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EXPLORING DIGITAL INNOVATION CAPABILITIES IN MSMES AGROSOCIOPRENEURSHIP : AN ENTREPRENEURIAL ECOSYSTEM PERSPECTIVE

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Abstract

Digital transformation is a strategic factor for agrosociopreneurial MSMEs to enhance competitiveness and business sustainability . This study aims to develop a conceptual model explaining the relationships between the Digital Entrepreneurial Ecosystem (DEE), Innovation Capability (IC), and Business Performance (BP). An exploratory – theoretical design was employed using bibliometric and systematic literature review (SLR) methods . Data were analyzed using VOSviewer for trend mapping and Co- occurrence Matrix. The study population compressed scientific publications , industry reports , and experts and academics in digital innovation , green economy , and MSME development , with a sample consisting of research articles from the past ten years and ten purposively selected experts . The findings indicate that DEE plays a crucial role in enhancing the innovation capability of agrosociopreneurial MSMEs . Value co-creation is identified as a key mechanism mediating the DEE–IC relationship and potentially strengthening the impact of DEE when stakeholders engagement is high . The proposed conceptual model provides a theoretical contribution by integrating DEE, co-creation , and IC, as well as practical recommendations to strengthen digital collaboration , technological literacy , and innovation policies for MSMEs .

Keywords: Digital Entrepreneurial-Ecosystem, Innovation Capability, Business-Performance, co -creation . SME-Agro

INTRODUCTION

MSMEs in the sector agrosociopreneurship own role strategic in support resilience food , sustainability environment and growth economy national . However , the limitations infrastructure technology , low digital literacy , and its weakness support ecosystem become obstacle main for innovation and power MSME (Struk et al., 2022)competitiveness . Various digital training , such as that carried out in Wukirsari - Sleman and Lebak Muncang-Ciwidey , shows that improvement digital skills are still very much needed (Maradona et al., 2023)

Digital transformation and current entrepreneurial dynamics have given birth to the phenomenon of *Digital Entrepreneurship. Ecosystem* (DEE), namely an ecosystem that integrates digital technology with entrepreneurial activities(Sussan & Acs, 2017) (Venâncio et al., 2023). (Bejjani et al., 2023; Elia et al., 2020) . Ecosystem digital entrepreneurship (*Digital Entrepreneurial Ecosystem/DEE*) which includes regulations government , access financing based technology , digital platforms, as well community innovator , assessed capable expand market access , increasing efficiency production , and speed up innovation product (Sussan & Acs, 2017a). However , the effectiveness of DEE on agrosociopreneurship MSMEs which have characteristics unique Still seldom tested in a way empirical .

Research that examines influence simultaneous DEE against *Innovation Capability* (IC) as well the implications on *Business Performance* (BP) are still limited . IC is factor the key that enables MSMEs to innovate in products , processes, and business models , so that capable respond market changes with more fast and effective (Rajapathirana & Hui, 2018; Yusof et al., 2023). Therefore that , research This aim develop a conceptual model that explains relationship of DEE, IC, and BP in the context of agrosociopreneurship MSMEs , so that can give contribution theoretical and practical for policy digital innovation in the sector So the question to be answered is: What is the conceptual model that can explain the relationship between DEE, IC, and BP in the context of agrosociopreneurship MSMEs ?

Theoretical basis

Review library This highlight role **Ecosystem Digital Entrepreneurship (DEE)** as driver main transformation MSME (Elia et al., 2020; Sussan & Acs, 2017a)businesses , in particular in increase **Capability Innovation (IC)** (Nasiri et al., 2023; Saunila, 2020). DEE includes digital infrastructure , regulation , financing technology and support community innovations that enable MSMEs to expand their markets, accelerate innovation , and improve efficiency . However , the implementation of DEE in the sector agriculture Still face obstacle like low digital literacy and limitations infrastructure .

Capability innovation viewed as key improvement **Business Performance (BP)** , because enable MSMEs to develop product friendly environment , efficiency chain supply , and adapt with the global market. Research previously shows IC has connection positive with BP and plays a role as variables mediation important between DEE and performance business (Ammirato et al., 2022; van Tonder et al., 2024).

Literature that studies DEE interaction with IC in the agro SME sector Still limited , so that required study continued . This study expected can produce a conceptual model that explains connection DEE, IC , and BP, all at once give contribution theoretical for literature digital entrepreneurship and contribution

practical for policy innovation for agro-sociopreneurial MSMEs .(Ahmad Tarmizi et al., 2020)

Research Methods

Study This use fundamental- theoretical approach For develop a conceptual model connection between DEE, IC , and BP in agrosociopreneurial MSMEs. Method done with Exploration Theoretical (SLR & Bibliometrics): mapping trends , concepts , and interrelationships variables through review library systematic . Data analysis was carried out with Python, R, and VOS Viewer, using matrix co-occurrence , index association , layout algorithm (Fruchterman –Reingold) , clustering modularity , and interpretation theory For produce a ready model tested in a way empirical .

Discussion

Data Presentation .

The data of this research consists of secondary data obtained from reputable international journals through Mendeley Web Importer , Sciencedirect , Elsevier Open Access, and other platforms to obtain complete data and research reports related to the topics of DEE, IC, and BP.

At the beginning of data collection, the researcher determined 100 articles per year for the past 12 years, from 2012 to 2025. Relevant articles covering the four topics of DEE, IC, and BP were then selected for analysis. The initial data were sorted based on article completeness, including title, abstract, keywords, and conclusion. Next, government policy data and expert opinion were analyzed using the Delphi method . To answer the research questions, the research data were stored in RI and SCV formats, which are interconnected for easy reporting. A complete list is available in the appendix. A total of 1,400 articles were obtained for each topic, bringing the total to 5,600 articles. The following describes the data collection procedures and data collection results.

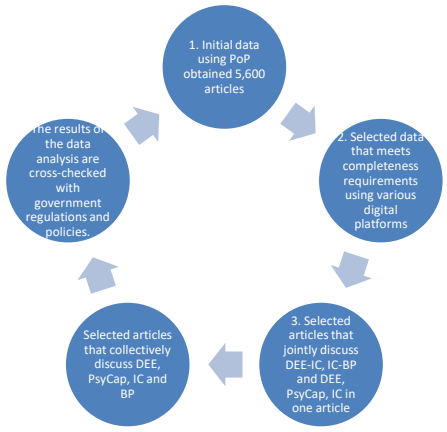

Figure 1. Data collection procedures

DEE to IC Data 2012-2025

Publication years:	2017-2025
Citation years:	8 (2017-2025)
Papers:	47
Citations:	520
Cites/year:	65.00
Cites/paper:	11.06
Cites/author:	520.00
Papers/author:	43.99
Authors/paper:	0.94
h-index:	11
g-index:	22
hI,norm:	11
hI,annual:	1.38
hA-index:	8

Figure 2: Data collection results

There are 47 articles relevant to this topic, with a total of 520 citations over 8 years (2017-2025). The average citations per year is 65 and per article 11.06. Each article involves an average of 43.99 authors. The h(11) and g(22) indices indicate significant influence, with h_coverage of 81.9% and g_coverage of 95.6%. This publication demonstrates high productivity with cumulative impact (ECC) reached 520.

Data Analysis Results .

Descriptive Analysis Results.

Data analysis of the role of DEE in increasing IC in agrosociopreneurship MSMEs based on articles from 2012 to 2025

Table 1: Results of Descriptive Statistical Analysis of DEE to IC

Variables	in	1	Median	3	ax	ean	Std Dev
Cites (Citations)			0		49	7.03	72.37
CitesPerYear			0		1.5	.72	15.55
CitesPerAuthor			0		75	.10	33.29
AuthorCount			2			.00	1.36
Age (Article Age)			2		2	.00	2.71

GSRank (GS Ranking)		9	37	5	3	7.00	21.22

Table 2: Distribution of Publication Years

Statistics	Mark
Minimum Years	2013
Year Maximum	2025
Median Year	2023
Average Year	2022.15

The majority of articles fall within the 2021–2025 period, indicating a focus on recent literature.

Implications of Analysis

a. Uneven distribution: many articles have no citations even though they were published several years ago.
b. outliers (example: an article with 549 citations) significantly impact the average value.
c. The distributions of CitesPerYear and CitesPerAuthor are also highly non-normal.

A text-based descriptive analysis of the key numeric variables in the dataset of 73 articles with complete data is This publication dataset is dominated by young articles (mean age 3 years), with the majority having no citations (median = 0). Although the average citation rate is 17 per article, this figure is heavily influenced by one very highly cited article (549 citations). Only a small proportion of articles show consistent annual citation growth. The average citation rate per author is also quite low (7.1) with large variations, indicating an uneven distribution of impact. Most articles are written collaboratively by 1–3 authors, with limited multidisciplinary involvement. Citation-based ranking (GSRank) is quite dispersed, but major contributions remain dominated by highly ranked articles.

Table 3: Most Cited Articles and Interpretation

No	Article Title	Writer	Year	Journal / Source	itation	Interpretation Short

	Digital technology, digital capability and organizational performance	Sabai Khin, Theresa CF Ho	2019	*International Journal of Innovation Science*	49	Discuss How digital capabilities contribute directly on the increase performance organization . Theoretical basis for digital capability models.
	Impact of digital leadership capability on innovation performance	Jose Benitez, Alvaro Arenas & all	2022	*Information & Management*	53	Focus on digital leadership as a driver of innovation . Support the importance of soft leadership skills in DEE.
	Digital technology adoption, digital dynamic capability and innovation performance	Lei Shen, Xi Zhang & all	2021	*Managerial and Decision Economics*	39	Connect adoption technology with capability dynamic . Strengthening dynamic capability theory .
	Innovation performance in digital economy: does intellectual capital matter?	Wen Jun, Muhammad Hamid Nasir & all	2021	*European Journal of Innovation Management*	4	Highlighting the role of intellectual capital (IC) in support innovation in the digital era. Relevant with IC model.
	Dynamic capability: The effect of digital leadership and organizational agility	Sasmoko , Leonardus W Wasono & all	2019	*Management Science Letters*	1	Analyze How Digital leadership increases organizational agility . Supports IC & DEE framework .
	Effects of	C	2	*J*		Review

	human capital on entrepreneurial ecosystems in the emerging economy: the mediating role of digital knowledge and innovative capability from India perspective	haudhuri ; Chatterjee ; Vrontis ; Vicentini	023	*ournal of Intellectual Capital*	4	connection between human capital ecosystem and ecosystem entrepreneurship . Investigating role mediation capability digital knowledge and capabilities innovation , as well as role moderation turbulence technology in ecosystem entrepreneurship .

Figure 3: Publication trends per year

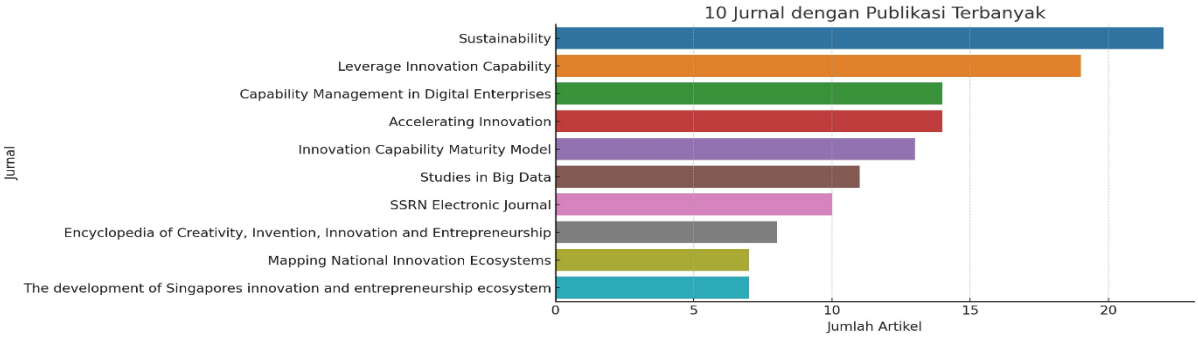

Figure 4: 10 Journals with the Most Publications

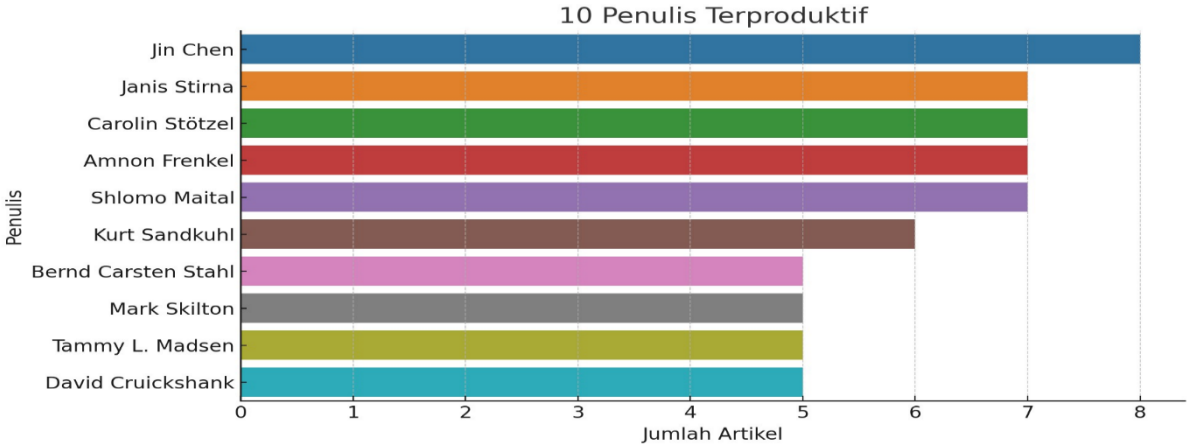

Figure 5: 10 Most Productive Writers

Bibliometric Analysis Using Vos Viewer and Interpretation

Image VOSviwer Digital Entrepreneurial Ecosystem (DEE) and *Innovation Capability* (IC) 2012-2025

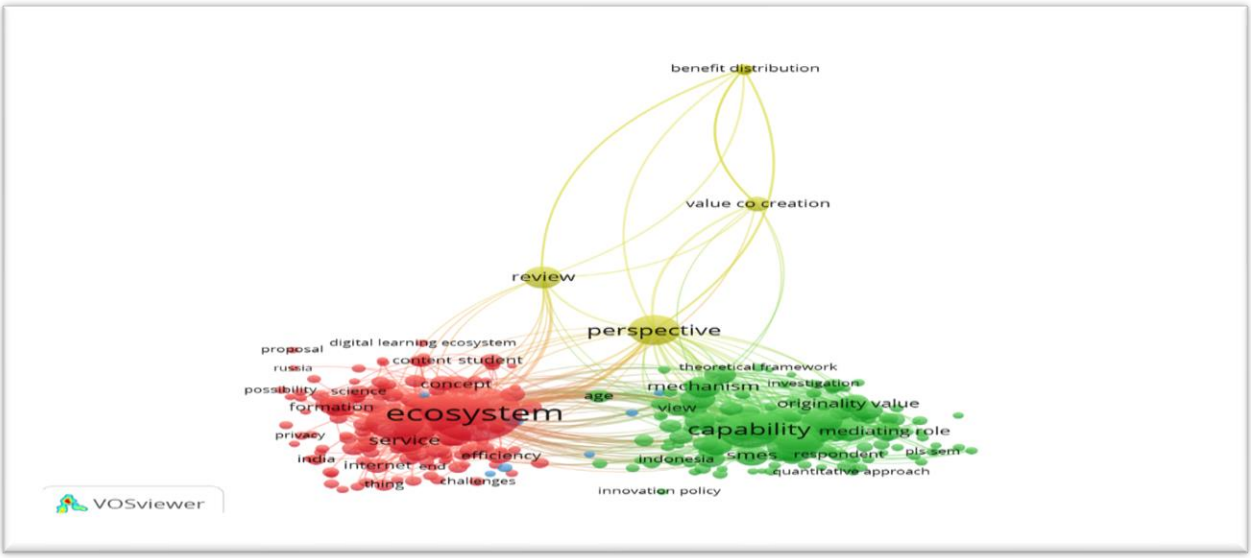

Figure 6: Vos Visualization Viewer DEE To IC

1. Results of Co- occurrence Matrix Analysis

Table 4: Co- occurrence Matrix table

Draft	EE	C
Digital Entrepreneurship Ecosystem (DEE)	5	2
Innovation Capability (IC)	2	1

2. Association Results Strength Index (Normalization)

Table 5: ASI DEE to IC

Parameter	Symbol	ark	Information
Co- occurrence of DEE and IC	Cij	2	Number of co-occurrences of DEE and IC
Total DEE	Ci	5	Total occurrence of the DEE concept
Total IC	Cj	1	Total emergence of the IC concept
Total Documents	N	7	Number of documents in the analysis
Association Strength Index	breast milk	.728	

3.Layout Results Algorithm – Force-Directed (Fruchterman-Reingold Layout)

Table 6. Algorithm Layout

Repulsive Force	6,528
Attractive Force	7.47
Ideal distance constant	.61

4. Clustering Results Algorithm (Modularity-Based)

Table 7: Clustering Algorithm (Modularity-Based)

Detected parameters	Mark
Number of concepts (n)	14
Total occurrences (A)	182
Empirical constant (C)	1
k	3,606
Modularity according to the formula	Q = 0.42

Cluster I	Infrastructure Cluster Technology

Cluster II	Learning Organization Cluster
Cluster III	Learning Organization Cluster

Bibliometric analysis shows a close relationship between Digital Entrepreneurial Ecosystem (DEE) and Innovation Capability (IC). DEE appears 25 times and IC 31 times, with 12 connections. The VOSviewer map displays DEE in the red cluster (ecosystem) and IC in the green cluster, connected by a bold line indicating the consistency of the literature in viewing DEE as an external ecosystem that strengthens IC as an internal capability. In the context of agrosociopreneurial MSMEs , this confirms that digital transformation through DEE has the potential to drive increased IC, competitiveness, and business sustainability.

The visualization shows three main clusters: red (ecosystem /technology), green (capability /learning & innovation), and yellow (perspective / co-creation). The yellow node *is value. Co-creation* connects DEE and IC, demonstrating that innovation and competitive advantage are created not by a single actor, but through cross-ecosystem collaboration. Bibliometric results also confirm this: *Attractive Force* is greater than *Repulsive Force* , the ideal distance constant (3.61) indicates conceptual closeness, and the *Modularity Q value of* 0.42 confirms the validity of the cluster structure.

Despite the strong DEE–IC relationship, a research gap remains as few studies have elaborated on the theoretical mechanisms that underpin this relationship, particularly in MSMEs. The contribution of this analysis is to open up a new model direction: DEE as a provider of digital resources, networks, and ecosystems can enhance IC through mediating or moderating mechanisms , such as PsyCap , collaboration, or *absorptive capacity* .

The Role of Co- Creation as Mediation and Moderation

As *a mediator* , co-creation explains how DEE strengthens IC. DEE provides digital infrastructure, networks, and collaboration platforms, but its impact does not automatically increase IC. Through co-creation , interactions between ecosystem actors are translated into tangible value in the form of synergy of ideas, knowledge, and resources, enabling MSMEs to learn, adapt, and innovate. As *a moderator* , co-creation strengthens the intensity of the DEE relationship with IC. If the level of co-creation is high, MSMEs are quicker to absorb digital opportunities and utilize the ecosystem for innovation. Conversely, if it is low, the potential of DEE is not optimal.

In the context of agrosociopreneurship-focused MSMEs , co-creation enables consumer-needs-driven product innovation, collaborative marketing through digital platforms, and access to technology and finance from ecosystem partners. Thus, co-

creation is key to transforming DEE into strengthening IC. The research model can be formulated as follows:

- Mediation: DEE → Co- Creation → IC
- Moderation : DEE × Co- Creation → IC

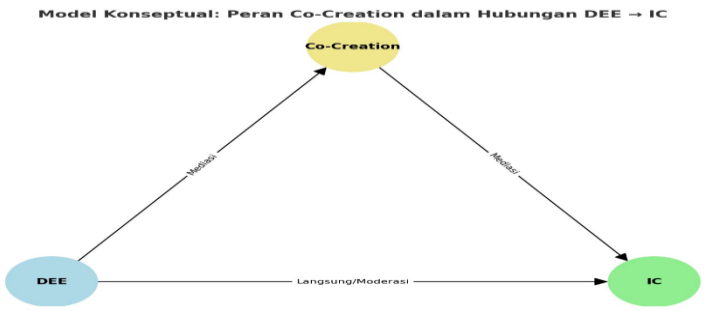

Figure 2: Conceptual Model of Co- Creation Roles between DEE - IC

This conceptual model illustrates that *Digital Entrepreneurial Ecosystem* (DEE) can directly influence *Innovation Capability* (IC). Furthermore, the relationship between the two can also be explained through a mediation mechanism, where *co-creation* acts as a bridge that allows DEE to drive IC improvement. Furthermore, co-creation can also function as a moderator, strengthening or weakening the influence of DEE on IC. Thus, co-creation has a dual role, as both a mediator and a moderator, depending on the direction and objectives of the research.

Interpretation of Theory

Bibliometric analysis (Q = 0.42) and the VOSviewer map identified three main clusters: (1) digital ecosystems as providers of infrastructure and resources, according to the *Digital Ecosystem theory* (Autio et al., 2018); (2) co-creation as a link between DEE and organizational capabilities, in line with *Service- Dominant Logic* ((Lusch & Vargo, 2006); and (3) *dynamic capability* and *innovation capability* as a driver of MSME performance, in line with the *Dynamic theory Capabilities* (D. J. Teece, 2018)). Thus, DEE functions as a foundation, co-creation as a connecting mechanism, and innovation as a capability as a strategic outcome that determines competitiveness.

Research Gap

The literature still tends to be partial, rarely testing the causal relationship between DEE– co-creation –IC, and minimally discussing the context of MSME agrosociopreneurship . Furthermore, the role of co-creation is often positioned conceptually without empirical evidence. This study fills this gap by proposing a conceptual model **of DEE → co-creation → IC** in the context of agro-SMEs, while empirically testing the role of mediation to provide practical recommendations in strengthening competitiveness based on digital transformation and collaboration.

Research Hypothesis

1. The Relationship between DEE and Co- Creation

H1: Digital Entrepreneurship Ecosystem (DEE) has a positive influence on co-creation in agrosociopreneurial MSMEs .

(Basic theory: Service- Dominant Logic , (Lusch & Vargo, 2006)*; DEE provides a collaboration platform that enables shared value creation).*

2. The Relationship between DEE and Innovation Capability

H2: Digital Entrepreneurship Ecosystem (DEE) has a positive influence on innovation capability in agrosociopreneurial MSMEs .

(Theoretical basis: Dynamic Capabilities , (D. Teece, 2019; D. J. , P. G. , & S. A. Teece, 1997; D. J. Teece, 2018, 2019)*; DEE provides infrastructure, technology, and market access that strengthen innovation).*

3. The Relationship between Co- Creation and Innovation Capability

H3: Co- creation has a positive effect on innovation capability in agrosociopreneurial MSMEs .
(Theoretical basis: Co- Creation & Service Innovation , (Prahalad & Krishnan, 2002)& (Ramaswamy & Ozcan, 2018)*, collaboration with stakeholders increases creativity and new solutions).*

4. The Role of Co- Creation Mediation

H4: Co- creation mediates the relationship between Digital Entrepreneurial Ecosystem (DEE) and innovation capability in agrosociopreneurial MSMEs .

(Theoretical basis: Mediation Frameworks ; DEE → providing opportunities, Co-Creation → actualize, IC → final result of competitiveness).

Conceptual Model (Hypothesis Flow)

DEE → Co- Creation → Innovation Capability (mediation effect)

direct effect (DEE → IC)

Conceptual Model Table of Hypothesis Flow for research (DEE → Co- Creation → Innovation Capability), complete with hypotheses, indicators and theoretical sources.

Table 7: Conceptual Model of the Research

Variables	Indicator	Hypothesis	Source of Theory
Digital Entrepreneurial Ecosystem (DEE)	1. Digital infrastructure (platform, network , cloud). 2. Market	**H1:** DEE has an effect positive to *Value Co-Creation* **H2:** DEE	(Autio et al., 2018)(2018);(Li & Liu, 2023; Wang & Li, 2023)

	access and networking 3. Support regulations and policies 4. Access to capital and resources Power	has an effect positive to *Innovation Capability*	
Value Co-Creation (Collaborative process) create mark)	1. Collaboration with stakeholders 2. Distribution benefit 3. Active participation of MSMEs 4. Innovation based market needs	**H3:** Value Co-Creation has an effect positive to *Innovation Capability* **H4:** Value Co-Creation mediates DEE → Innovation Capability relationship	(Prahalad & Krishnan, 2002)& (Ramaswamy & Ozcan, 2018)(2004);(Lusch & Vargo, 2006)
Innovation Capability (IC)	1. Ability to develop product new 2.Ability to improve processes 3.Absorption ability knowledge external (*absorptive capacity*) 4. Ability to commercialize innovation	- Variables Dependent (Outcome) Affected directly by DEE and Co-Creation	(Djoumessi et al., 2019; LAWSON & SAMSON, 2001)&(Laatikainen & Ojala, 2023; Linde et al., 2021)

Hypothesis Flow

1. **H1:** DEE → Co- Creation
2. **H2:** DEE → Innovation Capability

3. **H3:** Co- Creation → Innovation Capability
4. **H4:** Co- Creation mediates the influence of DEE on Innovation Capability

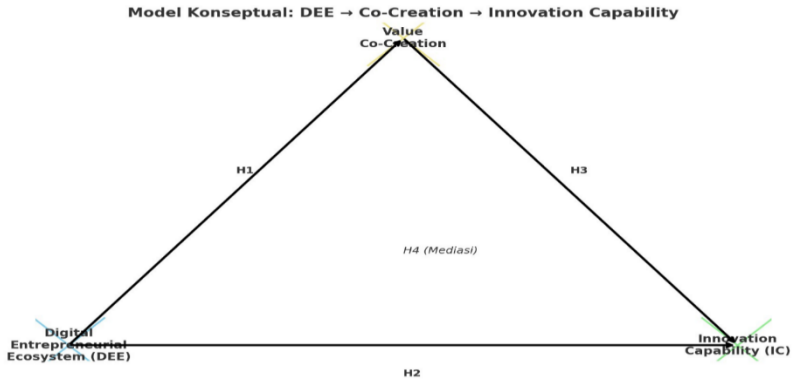

Figure 3: Visualization of the conceptual model of the hypothesis flow: Digital Entrepreneurial Ecosystem (DEE) → Value Co- Creation → Innovation Capability (IC), with hypothesis arrows (H1 – H4).

Operationalization Table of Variables for the research questionnaire instrument on agrosociopreneur MSMEs .

Table 8: Operationalization of Research Variables

Variables	**Dimensions**	**Indicator**	**Example Questionnaire Items (Likert 1–5)**	**Source**
Digital Entrepreneurial Ecosystem (DEE)	Digital Infrastructure	Internet access and digital platforms	My business easy access digital platforms to selling / networking ”	(Autio et al., 2018)(2018);(Li & Liu, 2023; Wang & Li, 2023)
	Support Policies & Regulations	Support government on digital transformation of MSMEs	" Policy government make it easier business I in utilization digitalization ”	(Sussan & Acs, 2017a, 2017b)
	Market Access & Networking	Connection with customers , suppliers , and digital communities	“Digital platforms help I reach new markets ”	(Nambisan, 2017; Nambisan et al., 2019)

	Access to Digital Financing	Convenience get capital through fintech/digital lending	"I can get financing business through digital platforms"	(Autio et al., 2018)
Value Co-Creation	Customer Participation	Involvement customer in the development process product	" Customer I often give input in development product "	(Ramaswamy & Ozcan, 2018)
	Knowledge Sharing	Sharing ideas and information with partners / communities	"I am active share ideas with partners or community business "	(Payne et al., 2008)
	Collaborative Innovation	Collaboration with customers / partners in innovation	" Product new I developed through collaboration with partners / customers "	(Ranjan & Read , 2016)
	Product /Service Co-Design	Customer follow as well as designing products / services	" Customer contribute in design products / services I "	(Liu & Zhao, 2021)
Innovation Capability (IC)	Product Innovation	Ability create product new	My business often launch product new "	(Djoumessi et al., 2019; LAWSON & SAMSON, 2001)
	Process Innovation	Improvement of production / operational processes	"I did innovation in the production process to make it more efficient "	(Migdadi , 2022; Yu et al., 2024)
	Organizational	Innovation in	My business	(Knight &

	Innovation	method work , structure , and management	adopt method Work new For increase performance "	Cavusgil , 2024; Velyako & Musa, 2023)
	Market Responsiveness	Ability respond change market needs	My business fast adapt self with market trends ”	(Chien, 2024; Rochiyati et al., 2022)

Discussion (Discussion)

The proposed conceptual model show role strategic Digital Entrepreneurial Ecosystem (DEE) as foundation transformation Agrosociopreneurial MSME innovation . Review results library and analysis bibliometrics confirm that DEE, which consists of on digital infrastructure , regulation , market access , and financing , are the main enablers that strengthen the ability of MSMEs to create value and increase Innovation Capability (IC).

Findings This in harmony with Digital Ecosystem (Autio et al., 2018)theory (, where DEE acts as provider source power and platform that enables entrepreneur access technology , collaboration with stakeholders, and utilize digital market opportunities . In context this , DEE works No only as facilitator innovation , but also as driver change organization and adaptation of business strategies .

The role of value co-creation becomes crucial in bridge the influence of DEE on IC. In line with Service-Dominant Logic (Lusch et al., 2007; Lusch & Vargo, 2006; Tadajewski & Jones, 2021; Vargo & Lusch, 2008, 2016), co-creation (Ramaswamy & Ozcan, 2018; Ranjan & Read, 2016)facilitates involvement customers , partners , and communities For share ideas, collaborate in design products , and create innovation together . This process increase quality innovation , acceleration response to market changes , and increase relevance product with need consumers . With Thus , co-creation plays a role as a transforming mediator digital opportunities become measurable innovative outputs .

In addition , this model also recognizes the potential for co-creation as a moderator, which strengthens or weaken the effect of DEE on IC depends on the level stakeholder involvement and participation . MSMEs with high co-creation involvement will more capable utilize DEE optimally compared to those with minimal collaboration . This consistent with Dynamic Capabilities Theory (D. J. , P. G. , & S. A. Teece, 1997; D. J. Teece, 2018, 2019)view) that organization need develop capability dynamic For integrate source Power external and adaptive in a way fast to dynamics environment business .

Discussion This also highlights the research gap that is filled by this study. this , namely lack of study empirical testing connection causal DEE → co-creation → IC, esp in context of agro MSMEs . The majority literature previously only discuss DEE concept and co-creation in general partial without test mechanism mediation in a way comprehensive research This give contribution theoretical with unite third draft the in One integrated model framework , as well as contribution practical in the form of recommendation for maker policies and actors business For strengthen digital collaboration as an improvement strategy innovation .

The implication is that research This push strengthening collaborative digital platforms , increasing digital literacy of MSME actors , as well as development policy incentive For encourage co-creation. With approach this , digital transformation in the sector agriculture can walk more effective , improve Power competitiveness of MSMEs, and encourage sustainability business in the economic era based knowledge .

Conclusion

Study This confirm that the Digital Entrepreneurial Ecosystem (DEE) plays a role important as foundation for Improving Innovation Capability (IC) in agro-sociopreneurial MSMEs . Digital infrastructure , support regulation , market access , and financing based technology proven become driver main creation innovation .

Apart from the influence direct DEE to IC, research This highlight role strategic **value co-creation** as mechanism connector . Co-creation mediates DEE–IC relationship with change digital opportunities to become innovation real through collaboration customers , partners , and communities . More far , co-creation also has the potential moderate the influence of DEE on IC, strengthening impact positive when level high stakeholder involvement .

The proposed conceptual model give contribution theoretical with integrating DEE, co-creation, and IC in One framework research , as well as contribution practical in the form of recommendation strengthening digital collaboration , literacy technology and support policy for agro MSMEs . With Thus , research This open opportunity testing empirical in the future For validate mechanism proposed mediation and moderation as well as enrich literature digital entrepreneurship in the sector agriculture .

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