E-ISSN : 2962-9713
P-ISSN : 2963-928X

SECI-Based Knowledge Creation For Sustainable Agricultural And Aquaculture Communities In The Digital Age: A Systematic Literature Review And Future Research Agenda

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Abstract

Digital transformation and sustainability demands have made knowledge creation a critical factor in supporting innovation and competitiveness within agricultural and aquaculture communities. Studies on the application of the SECI (Socialization, Externalization, Combination, Internalization) model in local production-based communities remain relatively limited and are dominated by formal organizational contexts. This study aims to analyze the application of the SECI model in explaining community-based knowledge creation, its contribution to innovation and business sustainability, as well as its impact on economic, social, and environmental sustainability. The study employs a *Systematic Literature Review (SLR)* method following the PRISMA guidelines, analyzing 44 Scopus-indexed articles from 2016 to 2026. The results of the study indicate that the SECI model remains relevant as a conceptual framework for explaining the conversion of tacit and explicit knowledge that drives collective learning, innovation, adaptation to change, and business sustainability. Digital technology, ICT, and digital platforms serve as enablers that accelerate the processes of knowledge creation and collaboration among actors. This study also identifies research gaps and proposes a future research agenda for the seaweed farming community. The study's findings contribute to the development of knowledge management research by extending the application of the SECI model from formal organizations to agriculture and aquaculture communities focused on sustainability.

Keywords: *SECI Model, Knowledge Creation, Agricultural Community, Aquaculture, Sustainability, Digital Transformation, Seaweed Cultivation.*

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INTRODUCTION

Digital transformation and the demands of sustainable development have changed the way the agriculture and aquaculture sectors address various global challenges. Natural resource based production communities are not only required to increase productivity and product quality but must also be able to adapt to environmental changes, market uncertainties, and technological advancements. Under these conditions, knowledge becomes a strategic resource that determines a community's ability to innovate, make decisions, and maintain business sustainability. Various studies indicate that the ability to create and manage knowledge contributes to increased innovation, competitiveness, and

E-ISSN : 2962-9713
P-ISSN : 2963-928X

sustainable performance (Awad & Martín-Rojas, 2024; S. Chen & Zheng, 2022; Yu et al., 2017). Advances in digital technology further underscore the importance of knowledge creation. Information technology, digital platforms, and data-driven systems enable the processes of knowledge creation, storage, and dissemination to occur more rapidly and on a broader scale than conventional mechanisms (Gupta & Jain, 2017; Tomo et al., 2020). A number of studies indicate that digital transformation can enhance organizational learning, innovation capabilities, and organizational sustainability through more effective knowledge creation processes (Ruel et al., 2021; Sherani & others, 2025; Wairimu et al., 2022). One of the most widely used theories to explain the knowledge creation process is the SECI Model developed by Nonaka and Takeuchi (1996). This model explains that knowledge is created through the continuous conversion between tacit and explicit knowledge across four stages: socialization, externalization, combination, and internalization. Various studies have applied the SECI model in the contexts of business organizations, education, small and medium-sized enterprises, digital innovation, and supply chains (Chiu & Lin, 2022; Songkram & Chootongchai, 2020; Tung et al., 2022). Recent research also indicates that digital transformation expands the mechanisms of knowledge creation and strengthens learning and innovation processes (Cerchione et al., 2024; S. Chen & Zheng, 2022). In addition to playing a role in innovation, knowledge creation also contributes to economic, social, and environmental sustainability. Knowledge generated through learning processes enables organizations and communities to develop technological innovations, green innovations, and practices that are more adaptive to environmental changes (Bhatia, 2021; Qiao et al., 2023). Therefore, knowledge creation is increasingly viewed as a crucial foundation for achieving sustainable development (Mollah et al., 2023; Zhuge et al., 2023).

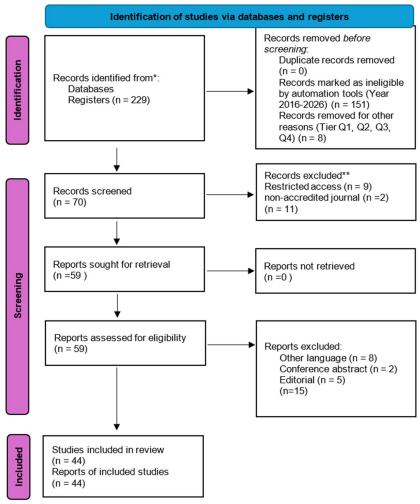
Most research on SECI and knowledge creation still focuses on formal organizations such as companies, educational institutions, manufacturing firms, and SMEs. Studies examining the application of SECI in agricultural and aquaculture communities remain relatively limited, even though these communities have distinct characteristics because their learning processes are largely built through field experience, social interaction, and local knowledge. Furthermore, research integrating SECI based knowledge creation with innovation and multidimensional sustainability in communities centered on local production is still scarce. A research gap is also evident in seaweed farming communities, which heavily rely on knowledge regarding environmental conditions, cultivation techniques, production management, and market access. To date, few studies have systematically explained how the processes of socialization, externalization, combination, and internalization occur within seaweed farming communities, nor how these processes generate innovation and economic, social, and environmental sustainability. These conditions indicate theoretical, contextual, and methodological gaps that require further study. Based on these gaps, this study aims to conduct a systematic literature review to analyze the role of the SECI Model in the creation of community based knowledge, its contribution to innovation and business sustainability, and its impact on economic, social, and environmental sustainability. The novelty of this study lies in its effort to reposition the SECI Model from the context of formal organizations to agricultural and aquaculture communities, while simultaneously developing a conceptual synthesis that links knowledge creation, innovation, and multidimensional sustainability as the foundation for developing future research agendas in seaweed farming communities. This study addresses three main research questions: (RQ1) how the SECI Model is used to explain community-based knowledge creation; (RQ2) how SECI based knowledge creation contributes to innovation and business sustainability; and (RQ3) how such knowledge creation leads to economic, social, and environmental sustainability.

E-ISSN : 2962-9713
P-ISSN : 2963-928X

METHOD

This study employs a Systematic Literature Review (SLR) approach to identify, evaluate, and synthesize research related to the SECI Model, knowledge creation, organizational learning, innovation, and sustainability. The SLR approach was chosen because it enables researchers to gain a comprehensive, systematic, and replicable understanding of research developments in a given field of study. The review process was conducted in accordance with the Preferred Reporting Items for Systematic Reviews and Meta Analyses (PRISMA 2020) guidelines, which consist of the stages of identification, screening, eligibility assessment, and article inclusion (Page, 2021). The literature search was conducted in May 2026 using the Scopus database, as it is one of the international scientific databases with broad coverage and high publication quality standards. The search strategy was developed based on keywords relevant to the research focus, namely *"SECI Model," "knowledge creation," "organizational learning,", "innovation," "digital transformation,"* and *"sustainability*." These keywords were combined using Boolean operators (AND and OR) to identify articles relevant to the research objectives. The search process targeted the titles, abstracts, and keywords of the articles.

Figure 1. *PRISMA*



Source: Page MJ, et al. BMJ 2021;372:n71. doi: 10.1136/bmj.n71.

The inclusion criteria used were as follows: (1) Scopus indexed journal articles; (2) published between 2016 and 2026; (3) written in English; (4) discussing the SECI Model, knowledge creation, organizational learning, innovation, digital transformation, or sustainability; and (5) available in full text. Meanwhile, the exclusion criteria included: (1) duplicate articles; (2) conference proceedings, books, book chapters, editorials, and non-systematic reviews; (3) articles that did not have substantive relevance to the research focus; and (4) articles that were not available in full for analysis. The identification stage yielded 229 articles retrieved from the Scopus database. Next, a screening process was conducted based on titles, abstracts, and keywords, resulting in 70 articles deemed relevant to the research topic. During the eligibility stage, the articles were read in greater depth to assess their alignment with the research objectives, leaving 59 articles. After a final evaluation based on the inclusion and exclusion criteria, 44 articles were selected as the primary sources for the literature synthesis.

E-ISSN : 2962-9713
P-ISSN : 2963-928X

Data from the selected articles were extracted and analyzed using a thematic synthesis approach. The analysis was conducted by identifying key themes related to the application of the SECI Model, the process of knowledge creation, innovation, business sustainability, as well as economic, social, and environmental sustainability. Subsequently, the results of the synthesis were used to answer the three research questions that had been formulated, namely regarding the role of the SECI Model in community based knowledge creation, its contribution to innovation and business sustainability, and its impact on multidimensional sustainability. The article selection process in this study followed the PRISMA 2020 flowchart, which consists of the identification, screening, eligibility, and inclusion stages, as shown in Figure 1. The use of the PRISMA guidelines aims to enhance the transparency, consistency, and reproducibility of the review process so that the research results have stronger validity.

RESULTS AND DISCUSSION

Results

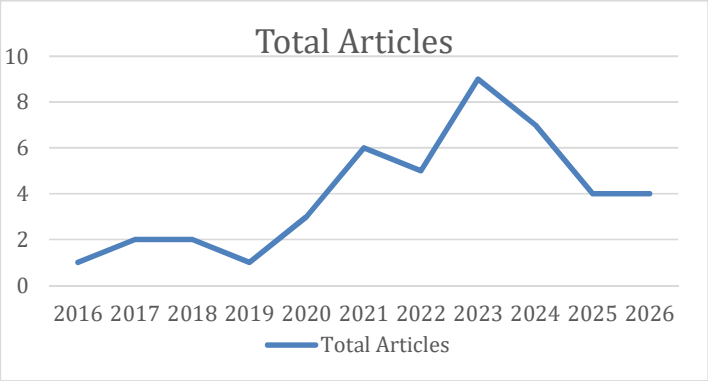


Figure1 . Year Classification

Based on Figure 2: Year Classification, the trend in publications shows a fairly strong increase over the past five years. Out of a total of 44 articles, the number of publications began to rise in 2020, peaked in 2023 with 9 articles, followed by 7 articles in 2024, and 6 articles in 2021. This pattern indicates that the themes of *knowledge creation, organizational learning, digital capability, innovation, and sustainability* have increasingly become the focus of academic attention following the acceleration of digital transformation and changes in the post-pandemic business environment. The study (Ruel et al., 2021), which discusses the role of leadership and organizational learning in digital business strategies; (Aboobaker & Zakkariya, 2021), which links digital learning orientation to innovative behavior; and (Mollah et al., 2023), which explains the relationship between digital leadership, IT capabilities, and organizational learning on sustainable performance. This is relevant because it indicates that the SECI based knowledge creation process is no longer viewed solely as an internal organizational process but is increasingly linked to digital capabilities, collective learning, and the creation of sustainable innovation. The peak in publications during 2023–2024 indicates a growing interest in how knowledge creation, digital capabilities, and organizational learning drive innovation and business sustainability, as seen in the study (Cerchione et al., 2024; Y. Chen et al., 2024; Mollah et al., 2023; Qiao et al., 2023) even directly reinterpret the SECI model in the context of digital transition , specifically regarding the use and adaptation of SECI. Meanwhile, research on digital capability, green knowledge creation, supply chain innovation, and business sustainability continues to be explored, as it demonstrates that knowledge creation

E-ISSN : 2962-9713
P-ISSN : 2963-928X

can contribute to innovation, business sustainability, and economic, social, and environmental impacts. Thus, the annual distribution of articles not only reflects the growth in the number of publications but also indicates that the themes of SECI, innovation, and sustainability are becoming increasingly relevant for study within the agriculture and aquaculture communities in the digital age.

Table1 . Journal Classification

No	Journal Name	Total Articles
1	Sustainability	7
2	Business Process Management Journal	2
3	Education and Information Technologies	2
4	Journal of Innovation and Knowledge	2
5	International Journal of Environmental Research and Public Health	1
6	Competitiveness Review	1
7	International Journal of Entrepreneurial Behavior and Research	1
8	International Journal of Educational Management	1
9	Journal of Enterprise Information Management	1
10	Journal of Knowledge Management	1
11	Management Research Review	1
12	International Journal of Innovation Management	1
13	Journal of Innovation and Entrepreneurship	1
14	Frontiers in Psychology	1
15	Systems	1
16	International Journal of Data and Network Science	1
17	Studia Paedagogica	1
18	Industrial Marketing Management	1
19	Journal of Public Affairs	1
20	Sustainable Development	1
21	Journal of Educational Change	1
22	Educational Technology Research and Development	1
23	Journal of the Academy of Marketing Science	1
24	Operations Management Research	1
25	International Journal of Information Management	1
26	International Journal of Medical Informatics	1
27	Business Strategy and the Environment	1
28	Regional Studies	1
29	Geografiska Annaler, Series B: Human Geography	1
30	Journal of Computer Information Systems	1
31	Technology Analysis and Strategic Management	1
32	European Planning Studies	1
33	EMJ - Engineering Management Journal	1
34	Innovation: Management, Policy, and Practice	1
35	Asia Pacific Journal of Marketing and Logistics	1
	TOTAL	**44**

Based on Table 1. Journal Classification, the distribution of articles shows that the themes of SECI based knowledge creation, organizational learning, digital capability, innovation, and sustainability are spread across interdisciplinary journals, but appear most prominently in the journal *Sustainability*. The dominance of this journal indicates that the issue of knowledge creation is increasingly linked to the sustainability agenda, whether at the organizational level, the supply chain level, or in the context of digital transformation. Studies such as (Contreras-Medina et al., 2020) on *knowledge creation* in

E-ISSN : 2962-9713
P-ISSN : 2963-928X

sustainable practices within the coffee supply chain, (Yu et al., 2017) on the process of knowledge creation and sustainable competitive advantage, Mollah et al. (2023) on digital leadership and organizational learning, as well as (Qiao et al., 2023) on digital capability and green supply chain innovation, demonstrate that knowledge creation is not only understood as a managerial activity but also as a mechanism for generating innovation and sustainability. This research is worth exploring because the cited studies reinforce the premise that SECI can be used to explain how tacit and explicit knowledge are converted into innovation, business sustainability, and economic, social, and environmental impacts.

In addition to *Sustainability*, several other journals such as the *Business Process Management Journal*, *Education and Information Technologies*, and the *Journal of Innovation and Knowledge*, as well as journals like the *Journal of Knowledge Management*, *Industrial Marketing Management*, *International Journal of Information Management*, *Business Strategy and the Environment*, and *Sustainable Development*, are also discussed. This distribution indicates that research on SECI based knowledge creation is multidisciplinary: it falls not only within the realm of knowledge management but also within education, information systems, innovation, marketing, business strategy, and sustainability. The study, (Cerchione et al., 2024) directly reconstructs the SECI model in the context of digital transformation; (Sherani et al., 2025) discusses the knowledge creation process in digital innovation; (Chiu & Lin, 2022) links the knowledge creation process to open innovation capability; and Chen et al. (2024) explain how digital transformation enables knowledge creation.

Table2 . Previous Research

No	Name (Year)	Title	Method	Results
1	(Zhuge et al., 2023)	*Does Digital Capability Promote the Sustainable Development of New Ventures? The Dual Impact of Green Knowledge Creation and Green Pressure*	Quantitative	Digital capability enhances business sustainability through green knowledge creation and green pressure.
2	(Sherani et al., 2025)	*Unlocking Digital Innovation: A Moderated-Mediation Approach Exploring the Knowledge Creation Processes, IT-Enabled Capabilities, and Absorptive Capacity in Software SMEs*	Quantitative	Knowledge creation and absorptive capacity strengthen digital innovation in software SMEs.
3	(Ruel et al., 2021)	*Digital Business Strategizing: The Role of Leadership and Organizational Learning*	Empirical study	Organizational learning supports digital business strategies and organizational adaptation.
4	(Yazdanpanah et al., 2023)	*The Influence of Entrepreneurial Culture and Organizational Learning on Entrepreneurial Orientation*	Quantitative	Entrepreneurial culture and organizational learning enhance entrepreneurial orientation.
5	(Aboobak	*Digital Learning*	Quantitative	Digital learning

E-ISSN : 2962-9713
P-ISSN : 2963-928X

No	Name (Year)	Title	Method	Results
	er & Zakkariya, 2021)	*Orientation and Innovative Behavior in the Higher Education Sector*		orientation enhances innovative behavior through learning culture.
6	(Gupta & Jain, 2017)	*Harnessing Information and Communication Technologies for Effective Knowledge Creation*	Conceptual	ICT plays a crucial role in supporting knowledge creation in the digital age.
7	(Cerchione et al., 2024)	*The WISED Knowledge-Creating Company: Rethinking the SECI Model in Light of the Digital Transition*	Conceptual	The SECI model is reinterpreted in the context of an organization's digital transformation.
8	(Al Dari et al., 2021)	*How Types of Organizational Culture and Technological Capabilities Contribute to Organizational Learning*	Quantitative	Organizational culture and technological capabilities enhance organizational learning.
9	(Ibeku, 2018)	*Organizational Learning, Innovation, and Performance of Technology Start-Ups in Lagos, Nigeria*	Quantitative	Organizational learning enhances innovation and the performance of technology startups.
10	(Awad & Martín-Rojas, 2024)	*The Influence of Digital Transformation on Organizational Resilience Through Organizational Learning and Innovation*	Quantitative	Digital transformation enhances organizational resilience through innovation and learning.
11	(S. Chen & Zheng, 2022)	*The Influence of Organizational Learning and Dynamic Capabilities on Organizational Performance*	Quantitative	Organizational learning and dynamic capability improve organizational performance.
12	(Nazir et al., 2024)	*Analyzing How COVID-19 Moderates the Relationship Between Organizational Learning Capabilities*	Quantitative	COVID-19 moderates the relationship between organizational learning and innovation and performance.
13	(Contreras-Medina et al., 2020)	*Roadmapping as a Driver for Knowledge Creation*	Case Study	Emerging technologies support sustainable practices through knowledge creation.
14	(Tung et al., 2022)	*Knowledge Creation for Digital Innovation in Malaysia*	Qualitative	Knowledge creation plays a crucial role in digital innovation.
15	(Mollah et al., 2023)	*Exploring a Pathway to Sustainable Organizational*	Quantitative	Digital leadership and IT capability enhance

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No	Name (Year)	Title	Method	Results
		Performance in the Digital Age		organizational learning and sustainability.
16	(Qiao et al., 2023)	*How Does the Digital Capability Advantage Affect Green Supply Chain Innovation?*	Quantitative	Digital capability drives green innovation through inter-organizational learning.
17	(Han et al., 2025)	*Artificial Intelligence Technology, Organizational Learning Capability, and Corporate Innovation Performance*	Quantitative	AI technology enhances innovation performance through learning capability.
18	(Ayoub & Sopuru, 2026)	*Reconfiguring Strategic Capabilities in the Digital Era*	Quantitative	AI-enabled capabilities and organizational learning enhance firm performance.
19	(Yu et al., 2017)	*Knowledge Creation Process and Sustainable Competitive Advantage*	Quantitative	Knowledge creation strengthens sustainable competitive advantage.
20	(Grumbkow et al., 2026)	*The Role of Promoters in Organizational Learning Within the Digital Transformation of Schools*	Case Study	Organizational learning supports the digital transformation of schools.
21	(Almujaini et al., 2021)	*Corporate Foresight, Organizational Learning, and Performance*	Quantitative	Digital transformation moderates the relationship between organizational learning and performance.
22	(Kajamaa et al., 2018)	*A Digital Learning Environment Mediating Students' Funds of Knowledge and Knowledge Creation*	Qualitative	A digital learning environment facilitates knowledge creation.
23	(Baah et al., 2026)	*Digital Co-Transformation, Interfirm Knowledge Creation, and Collaborative Innovation*	Quantitative	Interfirm knowledge creation enhances collaborative innovation.
24	(Hussain et al., 2022)	*An Empirical Investigation of Knowledge Management and Organizational Innovation*	Quantitative	Social media technologies support organizational learning and innovation.
25	(Zada et al., 2025)	*Driving Sustainable Development Through CSR Leadership*	Quantitative	Organizational learning supports sustainable development and innovation.

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No	Name (Year)	Title	Method	Results
26	(Songkram & Chootongchai, 2020)	*Effects of Pedagogy and Information Technology Utilization on Innovation Creation Using the SECI Model*	Quantitative	The use of technology and pedagogy supports SECI-based innovation creation.
27	(Zhang et al., 2023)	*How Can Technology Leverage Innovation in University Teaching and Learning?*	Longitudinal Study	The knowledge creation perspective supports technology-based learning innovation.
28	(Rikkerink et al., 2016)	*A New Model of Educational Innovation*	Conceptual	Organizational learning and digital technologies support educational innovation.
29	(Tan et al., 2021)	*Knowledge Building: Aligning Education with the Needs for Knowledge Creation in the Digital Age*	Conceptual	Knowledge creation forms the foundation of learning in the digital age.
30	(Zuo et al., 2019)	*Organizational Learning and Technological Innovation*	Quantitative	Organizational learning enhances innovation and firm performance.
31	(Ngo et al., 2023)	*Digital Supply Chain Transformation*	Quantitative	Knowledge creation capability supports supply chain transformation.
32	(Asadullah & Faik, 2026)	*How Resources Provided by Digital Platforms Enable SMEs to Develop Organizational Capabilities*	Conceptual	Digital platforms strengthen organizational learning and capabilities in SMEs.
33	(Cousins et al., 2023)	*Building Resilient Hospital Information Technology Services Through Organizational Learning*	Case Study	Organizational learning supports the resilience of healthcare technology services.
34	(Bhatia, 2021)	*Green Process Innovation and Operational Performance*	Quantitative	Organizational learning enhances green innovation and operational performance.
35	(Chiu & Lin, 2022)	*Developing Supply Chain Open Innovation Capability*	Quantitative	Knowledge creation mediates open innovation capability.
36	(Y. Chen et al., 2024)	*How Does Digital Transformation Empower Knowledge Creation?*	Quantitative	Digital transformation strengthens an organization's knowledge creation process.
37	(Johnston et al.,	*Examining the Roles of Universities in Place-Based*	Empirical Study	Universities support regional knowledge

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No	Name (Year)	Title	Method	Results
	2023)	*Industrial Strategy*		creation.
38	(Gómez, 2023)	*MNEs and Knowledge Creation in Medellín's Emerging ICT Hub*	Qualitative	The ICT hub supports knowledge creation and the innovation ecosystem.
39	(Wairimu et al., 2022)	*Digital Investments in Organizational Learning and Entrepreneurial Agility*	Quantitative	Digital investments enhance agility through organizational learning.
40	(Tomo et al., 2020)	*Information Systems and Information Technologies as Enablers of Innovation and Knowledge Creation*	Empirical study	Information systems support innovation and knowledge sharing.
41	(Wessendorf et al., 2025)	*Key Enabling Technologies in the Technological Space*	Quantitative	Technological embeddedness enhances regional knowledge creation.
42	(Gamón-Sanz et al., 2024)	*Lean Startup and Organizational Learning Capability*	Case Study	Organizational learning capability supports organizational innovation.
43	(Tripathi & Kalia, 2024)	*Examining the Effects of a Supportive Work Environment and Organizational Learning Culture*	Quantitative	Learning culture enhances organizational innovation and performance.
44	(Prayag et al., 2024)	*Dynamic, Technological, and Marketing Capabilities in MSMEs' Recovery from COVID-19*	Quantitative	Organizational learning strengthens the recovery and resilience of MSMEs.

Based on Table 2 from previous research, the reviewed literature indicates that the topics of *knowledge creation, organizational learning, digital capability, innovation, and* sustainability have evolved significantly, but most studies still focus on the contexts of formal organizations, SMEs, education, manufacturing, services, and supply chains. (Ayoub & Sopuru, 2026; Han et al., 2025; Mollah et al., 2023; Qiao et al., 2023; Zhuge et al., 2023) identifies digital capabilities, digital leadership, AI, and organizational learning as key factors driving innovation and sustainable performance. Meanwhile, (Cerchione et al., 2024) more specifically reinterprets the SECI Model in the context of digital transition, while (Songkram & Chootongchai, 2020) demonstrates that SECI can be used to explain the creation of innovation through the utilization of technology and learning processes. The findings of this study reinforce the theoretical basis that SECI is not only relevant to business organizations but can also be extended to practice based communities, including agricultural and aquaculture communities. However, the list of prior research also indicates that studies directly linking SECI, aquaculture communities, business innovation, and multidimensional sustainability remain limited.

Previous research provides a strong foundation for addressing the main research questions. Analysis of the SECI model has been used to explain community based knowledge creation in studies (Cerchione et al., 2024; Gupta & Jain, 2017; Kajamaa et al.,

E-ISSN : 2962-9713
P-ISSN : 2963-928X

2018; Tan et al., 2021), which show that the knowledge creation process can occur through the interaction between tacit, explicit, and technological knowledge, as well as collective learning. Regarding the issue of SECI-based knowledge creation contributing to innovation and business sustainability, research (Baah et al., 2026; Chiu & Lin, 2022; Sherani et al., 2025; Yu et al., 2017) confirms that knowledge creation plays a role in strengthening innovation, collaborative capabilities, and business excellence. Regarding sustainability impacts, research on (Bhatia, 2021; Contreras-Medina et al., 2020; Ngo et al., 2023; Qiao et al., 2023; Zada et al., 2025) demonstrates the relationship between knowledge creation, green innovation, supply chain transformation, and sustainable development. Thus, previous research has not only provided a conceptual foundation but has also highlighted a significant gap: this SLR study needs to shift its focus from formal organizations to agricultural and aquaculture communities, specifically examining how seaweed farming communities generate knowledge, produce business innovations, and foster economic, social, and environmental sustainability.

Discussion

This study explains that SECI based knowledge creation in agricultural and aquaculture communities must be understood as a community learning mechanism that links the conversion of tacit and explicit knowledge to innovation, business sustainability, and economic, social, and environmental sustainability. Through *a systematic literature review*, this study aims to explain how the SECI Model is used, adapted, or reinterpreted in agricultural and aquaculture communities; how these knowledge creation processes contribute to innovation and business sustainability; and how community based knowledge creation generates multidimensional sustainability impacts and opens up future research agendas for seaweed farming communities.

The SECI Model in Explaining Community Based Knowledge Creation

In the literature, the SECI Model is used to explain the concept of knowledge created through the dynamic interaction between tacit and explicit knowledge. Although most studies still focus on organizational, educational, technological, and business aspects, these findings provide a strong conceptual foundation for understanding agricultural and aquaculture communities as spaces for knowledge creation. (Songkram & Chootongchai, 2020) indicates that SECI can be used to explain learning processes and innovation creation in information technology supported educational environments. This is important because agricultural and aquaculture communities are also spaces for collective learning, where practical knowledge is developed through interaction, observation, experience, and exchange among community members. In agricultural and aquaculture communities, the socialization stage can be understood as the process by which farmers, aquaculturists, extension workers, cooperatives, and local actors share experiences directly. Knowledge regarding planting seasons, water quality, plant or seaweed diseases, cultivation techniques, and strategies for dealing with price fluctuations is often unwritten but passed down through shared practice. At this stage, tacit knowledge forms the core of community learning. Unlike formal organizations, agricultural and aquaculture communities rely on social trust, geographical proximity, and collective experience as the primary means of knowledge creation.

The externalization stage occurs when the community's practical experiences begin to be translated into more explicit forms, such as cultivation guidelines, best-practice records, quality standards, training documentation, or technical recommendations from extension agents. In the digital realm, (Cerchione et al., 2024) emphasizes that SECI needs to be reinterpreted because digital platforms, data, and artificial intelligence can expand the

E-ISSN : 2962-9713
P-ISSN : 2963-928X

ways in which knowledge is converted, stored, and disseminated. For agricultural and aquaculture communities, this means that local experiences are no longer circulated solely through oral means but can be codified via digital media, extension applications, online communication groups, or production information systems. The combination and internalization stages demonstrate how communities integrate various knowledge sources and transform them into new practices. Combination occurs when local knowledge is blended with scientific knowledge, market information, environmental data, and institutional policies. Internalization occurs when this new knowledge is fully applied in daily practices, such as changes in cultivation techniques, planting density, seed selection, harvesting methods, or environmental management practices. Thus, SECI can be used to explain that community based knowledge creation is not a linear process, but rather a continuous learning cycle that strengthens the adaptive capacity of agricultural and aquaculture communities.

SECI-Based Knowledge Creation Contributes to Innovation and Business Sustainability

SECI based knowledge creation contributes to innovation because each stage in the SECI process enables communities to transform practical experience into knowledge that can be used to improve production systems and businesses. (Yu et al., 2017) indicates that the knowledge creation process can strengthen sustainable competitive advantage through technological innovation capabilities. In agricultural and aquaculture communities, this relationship can be interpreted as the community's ability to transform cultivation experiences, local knowledge, and technical information into cultivation innovations, processing innovations, marketing innovations, and institutional innovations. SECI's contribution to innovation is also evident through the community's ability to absorb and integrate new knowledge indicates that the knowledge creation process mediates the relationship between information technology based capabilities, absorptive capacity, and digital innovation. (Chiu & Lin, 2022) also confirms that the knowledge creation process plays a role in building open innovation capabilities within supply chains. In agricultural and aquaculture communities, this capacity is crucial because innovation depends not only on technology but also on the community's ability to understand, adapt, and apply new knowledge in accordance with local conditions.

In terms of business sustainability, SECI based knowledge creation helps communities maintain production continuity, reduce risks, improve product quality, and expand market access. (Zhuge et al., 2023) indicates that digital capabilities can drive sustainable development through the creation of green knowledge and green pressure. (Mollah et al., 2023) also highlights the importance of digital leadership, IT capabilities, and organizational learning in supporting sustainable organizational performance. These findings are relevant to the seaweed farming community, as the sustainability of their enterprises is heavily influenced by the community's ability to learn from environmental changes, market demand, quality standards, and supply chain dynamics. Thus, SECI explains that innovation in agricultural and aquaculture communities is not merely the result of adopting external technologies, but rather the outcome of the community's learning process. Innovation can manifest in the form of more efficient cultivation techniques, improved drying methods, more consistent quality standards, product diversification, collective marketing, integration into digital markets, and the strengthening of business institutions. The iterative creation of knowledge through socialization, externalization, combination, and internalization enables communities to build long-term business resilience. Therefore, SECI based knowledge creation can be positioned as a

E-ISSN : 2962-9713
P-ISSN : 2963-928X

strategic mechanism that links community learning with innovation and business sustainability.

Knowledge Creation Generates Economic, Social, and Environmental Sustainability Impacts

Community-based knowledge creation can generate economic sustainability impacts through improved productivity, cost efficiency, product quality, market access, and income continuity. (Contreras-Medina et al., 2020) indicates that roadmapping can serve as a driver of knowledge creation to improve sustainable practices in the coffee supply chain. (Ngo et al., 2023) lso highlights the importance of knowledge creation capabilities in digital supply chain transformation when organizations face the risk of disruption. In agricultural and aquaculture communities, this demonstrates that economic sustainability can be achieved when local and external knowledge are combined to improve production, distribution, and market strategies. The social impacts of knowledge creation manifest through strengthened community cohesion, participation, trust, empowerment, and intergenerational knowledge transfer. (Hussain et al., 2022) links knowledge management, organizational learning, organizational innovation, and organizational culture to the role of social media technology, indicating that knowledge creation is also influenced by social relationships and organizational culture. In agricultural and aquaculture communities, these social dimensions are particularly important because many learning processes occur informally through community gatherings, collaborative work, training, family experiences, and local networks. Thus, social sustainability does not only mean the survival of the community as a production group but also the community's ability to maintain solidarity, trust, and intergenerational learning.

The environmental impact of knowledge creation is evident when communities are able to develop production practices that are more environmentally friendly, adaptive to ecological changes, and responsive to natural resource risks. (Bhatia, 2021) indicates that green process innovation is related to proactive environmental strategies, technological capabilities, and organizational learning. Also indicates that digital capability can influence green supply chain innovation through the perspective of inter-organizational learning. In seaweed farming communities, this dimension is highly relevant because production success is highly dependent on water quality, temperature, currents, diseases, and coastal ecosystem conditions. Based on this synthesis, future research should focus on more specific empirical studies of aquaculture and seaweed farming communities. Current research still largely highlights formal organizations, manufacturing, education, SMEs, and supply chains, while studies on the application of SECI in coastal aquaculture communities have not yet developed significantly. Therefore, future researchers can directly examine how the SECI cycle unfolds in seaweed cultivation practices, how communities integrate local knowledge with digital knowledge, how women and vulnerable groups contribute to knowledge creation, and how these processes simultaneously promote economic, social, and environmental sustainability. Thus, this knowledge creation which yields economic, social, and environmental sustainability impacts not only explains these sustainability impacts but also offers a conceptual foundation for developing future research agendas on SECIbased knowledge creation for sustainable seaweed farming communities.

CONCLUSION

The SECI model remains relevant as a conceptual framework for explaining the knowledge creation process in agricultural and aquaculture communities. The processes of socialization, externalization, combination, and internalization enable the conversion of tacit and explicit knowledge, supporting collective learning, innovation, adaptation to

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P-ISSN : 2963-928X

change, and business sustainability. The findings also indicate that digital technologies, ICT, and digital platforms serve as enablers that accelerate the knowledge creation process and strengthen community capacity to achieve economic, social, and environmental sustainability. The novelty of this research lies in its effort to reposition the SECI Model from the context of formal organizations to local production based communities specifically agriculture and aquaculture and to develop a conceptual synthesis linking knowledge creation, community learning, innovation, and multidimensional sustainability in the digital age.

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