cultural conditions.

Table 5: Research Clusters and Keywords in Sustainability and Hospitality (2016-2022)

Cluster	Centrality	Year	Keywords
1	0.856	2020	environmental impact; food consumption; cooking scale; sustainable food practice; full-service restaurant
2	0.873	2017	tourism companies; econometric analysis methods; corporate governance mechanisms; content analysis; situational factors
3	0.678	2021	sustainable practices; online customer reviews; environmentally-framed reviews; hospitality industry; big data analytics
4	0.761	2019	waste management; hospitality industry; resource management; circular practices; tourism research
5	0.89	2021	brand attitude; brand performance; consumer behavior; green restaurants; brand awareness environmentally-framed reviews; hospitality industry; sustainable practices
6	0.748	2020	consumer attitude; premium price; consumer satisfaction; sustainable practices; consumer willingness
12	0.991	2019	behavioral intention; demographic factor; cognitive driver; indoor smart farm restaurant; experimental intervention
6	0.948	2022	territorial differences; circular destination assessment; regional clusters; sustainable tourism measures; sustainable decision-making
4	1	2016	sustainable holiday; ethical standard; travel agent; eco-friendly certifications; green consumerism

Table 6 presents the burst keywords in sustainable tourism and hospitality research, with a specific focus on sustainable restaurants from 2014 to 2024. Each keyword reflects a period during which it gained significant academic attention, marked by its strength, beginning, and end year. The keywords highlight various themes and trends that have shaped the research landscape, illustrating how the focus of sustainability research has shifted over time.

One of the prominent themes in this table is environmental sustainability. The keyword environmental sustainability shows the most substantial burst value of 2.08 from 2020 to 2021, reflecting a heightened academic interest in this area, particularly in relation to how businesses in the tourism and restaurant industries address environmental challenges. Similarly, environmental management (1.54) was a key focus earlier, from 2014 to 2018, emphasizing how organizations were being

scrutinized for their role in managing environmental impact. This trend is continued with environmental impact (1.13), which gained momentum between 2018 and 2021, showing a sustained concern with the consequences of tourism activities on ecosystems. These bursts collectively highlight the growing emphasis on mitigating the environmental impacts of tourism and hospitality operations over the years.

Another critical theme relates to organizational performance and sustainability practices. Keywords like firm performance (1.6) and environmental management practices (1.06) between 2015 and 2018 indicate a period where academic research linked sustainable practices with business outcomes. These keywords suggest a focus on how sustainability initiatives can improve operational efficiency and competitiveness. As sustainability became more embedded within organizational practices, the keyword framework (1.29) began to gain attention from 2021 to 2024, reflecting efforts to develop structured approaches for implementing sustainability in the tourism and hospitality industries. Additionally, keywords, such as impact (1.51) and industry (1.19) signal that recent research has begun assessing the broad-scale effects of sustainable initiatives across the entire sector.

Table 6 also reflects a significant interest in behavioral and cognitive factors that influence sustainability. Keywords like attitudes (1.01) and antecedents (0.96), which saw bursts from 2018 to 2020, suggest that research during this period focused on understanding the psychological and social drivers behind sustainable behavior among consumers and businesses. The keyword demographics (1.12), relevant between 2017 and 2018, further supports this trend, indicating that researchers were interested in examining how demographic factors affect attitudes toward sustainability. These findings show a significant shift toward exploring the human dimension of sustainability, particularly how individuals and organizations respond to environmental and social issues.

In recent years, there has been a rising concern with sustainable food practices and waste management. Keywords, such as food (1.11), which gained prominence from 2018 to 2019, and food waste (0.8), which became relevant from 2021 to 2022, reflect growing efforts to reduce food waste and promote sustainability in food sourcing and restaurant operations. Additionally, the appearance of anaerobic digestion (1.03) in 2020-2021 indicates a move toward investigating advanced waste management technologies for processing organic waste in the restaurant industry. These bursts demonstrate the increasing importance of resource efficiency and waste reduction in the sustainability agenda.

Finally, the recent bursts in conservation, critical success factors, and performance from 2022 to 2024 suggest that the field is now focusing on identifying the key drivers of successful sustainability initiatives. These keywords indicate that researchers are interested in determining which factors contribute to the long-term effectiveness of sustainable practices and how performance in sustainability can be measured and improved, reflects a strategic shift in the research focus toward creating actionable solutions that can help organizations achieve their sustainability goals more effectively.

In conclusion, the burst keywords identified in Table 6 highlight the dynamic evolution of sustainable tourism and hospitality research, with initial attention on

environmental management and organizational performance giving way to more recent concerns with waste management, food practices, and the development of sustainability frameworks. These keywords offer valuable insights into the past and future directions of the field, emphasizing the growing importance of understanding both the environmental impacts and human dimensions of sustainability.

Table 6: Breaking Keywords in Sustainable Restaurants (2014-2024)

Keywords	Year	Strength	Begin	End	2014 - 2024
Environmental management	2014	1.54	**2014**	2018	
Firm performance	2015	1.6	**2015**	2018	
Environmental management practices	2015	1.06	**2015**	2018	
Demographics	2017	1.12	**2017**	2018	
Environmental impact	2018	1.13	**2018**	2021	
Food	2018	1.11	**2018**	2019	
Attitudes	2018	1.01	**2018**	2020	
Antecedents	2019	0.96	**2019**	2020	
Environmental sustainability	2020	2.08	**2020**	2021	
Anaerobic digestion	2020	1.03	**2020**	2021	
Content analysis	2020	0.72	**2020**	2022	
Corporate social responsibility	2015	0.31	**2020**	2021	
Framework	2021	1.29	**2021**	2024	
Tourism	2017	0.89	**2021**	2022	
Food waste	2014	0.8	**2021**	2022	
Impact	2016	1.51	**2022**	2024	
Industry	2015	1.19	**2022**	2024	
Performance	2014	0.79	**2022**	2024	
Conservation	2022	0.72	**2022**	2024	
Critical success factors	2022	0.72	**2022**	2024	

5. Discussion and Conclusion

This study utilizes bibliometric analysis to explore the development of sustainable restaurant research from 2014 to 2024, employing the tool CiteSpace to map the intellectual landscape of the field. Data were collected from databases like Web of Science and Google Scholar, focusing on peer-reviewed journal articles, conference papers, and review articles. The final dataset comprised 78 relevant publications, which were analyzed using techniques, such as author collaboration networks, keyword co-occurrence networks, and cluster analysis. This approach identified key contributors, research institutions, and prominent themes within the field. Significant authors like Batat Wided and Filimonau Viachaslau, as well as institutions, such as Kyung Hee University and Griffith University, were highlighted for their contributions. The analysis revealed dominant research themes, including environmental impact, waste management, and green practices.

The study identified several key trends in sustainable restaurant research. First, research output has seen a marked increase, especially after 2020, with a sharp rise in

publications in 2023, reflecting heightened academic and societal interest in sustainability practices. Core research themes, such as environmental impact, waste management, and consumer behavior, underscore the industry's focus on reducing its ecological footprint and understanding consumer attitudes toward sustainability. Additionally, emerging technologies, such as artificial intelligence and blockchain, are increasingly recognized for their potential to enhance operational efficiency and transparency in sustainable restaurant practices. The study emphasizes the interdisciplinary nature of the research, integrating perspectives from environmental science, economics, and sociology, which are essential for addressing the complex challenges of sustainability in the hospitality industry.

The bibliometric analysis also highlights vital collaborations among authors, institutions, and countries in sustainable restaurant research. Batat Wided and Filimonau Viachaslau emerge as central contributors with significant publication records, demonstrating their influence in the field. Other prominent contributors include Cho Meehee and Raab Carola, although most author collaborations remain relatively dispersed, indicating that the field is still in the early stages of forming a cohesive research network. At the institutional level, Kyung Hee University and Griffith University stand out for their substantial research output and central roles in global research networks. Countries, such as China, Australia, and England are vital players in advancing global research on sustainable restaurant practices, demonstrating a global collaboration network that spans multiple institutions and regions.

In terms of research trends, the analysis of keywords shows a distinct evolution in focus areas. Early studies from 2014 to 2018 centered on keywords like "environmental management" and "food waste", emphasizing resource efficiency and environmental impact reduction. However, after 2018, the focus shifted to keywords, such as "behavior" and "green practices", reflecting a growing interest in consumer behavior and corporate practices that drive sustainability. More recent trends highlight the importance of "digital innovation," with terms like artificial intelligence and blockchain indicating a shift toward optimizing resource use and enhancing operational transparency through technology. Future research should focus on three key areas: the application of digital technologies to optimize resources, the role of consumer behavior in fostering sustainable practices, and the development of effective policy and management frameworks to support sustainability efforts in the restaurant industry.

Countries like Australia, China, and the United Kingdom. Compared to previous studies, this research introduces new findings and contributions to the field of sustainable restaurants. Earlier works, such as those by Munir (2022), primarily focused on systematic reviews of green restaurants and sustainable food consumption, examining topics like environmental management and food waste through keyword analysis. However, as consumer behavior, digital innovation, and green practices have emerged, the focus of research has shifted.

Our study is the first to use CiteSpace to construct a knowledge map of the sustainable restaurant field, illustrating global collaborations among authors, institutions, and countries and revealing the critical influence. Finally, keyword co-occurrence analysis shows the thematic evolution from 2014 to 2024. We identified

emerging research directions, including the application of artificial intelligence and blockchain to optimize resource use and enhance supply chain transparency. Unlike Kristia & Rabbi (2023), our study highlights not only environmental impact and waste management but also the role of technology-driven innovation in advancing restaurant sustainability, offering guidance for future research.

In summary, this study extends beyond traditional analyses of sustainable practices by examining interdisciplinary and cross-regional collaboration networks. It provides novel insights that facilitate integration between industry and academia in sustainable dining, fostering advancement in this critical area.

The practical significance of sustainable restaurant practices lies in their ability to reduce the environmental impact of the food service industry while enhancing operational efficiency and responding to consumer demand for eco-friendly dining options. By implementing practices such as waste reduction, energy conservation, and sourcing locally-produced, organic ingredients, sustainable restaurants contribute to reducing carbon footprints and promoting environmental stewardship. Additionally, these practices can enhance a restaurant's brand image, attracting environmentally conscious consumers and fostering customer loyalty. Furthermore, the adoption of green technologies, such as energy-efficient appliances and digital innovations like blockchain for supply chain transparency, not only improves sustainability but can also lead to long-term cost savings, contributing to the financial viability of restaurant operations.

However, the implementation of sustainable practices faces several limitations. Financial constraints, particularly for small and medium-sized restaurants, often hinder investments in eco-friendly technologies and materials, given the high initial costs and tight profit margins (Bhatta et al., 2024). Moreover, the absence of standardized regulations and guidelines across the industry leads to inconsistent adoption of sustainability measures (Guo & Yuan, 2020). Consumer behavior also poses a challenge, as the gap between sustainability preferences and willingness to pay premium prices for eco-friendly services remains significant (Lim et al., 2023). Future research should therefore focus on developing cost-effective sustainability solutions accessible to all types of restaurants, strengthening policy frameworks and industry standards, and exploring consumer behavior to better align awareness with purchasing decisions. Additionally, investigating the integration of emerging technologies, such as artificial intelligence and blockchain to optimize sustainable operations and enhance supply chain transparency is a promising direction for advancing sustainability in the restaurant industry.

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Enhancing Human Resource Competency in Service Industry: A Case Study of Dusit Thani Hua Hin Hotel's Online Instructional Media Initiative

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Abstract

This study examines the online instructional media initiative for enhancing human resource competency in the service industry, using Dusit Thani Hua Hin Hotel as a case study. The research objectives were to: (1) evaluate human resource competency in the service industry, (2) analyze the efficacy of current online instructional media formats, and (3) formulate guidelines for developing effective online instructional media. The sample comprised 200 participants from various departments at Dusit Thani Hua Hin Hotel, selected through purposive and simple random sampling methods. The study used both quantitative and qualitative data collection techniques. Data were collected via a survey questionnaire online (n=150), semi-structured interviews (n=20), and focus group discussions (n=30). Quantitative data were analyzed using descriptive statistics, while qualitative data underwent thematic analysis. The obtained results indicated that: (1) personal characteristics were identified as the most critical aspect of human resource competency, (2) the current online instructional media format demonstrated high efficacy in competency enhancement, and (3) recommended guidelines for improving online instructional media include optimizing content density, ensuring content validity, and incorporating engaging elements to sustain learner motivation. These findings contribute to the body of knowledge on e-learning in the service industry and provide practical implications for human resource development practitioners.

Keywords*: Human resource competency, service industry, Dusit Thani Hua Hin Hotel, online instructional media*

1. Introduction

In the context of Thailand's 20-year national strategic plan (2017-2036) and the National Tourism Development Plan No. 2 (2017-2021), this research addresses the critical need for enhancing human resource competency in the service industry through innovative online instructional media. Thailand's ambitious goal to maintain its position as one of the world's top four countries in tourism revenue necessitates a strategic focus on developing a sustainable and preferred destination that offers value-driven experiences. This objective

requires a multifaceted approach, including the enhancement of personnel competencies to increase competitiveness in the service sector.

The tourism industry's evolving landscape demands a workforce equipped with advanced skills and knowledge aligned with organizational objectives. Online learning media present a promising solution, offering flexibility, cost-effectiveness, and accessibility. This aligns with previous researchers' perspective on the efficacy of e-learning in supplementing traditional training methods (Laohajarasaeng, 2002; Zhang et al. (2020). The Digital Government Development Agency (2018) earlier emphasized the role of accessible online learning in developing Thailand's tourism potential.

However, the development of effective online instructional media for the service industry presents unique challenges. It requires careful consideration of content design, user engagement, and alignment with industry standards. In this study, the researchers aimed at (i) Evaluating human resource competency in the service industry, (ii) Analyzing the efficacy of current online instructional media formats, and (iii) Formulating guidelines for developing effective online instructional media.

By focusing on these objectives, this research seeks to contribute to the body of knowledge on e-learning in the service/hospitality industry and provide practical implications for human resource development practitioners. The findings are expected to generate strategies for enhancing workforce competency, ultimately supporting Thailand's goals on sustainable tourism growth and economic development.

2. Literature Review

This section briefly covers the study background by major previous studies in support of online instructional media for human resource competency development: (i) Meaning and importance of learning, (ii) Electronic learning (e-Learning), (iii) Employee competency concepts and theories, (iv) Human resource development, (v) Information communication technology skills, (vi) A case study of Dusit Thani Hua Hin Hotel, and (vii) Related literature.

2.1 Meaning and Importance of Learning

Learning is a fundamental process for human development, enabling the acquisition of skills, concepts, and behaviors necessary for adaptation to diverse environments. Bloom's Taxonomy categorizes learning into six levels: knowledge, comprehension, application, analysis, synthesis, and evaluation. This taxonomy provides a structured approach to understanding the complexity of learning processes (Gagne et al., 1992; Krathwohl, 2002). Gagne's theory classifies learning outcomes into three groups: factual knowledge, intellectual skills (concepts and principles), and cognitive strategies, with problem-solving abilities representing the highest level of intellectual engagement (Gagne et al., 1992). The knowledge linkage theory, pertinent to the digital age, emphasizes collaborative knowledge creation facilitated by connections between individuals and information through various forms, such as symbols, text, images, and sounds across online networks (Siemens, 2005; Moral et al., 2013; Downes, 2012).

2.2 Electronic Learning (e-Learning)

E-Learning utilizes electronic devices and the internet to deliver educational content. It includes computer-assisted instruction, web-based instruction, and distance learning. Effective e-Learning systems allow for content editing, flexible study schedules, and accessibility from any location, which has increased their popularity for personnel development (Alessi, 1984; Clank & Mayer, 2003). The Learning Management System (LMS) integrates tools for lesson content, tests, questionnaires, and communication (e.g., email, web boards) (Relan & Gillani, 1997; Khan, 2021). WBI (Web-based Instruction) uses web technology to design interactive teaching experiences, fostering meaningful interactions between teachers and students (Driscoll, 1997; Horton & Horton, 2000).

2.3 Employee Competency Concepts and Theories

Competency, a concept introduced in 1973 by David C. McClelland, involves the personality traits that drive high-performance outcomes (McClelland, 1973). McClelland's work was followed by Spencer's Iceberg Model that further delineates competencies into visible aspects--knowledge and skills--and such hidden aspects as motivation and character traits (Dawson et al., 1993). According to quite a few researchers, core competencies are crucial for organizational growth and competitive advantage, comprising basic competencies and differentiating competencies that enable superior performance (Prahalad & Hamel, 1990; Wongthongdee, 2016; Zhang et al, 2020; Sukiam, 2021).

2.4 Human Resource Development

Human resource development (HRD) encompasses decision-making, and practices aimed at maximizing personnel effectiveness. Khunthongchan (2016) defines HRD as organizing and managing personnel to utilize their knowledge and abilities fully, aligning with the organization's strategy (Khunthongchan, 2016; Laohan, 2016). Competency application in HRD includes strategic planning, enterprise bargaining, training, career development, performance management, job design, and recruitment (Rylatt & Lohan, 1995). HRD promotes continuous learning and development, enhancing individual knowledge, skills, and attitudes to benefit the organization (Novelia et al., 2019; Thepwan, 2011).

2.5 Information Communication Technology (ICT) Skills

Proficiency in *ICT* includes computers, data communication systems, and digital tools, as essential skills for 21st-century learning. Information literacy involves accessing, evaluating, and creatively using information from various sources. Educational reforms stress practical skills, with UNESCO recommending skills in basic life functions, work-related tasks, and career-specific competencies (Secondary Education Administration Bureau, 2015). Effective information technology skills enhance communication, collaboration, and problem-solving, fostering efficient and modern organizational workflows (Thompson, 2016; Salem, 2017).

2.6 Case Study: Dusit Thani Hua Hin Hotel

Dusit Thani Hua Hin Hotel exemplifies luxury service in the hospitality industry, blending Thai elegance with modern amenities. The hotel's comprehensive facilities and services underscore the importance of continuous development in the service industry, necessitating well-trained and competent human resources (Dusit Thani Public Company

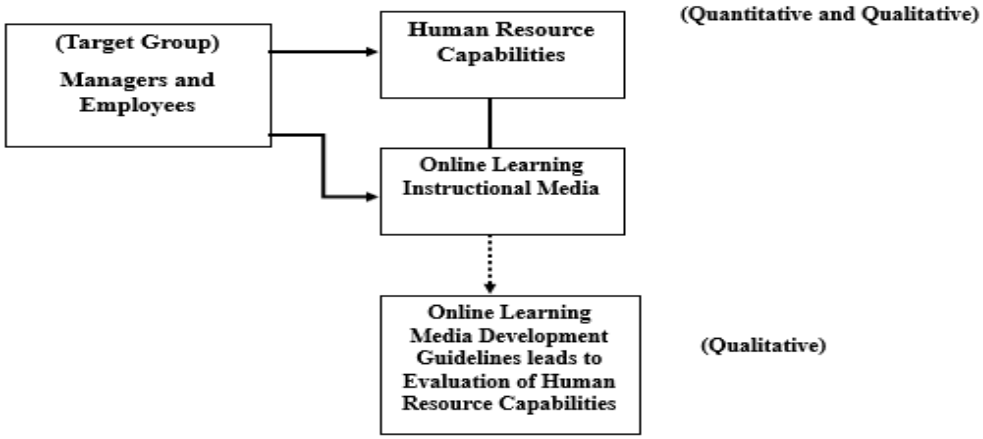
Limited, 2020). It should be noted that the hotel's online instructional media initiative has included all major aspects mentioned under 2.2 to 2.5 as shown above.

2.7 Related Literature

Sookwin & Suntornthanaphol (2023) identifies social context, crisis situations, financial issues, and policy problems as barriers to accessing learning media. Their study also discusses the application of Kurt Lewin's model for managing these problems. Two previous studies by Pin Kaew et al. (2018) and Phiphatpong-ampai et al. (2023) emphasize the significance of digital literacy, self-efficacy, and academic participation in effective online learning. Their findings indicate that well-rounded digital literacy enhances students' ability to learn online, and positive self-efficacy boosts students' confidence and response to online learning. Promsuth et al. (2021) focus on the need for developing human resource competencies to support the Thailand 4.0 initiative, emphasizing creativity, innovation, technology, and high-level service skills. Sarmento (2010), Singala (2010), and Chaisri (2020) examine the benefits of competency-based human resource management, highlighting its importance in recruitment, selection, performance evaluation, and career advancement in the hospitality industry. Kongthong (2019) and Boonmak et al. (2022) address counseling needs and competency development in specific sectors, suggesting tailored approaches to meet these needs. Pin Kaew et al. (2018) particularly advocate for an outcome-based E-learning system to enhance teaching and learning experiences, indicating high user satisfaction with the system.

As seen in these previous studies, online learning media play a significant role in developing human resource competency in the service industry (Collins et al., 2003). Different online media formats can enhance competency, promoting proactive strategies for organizational efficiency (Kim et al., 2011; Methalak et al., 2019). In this regard, the present research therefore utilizes a developmental approach with participatory action from the subjects under study to gather quantitative and qualitative data for creating guidelines for effective online learning media development. The focus is on fostering a learning environment that integrates technological advancements, thereby enhancing the overall competency of human resources in the service industry. As shown in Figure 1, this research and development with its participatory action research techniques (Participatory Action Research: PAR) collects both quantitative and qualitative data as responsive to its specific research objectives.

Figure 1: Research and Development Framework



3. Research Methodology

This study has its final goal on developing guidelines for online instructional media to enhance human resource competency at Dusit Thani Hua Hin Hotel using a Research and Development (R&D) model with Participatory Action Research (PAR). The researchers adopted data collection stages for the participants after those used by Relan & Gillani (1997) and Khan (2021), as shown in the research procedures below.

3.1 Research Procedures

Explanatory Meeting: An initial meeting was held with stakeholders to explain the research's significance, process, and introduce the research team. This session aimed to address questions and gather preliminary suggestions. This method was earlier used by Moral et al. (2013).

Document Study and Tool Creation: Relevant documents were reviewed as a basis to construct research tools. Data was then collected using questionnaires and informal group interviews, followed by data checking and analysis. This method was earlier used by Gagne et al. (1992) and Downes (2012).

Focus Group Discussion: Results from the initial data analysis were used in leading focus group discussion, where employees participated in developing guidelines for online instructional media. This method was earlier used by Spencer (1993).

3.2 Population and Sample Size

The researchers selected 200 participants by purposive sampling from the departments using online learning media in Dusit Thani Hua Hin Hotel as a case study. The participants were assigned randomly into three groups for three types of data collection: (i) 150 persons to respond to the *survey questionnaire*, (ii) 20 persons to give information via *informal group interviews*, and (iii) 30 persons to provide information on desired guidelines for online instructional media in focus *group discussion*. These three groups were to provide data as specified in the research instruments.

3.3 Research Instruments

Based on three identified research objectives, the researchers developed a set of specifications for the *questionnaire* items, questions used in the *informal group interview*, and guiding/prompting questions in *focus group discussion*. Three instruments for data collection--a survey questionnaire, informal group interview, and focus group discussion--were constructed and validated by five experts in online learning and human resource development in the hospitality industry.

The specifications of the three instruments primarily cover four dimensions of core competencies by roles: knowledge, skills, performance and attitudes. Other specific aspects are included to cover data collection via interviews and focus group discussion: specialized knowledge, awareness of high-service standards, document management skills, interpersonal coordination skills, problem-solving skills, skills in event activities/ product promotion, positive traits, openness to feedback, perception and experience with their roles within the hotel business. It should be noted that all three instruments carry a section on the participants' demographic variables.

The survey questionnaire containing two sections on demographic information of the participants and 20 question items on core competencies, respectively. It was checked for content validity by five experts and then tested for reliability by administering it to a sample of 30 persons with demographic variables similar to those of the real participants. As for group interviews with five members per group in one hour, the researchers used a set of 10 questions aligned with the specifications used in the survey questionnaire—also checked for content validity by five relevant experts. With the participants' consent, the interview data were audio-recorded for subsequent transcription. As for the third research instrument, focus group discussion incorporated 8 guiding/prompting questions based on specifications on the participants' viewpoints and suggestions for competency-based online instructional media formats as guidelines for efficiency in human resource competency training in the service industry. Discussion time was set as one hour per group of 10 members. With the group members' consent, the group discussion data were also audio-recorded for subsequent transcription.

Data was collected from the survey questionnaire online, informal group interviews, and focus group discussion to obtain comprehensive information about the general information of the sample group, human resource performance, and online learning media formats, which would be used to create guidelines. From the instrument trial using 30 persons with demographic variables similar to those of the real participants, the reliability test result of the survey questionnaire was 0.962; the questions with a confidence value at or above 0.6 were considered stable and consistent. As for content validity analysis of all items used in the three instruments, five experts' check yielded the Index of Item-Objective Congruence (IOC) with a quality criterion of .50 or higher. The opinions and suggestions obtained from the experts were used to revise the questions.

3.4 Data Collection and Analysis

The researchers used three instruments to collect both quantitative and qualitative data in the first half of 2024. The survey questionnaire was distributed online; the researchers arranged with the hotel's coordinator for access to the participants for informal group interviews and focus group discussion. Data analysis was divided into: (i)

quantitative data analyzed by percentage, mean, standard deviation, and factor analysis, and (ii) qualitative data analyzed by thematic analysis techniques for classified data types and typological data.

4. Results

The data obtained from three instruments are reported in a sequence of three research objectives on (i) evaluated human resource competency in the service industry, (ii) the efficacy of current online instructional media formats, and (iii) recommended guidelines for developing effective online instructional media for competency-based training in the service industry.

4.1 Human Resource Competency in the Service Industry

The findings on the participants indicate a near-even *gender distribution* among respondents, with 49.3% males and 50.7% females. Most respondents *were aged* between 31-40 years, followed by those in the range of 20-30 and 41-50 years, each constituting 26.0%. Only 7.3% of the respondents were over 50 years old. In terms of *income*, the largest segment earned between 15,001-20,000 baht, with other significant groups earning less than 15,000 baht and between 20,001-25,000 baht. As for *education*, the majority of respondents had a diploma or equivalent (48.7%), followed by those with a bachelor's degree (44.0%), a master's degree (2.7%), and other qualifications (4.7%).

In terms of *professional roles*, a significant number of respondents were employees in various non-operational departments (24.7%), followed by food and beverage management employees (18.0%), executive-level managers (17.3%), cooks (15.3%), housekeepers (14.0%), and both receptionists and luggage service personnel (10.7%).

From the participants' survey responses, the study found the high-performance levels of hotel business personnel, who demonstrated extensive knowledge and skills relevant to their roles. This included understanding hotel operations, adherence to regulations, negotiation skills, conflict resolution, and proficiency in various technical and service-related competencies.

The overall analysis further reveals that online learning media have significantly enhanced the knowledge, skills, and performance of hotel employees, fostering a positive work attitude. The participants particularly identified a positive attitude toward work as a common characteristic among employees at the hotel under study. They frequently mentioned other positive traits, such as customer care, responsibility, interpersonal relations, honesty, dedication, and openness to feedback. Employees generally possess 70%-80% of the required knowledge for their roles, but additional training in areas like *event services* and *product promotions* is necessary. On-the-job training (OJT) is consistently organized to maintain high service standards, especially amid the challenges posed by the COVID-19 pandemic. Core competencies observed include strong document management skills, basic knowledge of food menus, and effective interdepartmental coordination. The practical application of online learning is emphasized, particularly in problem-solving scenarios (Chaisri, 2020; Phromsuth et al., 2021).

The majority of participants (80%+) identified department-specific insights as follows:

- **Spa Department:** Emphasis on wellness transition, English communication, and problem-solving skills.
- **Housekeeping Department:** Training on room care measures and English communication, despite a predominantly Thai guest base.
- **Kitchen Department:** Focus on raw material selection, cost management, and teamwork.
- **Store Department:** Knowledge of products, order processing, and inventory management using the FIFO system.
- **Telephone Operator Department:** Data storage, equipment usage, paperwork, and listening skills for efficient service.
- **Event Department:** Proficiency in computer skills, data storage, and document organization.
- **Fire Life Safety Department:** Observation skills, loss analysis, and adherence to safety protocols.
- **Dusit Club Department:** High service attitude and proficiency with operating systems.
- **Maintenance Technician Department:** Multitasking and problem-solving skills supported by comprehensive work manuals.
- **Front Desk:** Effective communication, customer feedback receptivity, and a positive attitude.

4.2 Efficacy of Current Online Learning Media Formats

The qualitative analysis from informal group interviews and focus group discussion provides deeper insights into the efficacy of online instructional media and its impact on hotel employees' knowledge, skills, performance, and attitudes (Phromsuth et al., 2021). The interviews obtained information from the participating employees in various departments--operations, finance, food and beverage, housekeeping, and management. The participants' responses revealed employees' perceptions and experiences with their roles within the hotel business.

Knowledge and Skills: Group discussions revealed that most hotel employees possess around 70%-80% of the required knowledge for their roles. However, there is a strong need for additional training in specific areas, such as event services, new promotions, and product knowledge (as earlier emphasized by Chaisri, 2020). Employees highlighted the importance of continuous on-the-job training (OJT) sessions, which cover various standards and operational procedures to ensure service excellence. It should be noted that during the COVID-19 pandemic, training sessions were adapted to include social distancing measures, often conducted outdoors or via digital platforms like LINE applications.

Performance and Adaptability: Employees demonstrated high levels of performance and adaptability, often taking on multiple roles due to reduced staff numbers during the pandemic. For instance, some employees diversified their skills to include such

tasks as gardening and maintaining common areas. Departments like the sports and housekeeping sections introduced standard operating procedures (SOPs) to enhance service quality and customer satisfaction. Training on spa product knowledge and service standards was provided to front desk staff, while the steward department focused on chemical use and safety protocols (also earlier suggested by Phromsuth et al., 2021).

Attitudes and Team Dynamics: The participants identified a positive attitude toward work as a common characteristic among employees. They frequently emphasized traits, such as customer care, responsibility, interpersonal relations, honesty, dedication, and openness to feedback. The focus groups pointed to the importance of teamwork, with employees from different departments collaborating to address challenges and improve service delivery. For example, the housekeeping department highlighted the use of checklists for room inspections and guest education on housekeeping measures (also highlighted by Chaisri, 2020).

The majority of participants (80%+) identified department-specific insights as follows:

- **Spa Department:** Transitioning to wellness-focused services required enhancing employees' knowledge in this area. Emphasis was placed on improving English communication and problem-solving skills.
- **Housekeeping Department:** Training on post-checkout room care measures and English communication was essential, despite the majority of guests being Thai.
- **Kitchen Department:** Key competencies included raw material selection, condiment storage, and cost management based on guest numbers.
- **Telephone Operator Department:** Proficiency in data storage, equipment usage, and listening skills was necessary for efficient service.
- **Event Department:** Employees needed strong computer skills, data storage proficiency, and document organization abilities.
- **Fire Life Safety Department:** Observation skills, loss analysis, and safety protocols were critical for ensuring property safety.
- **Dusit Club Department:** A high level of service attitude and proficiency with operating systems was required.
- **Maintenance Technician Department:** Multitasking and problem-solving skills, supported by comprehensive work manuals, were essential.

4.3 Guidelines for Developing Effective Online Instructional Media for Competency-Based Training in the Service Industry

The focus groups provided specific online instructional media feedback to the formats used by Dusit Thani Hua Hin Hotel. All employees expressed satisfaction with the overall content and its applicability to their work. However, some challenges were noted for improvement, particularly small font sizes, distracting backgrounds, and fast-paced videos. Based on feedback derived from the participants' responses in informal group interviews and focus group discussion, their suggestions on incorporating interactive elements, enhancing font readability, and providing more engaging content, were integrated into the recommended guidelines.

5. Discussion and Implications

The study highlights the need for continuous *evaluation and improvement of online instructional media* to meet employees' evolving needs, as shown in the case study reported in this paper. From the majority of participants' responses (80%+), they valued online instructional media as significantly enhancing knowledge, skills, and performance as required in hotel employees. They particularly identified a positive attitude toward work which is part of personal characteristics and as the most critical aspect of human resource competency.

The research findings can benefit the development and implementation of online instructional media in the hotel industry. Firstly, the integration of technology and mobile devices has facilitated easy access to learning resources, allowing employees to engage in continuous learning anytime and anywhere. This accessibility promotes a more efficient and knowledgeable workforce, as employees can regularly update their skills and knowledge (Zhang et al., 2020; Phromsuth et al., 2021). The lessons provided cover general knowledge and department-specific content, which are crucial for maintaining high service standards. These resources have significantly contributed to enhancing work performance and fostering team efficiency. This approach aligns with the research of Phromsuth et al. (2021), which emphasizes the importance of human resource competencies, including knowledge, skills, and attitudes.

By engaging in online learning, employees acquire knowledge that is directly applicable to their jobs, leading to *improved skills and efficiency.* This reduces errors, expedites task completion, and enhances customer service quality, ultimately contributing to customer satisfaction, repeat patronage, and positive word-of-mouth promotion. These improvements in organizational performance also help in reducing turnover rates, as satisfied employees are more likely to remain in their roles, reducing recruitment and training costs (Chaisri, 2020; Khan, 2021).

Effective *online instructional guidelines* obviously offer cost-saving benefits by reducing the need for traditional classroom training. Employees can engage in self-paced learning, which saves time and resources. This method also minimizes environmental impact by reducing paper usage and conserving energy typically used in classroom settings (Phromsuth et al., 2021; Sookwin & Suntornthanaphol, 2023). To enhance *employee engagement and satisfaction,* online instructional media can offer a wider range of topics and provide employees with the autonomy to select topics of personal interest. Continuous evaluation of learner satisfaction and human resource competency is essential for refining online learning media.

In particular, Sukiam (2021) highlighted the importance of developing employee work competencies to create high-quality products and services in the hospitality industry. As expressed by most of the participating employees under study, strong competencies contribute to maintaining business competitiveness. Maintaining personnel with improved knowledge and skills to perform their assigned tasks or follow job descriptions can significantly enhance the organization's service quality.

Overall, the present study proves by empirical evidence from the hotel staff under study that effective use of online instructional media can noticeably strengthen the

knowledge, skills, and attitudes of hotel employees, leading to improved work performance and overall organizational efficiency.

6. Conclusion and Future Research

As reported in this paper, the researchers showed the impacts of online instructional media on human resource competency development in the service industry, using Dusit Thani Hua Hin Hotel as a case study. The findings in response to three research objectives were: (i) employees' positive attitude toward online instructional media used to enhance human resource competency in the service industry, (ii) the confirmed efficacy of current online instructional media formats as perceived by employees in various departments, and (iii) guidelines for developing effective online instructional media regarding knowledge, skills, and attitudes toward work, with considerations of content density, validity, and learning engagement. Despite the limited result generalizability of such a case study, the obtained findings can contribute to the body of knowledge on e-learning in the service industry and provide some practical implications for human resource development practitioners concerned.

As for future research, those who are interested in pursuing studies in online instructional media may consider investigating the impact of varied sizes of staff members on expected behavioral or learning outcomes, problems encountered in implementing online instructional media on selected platforms for human resource competency development, and comparative training programs of specific skills as required in hotel staffs in different cultural contexts.

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The Influence of Product Assortment on Consumer Process Satisfaction

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Abstract

With the development of the market economy, the classification of products or *product assortment* affects *consumers' decision-making and satisfaction*. In recent years, many researchers have shown that classification has an important influence on consumer satisfaction, but most domestic and international studies have focused on the scope of classification. Some international literature has also discussed product classification, but not on classification types. Structural matching theory reveals the effect of different types of classification on consumer process satisfaction, and its impact mechanism. At the same time, *product involvement* is added as a regulatory variable to explore its role in product classification and consumer satisfaction. Product assortment is currently relevant to online shopping malls, product manuals, and other corporate communication tools. While companies provide a wide range of product information for consumers to choose, they need to pay attention to customers' differences in types and preferences coming into contact with such information. For marketers, there is also a varied perception of the assorted product types. In this regard, this research aims to (i) assort products into both high and low involvement products according to the extent to which the degree of involvement in each product can impact consumers' decision-making, and (ii) investigate whether different types of products yield different levels of consumer process satisfaction. The researcher used an online survey questionnaire to collect needed data from 183 voluntary respondents. Based on the obtained findings, it is expected that the adjustment effect of product involvement can impact the effect of assortment type on consumers' decision-making and process satisfaction, as practical implications for operations in marketing communications.

Keywords: *Product assortment, product involvement, decision-making difficulty, consumer process satisfaction*

1. Introduction

1.1 Research Background

Today consumers face increasing product selection and product information. There are 225 air-conditioning products on some shopping sites, and they can even search for 2.57 million sports shoes products. On the official website of Samsung mobile phone, consumers can find 98 different types of mobile phone products. Schwartz (2000) believes that having

many alternatives is considered to be a great achievement of the modern society; however, studies, by Chermev (2003a, b) and Iyengar & Lepper (2001) have pointed out that the human brain's ability to operate is limited. It is very difficult to make choices among many different alternatives. Many studies have shown that people face difficulties in dealing with complex choices. Studies by Dhar (1997) showed that consumers experience a psychological struggle when the attractiveness of other choices increases. As a result, they delay decisions, seek other new options, select the wrong choices, and even make no choices at all. Hauser & Wernerfelt explained in 1990 that when the choice of alternatives and available information is increasing, consumers are more inclined to consider fewer options, and only one of them is concerned about the information available for their choice. In fact, some studies have shown that the choice, weighing, and information integration are affected significantly by alternative numbers, suggesting that when consumers believe that choices begin to become complex and difficult, they simplify their decisions by relying on simple exploration. For example, in Timmermans' study of a consumer's choice strategy in 1993 when faced with a different number of choices, it was shown that 21% of consumers used the removal in the case of 3 alternatives. When the strategy and alternatives were 6, 31% of consumers took this strategy, and when the option was increased to 9, 77% of consumers took the removal strategy. Research by Mogilner et al. in 2008 showed that even if labels are simply labelled for meaningless products to assort, they still have a significant impact on consumers' perceptions of differences between different options. Since there are a wide variety of goods circulated in the market, consumers face so many choices. Therefore, *product assortment* is very important to consumers in coping with the difficulties caused by information overload, thus affecting *consumer process satisfaction*.

The existing research focuses on the number of assortments (categorical scale). Kahn & Wansink (2004) found that *assortment scale assembly* leads to *high and low product involvement*. The more diverse the choice, the more that consumers will find a better product that suits their preferences. Consumers are uncertain about future tastes, so more diversified choices can maintain the "openness of choice." The influence of assortment scale on the simplification of the selection process has not been fully explored in the research community. Mogilner et al. (2008) studied and asserted that *the assortment of difference labels* is not important. Regardless of whether this assortment makes sense, the consumer decision making will observe accurately. This is the so-called *"simple assortment effect."* Based on the above analysis, we can find that the greater the scale of assortment, the high and low involvement of product, and consumers can realize higher autonomy when improving the degree of consumer satisfaction.

1.2 Research Objectives

this research aims to (i) assort products into both high and low involvement products according to the extent to which the degree of involvement in each product can impact consumers' decision-making, and (ii) investigate whether different types of products yield different levels of consumer process satisfaction. It is expected that the adjustment effect of

product involvement can impact the effect of assortment type on consumers' decision-making and process satisfaction. The obtained findings are to generate practical implications for operations in marketing communications.

2. Literature Review

This section covers five subtopics in support of the study's rationale: (i) consumer process satisfaction, (ii) difficult decision, (iii) product involvement, (iv) product assortment, and (v) product assortment method.

2.1 Consumer Process Satisfaction

In the early 1990s, a partner of Bain Management Consulting, and Sasser [not on the reference list], a professor at the Harvard Business School, first proposed that companies must cultivate *customer loyalty* in order to enhance their competitiveness and increase their economic efficiency (Dhar, 1997). In 1996 Vandermere, a professor at London Business School in the United Kingdom, also pointed out that *customer satisfaction* is difficult to measure, for its temporary and unstable psychological state. It is very difficult for companies to discover major innovation opportunities and gain competitive advantage through customer satisfaction surveys (Dhar, 1997). Although corporate management theorists and practitioners have reached a consensus on the importance of *customer loyalty,* there are still many debates in the business community and academia about whether customer satisfaction is irrelevant. In 1999, the famous American scholar Oliver published the article "Customer loyalty came from" in the "Marketing Quarterly" magazine. He conducted six different relationships among customers to find out depth and satisfaction of each customer based on business treatment; his method was used to find out customer satisfaction and loyalty. It should be noted that the empirical research conducted by many scholars point to a strong positive correlation between customer satisfaction and customer loyalty (Mogilner et al., 2008).

2.2 Difficult Decision

In the 20th century research, Miller (1956) proved through experimentation that if the two choices are similar in appeal or if one chooses the other that is similar, giving up one and choosing the other, such actions will cause delayed selection or a sense of conflict. Some researchers later proved this argument in that with the increase in the degree of similarity between choices, the sense of conflict that arises from this choice and concentration of choices will increase significantly. This argument was further explored in that the conflict of choice will increase, further contributing to confusion, anxiety, and even difficulty in making choices. Later studies have shown researchers' interest in analyzing *decision-making difficulties* caused by too many choices from the perspective of classification. Some also deal with the issue of excessive choices as significantly reducing the motivation for consumers to make choice decisions (Tversky & Shafir,1992; Schwartz, 2000).

2.3 Product Involvement

Product involvement is mainly affected by interactions between *product attributes* and *consumer traits*. Purchase decision involves the placement of important purchasing task. This will

encourage consumers to collect more relevant information, spend more time on product search, and ultimately aim to make correct purchase decisions. Purchase decision and product involvement, have a natural effect on each other. For example, the greater of product involvement, the greater level of involvement in purchasing decisions; and when the level of consumer purchase decision involvement is high, product involvement the degree of entry will also increase. The advertising degree of attention consumes place on advertisement information, the state of mind when they are exposed to advertisement, and the degree of cognitive response or information processing of advertisement information (Tversky, 1993; Chemev (2003a).

Consumer decision making is usually influenced by the involvement of factor product. The significance and importance of goods with different levels of involvement to consumers are very different. According to the difference between the risk and the effort required when consumers purchase goods, the goods can be divided into two categories: low and high involvement. Typical high-involvement commodities can be cars, houses, and pearls; typical low-involvement commodities include daily chemicals, cigarettes, and beverages. Research by domestic and foreign scholars has confirmed that consumer purchasing decisions are always affected by consumer product involvement. Products are involved in brand search, information processing, attitude change, and purchase intention formation in the field of consumer behavior. The importance lies consumers' perception in a product based on his or her own internal needs. According to this degree of difference, product involvement is usually divided into high involvement and low involvement. When consumers purchase high-involvement products, they will spend more time and energy to collect product and brand information than to purchase low-involvement products, which will affect their information processing and consumption (Wright, 1975; Dhar,1997; Chemev, 2003a; Chemev, 2003b).

2.4 Product Assortment

As known, traditional product assortment refers to the number of products under a certain product category. Assortment is very beneficial to the consumer selection process in various marketing activities. In general, providing information is the most important benefit of product assortment. The product provides tag information to help consumers understand the product's attributes and understand the differences between different assortments of goods so that consumers can establish preferences. The assortment of many alternatives can effectively help consumers improve their selection process. In fact, if a selector has a screening device, it can arrange a subset of available options in an orderly manner, and the selector can make a more high-quality choice. If categorization is beneficial to consumers, categorizing can guide consumers to choose their more preferred options among a wide variety of options (Hauser & Wernerfelt, 1990; Kahn & Wansink, 2004).

2.5 Product Assortment Method

Consumers are faced with objects that can be assorted in various ways. The characteristics of different assortments or breeds will significantly affect the perception of these consumers in their environment, and will influence their decision-making by affecting the differentiation of dependence and seeking diversity. Kahn & Wansink (2004) have studied

the formation of more choices through assortment, and the assortment based on goals, assortment based on brands or feature levels, or based on their supplements or the assortment of alternatives. In addition, these researchers believe that the consistency of the organization and symmetry of the assortment, and the organization of consumer and retailer plans, influence consumer decision-making. These externally applied various assortment methods and some consumption situation factors will comprehensively influence important decisions. For example, the difficulty and time of selection have an impact on the satisfaction of product types and consumption. In this regard, assortment commodities affect the consumer's response in the same context of decision-making (Wright, 1975; Tversky, 1993).

As seen, research proves that when consumers are only exposed to many narrow categories, they will be able to evoke a more complex world view of the consumer than a few and broad categories. Therefore, exposure to narrower assortments or extensive assortment will lead consumers to multi-dimensional analysis when dealing with given stimuli, and can perceive subtle details from each sub-category, thus affecting their decisions in particular contexts (Wright, 1975; Tversky, 1993; Kahn & Wansink, 2004).

3. Research Hypotheses and Research Framework

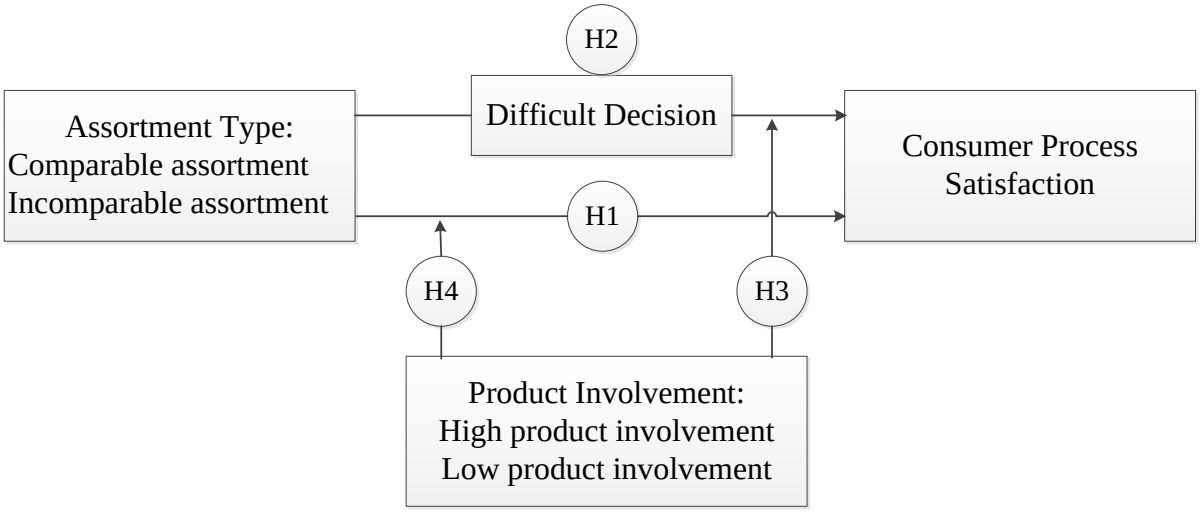
According to the theory of structural matching model, consumers are willing to give higher weight to comparable differences, because in the values of consumers, the difference in information caused by comparable attributes is more useful for their decisions, resulting in their willingness to use comparable attributes. Consumers guide their own judgments, because the comparable attributes are more in line with their own values. At this time, they have a stronger sense of autonomy and a better customer experience. When the attributes are incomparable, consumers are not involved in the consumer comparison process. Their decision-making may bring difficulties to consumers' choices, causing decision difficulties. On this ground, this present research extends this theory to product assortment domain. Assortment types are divided into *comparable* and *incomparable* assortments, and assortment types can affect process satisfaction.

The researcher made the following assumptions, hypotheses, and the conceptual model for this study, based on the literature review, as shown in Table 1 and Figure 1.

Table 1: Research Hypotheses

Summary of Assumptions	
No	**Research Hypotheses**
H1	The product assortment type has an effect on consumer process satisfaction.
H2	The influence of product assortment type on consumer process satisfaction is mediated by decision-making difficulties.
H3	The product assortment type has an impact on consumer decision-making difficulties.
H4	Product involvement regulates the impact of assortment type on consumer process satisfaction

Figure 1: The Conceptual Model of the Study



4. Research Methodology

The researcher approached research methodology as follows:

4.1 Participants

In this study, a total of 200 participants in the field of marketing management were selected on a voluntary basis to respond to the survey questionnaire online. The researcher approached college students in the area of business management as providers of data in product assortment, involvement, decision difficulty and process satisfaction, on the ground that they are active consumers in retail trade operations.

4.2 Research Instrument

The survey questionnaire was constructed in two sections with demographic information, followed by question items on product assortment, product involvement, process satisfaction, and decision difficulty (see Table 2). The question items were on a rating scale of 1 low to 4 high in agreement, as perceived by the participants under study. The instrument was assessed for reliability and data validity by SPSS 19.0 software.

4.3 Data Collection and Data Analysis

The researcher collected data in the second quarter of 2024. Data analysis was carried out by SPSS 19.0 software, executing reliability and data validity analysis, descriptive statistics, followed by paired sample t-test, variance analysis, and regression analysis on the variables and dimensions indicated in the research hypotheses on product type assortment, consumer decision, consumer process satisfaction and consumer product involvement. (See Table 1 and Figure 1.)

5. Results of the Study

5.1 Operational Definition of Variables

The independent variable of this research is the *assortment type*, which is assortment variable. The dependent variable is the *process satisfaction*, the intermediary variable is the *decision-making difficulty*, and the adjustment variable is the *product involvement degree.* The

three dependent variable scales have been well tested in previous studies. The scales used in three variables are shown in Table 2:

Table 2: Dependent Variable Scales

Variable	Scale Item Description		Meter Source
Product involvement	Important	unimportant	Johar (1995)
	Boring	interesting	
	Related	not related	
	Excited	not exciting	
	Meaningless	Significant	
	Attractive	Unattractive	
	Charming	Not charming	
	Worthless	Valuable	
	Related to me	It has nothing to do with me	
	Not required	Required	
Process satisfaction	Very annoying to decide which product to buy; a lot of good options for me to choose; satisfied with the optional process experience; choice is right; choose from a similar list of products when I next buy something; the process of deciding which product to choose is very interesting		Fitzsimons, Greenleaf & Lehmann (1997)
Difficult decision	When choosing among the above brands, it feels difficult that can easily explain choice/ making choices in the above brands is a nuisance		Chatterjee & Heath (1996

5.2 Effect of Product Assortment on Process Satisfaction

Product Involvement

The researcher needed to distinguish between the levels of *involvement* of the product selected in the study. Considering three products well-known at work, the researcher selected the notebook computer, U-disk, and shampoos as stimuli to prompt different levels of involvement (see Tables 3 and 4). It is necessary to check whether there is indeed a significant difference in the degree of involvement of laptops, USB flash drives, and shampoos. These three types of products are commonly used by consumers as familiar products. Johar's involvement scale was used to calculate the mean values of these three types of products and calculate the average value. The products were assorted into high/medium/low involvement

products. Of 200 questionnaires distributed, 175 were recovered, 4 invalid questionnaires were removed, and 171 valid questionnaires were obtained. Among them, 74 questionnaires were for notebook recovery, 59 questionnaires for shampoo recovery, and 38 questionnaires for U disk recovery.

In this study, reliability test was performed on the obtained data and scales measured. Reliability coefficient of the tested whole scale was as high as 0.95, indicating three types of selected products quite high in internal consistency. Overall, this scale has a very high degree of confidence, especially with respect to internal consistency, proving that this scale can serve as the official test in this research.

Table 3: The Test Results for Laptops, U-disks, and Shampoos

	Laptop	U-disk	Shampoo	Mean	Sample
Laptop	6.352"			5.7477	74
U-disk				4.1393	38
Shampoo	10.614"	-4.347"*		3.2436	59
Mean	9.615"	1.013	-5.256**	4.0000	

Among the three products under study, the average degree of involvement of notebook computers is the highest (Pmean = 5.75), followed by U-disk involvement (Pmean = 4.14), and the involvement of shampoos with the lowest degree (Pmean = 3.24). In order to determine which products are high, medium, and low-involvement products, the researcher compared the mean value of these three products with the median value of the scale 4, using a single-sample t-test. It was found that laptops and shampoos showed a significant difference between the mean and the median, but no significant difference between the U-mean and the median (1 = 1.013, p = 0.320), indicating the three products corresponding to the high, medium, and low levels of involvement. In order to verify whether there is a statistical difference in the average value of the involvement of the three products, an independent sample t-test was conducted. The results of the independent sample t-test are: (i) there is a significant difference between the high-involvement products and the low-involvement products (t=10.614, p=0.000) (SPSS19.0 software indicating the significance level of p value less than 0.001). There is also a significant difference between the high-involvement products and the mid-involvement products (t =-6.352, p=0.000); and there is a significant difference between the low-involvement product and the consumer-involved product (t=4.347, p=0.000).

Table 4: Product U-disk Properties Selection

Number	U-disk properties	Selected number	Ratio to the total value
1	Capacity	32	38%
2	Interface	21	25%
3	Exterior	16	19%
4	Use	8	10%
5	Characteristic	4	5%
6	Warranty time	2	2%
7	Others, please specify	1	1%

6. Results and Discussion

6.1 The Participants

A total of 200 questionnaires were collected from the participants. There were 17 invalid questionnaires and 183 valid questionnaires remained after exclusion. To exclude subjects who did not read the material carefully, the experiment set up two filtering issues. One was to set a direct question after each material: Do you read the above materials? The second was to set up test questions: "If you will choose this brand for the next purchase?" and "If you choose the next purchase, will you choose another brand?" Table 5 reports the participants' demographic information.

Table 5: Participants' Demographic Information (N=183)

Variable	Content	Coding	Frequency	Percentage
Sex	Male	1	95	51.91%
	Female	2	88	48.09%
Age	Under 25	1	111	60.66%
	Between 20-25	2	56	30.60%
	More than 25	3	16	8.74%
Education level	Undergraduate	1	161	87.98%
	Master	2	17	9.29%
	Doctor	3	5	2.73%

6.2 The Effect of the Assortment Type on Process Satisfaction

The effect of the assortment type on process of satisfaction was analyzed by comparing the consumer selection process under the two assortment types. In order to verify Hypothesis 1, the researcher compared the process satisfaction under the comparable assortment with the incomparable assortment, and uses the paired sample t-test to verify the hypothesis.

In the case of incomparable assortment, the average value of process satisfaction of consumers is $M_{non\text{-}comparable}$ assortment = 3.0051. In the case of comparable assortment, the average degree of process satisfaction rises to $M_{comparable}$ assortment = 3.5960, and the difference in mean change is significant (t = 7.910, p = 0.000). The results explain that the assortment type has a significant impact on process satisfaction. Hypothesis 1 is therefore established, as shown in Table 6.

Table 6: Descriptive Statistics and Paired Sample Test Results for Comparable and Incomparable Assortments

Variable t variable	**Type**	**N**	**Mean**	**Deviation**	**Error**
Process satisfaction	Non comparable	33	3.0051	0.40286	0.07013
	Comparable	33	3.5960	0.39094	0.06805

Dependent variable	Pair difference					t	df	Sig.
	Mean	Deviation	Error	95%confiden interval for difference				
				Lower limit	Upper			
Comparable- non comparable	0.59091	0.42917	0.07471	0.43873	0.74309	7.910	32	0.000

The standard error estimated from the regression statistics table is 0.23592, which indicates the error between the actual value and the estimated value. The purpose of the analysis of variance is to test the regression effect of the regression equation. The F statistic is equal to approximately 0.705, which is greater than the significance level of 0.05, indicating that the regression effect of the equation is significant. At least one regression coefficient in the equation is not significantly zero.

The regression formula is: $Y=7.910+0.07x_1+0.06x_2$, The p-value of the t-statistic of the product classification regression coefficient is approximately equal to 0.000. This indicates that the original hypothesis was rejected at a significance level of 0.05, and the null hypothesis was accepted at a 0.001 significance level. The p-value in this question proves that product classification is relevant to consumer process satisfaction.

The p-value of the regression coefficient statistic of the product classification is not high. Although the regression coefficient is close to the regression coefficient used for product classification to process satisfaction, such a small p-value indicates the difference between the product classification and the consumer process satisfaction. If there is a correlation, the probability that the extracted regression coefficient is zero is not necessarily the p-value (0.000). Given a 95% significance level, it cannot be rejected. Under the null hypothesis, the regression coefficient of product classification is significant.

The results confirm the existence of significant influence of assortment type on process satisfaction, and the comparable assortment ratio influences process satisfaction positively. This is in contrast to the consumers proposed in the Markman Structure Matching Model, who prefer to use comparable properties to help their decision-making. The conclusion of the process satisfaction has a certain degree of agreement: when product involvement is relatively high, consumers will increase their attention to incomparable attributes.

6.3 Mechanism of Product Assortment Affecting Process Satisfaction

The researcher tested whether the product of the selected high-involvement and low-involvement products is significantly different. An independent sample t-test is performed on these two products. The test results are shown in Table 7 below (t=10.614, p=0.000). It can be seen that the variance between the two is significant, demonstrating that the study can select notebooks and shampoos to represent both high-involvement and low-involvement products.

Table 7: Notebook and Shampoo Product Involvement: Independent Sample t-test Results

	Levene test of variance equation		**T-test of mean equation**				
Dependent variable	F	Sig.	t	df	Sig. (Bilateral)	Mean difference	Standard error value
Product involvement	0.705	0.403	10.614	81	0.000	2.50414	0.23592

The researcher designed the problem of product attribute selection, listed some of the most common attributes of the three products, and allowed consumers to make choices. According to statistics, it can be seen from Table 8. When consumers buy laptops, they respectively value: CPU, memory capacity, heat dissipation, graphics card, and hard disk capacity. When buying shampoos, they look for hair efficiency, specifications, origin, and gifts.

Table 8: Notebook and Shampoo Property Selection

Number	Notebook properties	Selected number (132)	Ratio to the total value	Shampoo properties	Selected number (88)	Ratio to total value
1	CPU	28	21.21%	Suitable for hair	34	38.63%
2	Memory capacity	26	19.69%	Effect	34	38.63%
3	Heat dissipation	18	13.63%	Specification	8	9.10%
4	Video card	14	10.61%	Origin	5	5.68%
5	Display size	9	6.82%	Gifts	1	1.14%
6	Hard drive capacity	13	9.85%	Others, please specify	6	6.82%
7	Weight	8	6.06%			
8	Battery life	5	3.79%			
9	Warranty time	5	3.79%			
10	Expand performance	4	3.03%			
11	Others, please specify	2	1.52%			

The data processing of this study uses variance analysis and regression analysis. The researcher first validated the main effect of assortment type on process satisfaction, using analysis of variance. Comparing the comparable assortment group with the incomparable assortment group, $M_{\text{comparable assortment}} = 3.2978$, $M_{\text{incomparable assortment}} = 2.9325$, the mean change was significant $t = -3.942$, $p = 0.000$, indicating that the assortment type has a significant impact on process satisfaction, preliminary verification Hypothesis 1. In the subsequent section, the author will further verify Hypothesis 1 in the case of the dependent variable—process satisfaction, as shown in Table 9:

Table 9: Sample t-test Results for Assortment Types

	Livened test of variance equation		T-test of mean equation				
Dependent variable	F	Sig.	t	df	Sig. (Bilateral)	Mean difference	Standard error value
Process satisfaction	0.655	0.420	-3.942	152	0.000	-0.36529	0.09266

As for the mechanism of the assortment type's effect on consumer process satisfaction, the researcher examined the mediating relationship between assortment type and process satisfaction, the decision-making difficulties, whether there is an intermediary effect. The analysis was in four steps:

(1) The effect of the independent variable on the outcome variable (Hypothesis 1, which has been supported);

(2) The effect of the independent variable on the intermediary variable. Based on the introduction of control variables, the researcher put the independent variable (assortment type) into the regression equation, and analyzed the influence of the assortment type on the decision-making difficulty;

(3) The influence of the mediation variable on the dependent variable. Based on the introduction of control variables, the researcher put mediation variables (difficulties in decision making) into regression equations to analyze the influence of decision-making difficulties on process satisfaction;

(4) Mediating effects (Hypothesis 2).

The results of the hierarchical regression analysis are shown in Table 10

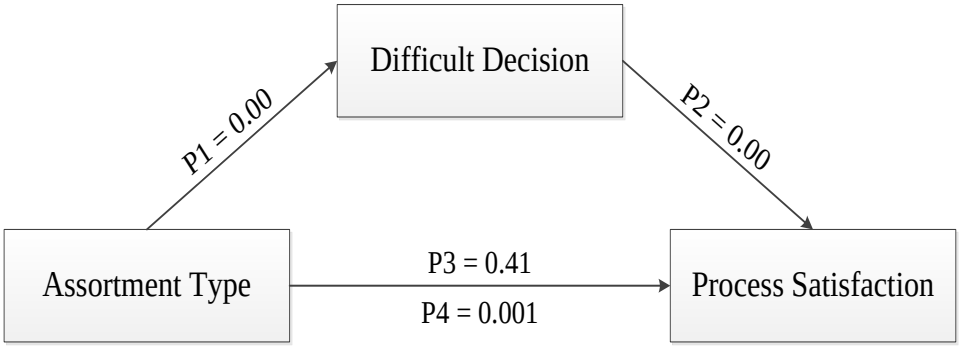
Table 10: Hierarchical Regression Statistics

Explanatory variables	**Difficult decision**		**Process satisfaction**					
Dependent variable	M1	M2	M3	M4	M5	M6	M7	M8
Control variable								
Sex	-0.162	0.186	-0.201	-0.213	-0.154	-0.171	-0.179	-0.177
Age	0.034	-0.032	0.026	0.025	0.016	0.018	0.013	0.010
Education level	-0.056	0.082	-0.087	-0.101	-0.071	-0.083	-0.075	-0.076
Independent variable								
Assortment type		-0.730		0.372		0.210	0.192	0.191
Mediating variables								
Difficult decision					-0.289	-0.221	-0.247	-0.237
Moderator								
Product involvement							-0.143	-0.143
Interaction items								
Difficult decision Product involvement								-0.126
R2	0.020	0.250	0.034	0.129	0.124	0.188	0.201	0.207
△R2	0.020	0.230	0.034	0.096	0.131	0.059	0.013	0.006
F	1.022	12.447	1.738	5.530	7.333	6.850	6.165	5.442
△F	1.022	45.807	1.738	16.373	23.343	10.689	2.413	1.802

From the results in Table 10, it can be seen that the assortment type has a significant influence on decision making difficulties (M2, b=-0.730, t=6.768, p=0.000). At the same time, decision-making difficulties have a significant negative effect on process satisfaction (M5, b=-0.289, t=4.831, p=0.000). After the mediation variable was added, decision-making difficulties still had a significant effect on process satisfaction (M6, b=-0.221, t=3.269, p=0.001), while the effect of assortment type on process satisfaction remained significant (M6, b= 0.210, t=2.067, p=0.041). Therefore, Hypothesis 2 is supported by the obtained data, that is, *decision-making difficulties play an intermediary role in the relationship between assortment type and*

process satisfaction, but decision-making difficulties only play a part here in the role of the intermediary.

Figure 2: Regression Test of the Mediating Role of Decision-Making Difficulties under Assortment Type



In Figure 2, P1 is the regression test value of the classification type for decision making difficulty, P2 is the regression test value of decision difficulty for process satisfaction, and P3 is the regression test value of classification type for process satisfaction. P4 is added in after the mediation variable, showing the regression test value of the classification type on process satisfaction.

Table 11: Assortment Type, Product Involvement, and Process Satisfaction in Two-Factor Variance Analysis Results

Source	Type III Sum of Squares	df	Mean square	F	Sig.
Correction model	6.9173	3	2.306	7.142	0.000
Intercept	1490.298	1	1490.298	4615.979	0.000
Assortment type	5.355	1	5.355	16.585	0.000
Product involvement	0.098	1	0.098	0.305	0.582
Assortment Type Process Satisfaction	1.663	1	1.663	5.150	0.025
Error	48.428	150	0.323		
Total	1545.222	154			
Corrected total	55.346	153			

Note: R^2= .125 (Adjustment R^2= .107)

As shown in Table 11, under the two-factor analysis of variance, the main effects of assortment type are significant (F=16.585, p<0.001), which indicates that the effects of incomparable assortment and comparable assortment on process satisfaction are significantly different, which further validates Hypothesis. 1.

In addition, the interactions between the assortment type and product involvement were also significant (F=5.150, p=0.025), indicating a significant interaction between the independent variables and the adjusted variables. Hypothesis 4 was therefore supported by these data.

6.4 Research Hypotheses

As reported, the results in Table 2-11 support three hypotheses with the obtained empirical evidence.

Table 12: Summary of Research Results

Number	Hypothesis	Result
H1	Assortment type has an effect on process satisfaction. Comparable assortment can improve process satisfaction more than incomparable assortment.	Valid
H2	The influence of assortment type on process satisfaction is mediated by decision-making difficulties.	Valid
H3	The product assortment type has an impact on consumer decision-making difficulties. Decision-making difficulties when determined by product involvement affects process satisfaction. Specifically, relative to high-involvement products, low-involvement products are promoting the impact of decision-making difficulties on process satisfaction.	Invalid
H4	Product involvement regulates the effect of assortment type on process satisfaction. Specifically, when the level of product involvement is low, compared with the incomparable assortment, the comparability assortment can more easily improve the process satisfaction; when the level of product involvement is high, the impact of comparability and incomparability assortment on process satisfaction is not significant.	Valid

7. Discussion and Conclusion

This research investigated consumer process satisfaction with assortment types to further enrich studies in product assortment. Some recent papers have already started the domestic research on product assortment scales. This study examined how the consumer's process satisfaction could be affected by the product assortment type. Throughout the study, three of four hypotheses have been verified.

The researcher proved that the assortment type does have a significant effect on process satisfaction. When consumers face a comparable assortment (M comparable assortment = 3.5960), their process satisfaction is higher than facing incomparable assortment (M cannot be compared assortment = 3.0051) (t=6.047, p=0.000). The researcher further confirmed that the proof of this main effect can help marketers handle decision-making difficulties that confuse consumers when encountered with complex product assortment. It was also found that the

mediating role of decision-making difficulties having its intermediary effect between the assortment type and consumer process satisfaction. The decision-making difficulty will arise when consumers are faced with various choices (Payne et al., 1988; Schwartz, 2005). It bridges in the middle of process satisfaction experienced by consumers; however, the study found that decision-making difficulties only play a partial intermediary role.

The adjustment effect of product involvement was carefully examined. In the case of low product involvement, consumers do not use much effort to compare and measure different assortments. If consumers are faced with incomparable assortment, their satisfaction will be significantly lower than the comparable assortment. In the case of high product involvement, for some psychological reason, consumers attach great importance to their own personal choice. This seems to suggest to marketers to consider the mobilization of cognitive resources to distinguish optimal choices (Wright, 1975; Tversky & Shafir,1992; Timmermans, 1993; Mogilner et al., 2008). As shown in this study, the comparable assortment effect can be adjusted lower, so that the difference in impact between incomparable assortment and comparable assortment on process satisfaction will not generate a significant effect.

8. Research Limitations and Further Suggestions

In this study, the researcher verified the main effect of assortment type on process satisfaction, and examined its impact mechanism. Decision-making difficulties were found as only playing a partial intermediary role. The issue of impact mechanism of product assortment on other consumer-related variables could be further studied.

The size of the product assortment under study was rather limited, and the issue of assortment impact could be further studied to shed more light onto marketing strategies in directing consumer process satisfaction as desired. As emphasized by cognitive psychologist Miller (1956), the human brain can process up to six messages at a time and people's short-term memory can remember up to seven information points at a time. In this regard, further research can expand the scale of assortment. The interaction between assortment size and assortment type can also be pursued in future research.

Finally, this study can provide some support for research on consumer choice regarding how consumers react to a series of options using the same dimension description compared to the options used to describe the unique characteristics. As shown in this study, consumers are exposed to incomparable assortment, and in turn, it has increased the decision-making difficulty. Under such condition, the two options are not easy to compare, and consumers are more likely to have unsatisfactory emotions. When consumers choose among incomparable attributes, consumers will be more steadfast in deciding on deferred choices, and deferring choices are more likely to occur. When the satisfaction of the selection process is high, it will be easier to generate a search for a decision. It is expected that later studies may consider the choice of will as a dependent variable and consider the assortment type as one of the influencing factors. For marketers, they need to update their knowledge on product assortment,

decision-making mechanism, and consumer process satisfaction so that they formulate their consumer-based strategies for success in business operations.

9. The Author

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Factors of Digital Leadership for Basic Educational Administrators in Nonthaburi Province, Thailand

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Abstract

The objective of this research was to study digital leadership by exploratory and confirmatory factor analysis of digital leadership for basic educational administrators in Nonthaburi Province, Thailand. The researcher used a constructed questionnaire with content validity between .67-1.00 and reliability value of .91. The sample was 400 teachers selected by stratified random sampling by school sizes. The data were analyzed by percentages, means, standard deviation and factor analysis. The results were: (1) The digital leadership for basic educational administrators in Nonthaburi Province in total was at the high level: the highest was *visionary leadership,* followed by *talent management*, *professional practice*, *data driven*, and *digital age learning culture*. (2) The exploratory factor analysis revealed 4 factors. The first factor was *creation of innovative digital leadership,* followed by *visionary leadership, data driven,* and *professional practice,* respectively. (3) The confirmatory factor analysis indicated the fit of empirical data with (χ^2 /df) = 2.00 CFI=.89, RMSEA=.047, CN=254, largest standardized residual=.20. It is expected that the obtained findings on the identified factors can be used as guidelines for human resource training in support of digital leadership in schools under the Basic Education Office at the provincial and national levels.

Keywords*: Digital leadership, basic education, school administrators, factor analysis*

1. Introduction

Advances in digital technology require changing work patterns and processes. Especially with school administrators, it is necessary to know and have digital skills to keep up with the rapid changes. The digital technology is considered an important tool and method in current management. School leaders have their role in leading and mentoring teachers and learners. Educational institutions need digital technology to deliver learning management, including having a digital media library so that students can access it to develop themselves anytime, anywhere. Chaemchoi (2019) asserted that currently, technology not only plays a role in life, but also has an influence on learning management for students in educational institutions in a holistic manner, whether it is on a smartphone, tablet, or notebook. When these devices are connected to the Internet, it will result in learning that is limitless in terms of time, place, and the amount of knowledge that students can access from all over the world. The evolution of these

technologies has led to new forms of learning for students. In this regard, administrators of educational institutions need to adjust their operations and learning management to be appropriate for the direction of the era in support of learning autonomy. The current context of Thai educational institutions requires modern technology that is convenient, quick, and easy to use (Petchroj, L. (2021a).

As for teachers' teaching and learning organization in the digital age, the creation of innovative digital media for education has been in place, such as new media in 3D format, animation, and artificial intelligence (AI) as new products and services. Digital innovation is used to meet the needs of teaching and learning that adapt to the context of rapidly changing educational requirements. Therefore, the implementation of digital technology should begin by setting clear goals for ongoing and future education management in the first place. Then educational leaders can set a strategy on applying appropriate digital innovation technology to align with the educational institution's vision and mission. All of these tasks certainly depend on the leadership of school executives. Their ultimate goal apparently rests upon how to support students' learning autonomy toward the expected outcomes to be able to further their study at a higher level, entering the job market with required competencies, and continue to function as quality human resources for target professional fields and industries.

2. Background of the Study

Digital Technology

The digital technology utilizes information via electronic media both online and offline formats. Teachers and students with digital literacy skills can benefit from access to information sources as desired. Therefore, school administrators must provide for teaching and learning media and skills training in using technology via academic in-services. Teachers and students need both main and supplementary media, as well as suitable e-learning platforms. These are added to the normal teaching and learning management system. Learning through electronic media can be organized in many formats, such as online-offline format, education via website learning through mobile phones (m-Learning) and multimedia (Multimedia), which combine various types of media altogether. Learners must learn and adapt to keep up with current information skills. They can freely search through the web and even create their own web page. They can practice through e-books and interact with groups, while selecting at will--blog, podcast, webcast, YouTube, Wikis, Skype, and Line, for information search, learning and sharing.

Learners' Abilities

Learners' abilities can be divided into three dimensions. The first deals with fluency in use. Essential techniques for using computers and the internet skills range from basic techniques for using computer programs, such as word processors, web browsers, e-mail, and other communication tools, to more advanced techniques for accessing and using knowledge, such as programs that help in searching for information and accessing online databases, including cloud computing. The second dimension involves a set of skills to help learners understand the context and evaluate digital media. The third

supports creation with an emphasis on the ability to produce content and communicate effectively through a variety of digital media tools. Students are trained to create contents for communication in different contexts by using rich media, such as images, videos and audios, as well as creating efficiently, such as blogs and image sharing, videos, social media, and other formats (Media Smarts, 2015).

Digital Leadership

Digital Leadership can be referred to as a mindset and relevant skills that will allow individuals or organizations to lead other members of the organization to survive in the digital age. Leadership skills essentially required in the digital age focus on adaptability to use technology Buachu & Buachu (2019). Digital leadership includes the characteristics, knowledge, skills, abilities, and behaviors in school directors or leaders who can influence teachers and personnel in the school context. In general administration, personnel management, academic administration, and budget management, staffs need to have clear understanding of access and use in digital technology at work. Education with technological changes and the new concept of organizing education in a crisis situation, prompt schools to adapt the use of various digital platforms for online teaching, such as Tencent Live Streaming, Google Hangout Meet, Google Classroom, Microsoft Team, Class Start, and Zoom. These platforms enable administrators, teachers and students to work efficiently toward the identified mission and goal.

Basic Education Teacher Training in Nonthaburi, Thailand

Basic education in Thailand is for students for at least 12 years before entering higher education. As specified by the Ministry of Education, there are three levels: pre-primary education (6 years), primary education (3 years), and secondary education (3 years). Teacher training is provided at the higher education level. In this study, Rajapruk University as a higher-education institution is involved in basic education teacher training by offering a graduate program in education. The Master of Education Program has more than 80 percent of registered students who are educational administrators, heads of departments, and teachers in Nonthaburi Province. The program organizes academic activities in collaboration with educational institutions in Nonthaburi Province in the school mentoring project in cooperation with the Nonthaburi Provincial Administrative Organization Office. The subject of professional training in educational administration is of prime importance, including training in research potential development, creating innovative media, developing teaching and learning management capabilities, measurement and evaluation, updated academic and research skills, along with change strategies in education management technology. It should be noted that the past situation of COVID-19 in 2020-2023 has prompted educational administrators to use various technology platforms for online teaching and learning.

3. The Study

Considering *changing technology and individual learning styles* in the digital age and beyond in higher education as affecting the quality of education administration, the researcher would like to find out a model in learning administration in Thai basic education in the digital age, as perceived by educators concerned. It was expected that the obtained findings could benefit short- and long-term planning for faculty members and

students in educational institutions in line with changes from the disruption of the digital revolution in all areas of education and industry.

In this study, the researcher aimed to identify the factors of digital leadership for educational administrators in basic education institutions in Nonthaburi Province. It was expected that the obtained findings would generate guidelines for academic content design and implementation regarding the roles of digital leadership administrators in coping with changes in educational practices imposed by the digital revolution.

4. Research Objective

The objective of this research was to study digital leadership by exploratory and confirmatory factor analysis of digital leadership for basic educational administrators in Nonthaburi Province, Thailand. The obtained findings were expected to generate guidelines for basic education administrators to adjust their role in coping with changes in educational operations imposed by the digital revolution.

5. Conceptual Framework

The conceptual framework in this study was based on digital technology to enhance educational administration tasks as follows:

(1) Digital technology can support on the spur of educational changes, particularly *administration process* in teaching and learning, research, academic services, and art and culture promotion. The conceptualization of digital learning and digital citizens will generate new teaching and learning modes via information communication technology (ICT) (Petchroj, 2022).

(2) In Thailand, ICT is considered one of the main elements in integrating information systems for modern education via networking and online courses (Suchato, 2017).

(3) Leadership in the digital economy era aims at sustainable development of educational organizations with visionary leadership and digital learning culture. Digital skills and sustainable development determine administrative competencies in the 21st century for efficient leaders in the field of education (Chaemchoi, 2019).

6. Research Methodology

The population consists of 2,254 teachers: (i) 1,723 secondary school teachers under Nonthaburi Secondary Educational Service Area Office, and (ii) 531 primary school teachers under Nonthaburi Primary Educational Service Area Office Area 1 (n=162) and Area 2 (n=369).

The sample was 400 selected by stratified random sampling: 307 secondary teachers, and 93 primary teachers. All selected participants hold qualifications for administrative positions as specified by the Basic Education Office in Nonthaburi Province, and have educational management experience at the school level for at least five years. It should be noted that the gender variable is not considered for its impact on the participants' perception toward digital leadership of education administrators in this study. By school arrangements, the participants provided their responses to the survey questionnaire online in the first quarter of 2024.

The research instrument was an online survey questionnaire to collect data on the respondents' opinions on digital leadership of education administrators in six aspects: (i) Overall, (ii) Visionary Leadership, (iii) Professional Practice, (iv) Data Driven, (v) Talent Management, and (vi) Digital Age Learning Culture. The question items were based on the six aspects of digital leadership, on a scale of 1 low to 5 high. The constructed questionnaire was validated by three experts in educational administration for IOC value in each item between .67-1.00, having reliability of Cronbach' alpha co-efficient .91. The data analysis used percentages, means, standard deviation, factor analysis in two types: exploratory factor analysis and confirmatory factor analysis.

The researcher used statistics to measure consistency as follows:

(1) A chi-square value that is not statistically significant is a p-value higher than .05.

(2) The chi-square ratio/degrees of freedom (χ^2 / df) value should not exceed 2.00.

(3) Goodness of fit index: GFI, adjusted goodness of fit index: AGFI, comparative fit index: CFI has values from 0.90-1.00.

(4) The standardized root mean squared residual: standardized RMR, root mean square of error approximation: RMSEA values are lower than .05.

(5) The critical n: CN value is equal to or greater than 200 of the sample.

(6) The largest standardized residual has a value of -2 to 2.

7. Data Analysis

This section reports the results of the study in two parts. The first part is on the respondents' opinions on digital leadership of education administrators in six aspects: (i) Overall, (ii) Visionary Leadership (a), (iii) Professional Practice) (b), (iv) Data Driven (c), (v) Talent Management (d), and (vi) Digital Age Learning Culture (e) (see Tables 1-7). The second part shows the results from exploratory and confirmatory factor analyses (see Figures 1 and 2).

7.1 Respondents' Opinions on Digital Leadership for Educational Administrators of Basic Educational Institutions in Nonthaburi Province

Table 1 shows that the mean and standard deviation of the digital leadership opinions in *Overall* at a high level ($\bar{x}$ = 4.19, SD =.47). When considering each aspect, every aspect had an average level of high and the highest levels. The aspect with the highest mean value was *Visionary leadership* at the highest level ($\bar{x}$ = 4.61, SD=.54), followed by *Professional practice*, *Data driven*, *Digital age learning culture* and *Talent management*, respectively.

Table 1: Respondents' Opinions on Digital Leadership for Education Administrators *Overall*: Mean and Standard Deviation (N=400)

Aspect	Description	$\bar{x}$	SD	Meaning	Rank
1	Visionary Leadership) (a)	4.61	.54	highest	1
2	Professional Practice) (b)	4.16	.56	high	2
3	Data Driven (c)	3.97	.66	high	3
4	Talent management) (d)	3.31	.56	high	5
5	Digital Age Learning Culture (e)	3.91	.67	high	4
	Total	4.19	.47	high	

Table 2 reports the respondents' opinions on digital leadership of education administrators in *Visionary leadership* with the total at a highest level and four items at the highest level. The highest number was *Apply digital to enhance organizational excellence*. The lower numbers were *Able to exchange and convey visions with personnel thoroughly, Have an idea about organizational transformation through the development of digital innovation,* and *Have an understanding of strategies that support your goals will increase your chances of competing*.

Table 2: Respondents' Opinions on Digital Leadership for Education Administrators *Visionary Leadership(a)*: Mean and Standard Deviation (N=400)

Item	Visionary Leadership) (a)	$\bar{x}$	SD	Meaning	Rank
a1	Able to exchange and convey visions with personnel thoroughly.	4.63	.58	highest	2
a2	Have an idea about organizational transformation through the development of digital innovation.	4.58	.59	highest	3
a3	Apply digital to enhance organizational excellence.	4.68	.57	highest	1
a4	Have an understanding of strategies that support your goals will increase your chances of competing.	4.57	.75	highest	4
	Total	4.61	.54	highest	

Table 3 shows all items at a high level; the highest aspect was *School administrators are leaders in being fluent in digital usage.* The lower aspects were *Able to organize a professional digital innovation learning environment, Able to organize a professional digital innovation learning environment,* and *Belief in using technology in the digital age and searching for various digital learning resources*.

Table 3: Respondents' Opinions on Digital Leadership for Education Administrators *Professional Practice) (b)*: Mean and Standard Deviation (N=400)

Item	Professional Practice) (b)	$\bar{x}$	SD	Meaning	Rank
b1	School administrators are leaders in being fluent in digital usage.	4.36	.67	highest	1
b2	Belief in using technology in the digital age.	4.21	.77	high	3
b3	Able to organize a professional digital innovation learning environment.	4.26	.72	high	2
b4	Searching for various digital learning resources.	3.79	1.05	high	4
	Total	4.16	.56	high	

Table 4 indicates that all items were at a high level; the highest aspect was *Able to retrieve information using technology*. The lower aspects were *Strategic planning of quality data management, Use information resources with technology effectively*, and *Use information in management to achieve maximum benefit.*

Table 4: Respondents' Opinions on Digital Leadership for Education Administrators *Data Driven (c)*: Mean and Standard Deviation (N=400)

Item	Data Driven (c)	$\bar{x}$	SD	Meaning	Rank
c1	Strategic planning of quality data management	4.00	.73	high	2
c2	Able to retrieve information using technology	4.05	.76	high	1
c3	Use information resources with technology effectively	3.95	.89	high	3
c4	Use information in management to achieve maximum benefit.	3.89	.85	high	4
	Total	3.97	.66	high	

Table 5 reveals that all items were at a high level; the highest number was *Able to manage the recruitment of talented, quality personnel for educational institutions*. The lower aspects were *Develop personnel with knowledge and innovative ideas, Able to develop creative thinking in digital innovation for teachers and students,* and *Manage and balance the skills and abilities of personnel to suit the situation.*

Table 5: Respondents' Opinions on Digital Leadership for Education Administrators *Talent Management (d)*: Mean and Standard Deviation (N=400)

Item	Talent Management (d)	$\bar{x}$	SD	Meaning	Rank
d1	Manage and balance the skills and abilities of personnel to suit the situation.	4.05	.83	high	4
d2	Able to manage the recruitment of talented, quality personnel for educational institutions	4.42	.59	high	1
d3	Able to develop creative thinking in digital innovation for teachers and students	4.37	.67	high	3
d4	Develop personnel with knowledge and innovative ideas	4.41	.60	high	2
	Total	4.31	.56	high	

Table 6 showed that all items at a high level; the highest number was *Create dynamics in using technology Digital innovation normalized in educational institutions*. The lower aspects were *Support and encourage all personnel to have access to digital innovation*, *Create a culture of learning in the digital world in educational institutions,* and *Promote mutual learning in the digital world until it is adhered to as a practice.*

Table 6: Respondents' Opinions on Digital Leadership for Education Administrators *Digital Age Learning Culture (e)*: Mean and Standard Deviation (N=400)

Item	Digital Age Learning Culture (e)	$\bar{x}$	SD	Meaning	Rank
e1	Create dynamics in using technology Digital innovation normalized in educational institutions	4.21	.69	high	1
e2	Create a culture of learning in the digital world in educational institutions.	3.84	.94	high	3
e3	Support and encourage all personnel to have access to digital innovation.	3.95	.67	high	2
e4	Promote mutual learning in the digital world until it is adhered to as a practice	3.58	.82	high	4
	Total	3.89	.67	high	

7.2 Results of Exploratory Factor Analysis

Table 7 reveals a total of four factors, each factor having at least 3 variables, with the weight of Factor Loading between .595 to.949. The factors are shown below:

Table 7: Factor Loading of Exploratory Elements after Rotation

Rotated Component Matrix[a]

Item	Factor Loading			
	1	2	3	4
e1) Create dynamics in using technology Digital innovation normalized in educational institutions	.935			
d4) Develop personnel with knowledge and innovative ideas	.834			
e2) Create a culture of learning in the digital world in educational institutions.	.722	.		
c1) Strategic planning of quality data management	.700			
d2) Able to manage the recruitment of talented, quality personnel for educational institutions	.640			
a2) Have an idea about organizational transformation through the development of digital innovation.		.949		
a1) Able to exchange and convey visions with personnel thoroughly.		.889		
a3) Apply digital to enhance organizational excellence		.831		
a4) Have an understanding of strategies that support your goals will increase your chances of competing.		.719		
C2) Able to retrieve information using technology.			.911	
c3) Use information resources with technology effectively.			.872	
c4) Use information in management to achieve maximum benefit.	.		.595	
b1) School administrators are leaders in being fluent in digital usage.				.880
b2) Belief in using technology in the digital age.				.789
b3) Able to organize a professional digital innovation learning environment.				.744
Eigen Value	6.552	2.885	1.737	1.271

Extraction Method: Principal Component Analysis
Rotation Method: Varimax with Kaiser Normalization
[a.] Rotation converged in 6 iterations

As seen in Table 7, Factor 1 had an Eigen Value of 6.552, consisting of 4 variables of executives: *'Create dynamics in using technology Digital innovation normalized in educational institutions*' (e1), *'Develop personnel with knowledge and innovative ideas' (d4), 'Create a culture of learning in the digital world in educational institutions'* (e2), '*Strategic planning of quality data management*' (c1) and *'Able to manage the recruitment of talented, quality personnel for educational institutions'* (d2). Therefore, the name of this digital leadership factor was "Components of Creation of Innovative Digital Leadership."

Factor 2 had an Eigen Value of 2.885, consisting of 4 variables of executives: *'Have an idea about organizational transformation through the development of digital innovation'* (a2), *'Able to exchange and convey visions with personnel thoroughly'* (a1), *'Apply digital to enhance organizational excellence'* (a3), and *'Have an understanding of strategies that support your goals will increase your chances of competing'* (a4). This factor was therefore named "Components of having a Visionary Leadership."

Factor 3 had an Eigen Value of 1.737, consisting of 3 variables of executives: *'Able to retrieve information using technology'* (c2), *'Use information resources with technology effectively'* (c3), and *'Use information in management to achieve maximum benefit*' (c4). This factor was named "Components of the ability to use information systems using Data Driven"

Factor 4 had an Eigen Value of 1.271 consisting of 3 variables of executives: *'School administrators are leaders in being fluent in digital usage'* (b1), *'Belief in using technology in the digital age'* (b2), and *'Able to organize a professional digital innovation learning environment'* (b3). Therefore, this factor was named "Components of being a professional and fluent digital using Professional Practice."

7.3 Results of Confirmatory Factor Analysis

The structure appears in Figures 2 and 3 as follows:

(1) Chi-square values not statistically significant are p-values higher than 0.05 (not consistent with the value obtained at .005).

(2) The chi-square ratio/degrees of freedom ($\chi 2$ / df) value should not exceed 2.00 (corresponds to the value obtained at 2.00).

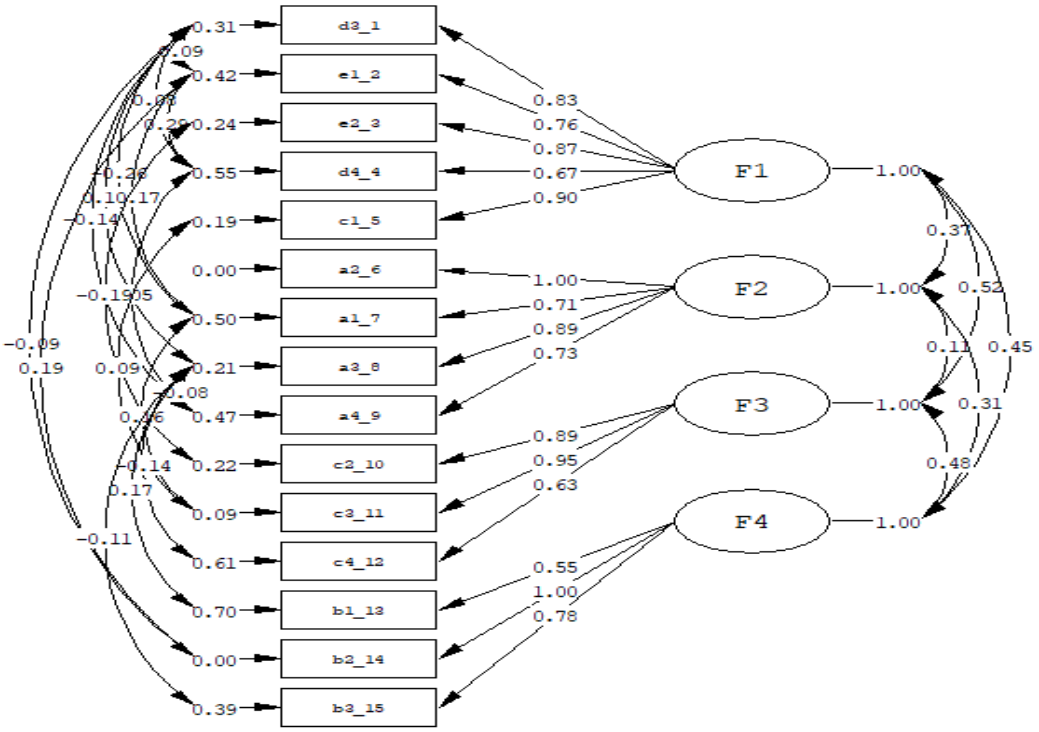
(3) Goodness of fit index: GFI, adjusted goodness of fit index: AGFI, comparative fit index: CFI with values from 0.90 – 1.00 (corresponding to the value obtained .89)

(4) The standardized root mean squared residual: standardized RMR, root mean square of error approximation: RMSEA values are lower than 0.05 (corresponding to the obtained value .047).

(5) The critical n: CN value is equal to or greater than 200 of the samples (corresponding to 254).

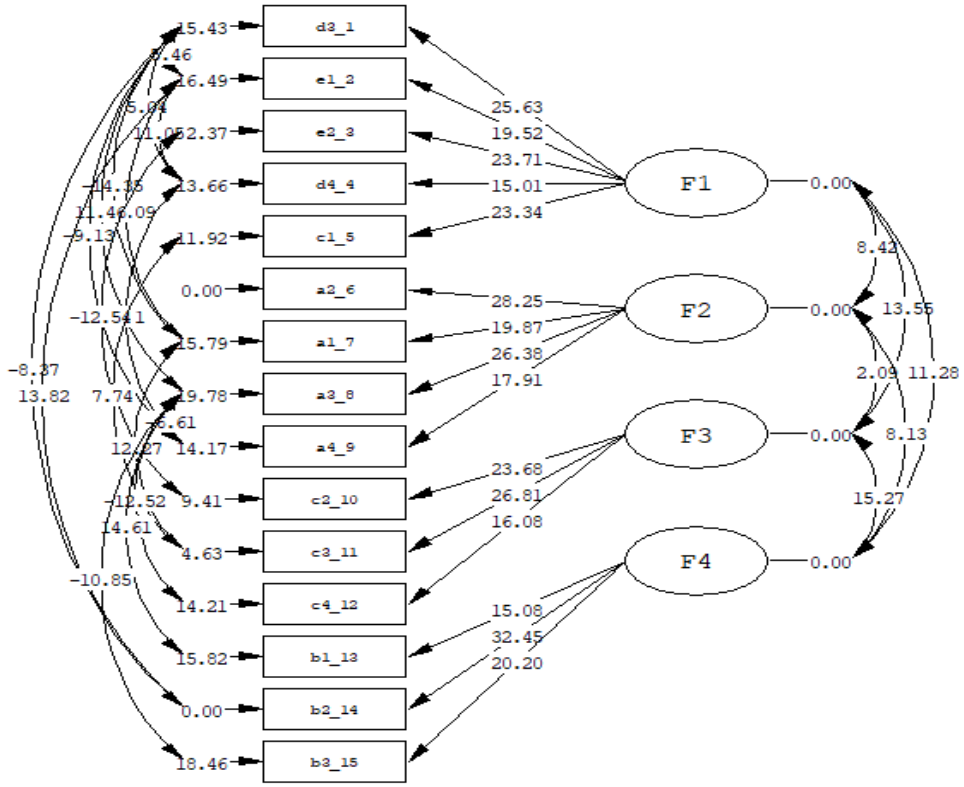
(6) The largest standardized residual has a value of -2 to 2 (corresponds to .20).

Figure 1: Results of Confirmatory Factor Analysis (1)



Chi-square=190.60, df = 95, p-value=.045, RMSEA=.047

Figure 2: Results of Confirmatory Factor Analysis (2)



8. Conclusion and Discussion of Research Results

The conclusion and discussion of the research results are responsive to the identified research objective: to study digital leadership by exploratory and confirmatory factor analysis of digital leadership for basic educational administrators in Nonthaburi Province, Thailand. The researcher expected that the obtained findings on the identified factors can provide guidelines for training in digital leadership development in schools under the Basic Education Office at the provincial and national levels in Thailand. The major findings are concluded and discussed in this section:

(1) The digital leadership opinions in *Overall* were at a high level. When considering each aspect, the highest mean was *Visionary Leadership* at the highest level, followed by the high level by *Professional Practice*, *Data Driven*, *Digital Age Learning Culture*, and *Talent Management*, respectively. The researcher also performed exploratory and confirmatory factor analyses on the obtained data and found four factors: (i) Creation of Innovative Digital Leadership (ii) Visionary Leadership (iii) Data Driven, and (iv) Professional Practice. The findings are discussed in this section.

(2) From the findings derived from the respondents' opinions on digital leadership for educational administrators in basic education in Nonthaburi Province, *Visionary Leadership* was identified as the most prominent aspect. This aspect appears to stem from the rapidly changing technology in the digital era. It has become an important tool and method for management; therefore, administrators need to adapt themselves to cope with rapid changes from digital disruption, and accommodate their human resources--teachers and students to use modern technology conveniently, quickly, and easily. Teachers must be trained and supported to organize effective learning management, create innovative digital media for education, such as new media in 3D, animation, and artificial intelligence (AI). They must apply digital technology to meet the needs of new modes for teaching and learning management. This is consistent with Buachu & Buachu (2019) who concluded that digital leadership of school directors can have direct impacts on teachers and educational personnel in schools in all areas of administration: registration and documentation, personnel management, academic task execution, and budget and finance. School leaders must be digitally literate--understand, be able to create, access, and use digital innovation technology in school administration. They need to handle educational management in crisis, as in the past situation of COVID-19, by adapting online platforms for teaching and learning. This finding also aligns with the earlier research by Kantham & Thammaphisamai (2018) that emphasized four main components in the digital leadership measurement model: (i) Communication skills, (ii) Creative thinking skills, (iii) Vision skills, and (iv) Cooperation skills—all these in support of digital leadership at the school and university levels.

(3) From the results of exploratory and confirmatory factor analyses, four factors are evident to be integrated into the guidelines for digital leadership of educational administrators in basic education institutions in Nonthaburi Province. These four factors are: (i) Creation of Innovative Digital Leadership (ii) Visionary Leadership (iii) Data Driven (iv) Professional Practice.

Creation of Innovative Digital Leadership as Factor 1 consists of five variables: (i) Create dynamics in using technology Digital innovation normalized in educational institutions, (ii) Develop personnel with knowledge and innovative ideas, (iii) Create a culture of learning in the digital world in educational institutions, (iv) Strategic planning of quality data management, (v) Able to manage the recruitment of talented, quality personnel for educational institutions. As known, the creation of digital innovation is a necessity that administrators must adapt to suit the context of each school, which has different readiness in terms of teachers' and students' abilities, and the modernity of technology and budget. Differences in school contexts were earlier emphasized by Suwannarat (2020) who also studied digital leadership for school administrators under the Nonthaburi Secondary Educational Service Area Office. This researcher especially pointed to the significance of personnel assessment in digital knowledge and skills in the organization, and the use of digital technology in evaluating the entire digital technology systems selected by individual secondary school contexts.

Visionary Leadership as Factor 2 consists of 4 variables: (i) Have an idea about organizational transformation through the development of digital innovation, (ii) Able to exchange and convey visions with personnel thoroughly, (iii) Apply digital to enhance organizational excellence, (iv) Have an understanding of strategies that support your goals. School administrators need to adapt themselves to online teaching and learning, using media and technology skills--both for in-class instruction and supplementary media. An emphasis should be on the use of electronic media (e-Learning) in various forms, such as online, offline, studying via websites, learning via mobile phones (m-Learning), mixed media (Multi Media), which is the use of various types of media altogether. Learners must develop information skills by searching via the Web and creating Webpages, assessing understanding by taking online quizzes and supplementary practices via e-books, and interacting with groups, Vlog, Podcast, Webcasts, You Tube, Wikis, Skype by various computer media available (Petchroj, 2021a).

Data Driven as Factor 3 consists of 3 variables: (i) Able to retrieve information using technology, (ii) Use information resources with technology effectively, and (iii) Use information in management to achieve maximum benefit. This factor gives significance to the information system and technology regarding quick and easy access. The Ministry of Education Policy (announced in 2016) has set management standards and educational institution development as a model for the use of information technology (ICT) to develop autonomous and life-long learning nationwide. In terms of internal management of educational institutions, the information technology development plan must be included in the annual action plan on the Internet/LAN network system in educational institutions. Teachers can use information technology to organize learning activities for students effectively. Such requirement appears consistent with the study by Domeny (2017) in support of the relationship between digital leadership of school administrators and that of teachers in elementary schools in Missouri, USA. The researcher asserted that the level of digital leadership of administrators is closely associated with teachers' self-awareness in the created skill model by the ISTE standard for administrators.

Professional Practice as Factor 4 consists of 3 variables: (i) School administrators are leaders in being fluent in digital usage, (ii) Belief in using technology in the digital age, and (iii) Able to organize a professional digital innovation learning. As required, administrators need to develop the characteristics of educational institution administrators in the digital era. ICT Leadership means the ability of administrators to learn, understand, accept changes in ICT, be able to apply it appropriately and create the most benefit to their educational institution. This is consistent with the research of Petchroj (2021b) and Ridho et al. (2023) in that digital leadership is in the scope of education management. In the era of Industrial Revolution 4.0 or the first phase of digital revolution, educational administrators need to update and adapt policies, plans, and development principles to changes caused by digital disruption. Digital leaders must integrate work flexibly, emphasizing the use of technology to coordinate work with teachers, students, and parents that are appropriate for the current world. According to the 4C formula (Critical thinking, Creativity, Communication, and Collaboration) prescribed by the Ministry of Education Thailand, one of the keys must be applied to digital leadership in the educational environment. Digital leadership strategies can be implemented through transparent leadership in all aspects of the school.

As seen in the results under discussion, administrators and teachers need to understand the dramatic changes of the digital age that require the development of current technological skills. The digital leadership of administrators should be visible in digital innovation creation, vision, ability to use information systems and technology in practices, and capacity as professional digital users. These are digital competencies emphasized by Pakorn et al. (2022) in the digital leadership model of educational administrators under the Office of the Basic Education Commission, Thailand. The reported model carries seven factors: (i) digital vision, (ii) digital knowledge and skills, (iii) digital management, (iv) digital culture, (v), *digital collaboration networks*, (vi) digital adaptation, and (vii) digital strategies. Of these seven factors (derived from the responses of 360 administrators and teachers in educational institutions under study), the one on *digital collaboration networks* has called attention from administrators regarding the importance networking as an essential characteristic of the digital culture. The Office of the Basic Education Commission has also taken this point into consideration by developing and supporting human resources in the field of education to move forward effectively.

9. Recommendations

Based on the obtained findings, the Area Education Office can accelerate the process of digital leadership training for school administrators by taking four factors into consideration. First of all, *Data Driven* should be promoted and developed for administrators' ability to use information systems and technology via school networks or public/private higher education institution networks for learning and sharing. The next step could be a full-scale learning management in the cyber world in order to reach a high level of digital skills competency.

It is important for schools to organize seminars and training programs to equip personnel with strategies that support the goal and increase competitiveness as a school

with digital innovation. Schools need to increase channels to find various digital learning resources. The short-term and long-term strategic plans should target maximum benefits for quality infrastructure, required communication skills, training programs, information and communication technology systems, and facilities on selected digital platforms. Future research can be pursued in line with the obtained findings on the four identified factors as guidelines for school administrators to achieve digital leadership for effective school management and operations.

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11. The Author

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Organizational Strategic Factors Affecting the Success of AI Technology Implementation for Higher Education Institution Management in Bangkok

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Abstract

The objectives of this research were: (1) to investigate the organizational strategic factors affecting the success of AI technology implementation for higher education institution management in Bangkok; and (2) to propose guidelines for the development of models and methods in using AI technology for higher education institution management in Bangkok. This research used a mixed quantitative-qualitative research method. The sample consisted of personnel from higher education institutions in Bangkok, obtained through multi-stage sampling, totaling 687 individuals. The research instruments included a survey questionnaire, interviews, and observation techniques. Quantitative data were analyzed using statistical methods with computer software, specifically multiple regression analysis, and qualitative data were analyzed through inductive content analysis. The research findings revealed five organizational strategic factors affecting the use of AI technology for higher education institution management: (1) organizational policies; (2) management support; (3) user experience and AI technology usage competency; (4) user knowledge of AI technology for management; and (5) the ability of the AI technology development team to coordinate with users. The guidelines for developing models and methods for using AI technology consisted of: (1) considerations, including (i) awareness, (ii) capability, and (iii) provision; (2) the principles of designing modern database systems for AI technology, which included (i) covering user needs, (ii) aligning with the data in the system to be used, (iii) ensuring easy system access without problems, (iv) maximizing the connection of data in the system, and (v) ensuring maximum system stability and security; (3) the design and development methods, which included seven key stages: (i) feasibility study, (ii) system analysis, (iii) system design, (iv) programming, (v) system testing, (vi) system deployment, and (vii) system maintenance; (4) the planning and development of appropriate and efficient AI technology systems, including (i) user participation, (ii) educational innovation design, (iii) supporting both offline and online teaching and learning, (iv) standard verification, (v) the impact of device usage on user health, (vi) user problem-solving processes, (vii) system security, and (viii) compliance with ICT laws; and (5) the methods for using and evaluating the efficiency of AI technology, including (i) system reliability, (ii) system readiness, (iii) system security, and (iv) system error management. The obtained findings are expected to guide higher education institutions in Bangkok to succeed well in establishing good standards and practices in AI technology for their organizations.

Keywords: *Organizational strategy, AI technology, higher education institution management, Bangkok*

1. Introduction

The changing global context is driven by knowledge, innovation, technology, society, culture, environmental friendliness, and rapid change (Armanious & Padgett, 2021; Aad & Hardey, 2025). Thailand has currently faced changing trends, both rapid and disruptive, which present both opportunities and risks for national development across almost all dimensions. Amidst the changes of modern society, which relies on knowledge and the transition to a new dimension of digital-era living, all types of organizations, whether public, business, state enterprises, services, or education institutions, need to adapt to build capabilities and advantages under competitive conditions (Laudon & Laudon, 2019). The education sector is a crucial mechanism for developing national human resources, aiming to create learners with standardized knowledge and skills that meet the demands of the job market and society, including both domestic and international stakeholders (Sriboonnark, 2020; Phakamach et al., 2023c; Luckin, 2025).

A key and essential learning area is the Information and Communication Technology (ICT) system. The development of ICT systems has continually caused a major global transformation in the past, present, and future, becoming essential for all organizations. It can be said that the world has fully transitioned into an e-Society (Vodenko & Lyausheva, 2020; Phakamach et al., 2021). Furthermore, in the field of educational management, the development of AI Technology for Education, which is a Big Data management system in educational organizations (Flavin & Quintero, 2020; Cain et al., 2023; Thottoli & Thomas, 2024; Phakamach & Panjarattanakorn, 2024), is part of the widespread application of ICT systems. The aim is to maximize document management efficiency. For organizations that can appropriately develop and apply AI technology for education, it helps administrators and staff receive accurate and timely information, leading to more effective decision-making in organizational planning. Problem-solving becomes more timely, competitive advantages can be gained, and customer services can be improved efficiently (Sinlarat, 2020; Kang, 2023; Gavhane & Pagare, 2024; Salinas-Navarro et al., 2024).

Thailand has increasingly adopted ICT policies and strategies in the education sector due to the rapid spread of electronic devices and ICT systems, including modern communication channels. This has led to the exchange of educational electronic data (EDI), educational applications, distance education, alternative education, and active learning through online systems, enhancing the quality and efficiency of teaching and learning at all levels. Particularly, higher education needs to improve quality both in depth and breadth to create quality Thai citizens amidst free competition in the digital economy (Ruel et al., 2021; Phakamach et al., 2022b; Phakamach & Panjarattanakorn, 2024; Thottoli & Thomas, 2024).

In the current trend of AI technology, the application of ICT systems under strategic management processes helps improve process efficiency and competitive advantages in several key areas, including reducing production costs, improving quality, increasing flexibility, connecting with competitors, responding quickly to learners, maintaining loyal customer bases and expanding to new customer groups. Organizations can use fewer resources, create diverse service models, develop new work processes, and adapt to the

changing needs and expectations of educational service recipients. Thus, modern education management must adapt and develop to align with changing contextual conditions. Administrators at all levels must continuously seek knowledge and self-improvement, creating a digital learning environment to ensure organizational survival and achieve the objectives of digital-era education (Vodenko & Lyausheva, 2020; European Commission, 2021; Manoharan et al., 2022; Tulowitzki et al., 2022).

Okunlaya et al. (2022) argued that AI technology for education is an ecosystem of ICT tools that helps administrators, teachers, educational staff, learners, system administrators, and parents access relevant information needed for teaching and learning. Users can access what they need anytime and anywhere with an internet connection, without being physically present. Teachers and staff can share information, learners can access resources to aid learning, system administrators can access and manage critical data securely, and educational organizations can communicate and share information better, enabling full digital operations (Kang, 2023; Phakamach et al., 2023d; Gavhane & Pagare, 2024; Salinas-Navarro et al., 2024).

Organizational Strategy is crucial for determining an organization's success or failure. This includes factors, such as management support, user experience and platform competency, user knowledge of ICT systems for digital platform development, and the platform development team's ability to coordinate with users. Understanding and studying organizations that successfully use management strategies can help administrators recognize the benefits of strategies that support organizational success (Barney & Hesterly, 2020; Ziadlou, 2021; Cain et al., 2023). Strategies must be selected and applied appropriately to the organization (Luckin, 2025). *Strategic management* is a systematic administration that requires leadership vision and step-by-step planning. Because strategic management is holistic, administrators need effective and practical strategies that avoid failure. Thus, both the strategy and the administrators who decide on and implement it are equally important (Vodenko & Lyausheva, 2020; Ruel et al., 2021; Okunlaya et al., 2022; Phakamach et al., 2022b), especially in higher education, which requires the application of modern educational innovations and technologies for effective educational service delivery.

All higher education institutions in Bangkok have recognized the importance of *strategic planning* and *AI technology* for educational management. Each institution has policies to develop educational strategic plans and AI technology for educational management under the new normal, including adapting current work systems to achieve future goals. However, past strategic planning in higher educational institutions in Bangkok has faced various problems and obstacles from rapid changes in internal and external environments, such as economic, political, and digital technology conditions (Phakamach, 2023b). These changes hinder strategic planning and the use of AI technology for educational management at the higher education level in Bangkok and may affect future educational model adjustments and development. Therefore, administrators need to review educational development concepts and directions to align digital strategic planning and AI technology for educational management with these disruptive changes.

This research focused on identifying the organizational strategic factors affecting the success of AI technology implementation for higher educational institution management in

Bangkok, using a mixed quantitative-qualitative research approach to examine the relationship between organizational strategic factors and the successful implementation of AI technology in higher educational institutions in Bangkok. Specifically, organizational strategic factors are crucial for developing models and methods to improve the efficiency of AI technology used by higher educational institutions in Bangkok. The researchers expected to modernize, enhance efficiency in AI technology practices in higher educational management in Bangkok, and further support the quality operations of higher educational institutions by Thailand's 20-year National Education Strategy.

2. Research Objectives

There were two research objectives in this study:

(1) To investigate the organizational strategic factors influencing the success of AI technology implementation of AI technology for higher education institution management in Bangkok.

(2) To propose guidelines for the development of models and methods in using AI technology for higher education institution management in Bangkok.

3. Background of the Study

This section reports previous studies as background in the use of AI technology in the educational context in two parts: (i) Related concepts and theories, and (ii) Literature and related research.

3.1 Related Concepts and Theories

The present era of digital technology has significantly transformed global society. The internet and global networks have become systems that connect the world without borders, and smartphones have seamlessly linked people worldwide, enabling access to information and services to a great extent. This puts the information age in everyone's hands, regardless of location or time (Laudon & Laudon, 2019; Barney & Hesterly, 2020). Therefore, studying the appropriate ICT systems for organizational use is crucial for timely decision-making. This requires concrete management planning, appropriate ICT system structuring, and strategies that align with core strategic plans, as well as systematic management strategies to achieve organizational goals, ensure continuous development, and foster sustainable growth (Cain et al., 2023; Phakamach, 2023a).

In addition to helping organizations achieve their goals, ICT systems are tools for reengineering and transforming organizations at four levels: (1) *Automation*, the most common form of change, enables employees to work more conveniently and quickly, reduces data errors, and increases work efficiency. For example, online ticket services for trains and airplanes significantly reduce front-end employee workload; (2) *Rationalization of Procedures*, which occurs after automation, reveals inefficient work processes, necessitating the revision of Standard Operating Procedures (SOPs) to support new, efficient, and standardized processes and address operational bottlenecks; (3) *Business Process Reengineering (BPR)* involves rethinking and radically redesigning business processes to improve quality and service, enhance operational speed, reduce costs, and streamline operations for greater efficiency; and (4) *Paradigm Shifts*, which involve changing business concepts to modern systems, may entail altering customer, product,

service, or business model perspectives without adhering to traditional frameworks. This transformative change requires significant effort and high-risk management, but successful implementation yields substantial returns (Armanious & Padgett, 2021; Phakamach, 2023b; Aad & Hardey, 2025).

Strategic and integrated ICT systems support organizational operations and align with organizational strategies, offering benefits in the following areas: (1) *Innovative Applications*, applying innovation to directly support strategies for organizational advantage; (2) *Competitive Weapons*, using ICT systems as competitive tools; (3) *Changes in Processes*, using ICT systems to support business process changes that translate strategies into advantages; (4) *Links with Business Partners*, enabling efficient and effective connections with trade partners; (5) *Cost Reductions*, using ICT systems to reduce company costs; (6) *Relationships with Suppliers and Customers*, using ICT systems to build relationships that create variable pricing; (7) *New Products*, adjusting ICT investments to create market-demanded products; (8) *Competitive Intelligence*, using ICT systems to gather and analyze market, competitor, and environmental data for business intelligence (Vodenko & Lyausheva, 2020; Saveliev & Zhurenkov, 2021; Ziadlou, 2021; Phakamach, 2023b).

3.2 Literature and Related Research

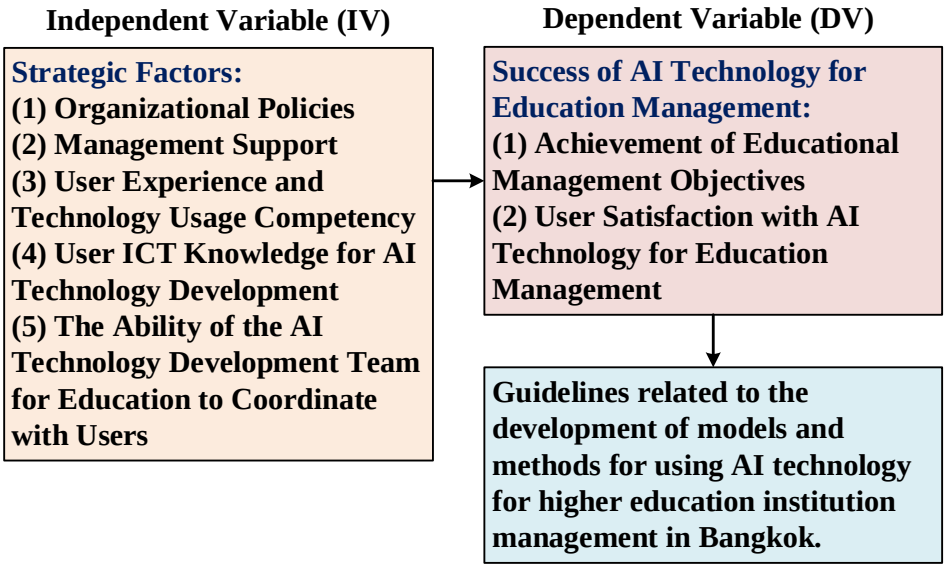
Literature and research related to organizational strategic factors affecting success in using AI technology for educational management have signified the impact of AI technology on education management. Saveliev & Zhurenkov (2021) and Cain et al. (2023) reported six factors that affect success in using AI technology for educational management: (1) organizational policies, (2) management support, (3) user experience and competency, (4) user ICT knowledge for AI technology development, (5) standardized system development processes, and (6) the expertise of the system development team. These are crucial strategies for the successful implementation of AI technology in educational management

Quite a few previous studies indicate the success of AI technology in educational management includes (1) achieving educational management objectives and (2) user satisfaction with AI technology for educational management. Specific details for strategic development depend significantly on the organizational context and system development capabilities (Kumar & Vivekanandan, 2018; Atasoy et al., 2020; Flavin & Quintero, 2020; Ruel et al., 2021; Phakamach et al., 2022a; Kang, 2023; Phakamach, 2023b; Aad & Hardey, 2025; Luckin, 2025).

4. Research Conceptual Framework

From the review of previous studies related to the organizational strategic factors affecting success in using AI technology for education management, the researchers developed a conceptual framework to seek answers responsive to the two research objectives, as shown in Figure 1:

Figure 1: Research Conceptual Framework



5. Research Methodology

This research dealt with the relationship between organizational strategic factors (independent variables) that affect success in using digital platforms for educational management (dependent variables) in higher education institutions in Bangkok, using a mixed-methods research approach. This section gives information on the participants and research instruments.

5.1 Population and Sample

Population:

The research population consisted of executives and personnel from 16 higher educational institutions in Bangkok [all names revealed with permission]: (1) six autonomous public universities, namely Chulalongkorn University, Mahidol University, King Mongkut's University of Technology Thonburi, King Mongkut's University of Technology North Bangkok, King Mongkut's Institute of Technology Ladkrabang, and Thammasat University; (2) six public universities, namely Kasetsart University, Srinakharinwirot University, Ramkhamhaeng University, Silpakorn University, Sukhothai Thammathirat Open University, Pathumwan Institute of Technology, and Suan Dusit University; (3) four Rajabhat University groups, namely Bansomdejchaopraya Rajabhat University, Phranakhon Rajabhat University, Suan Sunandha Rajabhat University, and Thonburi Rajabhat University; and (4) two Rajamangala University of Technology groups, namely Rajamangala University of Technology Krungthep and Rajamangala University of Technology Phra Nakhon.

Sample:

The quantitative sample comprised educational personnel in higher educational institutions under the Bangkok Metropolitan Administration, obtained through a multi-stage sampling scheme, as follows:

Stage 1: Cluster sampling, dividing Bangkok Metropolitan Administration universities into 4 groups: (1) six autonomous public universities (186 educational personnel), (2) six public universities (177 educational personnel), (3) four Rajabhat

University groups (166 educational personnel), and (4) two Rajamangala University of Technology groups (158 educational personnel).

Stage 2: Stratified sampling, distributing the calculated sample size of 687 individuals proportionally among the personnel in Stage 1 to ensure equal representation of sample universities.

Stage 3: Simple random sampling using the lottery method, distributing copies of the survey questionnaire online to the randomly selected higher education institutions until the calculated sample size of 687 was reached.

The qualitative sample consisted of 10 ICT and educational innovation experts, selected through purposive sampling.

5.2 Research Instruments

The research instruments included:

Quantitative Research Instruments: A survey questionnaire on organizational strategic factors affecting the success of AI technology implementation for higher education institution management in Bangkok. The questionnaire was divided into three sections:

Section 1: Demographic information (gender, age, education level, and work experience).

Section 2: Five organizational strategic factors (organizational policies, management support, user AI technology experience and competency, user ICT knowledge for AI technology development, and AI technology development team's ability to coordinate with users).

Section 3: Success of digital platforms for educational management (achievement of educational management objectives and user satisfaction). Sections 2 and 3 used a 5-point rating scale (5 = highest, 1 = lowest).

The questionnaire's validity was assessed by 5 instrument experts, and it was pilot-tested with 30 non-sample participants. The Index of Item-Objective Congruence (IOC) ranged from 0.7 to 1.00. The Cronbach's Alpha coefficient was used to assess reliability, with values ranging from 0.886 to 0.927 for each factor and 0.923 for the overall questionnaire.

Qualitative Research Instruments: (1) *Open-ended structured group interview guide* contained ten question items for 10 ICT and educational innovation experts, to identify relevant variables on success in using AI technology for educational management, and develop guidelines for digital platform development. The length of the group interview was set in 90 minutes; (2) *Observation guide* for observing digital platform usage behaviors of 30 participants from one voluntary university as related to organizational strategic factors and development guidelines. The observation criteria focused on digital skills, problem-solving skills, AI-based instructional delivery, and multi-media use online and offline. The length of observation was also in 90 minutes.

5.3 Data Collection

Quantitative data was collected through the online questionnaire distributed to 687 respondents in the participating higher education institutions in Bangkok, with 100% response rate. Qualitative data collection from a group interview with 10 ICT and educational innovation experts, and the observation of AI-usage behaviors in one voluntary university, was conducted in October to December 2024.

5.4 Data Analysis

Quantitative data was analyzed using multiple regression analysis (stepwise selection) with a statistical significance level of .05 to determine the relationship between organizational strategic factors (independent variables) and success in using AI technology for educational management (dependent variables).

Qualitative data was analyzed through inductive content analysis of interview and observation data, categorizing and indexing information to identify factors aligning with the questionnaire results, and synthesizing findings to develop guidelines for digital platform development in higher education institutions in Bangkok.

6. Research Results

The research findings on the identified organizational strategic factors that affect the success of AI technology implementation for higher education institution management in Bangkok are reported in accordance with the research objectives in this section.

6.1 Organizational Strategic Factors Affecting the Success of AI Technology Implementation for Higher Education Institution Management in Bangkok

Respondents' Variables

Of 687 survey respondents' gender, there were 394 females (57.35%) and 293 males (42.65%). The respondents' age was distributed: 246 respondents aged 26-35 (35.81%), 284 respondents aged 36-45 (41.34%), and 157 respondents aged 46-55 (22.85%).

The respondents' educational levels were: 178 bachelor's degree holders (25.91%), 326 master's degree holders (47.45%), and 183 doctoral degree holders (26.64%). Their work experience was: 246 respondents with 1-10 years of experience (35.81%), 284 respondents with 11-20 years of experience (41.34%), and 157 respondents with 21-30 years of experience (22.85%)

The Results of the Stepwise Multiple Regression Analysis

The results of the stepwise multiple regression analysis regarding success in using AI technology for higher education institution management in Bangkok are shown in Table 1.

Table 1: Results of Stepwise Multiple Regression Analysis Regarding the Success of AI Technology Implementation for Higher Education Institution Management in Bangkok

Strategic Factors	b	t	Sig.
1) Organizational Policies	0.241	3.504*	0.002
2) Management Support	0.207	3.312*	0.001
3) User AI Technology Experience and Competency	0.202	3.306*	0.001
4) User ICT Knowledge for AI Technology Development	0.286	4.498*	0.001
5) The Ability of the AI Technology Development Team for Education to Coordinate with Users	0.231	3.425*	0.002

Note: *Sig. < 0.01

Table 1 reveals five organizational strategic factors having a statistically significant effect on the success of AI technology implementation for higher education institution management under study: (1) Organizational Policies (b=0.241, Sig.<0.002), (2) Management Support (b=0.207, Sig.<0.001), (3) User AI Technology Experience and Competency (b=0.202, Sig.<0.001), (4) User ICT Knowledge for AI Technology Development (b=0.286, Sig.<0.001), and (5) The Ability of the AI Technology Development Team for Management to Coordinate with Users (b=0.231, Sig.<0.002). These factors can explain 54.26% (R_2) of the variance in the achievement of AI technology implementation objectives for higher education institutions in Bangkok.

The results of the stepwise multiple regression analysis regarding *user satisfaction* with AI technology for higher educational institution management in Bangkok are shown in Table 2.

Table 2: Results of Stepwise Multiple Regression Analysis from the Perspective of User Satisfaction with AI Technology for Higher Education Institution Management in Bangkok

Strategic Factors	b	t	Sig.
1) Organizational Policies	0.242	3.411*	0.002
2) User AI Technology Experience and Competency	0.213	3.281*	0.001
3) User ICT Knowledge for AI Technology Development	0.319	4.723*	0.001
4) The Ability of the AI Technology Development Team for Education to Coordinate with Users	0.257	3.389*	0.002

Note: *Sig. < 0.01

Table 2 indicates that four organizational strategic factors have a statistically significant effect on *user satisfaction* with AI technology for educational management: (1) Organizational Policies (b=0.242, Sig.<0.002), (2) User AI Technology Experience and Competency (b=0.213, Sig.<0.001), (3) User ICT Knowledge for AI Technology Development (b=0.319, Sig.<0.001), and (4) The Ability of the AI Technology Development Team for Education to Coordinate with Users (b=0.257, Sig.<0.002). These factors can explain 50.39% (R_2) of the variance in user satisfaction with AI technology for higher education institution management in Bangkok.

From the quantitative data analysis above, including a group interview and observations of sample groups' behaviors in using AI technology for educational management in instructional areas, and from the qualitative interviews with 10 ICT and educational innovation experts, it can be concluded that the organizational strategic factors affecting the success of AI technology implementation for educational management in higher education institutions in Bangkok, *overall*, consist of 5 factors: (1) Organizational Policies, (2) Management Support, (3) User AI Technology Experience and Competency, (4) User ICT Knowledge for AI Technology Development, and (5) The Ability of the AI Technology Development Team for Education to Coordinate with Users. At this point, the researchers considered important in relating each identified factor to previous research as follows:

(1) *Organizational Policies*: Organizational or institutional policies have an impact on the success of AI technology implementation for educational management at the higher education level, which aligns with the concept of Butner (2019) and the research of Phakamach et al. (2023c), stating that preparation for successful ICT system development includes various aspects: (i) Man, which involves preparing personnel to be ready for the creation, development, and use of ICT systems; (ii) Budget, which involves setting financial limits and guidelines for securing sufficient funds for ICT system development according to the plan, as well as budgeting for future system development; and (iii) Planning, where management must develop short-term and long-term system creation or development plans, which should include establishing a dedicated ICT task force comprising management, users, analysts, designers, and external experts to work together effectively. This also aligns with the research of Phakamach (2023b) and Nilsson & Lund (2023), which found that organizational policies influence the success of ICT systems for educational AI technology development, as policies are the rules and regulations for operations. Organizations must clearly define ICT strategies for AI technology development to ensure that personnel understand the correct direction and work together in the same direction, especially in building educational networks that are broad and accessible to communities or localities. Therefore, organizational policies, including ICT development projects for educational AI technology, are key factors that contribute to the short-term and long-term success of the system and the use of AI technology for management.

(2) *Management Support*: Management support affects the success of AI technology implementation for management, is aligned with the concept of Phakamach et al. (2023c), Gavhane & Pagare (2024), and Salinas-Navarro et al. (2024), which states that management support influences the success of ICT system development in organizations. Therefore, the development of ICT systems requires strong support from institutional management in building confidence and dedication among users and stakeholders. Higher educational institutions in Bangkok, as providers of educational services, need support from top management in areas, such as budget, ICT infrastructure, and adequate personnel training to ensure that educational services are convenient, accurate, fast, and efficient. Management should also develop organizational strategic plans for modern AI technology in use, considering (i) Business Alignment, which involves investing in ICT with business vision and strategic goals; (ii) Competitive Advantage, which supports leveraging ICT to create innovative business systems and strategies for competitive advantage; (iii) Resource Management, which develops plans for efficient and effective management of organizational ICT resources; and (iv) Technology Architecture, which involves developing technology policies and designing ICT system architecture for the organization.

(3) *User AI Technology Experience and Competency*: User AI technology experience and competency affect the success of AI technology implementation for management, appear to align with the research of Phakamach et al. (2023d), Nilsson & Lund (2023), Gavhane & Pagare (2024), and Salinas-Navarro et al. (2024). These previous studies pointed to user AI technology experience and competency influencing the success of ICT system implementation in organizations. Most personnel have experience in using the system for more than three years. Therefore, additional management support in

appropriate training, continuous skill development, and systematic user involvement in educational technology and innovation will enhance the efficiency of AI technology use for educational management and services.

(4) *User ICT Knowledge for AI Technology Development*: User ICT knowledge for AI technology development affects the success of AI technology implementation. This identified factor supports the earlier research of Phakamach (2023b), Nilsson & Lund (2023), Leoni et al. (2024), Gavhane & Pagare (2024), and Salinas-Navarro et al. (2024). It should be noted that the experts' recommendations under study also pointed to user AI technology knowledge influencing the success of system in use. In addition, AI technology for educational management should be user-friendly, making it easy for personnel to learn and understand. Importantly, providing knowledge on the ICT system development lifecycle will help personnel maximize the benefits of the designed system for higher educational institutions.

(5) *The Ability of the AI Technology Development Team for Education to Coordinate with Users*: This fifth factor obviously supports the research of Phakamach (2023b), Gavhane & Pagare (2024), and Salinas-Navarro et al. (2024). The experts' recommendations under study also signified the AI technology development team's ability to coordinate with users for success of the ICT system in use. Coordination is a positive factor for smooth and fast organizational operations. The development team is crucial for facilitating and resolving issues during personnel operations. Good coordination and willingness to serve help create a positive digital organizational culture.

6.2 Guidelines for Developing Models and Methods in Using AI Technology for Higher Education Institution Management in Bangkok

Interview responses from 10 ICT and educational innovation experts, and observation data from one voluntary university pointed to the following key guidelines as shown in Figure 2:

(1) Considerations for Using ICT Systems to Develop AI Technology for Management: (i) Awareness, which involves creating awareness among users, including AI literacy and awareness of usage capabilities, inappropriate content prevention, and information filtering; (ii) Ability, which maximizes ICT benefits through continuous learning and practical application; and (iii) Availability, which provides equitable ICT access to all users with digital technology--allowing free system selection under international rules.

(2) Principles of Designing Modern Database Systems for AI Technology Management: (i) Design to meet user needs; (ii) Design to align with system data structures; (iii) Design for easy and concurrent system access; (iv) Design for maximum data correlation; and (v) Design for maximum system stability and security.

(3) ICT System Design and Development Methods for AI Technology Management: Seven key stages: (i) Feasibility Study, (ii) System Analysis, (iii) System Design, (iv) Programming, (v) System Testing, (vi) System Implementation, and (vii) System Maintenance.

(4) Planning and Developing Efficient AI Technology Systems for Higher Education Institution Management: (i) User Participation, (ii) Educational Innovation

Design, (iii) Offline and Online Teaching Support, (iv) Standard Verification, (v) Impact of Device Use on User Health, (vi) User Problem-Solving Processes, (vii) System Security, and (viii) Compliance with ICT Laws.

(5) Methods for Using and Evaluating AI Technology for Educational Management: Key system characteristics: (i) System Reliability, (ii) System Availability, (iii) System Security, and (iv) System Fault Management, including disaster recovery.

From these points on guidelines for models and methods in using AI technology for higher education institution management in Bangkok, ten ICT experts in the study confirmed five organizational strategic factors affecting the success of AI technology implementation in the participating higher education institutions: organizational policies, management support, user AI technology experience and competency, user ICT knowledge for AI technology development, and the ability of the AI technology development team for education to coordinate with users. Core strategic issues for guidelines as shown above in this section and Figure 2 below should be closely associated with these five identified factors to prompt concrete actions from those higher education institutions in Bangkok.

Figure 2: Guidelines for Developing Models and Methods for AI Technology Implementation in Higher Education Institution Management in Bangkok

Source: Phakamach et al. (2025)

7. Conclusion and Discussion

This section concludes and discusses major findings of the study as follows:

7.1 Conclusion

The data analysis results indicate five organizational strategic factors affecting the success of AI technology implementation for higher education institution management in Bangkok: (1) Organizational Policies, (2) Management Support, (3) User AI Technology Experience and Competency, (4) User ICT Knowledge for AI Technology Development, and (5) The Ability of the AI Technology Development Team for Management to Coordinate with Users.

The guidelines for developing models and methods in using AI technology in higher education institution management in Bangkok include:

(1) Considerations for Using ICT Systems to Develop AI Technology for Management: (i) Awareness, (ii) Ability, and (iii) Availability.

(2) Principles of Designing Modern Database Systems for AI Technology Management: (i) Design to meet user needs, (ii) Design to align with system data structures, (iii) Design for easy and concurrent system access, (iv) Design for maximum data correlation, and (v) Design for maximum system stability and security.

(3) ICT System Design and Development Methods for AI Technology Management: Seven key stages: (i) Feasibility Study, (ii) System Analysis, (iii) System Design, (iv) Programming, (v) System Testing, (vi) System Implementation, and (vii) System Maintenance.

(4) Planning and Developing Efficient AI Technology Systems for Higher education Institution Management: (i) User Participation, (ii) Educational Innovation Design, (iii) Offline and Online Teaching Support, (iv) Standard Verification, (v) Impact of Device Use on User Health, (vi) User Problem-Solving Processes, (vii) System Security, and (viii) Compliance with ICT Laws.

(5) Methods for Using and Evaluating AI Technology for Educational Management: Key system characteristics: (i) System Reliability, (ii) System Availability, (iii) System Security, and (iv) System Fault Management.

7.2 Discussion

From the research results, there are key issues that can be discussed in connection with past research and academic work as follows:

Five Factors

The overall organizational strategic factors affecting the success of AI technology implementation for higher education institution management in Bangkok pointed to five factors: (1) Organizational Policies, (2) Management Support, (3) User AI Technology Experience and Competency, (4) User ICT Knowledge for AI Technology Development, and (5) The Ability of the AI Technology Development Team for Management to Coordinate with Users. These five factors are supported by previous research in the past five years: Flavin & Quintero (2020), Saveliev and Zhurenkov (2021), Phakamach et al. (2022a), Phakamach (2023b), Mudkanna Gavhane & Pagare (2024), Salinas-Navarro et al. (2024), and Aad & Hardey (2025). In this regard, higher education institutions need to take these five factors as strategic issues for planning and implementing selected digital platforms for educational management.

Guidelines

The guidelines for developing models and methods for using AI technology in higher education institution management in Bangkok cover: (1) Considerations for Using ICT Systems to Develop AI Technology for Management, (2) Principles of Designing Modern Database Systems for AI Technology Management, (3) ICT System Design and Development Methods for AI Technology Management, (4) Planning and Developing Efficient AI Technology Systems for Higher Education Institution Management, and (5) Methods for Using and Evaluating AI Technology for Educational Management. These points for guidelines appear to align with previous research from 2021-2025: Ruel et al. (2021), Phakamach et al. (2022a), Phakamach (2023b), Abdekhoda & Dehnad (2024), Gavhane & Pagare (2024), Salinas-Navarro et al. (2024), and Aad & Hardey (2025). The development of models and methods in using AI technology for educational management needs to emphasize awareness, ability, and the provision of modern ICT systems, including standardized design and development, reliable planning and development teams, and continuous system performance evaluation for effective and efficient learner services.

The overall characteristics of AI technology implementation for educational management in higher education institutions in Bangkok, when based on the identified guidelines, reveal seven key dimensions with support from previous research as follows:

(1) *Social Equity*: Reducing educational opportunity inequality for social equity. Learners can access knowledge through educational ICT networks without limitations, even in remote rural areas, aligning with the research of Nosalska et al. (2020), Saveliev & Zhurenkov (2021), and Phakamach et al. (2023c).

(2) *Educational Quality*: Using AI as a tool to enhance educational quality. Electronic learning materials, Learning Management Systems (LMS), digital platforms, and AI technology for management provide learners with access to information beyond classroom lectures, and the use of quality media and AI technology improves learner quality (Phakamach et al., 2023d; Gavhane & Pagare, 2024); Salinas-Navarro et al., 2024).

(3) *Personnel Development:* Developing ICT knowledge for AI technology development among educational personnel. Organizations need to support experts to innovate educational ICT systems and provide continuous skill training (Butner, 2019; Saveliev & Zhurenkov, 2021; Gavhane & Pagare, 2024; Salinas-Navarro et al., 2024).

(4) *Digital Networks:* The role of the internet in education, connecting ICT networks for information dissemination and retrieval through the World Wide Web, online learning systems, and applications, enables borderless communication, emphasizing access to educational resources for teachers and learners, changing teacher and learner roles, enhancing communication between teachers and learners, and enabling learner-paced learning (Phakamach et al., 2023c; Abdekhoda & Dehnad, 2024; Aad & Hardey, 2025).

(5) *Lifelong Learning:* The goal of AI technology for learners is to support lifelong learning. Teachers need advanced knowledge and skills, including understanding AI technology development in education. Educational institutions using telecommunication networks transform into electronic institutions with AI technology for various management tasks, such as learner and teacher data management, budgeting, academic services, online activities, research information retrieval, and research data linking (Phakamach et al., 2021; Gavhane & Pagare, 2024; Salinas-Navarro et al., 2024).

(6) *Extended Media*: Organizing effective learning activities requires the integration of various technologies and learning materials, such as Cloud Computing, Smart Classrooms, TV Digital Platforms, Machine Learning (ML), Augmented Reality (AR), and Virtual Reality (VR). Teachers must understand media types, usage methods, and AI technology activities before applying them in education. Educational media should be well-researched and developed for both administrative and academic benefits (Singh et al., 2021; Abdekhoda & Dehnad, 2024; Gavhane & Pagare, 2024; Salinas-Navarro et al., 2024; Aad & Hardey, 2025).

(7) *Competency of Development Team:* Developing appropriate AI technology for educational management should start with clear organizational structure, scope, and objectives. The development team should have system development knowledge and experience, problem and requirement gathering skills, appropriate technology selection, accurate ICT resource trend analysis, and system development methodology selection to achieve objectives within time and budget constraints, and effectively manage development projects for organizational innovation in education (Gavhane & Pagare, 2024; Salinas-Navarro et al., 2024; Aad & Hardey, 2025).

The research results can help establish ICT management strategies for AI technology development in higher education institutions, enhancing efficiency and achieving educational innovation. Digital-era higher education administrators can use these factors as tools/plans/projects to manage and develop ICT systems in support of educational practices at all levels in the digital economy.

8. Suggestions

Based on the research findings on the factors and proposed guidelines for AI technology implementation at the higher education level, the researchers would like to suggest applications and future research as follows:

The research results can be used to develop strategic plans for ICT system development to support educational development and AI technology for educational management in educational organizations, based on user needs, and to exemplify applications to other government agencies and state enterprises. Innovations, including curriculum management, teaching methods, teaching materials, measurement and evaluation, and administration can be identified as relevant issues to each educational level. It should be noted that the success of AI technology implementation largely stems from management policies and user experience. In this regard, the researchers would like to recommended clear regulations or guidelines be established in the first place to make it possible for all dimensions of educational management to achieve expected student learning outcomes.

As for future research, the topics on the long-term impact of implementing AI technology for education management in higher education institutions should be pursued to obtain in-depth data for improving the efficiency of educational ICT systems. Researchers could consider exploring how to increase the resources and capabilities of ICT systems for digital education. To the researchers of this study, in-depth research on specific issues of the use of AI technology in educational institutions, and evaluation methods for the curriculum, and teaching and learning practices should deserve priority in attention

from educational administrators to benefit all stakeholders concerned directly in using selected AI-based platforms to their satisfaction both for now and beyond.

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Academic Paper

A New Messages Design for Communication in the Digital Age

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Abstract

This academic paper reports the concepts and processes of designing substances or messages in the digital age. New messages design is a critical process for creating more meaningful, quality, and efficient communication experiences in the age of technology and rapid connectivity. The design of digital messages essentially focuses on the use of artificial intelligence (AI) to assist in communication--prioritizing quick access to target information as well as creating a higher quality communication experience. In this paper, the authors report an analysis of digital communication dimensions, particularly design principles and tools, with considerations of privacy and data security in creating digital messages. The discussion of new messages design concepts and new tool availability sheds light on the provision of a practical guideline for message creators in using AI to design effective and safe communications in the digital age.

Keywords: *New messages design, communication, digital age*

1. Introduction

In the digital age, technology and communications play a crucial role in connecting the world and shaping human experiences in our daily lives. In this digital age, new messages design has become an important tool for creating more effective and deeper meaningful communications. This is a result of understanding the needs and behavior of users in an era where technology and communication are changing rapidly (Saengdueanchai, 2020; Aphisapthanakul, 2022).

Designing new content in the digital age is not simply about graphic design or data formatting, but also involves understanding the needs of the target audience and using technology to appropriately respond to those identified needs. Designs these days must not only be attractive and interesting. It still has to be convenient to use and easily accessible. There must be clear and effective communication in delivering the message or idea that needs to be communicated (Saengdueanchai, 2020). More importantly, designing messages in the digital age must take into account many factors, particularly the ability to access information. Understanding of content can create interaction with the audience and the digital technology can put messages, images, audio, video, and infographics as part of popular communication models. Since information can be conveyed quickly and clearly, it

can also create a memorable experience for the recipient. Such considerations result in designing new messages for communication on multi-platforms. The audience can access information through many channels—be it a computer, a smartphone, or a table; the design of the message must be flexible and easily adaptable so that information can be communicated at the right point and in a timely manner (Ramasut, 2021).

This academic paper discusses the concepts and processes of designing substances in the digital age, focusing on the adoption of artificial intelligence technologies. Quick access to information and high-quality experience join in forming strategies that lead to the design of new messaging that delivers useful everyday communication experiences in this digital age. This is along with critical concerns over the privacy and security of information communicated across all digital platforms. Message designers need to deliver new communications that are reliable and safe for all users. New communications in the digital age transforms existing ideas and methods in designing new substances to share with those on the same digital platform. Both message designers and end users are looking for new substances that are reliable and safe in the current era of disruptive technology. In this paper, the authors, having synthesized findings from previous relevant studies and AI reference sources, will focus on four critical considerations in new messages design: (i) new messages design concepts and processes, (ii) the characteristics of quick access and meaningful experience, (iii) designer/user concerns over data privacy and security, and (iv) a recommended guideline for message creators to ensure the reliability and safety of communicated information.

2. New Messages Design Concepts and Processes

This section deals with three dimensions of new messages design concepts and processes: (i) new messages design, (ii) principles of substance design, and (iii) tools used in designing substances.

2.1 New Messages Design

In new messages design, a publishing process focuses on creating media that is relevant to the changing world, and rapidly increasing access to information. According to Samakupta (2019), message design is divided into the steps of planning, creating, executing, and evaluating to create valuable media that has an impact on users in the digital world. The study by Samakupta (2019) emphasizes the importance of designing new substances as follows:

(1) User focus: Message design focuses on user needs and continually improves their communication experience by using data and a deep understanding of the target audience.

(2) Bringing new technology into use: New technologies, such as artificial intelligence machine learning or virtual reality technology help create an interesting and diverse communication experience.

(3) Creating meaningful experiences: Designed messages are to create meaningful communication experiences that influence user behavior by focusing on valuable content and building relationships with users.

(4) Using information for decision-making: The use of data and data analysis helps design new substances make practical decisions on improving and adapting media to suit user needs and behavior.

(5) Prioritizing privacy and security: Designed messages prioritize privacy and data security by using encryption technology and controlling access to data.

As seen in these five considerations, new messages design aims at creating valuable and impactful media in a rapidly growing digital world by delivering memorable and meaningful communication experiences to users' daily lives in the current digital era.

2.2 Principles of Substance Design

Wattananarong (2020) listed several message design principles in making content more effective in reaching digital users as follows:

(1) Find the content needed by audience: The message designer must identify the audience's needs accurately.

(2) Accept differences and uncertainties: The message designer needs to update what may occur in the current content and issues presented on the digital platform.

(3) Arrange the content logically: The content must be presented in a form that can be easily understood and well-covered in all aspects.

(4) Give importance to the principles and processes of media creation: Media design, media use, and media production need to integrate images, graphics, letters, colors, and sounds in a professional appearance. Both quantitative and qualitative aspects of the components are required in each type of media.

(5) Explaining and elaborating matters that are difficult to understand: The message designer needs to create a correct balance within content that is complex or difficult to facilitate the audience's understanding.

2.3 Tools Used in Designing Substances

Williams (2021) identified ten substance design tools that can help designers/users create engaging and effective content:

(1) Adobe Creative Cloud: A suite of graphic design, video, and audio tools, such as Photoshop, Illustrator, Premiere Pro, and After Effects that help create high-quality designs.

(2) Canva: An easy-to-use online tool for graphic design--suitable for users of all levels. There are many templates and design elements to choose from.

(3) Figma: A collaborative interface design and prototype tool for teams--good for UI/UX design and real-time collaboration.

(4) Sketch: A design program that focuses on creating UI/UX for applications and websites. It has features that help in creating prototypes and responsive designs.

(5) Invision: A platform for prototyping, testing, and collaboration--deal for user experience (UX) design and wireframe creation.

(6) Final Cut Pro: A video editing program for Mac users that offers professional video editing and high-quality video creation.

(7) Avid Media Composer: Professional video editing program used in film and television. It has the ability to handle large video files and detailed editing.

(8) Prezi: A slide presentation tool that emphasizes creativity and animation. It helps the presentation look interesting and lively.

(9) Piktochart: An easy-to-use online tool for creating infographics. There are many templates and design elements to choose from.

(10) Lumen5: A tool for creating videos from articles or textual content. It helps in creating interesting videos quickly.

These new messages design tools focus on modernity and rapid transformation. They support and facilitate online connections in creating a higher quality and efficient communication experience in today's world. It is evident that the traditional era and the digital era have yielded major differences in the design of new substances, as shown in Table 1 below:

Table 1: Differences in Design of Substances in the Traditional Era and the Digital Era*

Communication Style	Traditional Era	Digital Era
Communication channels	Print media, radio, television	Website, social media, email, chat, video calls
Media creation	Use of the imitation process, creating official media and a communication system with definite steps	Use of information technology to create media that is effective and can be updated according to user needs
Personal communication	Communication between individuals or small groups	Personal and online communications for both personal and business contacts
Creating experiences	Communication media with limitations in display and interaction	Creating diverse and immersive communication experiences with virtual reality and interactive technology
Privacy and security	Communication often in public and with little privacy	A strong focus on data privacy and security, such as the use of encryption and access control technology

*Summary by Santhuenkaew & Athikiate (2025)

3. Characteristics of Quick Access and Meaningful Experience

Communication in the digital age occurs through digital media or online information technology, such as websites, social media, email, chat, video calls, and other media platforms that use digital devices to contact individuals or groups of people. Communication in the present world is characterized by rapidity. It is convenient and can be accessed anytime, anywhere via the internet. It offers a variety of formats and content, such as text, photos, videos, and documents, which allow for effective and efficient communication. Communication as such connects the world for understanding between individuals or groups of people quickly in every aspect of daily life.

As for personal communication, work, education, business and entertainment, new digital messages have influenced the transformation of culture and interpersonal communication worldwide. The nature of communication in the digital age continues to be further transformed by the new technologies, particularly artificial intelligence, machine learning, cloud computing and the Internet of Things--all making world connections possible in remote work collaboration of different kinds as well as realizing relationships between and among global citizens.

We can witness applications of AI and new messages/substances for digital communication at work, especially in business like digital marketing, and education worldwide. As for digital marketing, An (2023) emphasized the *interactive characteristic* in marketing on Webcast Platform. He et al. (2023) reported customer loyalty to products by *high-quality short videos* accessible to users. Chang & Jotikasthira (2024) asserted that *high interactivity in e-commerce live streaming* has a direct impact on consumer perceived value and consumer perception. Chen & Zhan (2024) studied the impact of *content delivery* by internet celebrities on guiding consumers' recognition and emotions toward products. In addition, Rerkpichai & Santhuenkaew (2024) pointed to *personalization* in customer experiences via automated various tasks, and generated predictive insights. Major AI applications for marketing include natural language processing (NLP), sentiment analysis, image and video recognition, chatbots and virtual assistants, recommendation engines, and predictive analytics. The use of these tools primarily aims at enhancing customer engagement and retention.

The applications of new messages/substances are tremendous in use at the present time. Researchers and scholars reported their findings on practices in the field of education. Here are a few examples as evidences on the significance of new messages and their designs based on the AI technology, with emphasis on users for quick access (i.e., fast loading times, responsive design, search optimization) and meaningful experience (i.e., personalization, emotional connection, trust and transparency) for teachers and learners. Phakamach & Senarith (2022) studied the new style of meta-education and metaverse-powered online distance education in providing formal and informal *blended learning experiences* in a virtual 3D online campus. Panjarattanakorn et al. (2023) reported the use of case-based learning with the characteristics of easy access, interaction, and combination of *digital communication substances* for learning satisfaction and success. Pengchuay & Whattananarong (2023) developed a digital learning model to enhance the elderly's *digital competencies* of media and information. Santhuenkaew (2023) supported technology learning, known as mathematical science in that it can provide students with *learning and computing thinking skills*. In the researcher's viewpoint, analytical thinking for problem solving is a step-by-step and systematic application of computer science knowledge, and information via communication technology is to solve problems in real life. Santhuenkaew (2024) initiated the IoT implementation in the classroom to help create intelligent and *interactive learning environments*, with cautions toward users' security and privacy. In addition, Santhuenkaew et al. (2024) developed *student guidance process* and services in various forms of guidance activities and tools in support of guidance work. There are both digital images in the form of media used in guidance and the tools to help manage the guidance procedure. The researchers also encouraged teachers to use major tools that incorporate new message designs, particularly computer assisted instruction, electronic books, video conference, and online learning.

As seen in those previous studies concerning the use of new digital messages, both in business operations like marketing and teaching-learning in the field of education, the AI technology enables both the new message/substance designers and the audience/end users to realize quick access of target information and enhance high-quality interaction on the digital platforms of their choice.

4. Designer/User Concerns over Data Privacy and Security

The applications of AI technology have been implemented in various areas ranging from communication, business operations, and practices in specialized fields. The major concern obviously rests upon data privacy and security for both creators and end users. As seen in one recent study as an example, Aphisapthanakul (2022) asserted that the concept of designing a new communication format in the digital age, comprises technical factors like quick access, interactive communication adaptability, and personalization interface, while prioritizing human-related factors like data privacy and security along with high-quality experience. The comprehensive list of major factors for new message design reads:

(1) Using artificial intelligence (AI) to create substances: The use of artificial intelligence in creating user messages that adapt to user behavior and needs at different times.

(2) Adaptive communication: Designing substances that can be adjusted according to the individual or target group. It uses information collected from users to custom-make communications to suit and align with individual needs.

(3) Use of friendly communication technology: Designing technology-based substances that are friendly and easily accessible to provide users with access to information and communication experiences without technical or hardware limitations.

(4) Creating a realistic communication experience: Using Augmented Reality or Virtual Reality technology to create a more realistic and impressive communication experience.

(5) Privacy and security considerations: Design messages that prioritize *privacy and data security* by using data encryption technology and strict control over data access. It is important that data privacy and security be executed with high-quality experience.

(6) Use of multimedia communication: Using a mix of text, photos, video and audio to create a rich and multi-dimensional communication experience.

(7) Use of multimedia: A combination of text, images, audio and video to make communications more diverse and interesting.

(8) Simple and clear design: A design that is simple, not complicated, but can clearly convey the meaning and is easy to understand.

(9) Interaction and participation: A design that focuses on allowing users to *interact or engage with* content, such as online surveys, liking, sharing, or commenting.

(10) Main use of mobile phones: Design adjustment to suit mobile devices as mainly used in the digital age.

(11) Platform Adaptation: Design messages that can adapt to various platforms, such as social media, websites, and applications so that the content looks good and is suitable for display on each platform.

(12) Using new technologies: Use of AR/VR, AI, and Chatbots to increase efficiency and interest in communication.

(13) Emphasizing individuality/*personalization*: Designing substances that can adapt and respond to the needs and interests of each user.

(14) Using information to make decisions: Analysis of user data and evaluation of communication results in order to improve and develop communication further.

(15) Environmental friendliness: Reduced use of resources; creation of environmentally friendly substances, such as reducing the use of paper and highly effective use of digital media.

These factors of concern for message designers are meant to contribute to the development of effective communication design in the digital age and in line with the needs of today's users.

5. A Recommended Guideline for Message Creators to Ensure the Reliability and Safety of Communicated Information

In the digital age where technology plays an important role in daily life, designing new messages for communication is of prime importance. New messages or substances here generally refer to text, images, audio, video, and other media used to transmit information or ideas to the recipient. As shown this paper so far, new messages designers need to pay attention to design concepts and processes, design tools, characteristics of quick access and meaningful experience, and concerns over data privacy and security. In particular, new messages designers or creators need to pay attention to data privacy and security in the aspects of: (i) accuracy and fact checking, (ii) disclosure of information sources, (iii) privacy and data protection, (iv) ethical consideration, and (v) monitoring by learning from past errors and case studies.

Based on the synthesized information derived from previous studies and selected reference sources, the authors would like to recommend a guideline for message creators to ensure the reliability and safety of communicated information, as shown in six considerations below:

(1) The use of a variety of media: Message creators can combine multiple media types, such as text, images, video, and audio, to deliver a message that makes interesting and easy to understand. For example, using a short video to explain a concept or product can help recipients understand faster than reading long messages.

(2) Visual information: Message creators can use graphics, infographics, and cartoons to explain complex information. This is to make it easier for the recipient to understand and remember better. Information should be presented in a visual format for attention-grabbing from the audience.

(3) Interactive and engaging: Message designers need to stimulate the recipient's participation, such as in questionnaires, playing games, answering questions, or giving feedback in time. It is a method that increases the interest and participation of the audience.

(4) Using digital platforms: Message designers select appropriate platforms for communication, such as social media, websites, mobile applications or video conferencing platform. Each platform has different features and limitations, including security protection features. Choosing the right platform increases the reliability/safety and efficiency in communication.

(5) Personalizing content for the target audience: Message creators need to understand the target audience and tailor content to their needs and interests. It is important to make the message effective, for example using language that is easily understood by different age groups, including the use of modern audio-visual techniques for engagement.

(6) Flexibility and adaptability: Both message designers and creators need to custom-make digital substances for recipients to be flexible and adaptable to changes in technology and user behavior, with content and images always updated. Consistent design helps the message remain appealing and effective. Therefore, designing a new message for communication in the digital age requires a combination of creativity and modern technology. It focuses on making messages interesting, easy to understand, reliable and safe, and effective in communicating in the digital age.

6. Conclusion

This academic paper demonstrates how message designers use concepts and processes of designing substances in the digital age, with characteristics of quick access and meaningful experience, followed by concerns over data privacy and security. From the synthesis of previous studies and selected reference sources, the authors highlighted the current AI message products that can interactively engage the end users with quick and friendly access for personalized and meaningful experience. The discussion of new messages design concepts and new tool availability is meant to provide a practical guideline within the cyber ethics framework for message designers/creators to execute their work for effective and safe communications. The authors finally recommended a guideline for message designers/creators to ensure the reliability and safety of communicated information. With current digital technology, though with safeguarded privacy rights and security protection on specific platforms, end users however need to observe their own behavior online as well as messages posted on their selected platform in a decent manner. In so doing, this is the way to protect themselves, and not to harm other fellows in digital communities at the global level.

7. The Authors

Thanarak Santhuenkaew and Khanchai Athikiate are staff members of the Faculty of Education, Ramkhamhaeng University, Bangkok, Thailand. They share research interest in the areas of digital technology in communication arts and educational management, communication message design, and current issues in digital technology innovation and management.

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Sharing Professional Viewpoint:

College Students in Agriculture Need Knowledge Sharing for Professional Skills Development

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1. Opening

College students majoring in agriculture need to engage in *knowledge sharing* to improve their *professional skills* in this field. By participating in knowledge sharing, agricultural college students can have access to a wider range of agricultural knowledge resources from various sources and fields. These resources may come from academic research papers, summaries of practical experience, and interpretations of policies and regulations, which can help them gain a more comprehensive understanding of various aspects of the agricultural field and expand their knowledge boundaries. In addition, knowledge sharing platforms usually gather the latest research results and technological innovation information. College students majoring in agriculture can timely access the latest knowledge and technology, understand the cutting-edge trends in the agricultural field, and keep up with the times (Henttonen et al., 2016).

2. College Agriculture-Major Students

College students majoring in agriculture can promote academic exchange and cooperation by knowledge sharing. It can expose students to the latest research results and academic perspectives from different schools, research teams, and even countries. This cross-border exchange helps them broaden their academic horizons, understand the research trends and cutting-edge technologies in different fields, and thus stimulate innovative thinking and inspiration. Besides, the knowledge sharing platform provides a convenient communication channel for college students majoring in agriculture. They can engage in real-time communication and interaction with experts, peers, and even agricultural practitioners through discussion forums, online lectures, academic seminars, and other forms on the platform. This communication platform not only helps them solve academic doubts and problems, but also promotes the development of academic cooperation (Naylor et al., 2023).

Agricultural college students can cultivate *teamwork* spirit. Firstly, cooperation in the process of knowledge sharing also requires the establishment of trust relationships among team members. When sharing knowledge and experience, everyone needs to believe that others will contribute their wisdom and efforts, and support and encourage each other. The establishment of this trust relationship helps to enhance team cohesion and centripetal force, making team members more willing to cooperate with each other and work together toward the team's goals. Secondly, by participating in knowledge sharing, agricultural college students can also learn how to leverage their strengths and strengths within a team, as well as how to complement and collaborate with others. They can learn different ways of thinking, problem-solving methods, and experiences, thereby improving their overall quality and abilities. The cultivation of

complementary and collaborative abilities is also crucial for future team collaboration, as it can help team members better support and cooperate with each other to achieve tasks and goals together (Imam & Zaheer, 2021).

3. Innovation for Agricultural College Students

In enhancing their innovation ability, agricultural college students are exposed to knowledge from different fields, perspectives, and methods. This diversified knowledge input can stimulate their innovative thinking, prompting them to think about problems from different perspectives and find new solutions. Meanwhile, in the process of knowledge sharing, they can constantly discover new knowledge points and ideas, which will stimulate their curiosity and desire to explore. When they have a strong interest in a certain problem, they will actively seek solutions and propose innovative ideas (Maitra et al., 2021).

There are many benefits for agricultural college students to participate in knowledge sharing, but currently some people believe that agricultural college students tend to lack practical agricultural production experience. If the research results of college students have not been fully validated and demonstrated, or are still in the initial stage, participating in knowledge sharing may lead to the dissemination of immature or inaccurate information. This may mislead others and reduce academic credibility (Chen, 2022). Therefore, the knowledge they share may not be practical enough or not close enough to the actual situation, which affects the effectiveness of knowledge sharing.

There are many ways to avoid the adverse consequences of agricultural college students lacking practical agricultural production experience in participating in knowledge sharing. For example, they can take advantage of their spare time or winter and summer vacations to participate in on-site inspections and practical activities, and experience the entire process of agricultural production firsthand. By visiting on-site places such as farmland, farms, and livestock farms, agricultural college students can understand the actual situation of agricultural production, gain practical experience, and understand various links in the agricultural industry chain. They can also actively participate in laboratory research and practical projects related to agriculture, learn and master agricultural technology and experimental skills. Through laboratory research and practical projects, college students can gain deeper professional knowledge and provide more substantial content and contributions for participating in knowledge sharing (Sephokgole et al., 2023).

4. Reflection

Undoubtedly, by sharing knowledge, college students majoring in agriculture can deepen their understanding of their professional field and improve their skill level. It is also possible to receive feedback and suggestions from others, thereby continuously improving one's understanding and knowledge system. Meanwhile, their sharing of professional knowledge and experience can enhance their reputation and influence in the industry, laying a solid foundation for future career development (Castañeda & Cuéllar, 2021). Overall, the sharing knowledge

behavior of agricultural college students can help to promote the development and progress of the industry, strengthen community cooperation, improve personal skills for learning and discovery. With support from the instructional program and relevant learning activities encouraging innovation, problem-solving skills, team work collaboration, and agricultural on-site inspections, it would make possible for an agricultural college to produce graduates to cope with the latest challenges in the field and the future trend.

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RJCM Publication Policy

1. Policy

RICE Journal of Creative Entrepreneurship and Management (RJCM) has its focus on original contributions on research work or academic issues in the areas of creative entrepreneurship and management as practiced by academics or scholars in their fields of specializations in social sciences. It is a double-blind three-peer-reviewed journal and each volume is published online-plus-print three times a year: No.1 in April, No.2 in August and No 3 in December. Original research articles, academic papers and brief professional viewpoints for sharing will be included in this journal. The details and views expressed in the published papers are entirely the responsibility of those authors.

2. Submission of Manuscripts

Authors should submit a non-formatted WORD file of their manuscript in single spacing (see Section 3: For Authors below) to Editor-in-Chief 2 Ruja Pholsward <rujajinda@gmail.com>.

- The Office of the Editors-in-Chief is at Science and Technology Building, Floor 4, Rattanakosin International College of Creative Entrepreneurship, Rajamangala University of Technology Rattanakosin, Thanon Putthamonthon Sai 5, Salaya, Nakhon Pathom 73170, Thailand.

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- There will be no publication fee for both the online-plus-print versions for papers printed in *RICE Journal of Creative Entrepreneurship and Management (RJCM)* Volumes 1-4.

- Publication Fee and Payments are effective from Volume 5 onward.
  RICE, RMUTR Announcement on Publication Fees (Document dated 5.04.23)
  * General authors: 6,000 baht
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  *The author please send a copy of the transfer slip to the editor-in-chief so that the review stage can proceed.
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- The latest date for submission of the first draft of the manuscript to be published in *RJCM* each year: (1) Number 1 in February, (2) Number 2 in June, and (3) Number 3 in October.

3. For Authors

Arrangement and Style of Manuscript

3.1 Paper and Page Setup:

Paper size: Standard A4

Top margin: 1 inch	Bottom margin: 1 inch
Left margin: 1.25 inches	Right margin: 1 inch
Header: 0.5 inch	Footer: 0.5 inch

3.2 Manuscripts of Original Articles, for both print and online versions, should be submitted in a WORD file of the A4-sized paper, using the Times New Roman (12-point font). Symbols used should be of a similar size and typed on the corresponding lines of text used in each section. Manuscripts of the original article should contain the following sections: title, author's name, author's workplace, abstract and keywords, the main text/ body text, acknowledgements, references, tables, figures, captions/legends and illustrations. Each page should be clearly numbered in the bottom center of each sheet. Authors should carefully edit and proofread their manuscripts before submission.

3.2.1 The Title: The **title of the article** must not exceed 2 lines. A title itself has to be informative and indicates the main topic in the article. The title should be set in the center of the page, using upper and lower case letters of Times New Roman 12 points and printed bold. If there is any symbol, its size must be the same as the text in that line.

3.2.2 Author's Name: The author's name and last name are in Times New Roman 11 points in upper and lower case letters in the center of the page below the title of the article. In the case of multi-authorship, identify each author by superscript numbers at the end of the author's last name.

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3.2.4.1 Abstract should be informative and state what was done, obtained and concluded. It should be accurate, self-contained, concise and specific, coherent and readable, and reflect only what appears in the original paper. An abstract should contain the following basic components: (1) purpose/motivation/problem statement, (2) methods/design/procedure/approach, (3) results/findings/products, (4) conclusion/applications/research limitations/implications (if applicable), practical implications (if applicable), pedagogic or social implications (if applicable), and (5) originality/value. The length of the abstract should be about 150 words and not exceed 200 words. Type the word "**Abstract**," using Times New Roman 11 points and print bold, left-hand justified. The abstract should be written in one single-spaced paragraph under the heading.

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3.2.6 In-text Citations: Authors are to give references to all the information obtained from books, papers in journals, websites, or other sources. The Author-Date System should be used to cite references within the paper by using the author's last name and date (year), separated by a comma in parentheses; for example, name(s), year.

3.2.7 Tables and Figures:

3.2.7.1 Tables: The large-sized table format should not be split into two columns but small-sized table can be fit into the column. Each table must be titled, numbered consecutively and complete with heading (title with a description that goes above the table). The word "**Tables**," including number should be typed using Times New Roman 11 points and bold, left-hand justified, and follow by regular 11 points Times New Roman for the heading.

3.2.7.2 Figures: Line-drawn graph or Figure (in black) is accepted. Also, in the case of photographs, glossy photographic prints, 3.5 x 5.0-inches, should be submitted concurrently. Similar to tables, large-sized figure format should not be split into two columns but small-sized figure can be fit into the column. Each figure must be numbered consecutively and complete with caption under the figure. The word "**Figure**," including number should be typed using Times New Roman 11 points and bold, left-hand justified, and followed by regular 11 points Times New Roman for the caption.

3.2.8 Symbols and Units: Every used symbol must be defined in the text and written in the simplest possible way.

3.2.9 Numbering Pages: Manuscript pages must be consecutively numbered throughout the paper except the first page in the bottom center of the page, using bold Times New Roman 12 points.

3.2.10 Reference Lists: The final page contains a list of resources cited in the paper. The style of citations used in RJCM should conform to the American Psychological Association (APA). It is the author's responsibility to ensure the accuracy of all references cited in the paper. References should be listed in alphabetical order using regular Times New Roman 11 points.

3.3 Guideline to References

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Format:

Author.//(Year of publication).//Title of Abstract (abstract).//*Journal Title,/Year,/ Volume(*Number),/Page numbers.

Example:

Osti, L. & Cicero, L. (2018). Tourists' perception of landscape attributes in rural tourism (abstract). *Worldwide Hospitality and Tourism Themes, 2018, 10*(2), 211.

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Jareonsubphayanont, N. (2014). The international student policy in Thailand and its implication on the 2015 ASEAN Economic Community. *Southeast Asian Studies in Asia from Multidisciplinary Perspective International Conference, March 2014*, Kunming, China.

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Trongratsameethong, A. & Woodtikarn, P. (2019). Thai QBE for ad hoc query. *Journal of Technology and Innovation in Tertiary Education, 2019, 2*(2), 1-24. doi 10.14456/jti.2019.7

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Author.//(Year of publication).//Title of Letter (letter).//*Journal Title,/Year,/Volume (if any),*/Page numbers.
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Websites
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Author.//(Year of publication).//Title.//(Online).//the full address of the web page,/ accessed date.
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3.4 Manuscripts of Brief Professional Viewpoints for Sharing

The length of Brief Professional Viewpoints for Sharing is about 8-10 typed A4 pages. Its content should be arranged as follows: **title**, **name of the author, name and address of the institution**, **3-5 keywords**, **body text**, **the author's biography** of 50-80 words, and **references**. The format, font, and font size used in each section correspond to those in the section of **3.2. Manuscripts of Original Article**.

3.5 Reprints

During the years of publication (2020-present), authors will receive one free print copy of the journal.

RJCM Publication Ethics

RICE Journal of Creative Entrepreneurship and Management (RJCM) has policies on publication ethics after the guidelines given by Committee on Publication Ethics (COPE) <https://publicationethics.org>. Publication ethics policies mainly involve duties of (1) Authors, (2) Editors, and (3) Reviewers.

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Authors or paper contributors shall not submit simultaneous or duplicate manuscripts. It is imperative that authors submit work of original investigation and acknowledge concepts, research methodology and findings of preceding authors or researchers by giving proper references. If required, authors need to seek permission for the use of specific data or adaptation of research methodology as well as provide evidence on approval of professional ethics in the selected field of study. Plagiarism of all kinds is unacceptable and will result in paper rejection and permanent dismissal by *RJCM*. The use of AI for mechanical error check is advisable, but for copyrighted text creation is unacceptable. Authors shall be solely and fully liable for all viewpoints and research components used in published papers.

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RJCM Research Ethics

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Thailand's Institutional/National Board of Research Ethics on the Use of Human Subjects in Social Sciences requires as compulsory that researchers comply with the established criteria as well as secure a certified approval from the Board for the purpose of protecting the human subjects in the study from risks affecting their rights, security, health, privacy, and confidentiality.

The Board specifies research that imposes *three levels of risks* on the human subjects under study: (1) nil or very low, (2) low, and (3) higher than low, and instructs researchers to obtain a certified approval from the Board's classified reviews:

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(2) Expedited Review is for the research project that uses data that impose *low risks* to the human subjects under study. Researchers can obtain an expedited review approval from the Board via the consideration and recommendation of two Board members and an endorsement from the Board Chairperson.

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RICE Journal of Creative Entrepreneurship and Management (RJCM) is an international journal for academics and scholars at the higher education level to communicate and share their viewpoints and academic work with fellow professionals in the areas of creative entrepreneurship and management as practiced in their fields of specializations in social sciences. Currently, it is under the supervision of Thai-Journal Citation Index (TCI).

RJCM publishes three numbers per volume annually and welcomes contributors to submit their manuscripts in January, May, and September of each year. We accept both academic and research papers in social sciences from contributors. The papers are double-blind reviewed by three independent reviewers in each volume and published online-plus-print three times a year.

The length of the unformatted manuscript in WORD can be 15-25 pages in length including references. The contents of the manuscript should include (1) a title with the author's name, affiliate, email address and telephone contact, (2) an abstract of 150 words with 3-5 keywords, (3) an introduction, (4) a rationale and background of the study, (5) research objectives, (6) research methodology, (7) data collection procedure, (8) data analysis, (9) results and discussion, (10) research limitation (if any), (11) conclusion, (12) acknowledgement(s) (if any), (13) the author's biography of about 50-80 words, (14) references, and (15) an appendix or appendices (if any).

All interested readers and paper contributors please contact Editor-in-Chief: Ruja Pholsward, Ph.D., Associate Professor, Rattanakosin International College of Creative Entrepreneurship (RICE), Rajamangala University of Technology Rattanakosin (RMUTR) <rujajinda@gmail.com>, <ruja.pho@rmutr.ac.th>. Please check *RJCM* Publication Policy as guidelines to paper submission.

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