

A NOVEL ECOSYSTEM MODEL FOR SUSTAINABLE TOURISM VILLAGES IN LAKE TOBA" (IT IS CONCISE, INTRODUCES A CATCHY ACADEMIC CONCEPT—"THE HUMAN INTEGRATOR" —AND SPECIFIES THE CONTEXT)

Vina Maria Ompusunggu, Ritha F. Dalimunthe, Elisabet Siahaan, Robert Sibarani

Postgraduate Studies, Department of Management, Faculty of Economics and Business, University of North Sumatra, Indonesia

Corresponding Author: Vina Maria Ompusunggu

Email: vinamaria@students.usu.ac.id

<https://orcid.org/0000-0002-7958-1260>

Abstract:

The global shift toward Sustainable Development Goals (SDGs) underscores the strategic role of tourism in fostering economic growth, community resilience, and environmental preservation. Despite its designation as a Super Priority Tourism Destination, the Lake Toba region in North Sumatra, Indonesia, faces a significant developmental paradox: its rich natural and cultural heritage has not translated into competitive, equitable, or sustainable destination management. This study addresses this gap by investigating the systemic limitations in tourism management, specifically the suboptimal utilization of Human Resources (HR). Moving beyond the traditional view of HR as a mere supporting factor, this research introduces an integrative, HR-driven ecosystem model—the "Human Integrator"—which positions human capital as the central systemic driver of the tourism village ecosystem. Utilizing a qualitative case study approach across seven regencies, the research employs an interactive capacity-interaction-outcome mechanism to evaluate how empowered local communities can effectively drive Pentahelix collaboration and elevate the 4ASC ecosystem (Attractions, Accessibility, Amenities, Ancillary, Safeness, and Comfort). The findings reveal that high potential is inert without human intervention; thus, sustainability is fundamentally dictated by the capacity of local HR to act as the systemic "glue" that ensures economic, socio-cultural, and environmental sub-systems function harmoniously. This research offers both a theoretical advancement for ecosystem-based destination management and practical strategies for transforming Lake Toba into a globally competitive, sustainable destination through grassroots empowerment. The study reveals that natural and cultural assets in Lake Toba are "inert" without human intervention. It shifts the focus from physical infrastructure to the capacity of local Human Resources (HR) to act as the systemic "glue" that harmonizes economic, socio-cultural, and environmental sub-systems. Baseline competencies in hospitality, digital literacy, and risk mitigation are required to elevate the destination.

Keywords: Ecosystem-based Destination Management, Human Integrator, Grassroots Empowerment, Capacity-Interaction-Outcome Mechanism, Community-Based Tourism, Regional Development Policy

INTRODUCTION

The global development paradigm currently emphasizes the achievement of Sustainable Development Goals (SDGs), wherein the tourism sector plays a strategic role in fostering economic growth, sustainable communities, and environmental preservation. The Lake Toba region in North Sumatra,

A Novel Ecosystem Model for Sustainable Tourism
Villages in Lake Toba" (It Is Concise, Introduces A Catchy
Academic Concept—"The Human Integrator"—and
Specifies the Context)

Indonesia, has been designated as a Super Priority Tourism Destination (DPSP) due to its world-class geological landscape and rich Batak cultural heritage. "While Baggio et al. (2010) view destinations as a systemic network of interactions, this study demonstrates that such networks are 'static' in the absence of human agents mediating them. Conventional CBT literature tends to position communities as passive, empowered subjects. Our findings shift this position: communities (through local human resources) are active integrators who determine whether an attraction will be economically valuable or ecologically degraded.

The global development paradigm is increasingly aligned with the United Nations' Sustainable Development Goals (SDGs), which emphasize a critical, delicate balance between rapid economic growth, rigorous environmental sustainability, and equitable social outcomes. Within this complex framework, tourism serves as a vital strategic catalyst for achieving specific, high-priority objectives, most notably SDG 8 (Decent Work and Economic Growth), SDG 11 (Sustainable Cities and Communities), SDG 12 (Responsible Consumption and Production), SDG 13 (Climate Action), and SDG 17 (Partnerships for the Goals). However, contemporary tourism development often reveals a fundamental, troubling paradox: the mere abundance of world-class natural and cultural resources does not automatically translate into superior, competitive, or truly sustainable destination management performance. This specific phenomenon is particularly evident in the Lake Toba region of North Sumatra, Indonesia, which has been formally designated as a Super Priority Tourism Destination (DPSP). Despite its world-class geological landscape and rich Batak cultural heritage, the region continues to struggle in its efforts to effectively convert these existing assets into optimal, equitable, and long-term tourism performance outcomes.

The core of this persistent disparity lies not in the scarcity of physical resources, but in the systemic limitations inherent to current destination management practices. While the post-pandemic era has witnessed a significant and encouraging resurgence in both global and domestic tourist mobility, the overall distribution of these visits across Indonesia remains heavily concentrated on the island of Java, thereby exposing a stark and damaging competitiveness gap for destinations like Lake Toba. The systematic development of 135 tourism villages in the region, including the 19 that have received national accolades, unfortunately reveals profound and ongoing inconsistencies in critical areas such as service quality, digital literacy, entrepreneurial innovation, and environmental awareness among the local communities. These identified limitations clearly indicate that the primary challenge is deeply rooted in the currently suboptimal capacity of human resources (HR) to effectively manage, curate, and integrate the complex, multifaceted ecosystem of modern tourism. Consequently, addressing these HR deficits is essential for elevating the destination's status and ensuring that tourism contributes positively to the regional economy.

From a broader theoretical perspective, modern tourism management has significantly evolved, moving away from merely managing physical attractions to actively orchestrating a dynamic and interconnected tourism ecosystem. Success in Community-Based Tourism (CBT) relies heavily on the active, meaningful participation of local communities; yet, without adequate and sustained HR development, this community involvement often remains superficial, fragmented, and overly focused on short-sighted economic gains. Previous scholarly studies on sustainable tourism have extensively explored the 4ASC model—a framework encompassing Attractions, Accessibility, Amenities, Ancillary, Safeness, and Comfort—as a standard tool for evaluating overall destination quality. By utilizing this model, researchers can better identify the specific operational gaps that hinder long-term success. However, these frameworks often fail to account for the human element, which this study seeks to rectify by embedding HR capacity at the heart of the 4ASC structural assessment, ensuring that all physical components are supported by skilled, empowered, and well-trained local community members.

Furthermore, the pentahelix model—which advocates for synergistic, collaborative efforts among

government agencies, academic institutions, business sectors, local communities, and the media—is widely promoted as the gold standard for effective tourism governance. However, a significant and persistent research gap remains; existing literature continues to treat human resources merely as a secondary supporting factor of production rather than the central, driving force of the entire tourism ecosystem. Previous studies have also been notably fragmented, often isolating HR capacity from physical destination quality and ignoring the reality of multi-stakeholder collaboration. In practice, the implementation of the pentahelix model in many tourist destinations frequently gets bogged down in ceremonial formalities that lack real-world substance. This discussion highlights that the failure of the pentahelix approach in the Lake Toba region is rarely due to the total absence of actors, but is instead directly attributable to the low institutional capacity of local bodies (such as Pokdarwis and BUMDes) to effectively orchestrate these stakeholders and leverage their collective influence for sustainable development.

Furthermore, the pentahelix model (collaboration among government, academics, business, community, and media) is widely advocated for tourism governance. However, a significant research gap persists: existing literature tends to treat human resources merely as a supporting factor of production rather than the central, driving force of the ecosystem. Previous studies have also been fragmented, often separating HR capacity from physical destination quality and multi-stakeholder collaboration. The implementation of the Pentahelix model in tourist destinations often gets bogged down in ceremonial formalities. This discussion highlights that the failure of Pentahelix in the Lake Toba region is not due to the absence of actors, but rather to the low capacity of local institutions (such as Pokdarwis/BUMDes) to orchestrate these actors. Without human integrators with managerial competencies, the Pentahelix model is merely an empty structure lacking bargaining power against top-down policy interventions.

To bridge this conceptual and empirical gap, this study introduces a novel integrative model that positions human resources as the "core driver" and systemic integrator of the tourism village ecosystem. This research argues that the quality of the 4ASC elements is not determined solely by resource availability, but by the capability of local HR to activate, connect, and synergize these elements. By employing a capacity-interaction-outcome mechanism, this study aims to evaluate current HR competencies and design a comprehensive model where empowered local communities drive pentahelix collaboration and elevate the 4ASC ecosystem. Ultimately, this research seeks to redefine the role of human capital in sustainable tourism, offering both theoretical advancements for ecosystem-based destination management and practical strategies for transforming the Lake Toba region into a globally competitive, sustainable destination.

However, a fundamental paradox persists within the region's broader tourism development landscape. Although the area boasts high potential in terms of abundant natural and cultural resources, these assets have not automatically translated into superior or competitive destination management strategies. Despite the existence of 135 designated tourism villages—19 of which have achieved national recognition through the prestigious Indonesian Tourism Village Award (ADWI)—the actual quality of destination management remains profoundly inconsistent across the board. The primary challenge identified does not lie solely in the availability of these physical resources, but rather in the weak systemic capacity to integrate various tourism elements effectively, specifically regarding the professional quality and coordination of Human Resources (HR). While previous academic studies have largely relegated HR to a mere supporting factor, this research argues that HR must be viewed as the central systemic driver, aiming to design an integrative model that positions HR as the core element connecting the 4ASC components and pentahelix collaboration to ensure sustainable tourism success in Lake Toba.

Theoretical Framework and Literature Review

Sustainable Development Theory

The foundation of sustainable tourism is deeply rooted in Sustainable Development Theory, which gained global prominence through the Brundtland Report (1987). Brundtland defined sustainable development as progress that meets the needs of the present without compromising the ability of future generations to meet their own needs. This perspective was further expanded by Jeffrey Sachs (2015), who emphasized the necessity of integrating economic, social, and environmental dimensions to address global development challenges. In the context of tourism, this is operationalized through the Triple Bottom Line (TBL) concept introduced by John Elkington (1998), which encompasses three core pillars: People (social equity), Planet (environmental preservation), and Profit (economic viability).

Community-Based Tourism (CBT) Theory Community-Based Tourism (CBT) places local communities as the principal subjects—rather than objects—in the planning, management, and distribution of tourism benefits. The concept was pioneered by Murphy (1985), who argued for the integration of local communities in tourism development to ensure that socio-cultural and economic benefits directly impact residents. This framework was strengthened by Timothy and Tosun (2003), who posited that community participation is a critical element in creating inclusive and sustainable tourism. In this study, CBT serves as the operational context, demonstrating that active community involvement is contingent upon the continuous capacity building of local human resources.

Human Capital and Human Resource Development (HRD) Theories

To understand the role of human resources as the core driver of the tourism ecosystem, this study integrates Human Capital Theory and HRD Theory. Developed by Theodore Schultz (1961) and Gary Becker (1964), Human Capital Theory treats human resources as strategic assets whose economic and social value can be augmented through investments in education, training, and experience. In the service-intensive tourism sector, human capital dictates productivity, innovation, and destination competitiveness. Complementing this, Leonard Nadler (1970) introduced Human Resource Development (HRD) Theory, which Werner and DeSimone (2012) further defined as a systematic process to enhance individual knowledge, skills, and adaptive capacities. In tourism villages, HRD is essential for equipping locals with both technical skills (destination management, digital literacy) and soft skills (hospitality, environmental awareness).

Rindrasih et al. (2023) and Zhang et al. (2024) highlighted the critical role of social capital—comprising interpersonal trust, collective norms, and social networks—in driving active community participation. Their studies prove that sustainable destination governance is unachievable without robust social capital among local human resources. Wijaya and Santoso (2025) explored the integration of digital technologies and the Internet of Things (IoT) in tourism villages. Their theory concludes that technological advancement in a destination must be inextricably linked with HR training and digital literacy; otherwise, digital tools fail to improve services or marketing.

Stakeholder Theory and the Pentahelix Model

Tourism development requires multi-actor synergy, a principle rooted in Stakeholder Theory proposed by R. Edward Freeman (1984). Freeman emphasized that organizational or developmental success relies on building collaborative relationships with all parties affected by or capable of affecting the system. In modern tourism governance, this theory is applied through the Pentahelix model, which necessitates synergistic collaboration among the government, academics, business sectors, communities, and the media. This study argues that the effectiveness of this Pentahelix collaboration at the grassroots level heavily depends on the institutional capacity of local bodies (e.g., Pokdarwis and BUMDes), which is fundamentally driven by local HR.

Tourism Ecosystem and Destination Management Theory

The Tourism Ecosystem Theory, developed by Baggio et al. (2010), conceptualizes a tourist destination as a complex, dynamic network system formed by the interactions between actors, resources, and activities. Ritchie and Crouch (2003) further assert that destination competitiveness relies on the systemic interplay between internal and external factors, including HR quality, governance, and socio-cultural environments. From a managerial perspective, Destination Management Theory, articulated by Cooper et al. (2018) and Page (2019), emphasizes that successful destinations must orchestrate attractions, accessibility, facilities, and services in an integrated manner to ensure high-quality and safe tourist experiences. Goeldner and Ritchie (2019) also affirm that tourism is a phenomenon arising from the interactions between tourists, service providers, local communities, and the environment.

Zhang et al. (2021) and López and Zhang (2023) conceptualized the tourism village explicitly as a socio-ecological system. They emphasize that stakeholder interactions, rather than physical infrastructure alone, are the primary determinants of system sustainability, requiring HR to act as the balancing force between tourism activities and ecological carrying capacity. Baktash (2022) introduced agent-based modeling (ABM) for tourism ecosystems to map complex stakeholder interactions. This theoretical approach provides a framework to simulate how specific HR interventions and local policy changes impact the long-term sustainability of a tourism village.

The 4ASC Ecosystem Model

To operationalize the ecosystem assessment, this study employs the 4ASC model, an expansion of the traditional 4A framework. As articulated by recent scholars such as Dalimunthe and Indriany (2023) and Sujith et al. (2024), and aligned with the guidelines from the Indonesian Ministry of Tourism and Creative Economy (Kemenparekraf, 2023), the 4ASC model consists of: 1) Attractions: Natural and cultural assets managed creatively and sustainably by local HR. 2) Accessibility: Physical and digital connectivity facilitated by HR. 3) Amenities: Supporting facilities (e.g., homestays) requiring professional local management. 4) Ancillary: Institutional support and local governance. 5) Safeness: Risk mitigation and environmental security maintained by community awareness. 6) Comfort: The quality of hospitality, cleanliness, and service ethics provided by locals.

Hadi and Gunawan (2020), whose work was further developed by Akbar, Sibarani, and Rosa (2023) and Sujith et al. (2024), expanded the traditional 4A tourism framework into the 4ASC model (Attractions, Accessibility, Amenities, Ancillary, Safeness, and Comfort). These scholars argue that the addition of 'safeness' and 'comfort' is a necessary response to complex modern tourist demands and is entirely dependent on the operational capacity and hospitality of local human resources.

Systems Theory

Originating from the seminal work of **Ludwig von Bertalanffy (1950)**, Systems Theory posits that a system is characterized by the dynamic and complex interaction of its constituent elements. In the context of tourism, this theory underscores that a destination's success is not dictated by the isolated strength of individual components—such as natural beauty or cultural heritage alone—but by the systemic integration and synergy of all interacting elements. This theory forms the rationale for viewing the tourism village not as fragmented parts, but as a holistic ecosystem. It validates the premise that human resources must act as the systemic "glue" or integrator that ensures the environmental, economic, and socio-cultural sub-systems function harmoniously.

Community Empowerment Model

Advanced by scholars such as **Marc A. Zimmerman (2000)** and **Deepa Narayan (2005)**, the Community Empowerment Model emphasizes the psychological, organizational, and community-level processes through which individuals gain control over their environment and resources. Within the framework of sustainable tourism, empowerment goes beyond mere economic participation; it involves enhancing the collective capacity of the community to independently manage tourism

A Novel Ecosystem Model for Sustainable Tourism
Villages in Lake Toba" (It Is Concise, Introduces A Catchy
Academic Concept—"The Human Integrator" —and
Specifies the Context)

activities, negotiate with external stakeholders (as seen in the Pentahelix model), and sustain economic benefits while preserving local wisdom. This model theoretically supports the need for continuous capacity building and institutional strengthening (e.g., Pokdarwis and BUMDes) so that local communities transform from passive beneficiaries into active decision-makers.

Robert Sibarani, Echo Sibarani, and Peninna Simanjuntak (2020) proposed that local wisdom (kearifan lokal) serves as the interactive foundation for community participation in tourism management. Specifically analyzing the Lake Toba area, they argue that local cultural values act as the primary medium for human resources to sustainably govern their environment. Suharti, Sirine, and Martono (2023) and Antonio Giampiccoli (2024) provided critical evaluations of Community-Based Tourism (CBT). They affirm that CBT is only effective when supported by actual managerial capacity, social entrepreneurship, and strong local governance, warning that without capable HR, CBT risks leading to the commodification of culture.

Syahputra and Taqiyah (2025) established that community empowerment in sustainable tourism is fundamentally reliant on continuous training and mentoring. Their findings directly link the systematic development of HR to the operational resilience of the tourism village ecosystem.

Social Constructivism Theory

Although primarily a philosophical paradigm outlined by Michael Crotty (1998) and John W. Creswell (2007), Social Constructivism serves as a critical theoretical lens for understanding how local communities interpret and enact "sustainable tourism". This theory argues that meaning is not inherent in objects, but is socially and historically constructed through human interaction. Applied to the Lake Toba tourism ecosystem, this means that the concept of a "tourism village" is shaped by the subjective experiences, ancestral heritage, and daily social interactions of the Batak Toba community. Therefore, the preservation of culture and the environment cannot be imposed top-down but must be constructed collaboratively by the local human resources who live within and sustain the ecosystem.

Developed by Kastenholz, Carneiro, and Marques (2020), this perspective posits that the emotional involvement, solidarity, and "place attachment" of the local community significantly enhance the resilience and sustainability of rural tourism development. It suggests that human resources with a strong sense of belonging are more likely to protect the destination's ecosystem.

Theoretical Framework and Literature Review

The foundation of sustainable tourism integrates economic, social, and environmental dimensions to address global development challenges. Within this paradigm, Community-Based Tourism (CBT) traditionally places local communities as the principal subjects in the planning and distribution of tourism benefits to ensure inclusive development. However, a significant conceptual gap exists in traditional CBT literature: it frequently positions the community passively as a collective beneficiary or merely a "participant pool". This study introduces a theoretical shift through the "Human Integrator" concept. Moving beyond the conventional CBT framework that treats local human resources (HR) as a peripheral factor of production, the Human Integrator model positions HR as the active, central systemic engine. While traditional models assume that the presence of high-value natural and cultural assets automatically generates a tourism ecosystem, this novel model argues that physical ecosystems are inert without human intervention. Communities are not just participants; they are the active integrators who serve as the systemic "glue," determining whether an attraction will become economically viable or ecologically degraded (Sachs, 2015).

Modern tourism governance frequently relies on Stakeholder Theory and the traditional Pentahelix model, which advocates for collaborative synergy among the government, academics, business sectors, communities, and the media. Traditional stakeholder frameworks typically assume a balanced, often top-down coordination mechanism among these five nodes. This study theoretically

advances the Pentahelix framework by highlighting a critical operational flaw: at the grassroots level, Pentahelix models often deteriorate into superficial, "ceremonial formalities". The failure of multi-actor collaboration in destinations like Lake Toba is rarely due to the absence of stakeholders, but rather the low institutional capacity of local bodies (e.g., Pokdarwis and BUMDes) to orchestrate them. The proposed model diverges from traditional frameworks by positioning local HR as the central orchestrator rather than an equal, passive node. Without human integrators possessing managerial and entrepreneurial competencies, the Pentahelix structure remains an empty vessel lacking the bargaining power necessary to counter top-down policy interventions.

Destination management literature increasingly views tourism villages as complex socio-ecological systems where competitiveness relies on internal and external synergies. To operationalize this, the study adapts the 4ASC model—encompassing Attractions, Accessibility, Amenities, Ancillary, Safeness, and Comfort. Traditionally, frameworks like the 4A or 4ASC are utilized as static evaluation checklists of physical and structural assets. Grounded in Systems Theory, this research reframes the 4ASC ecosystem as a dynamic, human-activated network. A destination's success is not dictated by the isolated strength of its components, but by the systemic integration of all interacting elements driven by HR. For example, cultural 'Attractions' are sustained as "living cultures" through daily local practices, while 'Safeness' and 'Comfort' are not merely structural amenities but are fundamentally operationalized by HR capacity in risk mitigation, waste management, and service etiquette (Cooper et al., 2018).

To sustain this human-driven ecosystem, continuous capacity building is required to transition communities from passive recipients to active decision-makers capable of managing economic pressures without sacrificing environmental integrity. Viewed through the lens of Social Constructivism, "sustainable tourism" is not an inherent, physical trait of a landscape. Instead, it is socially constructed through the historical heritage and daily interactions of the local community. Therefore, the preservation of an ecosystem cannot be imposed exclusively through top-down infrastructure projects; it must be collaboratively constructed and managed by the human resources who live within and actively integrate the destination's sub-systems.

Ethical Considerations

This research was conducted in strict compliance with the ethical principles outlined in the Declaration of Helsinki regarding research involving human subjects. Institutional ethical approval for this study was granted by the Ethics Committee of the Faculty of Economics and Business, University of North Sumatra, under the official approval protocol number FEB-USU/2026/042-B. Prior to data collection, the study's objectives, potential risks, and benefits were clearly communicated to all 86 informants. Written and verbal informed consent was obtained from every participant, ensuring their voluntary participation, right to withdraw at any stage, and the confidentiality of their personal responses. Furthermore, all data gathered have been anonymized and processed solely for academic research purposes to protect the privacy of the participants and the integrity of the village communities involved.

METHODOLOGY

Research Design and Paradigm

This study employs a qualitative approach grounded in a social constructivist paradigm. This philosophical foundation is utilized to explore and interpret the subjective meanings that local communities, policymakers, and tourism actors attach to sustainable tourism practices and human resource (HR) roles. A case study design was selected to conduct an in-depth investigation into how tourism villages in the Lake Toba region manage their human and natural resources to build a resilient and sustainable tourism ecosystem.

Study Area and Informant Selection

The research was conducted across seven regencies encompassing the Lake Toba Super Priority Tourism Destination: Toba, Samosir, North Tapanuli, Humbang Hasundutan, Dairi, Karo, and Simalungun. The specific research sites were tourism villages that received the Indonesian Tourism Village Award (ADWI) between 2021 and 2024, as these locations represent best practices in community-based tourism within the region.

A total of 86 informants were selected using purposive and snowball sampling techniques to ensure data richness and representativeness. The informants were divided into two main categories: 1) Key Informants: Local policymakers (e.g., Tourism Office, Bappeda), the Lake Toba Authority Implementing Body (BPODT), village apparatus, Tourism Awareness Groups (Pokdarwis), Village-Owned Enterprises (BUMDes), homestay owners, and academics. 2) Additional Informants: Local community members, Micro, Small, and Medium Enterprise (MSME) actors, and both domestic and international tourists.

Data Collection Techniques To capture the complexity of the tourism ecosystem, data were collected triangulating four primary methods: 1) In-depth Semi-Structured Interviews: Guided by the 4ASC model (Attractions, Accessibility, Amenities, Ancillary, Safeness, Comfort), interviews were conducted to elicit narratives regarding HR capacity, destination governance, and community participation. 2) Non-Participatory Structured Observation: Researchers conducted direct field observations using established assessment grids to evaluate the physical condition of the 4ASC elements and the actual behavioral engagement of local HR in managing the destinations. 3) Focus Group Discussions (FGD): FGDs were held involving multi-stakeholder groups (government, community leaders, MSMEs, and academics) to cross-verify individual insights, capture collective perceptions, and identify synergistic strategies for HR capacity building. 4) Documentation Study: Secondary data were gathered from government policies (e.g., Regional Medium-Term Development Plans/RPJMD), institutional reports, academic literature, and visual media reflecting village activities.

Data Analysis Procedure

Data analysis was conducted concurrently with data collection, strictly following the interactive model developed by Miles, Huberman, and Saldaña (2014). This iterative process consisted of three interconnected components: 1) **Data Condensation**: Raw data from transcripts and field notes underwent open and axial coding. Meaning units were extracted and classified into a structured *Codebook*, which mapped themes such as HR knowledge, digital literacy, and pentahelix collaboration directly to the research questions. 2) **Data Display**: To identify patterns and cross-regional variations, the condensed data were organized into thematic matrices, convergence-divergence tables, and quotation banks. 3) **Conclusion Drawing and Verification**: Initial propositions regarding the systemic role of HR were iteratively tested against the displayed data. Conclusions were continuously refined and verified to establish robust causal relationships within the ecosystem model.

Trustworthiness and Rigor

To guarantee the scientific rigor and validity of the qualitative findings, this study applied Lincoln and Guba's criteria for trustworthiness: 1) **Credibility**: Maintained through source and methodological triangulation, prolonged engagement in the field, peer debriefing with academic colleagues, and member checking with key informants. 2) **Transferability**: Achieved by providing "thick descriptions" of the socio-cultural, geographical, and institutional contexts of the Lake Toba tourism villages. 3) **Dependability and Confirmability**: Ensured by maintaining a comprehensive audit trail of the coding process, iterative *Codebook* revisions, and the use of reflexive memos to mitigate researcher bias, guaranteeing that conclusions are strictly rooted in the empirical data.

RESULTS AND FINDINGS

Human Resource Knowledge, Awareness, and Sustainability Literacy The qualitative analysis of the tourism villages in the Lake Toba Super Priority Tourism Destination reveals a significant disparity in the conceptual understanding of sustainable tourism among local communities. 1) **Economic-Centric Awareness:** The primary motivation and awareness of local human resources are heavily skewed toward the economic dimension (profit). Tourism is widely perceived as an alternative livelihood to traditional agrarian or fishery sectors, resulting in a transactional approach to destination management. 2) **Fragmented Ecological and Social Consciousness:** While there is a baseline understanding of cultural preservation—such as maintaining traditional *Ulos* weaving in Lumban Suhi-Suhi Toruan (Dewi Lusi) and preserving *Rumah Bolon* (traditional houses) in Huta Tinggi—environmental conservation awareness remains fragmented. Ecosystem protection is often viewed as a secondary byproduct rather than a foundational necessity. 3) **Youth Sustainability Literacy:** The transfer of sustainability values to the younger generation faces challenges. Although youth are involved in digital promotion, their foundational literacy regarding ecological limits, carrying capacity, and long-term socio-cultural resilience requires systematic strengthening.

The qualitative analysis across the seven regencies of the Lake Toba Super Priority Tourism Destination reveals a significant disparity in the conceptual understanding of sustainable tourism among local communities. The findings indicate that the primary motivation and awareness of local human resources (HR) are heavily skewed toward the economic dimension (profit). Tourism is widely perceived primarily as an alternative livelihood to traditional agrarian or fishery sectors, resulting in a highly transactional approach to destination management.

While there is a baseline understanding of cultural preservation—such as maintaining traditional *Ulos* weaving in Lumban Suhi-Suhi Toruan (Dewi Lusi Destination) and preserving *Rumah Bolon* (traditional houses) in Huta Tinggi—environmental conservation awareness remains fragmented. Ecosystem protection is frequently viewed as a secondary byproduct rather than a foundational necessity for tourism. Furthermore, the study found that the transfer of sustainability values to the younger generation (youth sustainability literacy) faces considerable challenges; although youth are involved in basic digital promotion, their foundational literacy regarding ecological carrying capacity and long-term socio-cultural resilience requires systematic strengthening.

Destination Management Competencies and Digital Literacy

The transition from an agrarian society to a service-based tourism economy demands specific competencies, which currently show varying degrees of readiness across the seven regencies. Villages such as Lumban Bulbul and Martoba, which experience high intensity of water-based recreational visits, demonstrate active community involvement in providing services. However, professional hospitality standards, complaint management, and consistent service etiquette remain inconsistent, reflecting a lack of continuous HRD interventions.

In geotourism and ecotourism sites like Seribu Gua Banuarea (Humbang Hasundutan) and Hariara Pohan (Samosir), local guides operate informally. Their reliance on local knowledge is a strong social asset, but they lack standardized interpretive skills and risk mitigation training essential for adventure tourism. Local entrepreneurship is growing, evidenced by culinary ventures like Restoran Batugaja in Tipang and souvenir production in Simanindo. Nevertheless, digital literacy is largely confined to basic social media promotion, with minimal utilization of integrated reservation systems or data-driven digital marketing.

The transition from an agrarian society to a service-based tourism economy demands specific competencies, which currently exhibit varying degrees of readiness across the region. Villages such as Lumban Bulbul and Martoba, which experience a high intensity of water-based recreational visits, demonstrate active community involvement in providing direct services. However, professional

A Novel Ecosystem Model for Sustainable Tourism
Villages in Lake Toba" (It Is Concise, Introduces A Catchy
Academic Concept—"The Human Integrator" —and
Specifies the Context)

hospitality standards, complaint management mechanisms, and consistent service etiquette remain inadequate, reflecting a lack of continuous HR development interventions.

In geotourism and ecotourism sites like Seribu Gua Banuarea (Humbang Hasundutan) and Hariara Pohan (Samosir), local guides operate informally. While their reliance on deep local knowledge is a strong social asset, they lack standardized interpretive skills and the risk mitigation training essential for adventure and nature-based tourism. Local entrepreneurship is growing, as evidenced by culinary ventures like Restoran Batugaja in Tipang and souvenir production in Simanindo. Nevertheless, digital literacy is largely confined to basic social media promotion, with minimal utilization of integrated reservation systems, digital content management, or data-driven marketing.

Institutional Capacity and Pentahelix Collaboration Dynamics

The institutional framework at the grassroots level serves as the structural backbone for HR empowerment, yet structural inefficiencies persist. Institutions such as Tourism Awareness Groups (Pokdarwis) and Village-Owned Enterprises (BUMDes) are established in most ADWI-recognized villages. However, their operational capacity is often hindered by overlapping roles, limited managerial expertise, and a lack of clear standard operating procedures (SOPs). Collaboration among the government, academics, businesses, communities, and media is predominantly partial and ceremonial rather than strategic and continuous. While external interventions exist (e.g., infrastructure support like the Aek Tano Ponggol bridge or academic mentoring), local HR often lacks the institutional capacity to sustain these partnerships independently once external funding or monitoring concludes.

The institutional framework at the grassroots level serves as the structural backbone for HR empowerment, yet several operational inefficiencies persist. Institutions such as Tourism Awareness Groups (Pokdarwis) and Village-Owned Enterprises (BUMDes) have been established in most ADWI-recognized villages. However, their operational capacity is frequently hindered by overlapping roles, limited managerial expertise, and a lack of clear standard operating procedures (SOPs) or local village regulations. Collaboration among the government, academics, businesses, local communities, and the media is predominantly partial and ceremonial rather than strategic and continuous. While external interventions exist (e.g., infrastructure support like the Aek Tano Ponggol bridge or academic mentoring), local HR often lacks the institutional capacity to sustain these partnerships independently once external funding or monitoring concludes.

Evaluating the 4ASC Ecosystem Quality through an HR Lens

The physical and structural quality of the tourism ecosystem (4ASC) is directly mirrored by the capacity of the human resources managing it. Destinations offering "living culture," such as the traditional *Ulos* weaving in Kampung Ulos Huta Raja or the agrarian lifestyle in Meat Village, succeed because local HR embodies the attraction. The authenticity is maintained by the community's daily practices. Conversely, nature-based attractions require HR to actively curate and protect the assets, a skill that is currently underdeveloped. While macro-infrastructure (like Silangit Airport and the telecommunications network) has improved, micro-accessibility and amenities depend on local management. In Pulau Sibandang and Tipang Village, homestays and local culinary spots provide authentic experiences, but the lack of standardized public toilets and clear safety signages indicates a gap in HR-driven destination planning. The most critical HR deficit lies in managing safeness and comfort. Water-based destinations (e.g., River Side Juma Bulu and Lumban Bulbul) heavily rely on local HR for tourist safety. The absence of rigorous safety protocols, disaster mitigation, and standardized waste management severely threatens the ecosystem's resilience and the overall comfort of the tourist experience.

The physical and structural quality of the tourism ecosystem, analyzed through the 4ASC model, is directly mirrored by the capacity of the human resources managing it. Destinations offering "living

culture," such as the traditional *Ulos* weaving in Kampung Ulos Huta Raja or the agrarian lifestyle in Meat Village, succeed primarily because local HR embodies the attraction itself. The authenticity is maintained by the community's daily practices. Conversely, nature-based attractions require HR to actively curate and protect the assets, a skill that remains underdeveloped. While macro-infrastructure (such as Silangit Airport and regional road networks) has improved, micro-accessibility and amenities depend heavily on local management. In Pulau Sibandang and Tipang Village, homestays and local culinary spots provide authentic experiences; however, the lack of standardized public toilets and clear safety signages indicates a gap in HR-driven destination planning.

The most critical HR deficit identified in the region lies in managing safeness and comfort. Water-based destinations (e.g., River Side Juma Bulu and Lumban Bulbul) rely entirely on local HR for tourist safety. The absence of rigorous safety protocols, disaster mitigation plans, and standardized waste management severely threatens the ecosystem's resilience and significantly diminishes the overall comfort of the tourist experience.

Synthesis of Findings: HR as the Systemic Integrator

The findings collectively demonstrate that high natural and cultural potential does not automatically generate a sustainable tourism ecosystem. The empirical evidence across the Lake Toba region proves that the 4ASC elements are inert without human intervention. The quality, sustainability, and competitiveness of the tourism villages are fundamentally dictated by the capacity of local human resources to act as the "core driver"—integrating economic ambitions with ecological preservation, orchestrating local institutions, and activating multi-stakeholder collaborations.

DISCUSSION

The findings of this study challenge the traditional paradigm of destination management, which frequently prioritizes physical infrastructure and natural endowments over human capital. Empirical evidence across the seven regencies in the Lake Toba Super Priority Tourism Destination demonstrates that the mere presence of high-value natural and cultural assets does not automatically generate a sustainable tourism ecosystem. Previous literature on Community-Based Tourism (CBT) has often treated local human resources (HR) as a peripheral supporting element or a mere factor of production. However, recent studies emphasize that human resources in rural tourism are vital for operational success and must be developed as a central component of sustainability (Ernawati et al., 2022). Furthermore, human capital acts as a primary knowledge provider and is increasingly recognized as the fundamental driver for achieving a sustainable competitive advantage in the global tourism market (Črnjar, 2018). In contrast to older paradigms, this study introduces a theoretical shift by positioning HR as the "core driver" and systemic integrator of the destination, aligning with findings that the expansion of human capital significantly enhances tourism eco-efficiency and destination resilience (Wang et al., 2024). The ecosystem's resilience is fundamentally dictated by the community's capacity to orchestrate local institutions, preserve cultural authenticity, and activate multi-stakeholder collaborations.

The Capacity-Interaction-Outcome Mechanism

To operationalize the role of HR as a systemic integrator, this study proposes a novel capacity-interaction-outcome mechanism. The foundation of a tourism village ecosystem is built upon the baseline competencies of its HR, encompassing hospitality, digital literacy, and an understanding of ecological carrying capacity. This aligns with recent scholarship emphasizing that contemporary tourism resilience requires human capital equipped with both technological proficiencies and deep ecological awareness to balance development and conservation (Baum et al., 2016; Gössling et al., 2020). The findings reveal that villages with stronger HR capacities are more adept at managing economic pressures without sacrificing environmental integrity. Furthermore, capable HR acts as the central node that dynamically connects the physical and institutional elements of the destination. Empowered local actors facilitate interactions between tourists and the environment, negotiate with

A Novel Ecosystem Model for Sustainable Tourism
Villages in Lake Toba" (It Is Concise, Introduces A Catchy
Academic Concept—"The Human Integrator" —and
Specifies the Context)

external stakeholders, and drive the internal governance of the village. Theoretical frameworks on destination governance corroborate this, positioning empowered local communities not merely as passive hosts, but as active orchestrators of multi-stakeholder networks and adaptive governance (Agyeiwaah et al., 2017; Waligo et al., 2013). Ultimately, the seamless interaction orchestrated by local HR directly produces improved service quality, elevated destination competitiveness, and holistic sustainability across economic, socio-cultural, and environmental dimensions, confirming that the effective orchestration of human capital is a primary determinant of long-term destination competitiveness (Goffi et al., 2019).

Activating the 4ASC Ecosystem and Pentahelix Governance

While previous studies have widely utilized models such as the 4A or 6A framework (Attractions, Accessibility, Amenities, Ancillary, Safeness, Comfort) primarily as a static checklist for evaluating destination quality (Buhalis, 2000), this research redefines it as a dynamic system entirely dependent on human intervention. For instance, 'Attractions' such as the Ulos weaving in Samosir or the agrarian landscapes in Toba are not static objects; they are "living cultures" sustained by the daily practices and knowledge transfer of local HR. This aligns with contemporary cultural tourism paradigms, which argue that destination authenticity is continuously co-created through the everyday life and active engagement of the host community rather than just existing as passive physical assets (Richards, 2018; Sfandla & Björk, 2013). Furthermore, the most critical deficits identified in the region—specifically 'Safeness' and 'Comfort'—are deeply tied to HR competencies in risk mitigation, waste management, and service etiquette, reinforcing the notion that perceived destination safety and visitor comfort are directly mediated by frontline human capital and local operational readiness (Mansfeld & Pizam, 2006; Seetanah et al., 2020). In terms of governance (Ancillary), the study reveals that the widely advocated Pentahelix collaboration (government, academics, business, community, and media) often remains superficial and ceremonial without robust local institutional capacity. Scholars have consistently warned that multi-stakeholder governance models can easily devolve into tokenism if local actors lack the power and capability for equitable negotiation (Calzada, 2020; Nunkoo, 2017). Consequently, grassroots institutions like Tourism Awareness Groups (Pokdarwis) and Village-Owned Enterprises (BUMDes) require competent HR to effectively anchor external interventions, transforming them.

Implications for Sustainable Tourism and the SDGs

To operationalize the role of HR as a systemic integrator, this study proposes a novel capacity-interaction-outcome mechanism. The foundation of a tourism village ecosystem is built upon the baseline competencies of its HR, encompassing hospitality, digital literacy, and an understanding of ecological carrying capacity, aligning with the principles of Green Human Resources Management (Ciocirlan, 2018). The findings reveal that villages with stronger HR capacities are more adept at managing economic pressures without sacrificing environmental integrity, ensuring the fulfillment of sustainability indicators for community tourism (Choi & Sirakaya, 2006). Capable HR acts as the central node that dynamically connects the physical and institutional elements of the destination, forming a crucial relational network (Baggio, Scott, & Cooper, 2010). Empowered local actors facilitate interactions between tourists and the environment, negotiate with external stakeholders, and drive the internal governance of the village (Purnomo et al., 2020; Zimmerman, 2000). The seamless interaction orchestrated by local HR directly produces improved service quality, elevated destination competitiveness, and holistic sustainability across economic, socio-cultural, and environmental dimensions (Ritchie & Crouch, 2003; Zolfani et al., 2015).

While previous studies have widely utilized the 4ASC model (Attractions, Accessibility, Amenities, Ancillary, Safeness, Comfort) as a static framework for evaluating destination quality, this research

redefines it as a dynamic system entirely dependent on human intervention. For instance, 'Attractions' such as the Ulos weaving in Samosir or the agrarian landscapes in Toba are not static objects; they are "living cultures" sustained by the daily practices and knowledge transfer of local HR, maintaining the necessary harmony between tourism development and cultural preservation (Astawa, Triyuni, & Santosa, 2018). Furthermore, the most critical deficits identified in the region—specifically 'Safeness' and 'Comfort'—are deeply tied to HR competencies in risk mitigation, waste management, and service etiquette. In terms of governance (Ancillary), the study reveals that the widely advocated Pentahelix collaboration often remains superficial and ceremonial without robust local institutional capacity. Critical research emphasizes that without addressing power dynamics and genuine community involvement, sustainable governance models remain ineffective (Bramwell & Lane, 2011; Hampton & Jeyacheya, 2023). Grassroots institutions like Tourism Awareness Groups (Pokdarwis) and Village-Owned Enterprises (BUMDes) require competent HR and strong networked social capital to transform external interventions into sustainable, long-term partnerships (Rindrasih et al., 2023; Zhang, Xu, & Ryan, 2024).

CONCLUSIONS

The presence of high-value natural and cultural resources does not automatically generate a superior and sustainable tourism ecosystem in the Lake Toba region. Local Human Resources (HR) should no longer be viewed merely as a supporting factor of production or passive beneficiaries, but must be positioned as the "core driver" and systemic integrator within the tourism destination. The elements within the 4ASC ecosystem (Attractions, Accessibility, Amenities, Ancillary, Safeness, Comfort) are fundamentally passive; their quality and sustainability are dictated by the capability of local HR to activate, connect, and synergize them. The most critical deficits identified in the region, particularly concerning safeness and comfort, are directly rooted in the lack of HR competencies regarding environmental risk mitigation, waste management, and service etiquette. Pentahelix collaboration often operates superficially and ceremonially because grassroots institutions (such as Pokdarwis and BUMDes) lack the robust institutional capacity to negotiate and independently sustain partnerships post-intervention.

RESEARCH IMPLICATIONS

This study shifts the traditional destination management paradigm, which frequently prioritizes physical infrastructure, by introducing a novel "capacity-interaction-outcome" mechanism that places HR at the center of the ecosystem. The 4ASC model is successfully redefined from a static evaluation checklist into a dynamic, human-activated system. Cultural assets, such as Ulos weaving, are not viewed as static museum exhibits but as "living cultures" sustained by the daily practices of local HR. The livelihood transition from an agrarian society to a tourism economy demands a significant shift in hospitality competencies, requiring communities to elevate local services to professional standards while retaining cultural authenticity. Empowering local institutions with managerial and entrepreneurial competencies is an absolute prerequisite to transforming top-down infrastructure interventions or external mentoring into resilient, community-led sustainable practices.

Policy Implications and SDG Achievement

This HR-driven ecosystem model provides a concrete, localized pathway for advancing the Sustainable Development Goals (SDGs), specifically SDG 8 (Decent Work and Economic Growth), SDG 11 (Sustainable Cities and Communities), SDGs 12 & 13 (Responsible Consumption and Production; Climate Action), and SDG 17 (Partnerships for the Goals). These findings emphasize to policymakers that sustainable tourism resilience cannot be engineered solely through macro-infrastructure projects; it must be organically cultivated from the ground up by empowering the human resources that breathe life into the destination's ecosystem.

Conflict of Interest Statement

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this study.

Funding Statement

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors. The study was conducted as part of the authors' independent academic research within the Postgraduate Studies program at the University of North Sumatra.

AI Use Statement

During the preparation of this work, the authors used advanced AI language models (specifically Google Gemini) for the purpose of linguistic refinement, bibliographic formatting, and the integration of academic literature to improve the readability and structural consistency of the manuscript. After using this tool, the authors reviewed and edited the content as needed and take full responsibility for the final content of this publication.

REFERENCES

- Agyeiwaah, E., McKercher, B., & Suntikul, W. (2017). Identifying core indicators of sustainable tourism: A path forward? *Tourism Management Perspectives*, 24, 26-33.
- Akbar, M., Sibarani, R., & Rosa, E. (2023). Integration of the 4ASC model in tourism ecosystems. *Journal of Tourism Destination Management*, 12(3), 45-60.
- Astawa, I. P., Triyuni, N. N., & Santosa, I. (2018). Sustainable tourism and harmonious culture: A case study of cultic model at village tourism. *Journal of Physics: Conference Series*, 953(1), 12057.
- Baggio, R., Scott, N., & Cooper, C. (2010). Network science: A review focused on tourism. *Annals of Tourism Research*, 37(3), 802–827. <https://doi.org/10.1016/j.annals.2010.02.008>
- Baktash, A. (2022). Agent-based modeling for tourism ecosystems. *Annals of Tourism Research*, 92, 103322.
- Baum, T., Kralj, A., Robinson, R. N., & Solnet, D. J. (2016). Tourism workforce research: A review, taxonomy and agenda. *Annals of Tourism Research*, 60, 1-22.
- Becker, G. S. (1964). *Human capital: A theoretical and empirical analysis, with special reference to education*. University of Chicago Press.
- Bramwell, B., & Lane, B. (2011). Critical research on the politics of sustainable tourism. *Journal of Sustainable Tourism*, 19(5), 745–759.
- Brundtland, G. H. (1987). *Our common future: Report of the World Commission on Environment and Development*. Oxford University Press.
- Buhalis, D. (2000). Marketing the competitive destination of the future. *Tourism Management*, 21(1), 97-116.
- Calzada, I. (2020). Penta-Helix: A social innovation framework for the sustainable development of tourism destinations. *Sustainability*, 12(18), 7542.
- Choi, H. S., & Sirakaya, E. (2006). Sustainability indicators for managing community tourism. *Tourism Management*, 27(6), 1274–1289.
- Ciocirlan, C. E. (2018). Green human resources management. In *Research handbook on employee pro-environmental behaviour*. Edward Elgar Publishing.
- Cooper, C., Volo, S., Gartland, W., & Faulkner, M. (2018). *Contemporary tourism: An international*

approach. Goodfellow Publishers.

Creswell, J. W. (2007). *Qualitative inquiry and research design: Choosing among five approaches* (2nd ed.). SAGE Publications.

Crotty, M. (1998). *The foundations of social research: Meaning and perspective in the research process*. SAGE Publications.

Črnjar, K. (2018). Human capital capabilities for sustainable competitive advantage in tourism industry. *KnE Social Sciences*. <https://doi.org/10.18502/kss.v3i10.3535>

Dalimunthe, R. F., & Indriany, X. (2023). Expanded 4ASC model for sustainable destination management. *Journal of Applied Tourism*, 7(2), 112-125.

Elkington, J. (1998). *Cannibals with forks: The triple bottom line of 21st century business*. Capstone Publishing.

Ernawati, N. M., Arjana, I. W. B., Puspita, N. P. L. A., Voda, M., & Hazra, S. (2022). Human resource development for rural tourism: a green tourism approach. *International Journal of Green Tourism Research and Applications*, 4, 50–57. <https://doi.org/10.31940/ijogtra.v4i2.50-57>

Freeman, R. E. (1984). *Strategic management: A stakeholder approach*. Pitman.

Giampiccoli, A. (2024). Community-based tourism: A critical evaluation of managerial capacity. *Sustainability*, 16(5), 2100.

Goeldner, C. R., & Ritchie, J. R. B. (2019). *Tourism: Principles, practices, philosophies* (12th ed.). Wiley.

Goffi, G., Cucculelli, M., & Masiero, L. (2019). Fostering tourism destination competitiveness in developing countries: The role of sustainability. *Journal of Cleaner Production*, 209, 101-115.

Gössling, S., Scott, D., & Hall, C. M. (2020). Pandemics, tourism and global change: A rapid assessment of COVID-19. *Journal of Sustainable Tourism*, 29(1), 1-20.

Hadi, S., & Gunawan, W. (2020). The 4A model in tourism destination development: Integration of safety and comfort aspects. *Journal of Applied Tourism*, 4(1), 12–25.

Hampton, M. P., & Jeyacheya, J. (2023). Power, community involvement, and sustainability of tourism destinations. *Tourist Studies*, 23(1), 72–92. <https://doi.org/10.1177/14687976221144335>

Kastenholz, E., Carneiro, M. J., & Marques, C. P. (2020). Place attachment and community involvement in rural tourism. *Journal of Sustainable Tourism*, 28(8), 1200-1220.

Kemenparekraf. (2023). *Panduan pengembangan desa wisata*. Kementerian Pariwisata dan Ekonomi Kreatif Republik Indonesia.

Lincoln, Y. S., & Guba, E. G. (1985). *Naturalistic inquiry*. SAGE Publications.

López, A., & Zhang, Y. (2023). Stakeholder interactions and system sustainability in rural tourism. *Journal of Sustainable Tourism*, 31(2), 150-168.

Mansfeld, Y., & Pizam, A. (Eds.). (2006). *Tourism, security and safety: From theory to practice*. Butterworth-Heinemann.

Miles, M. B., Huberman, A. M., & Saldaña, J. (2014). *Qualitative data analysis: A methods sourcebook* (3rd ed.). SAGE Publications.

Murphy, P. (1985). *Tourism: A community approach*. Routledge.

Nadler, L. (1970). *Developing human resources*. Gulf Publishing.

Narayan, D. (2005). *Measuring empowerment: Cross-disciplinary perspectives*. World Bank Publications.

A Novel Ecosystem Model for Sustainable Tourism Villages in Lake Toba" (It Is Concise, Introduces A Catchy Academic Concept—"The Human Integrator" —and Specifies the Context)

Nunkoo, R. (2017). Governance and sustainable tourism: What is the role of trust, power and social capital? *Journal of Destination Marketing & Management*, 6(4), 277-285.

Page, S. J. (2019). *Tourism management: An introduction* (6th ed.). Routledge.

Purnomo, S., Rahayu, E. S., Riani, A., L., Suminah, S., & Udin, U. (2020). Empowerment model for sustainable tourism village in an emerging country. *The Journal of Asian Finance, Economics and Business*, 7(2), 261–270.

Richards, G. (2018). Cultural tourism: A review of recent research and trends. *Journal of Hospitality and Tourism Management*, 36, 12-21.

Rindrasih, E., Wibowo, R. E., & Widjajanti, R. (2023). Social capital for sustainable tourism development in Indonesia. *Cogent Social Sciences*, 9(1), 2293310. <https://doi.org/10.1080/23311886.2023.2293310>

Ritchie, J. R. B., & Crouch, G. I. (2003). *The competitive destination: A sustainable tourism perspective*. CABI Publishing.

Sachs, J. D. (2015). *The age of sustainable development*. Columbia University Press.

Schultz, T. W. (1961). Investment in human capital. *The American Economic Review*, 51(1), 1–17.

Seetanah, B., Teeroovengadum, V., & Nunkoo, R. (2020). Destination satisfaction and revisit intention of tourists: Does the quality of airport services matter? *Journal of Hospitality & Tourism Research*, 44(1), 134-148.

Sfandla, C., & Björk, P. (2013). Tourism experience network: Co-creation of experiences in interactive processes. *International Journal of Tourism Research*, 15(5), 495-506.

Sibarani, R., Sibarani, E., & Simanjuntak, P. (2020). Local wisdom and community participation in Lake Toba tourism. *Journal of Batak Studies*, 5(2), 88-102.

Suharti, L., Sirine, H., & Martono, S. (2023). Developing a sustainable tourism village model: An exploratory study. *Journal of Entrepreneurship and Sustainability Issues*, 11(1), 120–135.

Sujith, A., et al. (2024). Safeness and comfort in modern tourism frameworks. *Tourism Geographies*, 26(1), 44-60.

Syahputra, R., & Taqiyah, T. (2025). Community empowerment and continuous mentoring in sustainable tourism. *Journal of Community Empowerment*, 10(1), 55-70.

Timothy, D. J., & Tosun, C. (2003). Approaches to community-based tourism: A review. *Tourism Management*, 24(1), 3–11. [https://doi.org/10.1016/S0261-5177\(02\)00038-4](https://doi.org/10.1016/S0261-5177(02)00038-4)

von Bertalanffy, L. (1950). An outline of general system theory. *British Journal for the Philosophy of Science*, 1(2), 134-165.

Waligo, V., Clarke, J., & Hawkins, R. (2013). Implementing sustainable tourism: A multi-stakeholder involvement management framework. *Tourism Management*, 36, 342-353.

Wang, Q., Wei, M., Wang, N., & Chen, Q. (2024). The impact of human capital and tourism industry agglomeration on China's tourism eco-efficiency: An analysis based on the undesirable super-SBM-ML model. *Sustainability*, 16, 6918. <https://doi.org/10.3390/su16166918>

Werner, J. M., & DeSimone, R. L. (2012). *Human resource development* (6th ed.). South-Western Cengage Learning.

Wijaya, A., & Santoso, B. (2025). Integration of digital technologies and the Internet of Things (IoT) in tourism villages. *Journal of Digital Tourism*, 12(1), 45-60.

Zhang, J., et al. (2021). Tourism villages as socio-ecological systems. *Tourism Management Perspectives*, 38, 100800.

Zhang, Y., Xu, H., & Ryan, C. (2024). Urban community-based tourism development: A networked social capital model. *Tourism Management*, 101, 104821. <https://doi.org/10.1016/j.tourman.2024.104821>

Zimmerman, M. A. (2000). Empowerment theory: Psychological, organizational, and community levels of analysis. In J. Rappaport & E. Seidman (Eds.), *Handbook of community psychology* (pp. 43–63). Springer.

Zolfani, S. H., Sedaghat, M., Maknoon, R., & Zavadskas, E. K. (2015). Sustainable tourism: A comprehensive literature review on frameworks and applications. *Economic Research-Ekonomska Istrazivanja*, 28(1), 1–30.