

# Analyzing Innovation Capacity in Agricultural Cooperatives of Iran

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## Original Research Abstract

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The purpose of this study was to examine the role of open innovation in enhancing innovation capacity, mediated by knowledge management, in agricultural cooperatives in Iran. The study population comprised 3,823 members of agricultural cooperatives in Khuzestan Province, Iran. The sample size (n = 349) was determined using the Krejcie and Morgan table. A questionnaire was distributed to 349 members, with Chief Executive Officers (CEOs) serving as key informants, following the common single-respondent approach in knowledge management and open innovation studies. The questionnaire covered three main sections: open innovation, innovation capacity building, and knowledge management. Structural equation modeling was employed to analyze direct, indirect, and mediating effects. Data collection took place between June 2020 and January 2021. The findings suggest that knowledge management systems facilitate innovation capacity building and the development of innovative ecosystems. Open innovation, by leveraging internal and external knowledge flows, directly and through knowledge management, enhances innovation capacity. This study provides key scientific and managerial insights into innovation management and outlines future research directions in this field.

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**Keywords:** Open Innovation; Innovation capacity; Knowledge management; Agricultural cooperatives

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## INTRODUCTION

Agricultural development is a key driver of poverty reduction and economic growth (World Bank, 2012). It relies heavily on innovation systems and knowledge management (Rajalahti et al., 2008), which enhance productivity, competitiveness, and overall economic performance. Agricultural cooperatives face numerous challenges, necessitating innovative solutions and effective knowledge management for sustainability

(Hekmat, 2011). These cooperatives play a crucial role in rural economic development by adding value to local resources, fostering partnerships, and diversifying rural economies (Miranda et al., 2010). Research highlights their impact on entrepreneurship and innovation (Pishbin et al., 2015) and their role in strengthening social capital, trust, and livelihoods (Kustepeli et al., 2020). Cooperative membership improves teamwork, commercialization, and income among smallholder farmers (Ahmed & Mesfin, 2017; Markelova &

Mwangi, 2010), leading to enhanced productivity, food security, and allocative efficiency. Studies confirm their role in poverty reduction and livelihood improvement (Verhofstadt & Maertens, 2014; World Bank, 2012). However, despite their significance, the mechanisms through which innovation spreads within cooperatives remain underexplored (Reed & Hickey, 2016). Supporting collective action among farmers has been identified as a critical strategy for fostering innovation and rural development, improving working conditions, and preventing poverty fallouts (Gava et al., 2021).

Khouzestan province has 4,505 cooperatives, with 1,293 operating in the agricultural sector. Among them, 417 farming-oriented cooperatives, comprising 3,823 members and 4,417 employees, are actively engaged in agricultural production (KCO, 2019). However, these cooperatives face significant challenges, leading to stagnation, inactivity, and inefficiency. Key issues include members' limited knowledge of cooperative principles, lack of emphasis on creativity and innovation, and insufficient development of open innovation (Noorivandi et al., 2011).

The cooperative sector in Khouzestan also suffers from broader structural and financial constraints. These include the absence of an innovation center, lack of awareness regarding the impact of innovation, insufficient central and provincial funding, and the absence of a comprehensive innovation policy (KCO, 2019). Additionally, inadequate financial support for research and limited access to information on the benefits of innovation further hinder cooperative development.

Given these challenges, fostering innovation—particularly open innovation—is critical for enhancing innovation capacity in agricultural cooperatives. This study aims to examine the role of open innovation in strengthening innovation capacity through knowledge management, addressing the pressing need for sustainable and effective innovation strategies in Khouzestan's agricultural cooperative sector.

Innovation is a complex, multifactorial challenge and is widely recognized as essential for economic growth, the emergence of new industries, and addressing societal challenges (Sivam et al., 2019). Knowledge management plays a crucial role in supporting organizational innovation, serving as both a foundation and a driver for innovative processes. The effectiveness of knowledge management in fostering innovation depends on how well it is integrated into organizational design and strategy. Ultimately, the goal of knowledge management is to ensure the successful implementation of innovation-driven initiatives (Wu & Hu, 2018).

## The open innovation (OI) paradigm

Innovation is crucial for maintaining a competitive advantage and achieving market leadership (Abulrub & Lee, 2012). It is a key driver of economic success, requiring both internal efforts and external collaboration (Sivam et al., 2019). Organizations gain an edge by integrating internal and external knowledge, creatively combining insights to develop new products and services. Open innovation, introduced as a new paradigm by Chesbrough (2003), promotes leveraging external ideas, partnerships, and alternative markets to advance technology. It fosters integrated collaboration, co-creation, and innovation ecosystems, shifting innovation from an exclusive skill to a widely practiced discipline (Curley & Salmelin, 2013).

Unlike the traditional closed innovation model, where R&D remains confined within an organization, open innovation encourages cooperation among multiple stakeholders, optimizing expertise for mutual benefit (Coelho, 2016). This model strengthens interactions within business ecosystems, driving collaborative innovation (Wang & Islam, 2017). Organizations transitioning from closed to open innovation harness external knowledge, improving product development and market adaptability (Munir et al., 2017). By combining internal and external ideas, firms maximize value creation and explore alternative market channels, enhancing overall business growth and competitiveness (Sivam et al., 2019).

In the inbound open innovation model, firms acquire external knowledge from market-based partners (customers, suppliers, competitors) (Ferraris et al., 2017) or science-based partners (research centers, universities) (Santoro et al., 2016). Openness variety refers to the number of external sources involved, while partner intensity reflects the depth of these relationships (Santoro et al., 2018; Aloini et al., 2015).

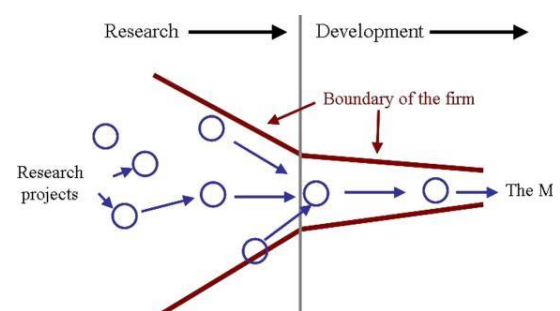


Figure 1. Closed Innovation Paradigm (Chesbrough, 2006; Sivam et al., 2019)

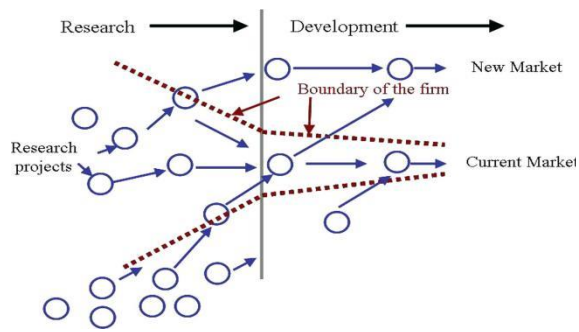


Figure 2. Open Innovation Paradigm (Chesbrough, 2006; Sivam et al., 2019)

Additionally, openness in innovation depends on a firm's willingness to collaborate and the level of trust established with external partners (Ahn et al., 2016).

### Innovation capacity (IC) building

IC Building is a process in which an organizational context is created that, through managerial feedback, supports the use and development of employees' knowledge, skills, and decision-making capabilities. This empowers employees to decide when to switch between activities pertaining to exploration and exploitation (Brix, 2019). The goal of IC building is to continuously develop the organization and its employees in such a way that the intended strategy can be realized. To achieve this, the focus is on utilizing existing knowledge and competencies as efficiently as possible while simultaneously developing this knowledge and these competencies to create new, smarter ways of working (Brix, 2019).

Tajvidi and Karami (2015) argue that innovation capacity has been defined as the continual improvement of firms' capabilities and resources to discover opportunities and engage in new product development. Similarly, Lanzerotti et al. (2017) define innovation capacity (IC) as an organization's ability to generate innovation repeatedly over time. They identify six elements that play a particularly important role in building innovation capacity. These elements serve as a useful baseline for building IC in organizations (Lanzerotti et al., 2017).

**Catalytic leadership:** Leaders throughout the organization demonstrate a commitment to innovation, articulate a clear vision and set of priorities, and provide others with the inspiration, freedom, and support needed to innovate (Denti & Hemlin, 2012).

**Diverse teams:** Teams are staffed and supported in ways that harness the power of diverse backgrounds,

perspectives, and skills (Schneider & Eckl, 2016).

**Idea pathways:** Criteria, processes, and pathways are in place to generate, prototype, test, develop, and scale new ideas. Innovation projects are clear, consistently applied, and effective (Kirchgeorg et al., 2010).

**Porous boundaries:** There is a fluid, efficient, and vibrant exchange of ideas and information between the organization and those it serves, between the organization and external voices, and within the organization itself (Lifshitz-Assaf, 2018).

**Ready resources:** Staff have access to the resources needed for innovation, including flexible funding, dedicated staff and staff time, and innovation tools and techniques (Lanzerotti et al., 2017).

**Curious culture:** Staff are empowered to act autonomously, and the organization values and supports the questioning of assumptions, experimentation, smart risk-taking, and transparency (Lifshitz-Assaf, 2018).

### Knowledge management

Knowledge is now recognized as a strategic resource that provides a competitive advantage and organizational stability (Ammar-Khodja & Bernard, 2008). The increasing complexity of global change in Knowledge Management (KM) necessitates interdisciplinary collaboration (Audretsch et al., 2020). KM focuses on optimizing organizational knowledge through effective information management and learning practices (Ahmad et al., 2015). Despite its evolution over the past decade, gaps remain in understanding KM's theoretical foundations, paradigms, and methodologies (Guo & Sheffield, 2008).

KM encompasses tools, techniques, and processes that facilitate the efficient management of intellectual assets (Guizzardi et al., 2004). Knowledge sharing, a critical component of KM, enhances both knowledge creation and organizational performance (Cynthia et al., 2015). Organizations must prioritize knowledge assets to maintain competitiveness in the information age (Guizzardi et al., 2004).

Santoro et al. (2018) define KM as information systems designed to manage, create, store, transfer, and apply knowledge. An effective KM system consists of three key components: IT infrastructures (hardware, software, networks), collaborative technologies (discussion forums, shared databases, document repositories), and ICT adoption (integrating collaborative technologies for seamless knowledge management) (Santoro et al., 2018; King & Marks, 2008).

**Relationship knowledge management, open innovation and innovation capacity building**

Open innovation leverages external knowledge sources to enhance innovation (Sivam et al., 2019; Ye & Kankanhalli, 2013). The ability to absorb and apply external innovations determines a firm's success in capturing value from collaborations and outsourced technologies (Vanhaverbeke et al., 2008). Through knowledge management, open innovation fosters the development and introduction of new, useful ideas, thereby strengthening innovation capacity (Wallin & Von Krogh, 2010).

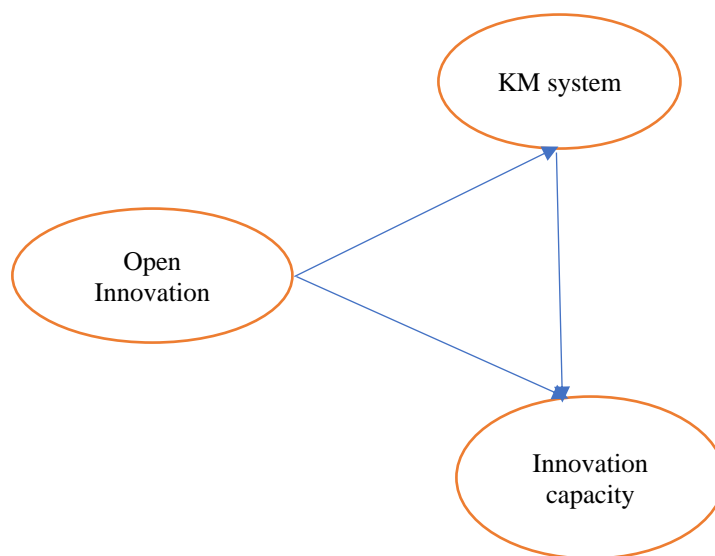
Innovative activities require collaboration, creativity, and effective knowledge management models to build innovation capacity. Organizational knowledge creation

relies on systematic methods for gathering and utilizing information (Zemaitis, 2014). The open innovation paradigm outlines knowledge flow direction and the degree of research and development collaboration (Chesbrough et al., 2006). However, despite the availability of knowledge and partnership networks, strong knowledge management frameworks are necessary to enhance knowledge absorption capacities (Zemaitis, 2014).

Thus, open innovation plays a crucial role in fostering innovation capacity through knowledge management. This study aims to explore the impact of open innovation on innovation capacity, mediated by knowledge management, within Iran's agricultural cooperatives. The key constructs and dimensions of this research are summarized in Table 1.

**Table 1.** Constructs and Dimensions According the Relevant Literature

Constructs	Dimensions	Literature
Innovation capacity	Catalytic Leadership	Denti & Hemlin, 2012
	Diverse Teams	Schneider & Eckl, 2016
	Idea Pathways	Kirchgeorg et al, 2010
	Porous Boundaries	Lifshitz-Assaf, 2018
	Ready Resources	Lanzerotti et al, 2017
	Curious Culture	Lanzerotti et al, 2017
KM system	IT infrastructures	Santoro et al, 2018; Soto-Acosta & MeroñO-Cerdan, 2008
	Collaborative technologies	Santoro et al, 2018;
	ICT adoption	Santoro et al, 2018; Lopez-Nicolas & Soto-Acosta, 2010
Open innovation	Openness variety	Santoro et al., 2018; Aloini et al., 2015
	Readiness to collaborate	Santoro et al., 2018; Ahn et al., 2016
	Partner intensity	Santoro et al., 2018; Aloini et al., 2015



**Figure 3.** Theoretical Framework of Research

## METHODOLOGY

This research employed a descriptive-correlational design. The statistical population comprised 3,823 members of agricultural cooperatives with a farming orientation in Khuzestan province, Iran. The sample size ( $n=349$ ) was determined using the Krejcie and Morgan table, and participants were selected through stratified random sampling (Table 2).

Data collection was conducted via a questionnaire distributed to 349 cooperative members. To ensure validity, the panel of experts' method was used, while reliability was assessed using Cronbach's alpha coefficient. After confirming validity, the questionnaire was administered to a pilot group of 30 individuals similar to the target population. Cronbach's alpha was calculated for different sections of the questionnaire, yielding coefficients above 0.7 in all cases, indicating acceptable reliability.

A single-respondent approach is frequently used in knowledge management and open innovation studies; therefore, we selected the Chief Executive Officer (CEO) as the key informant. The questionnaire consisted of three sections: open innovation, innovation capacity building, and knowledge management, adapted from the research of Lanzerotti et al. (2017) and Santoro et al. (2018).

Structural Equation Modeling (SEM) was used to analyze the data and test the direct, indirect, and mediating effects of open innovation on innovation capacity, with knowledge management as a mediator. According to Hair et al. (2010), a two-step approach is appropriate for SEM: first, assessing the measurement model, and second, assessing the structural model.

In this study, LISREL software was used for structural modeling due to the large sample size and the normality of the data. The fieldwork for this research was conducted between June 2020 and January 2021.

Each construct was associated with several dimensions based on the relevant literature (Table 1). For each dimension, multiple questions were developed to assess its importance using a 5-point Likert scale, where 1 represented low importance and 5 represented high importance.

Research hypotheses:

Hp. 1: open innovation is positively associated with innovation capacity.

Hp. 2: open innovation positively and indirectly influences innovation capacity via knowledge management.

Hp. 3: knowledge management is positive and

significant effect on innovation capacity.

Hp. 4: open innovation is positively associated with knowledge management.

## RESULTS

Based on Table 3, the respondents' ages ranged from 20 to 71 years, with a mean age of 43 years ( $SD = 12.9$ ,  $n = 349$ ). The majority (28.65%,  $n = 100$ ) were between 31 and 40 years old. Most respondents were male (88.54%), while only 40 (11.46%) were female. The highest level of education among respondents was primary education (32.52%). The current state of open innovation, knowledge management, and innovation capacity in Khuzestan agricultural cooperatives is presented in Table 4. The results indicate that innovation capacity is at a moderate level across all dimensions, with catalytic leadership being the top priority (mean = 3.381,  $SD = 0.815$ ). Similarly, knowledge management is also at a moderate level in all dimensions, with IT infrastructure ranked as the highest priority (mean = 3.219,  $SD = 0.906$ ). Likewise, open innovation remains moderate across all dimensions, with openness variety being the top priority (mean = 2.806,  $SD = 0.917$ ).

### Measurement model

SEM was used to test for the direct, indirect and mediating effects of the open innovation on innovation capacity mediated by knowledge management. The results of confirmatory factor analysis showed the initial measurement model to provide an acceptable fit for the data ( $X^2=712.312$ ;  $X^2/df=2.012$ ; Goodness of Fit Index (GFI)=0.92; Tucker-Lewis Index (TLI)=0.94; Comparative Fit Index (CFI)=0.97; Incremental Fit Index (IFI)=0.96; Root Mean Square Error of Approximation (RMSEA)=0.065). Therefore, the measurement model provided a reasonable fit (Table 5). Thus, the hypothesized model was judged suitable for the SEM.

### Convergent validity (CV)

A first condition for convergent validity is that the standardized factor loadings should all be significant ( $t$ -value  $> 1.96$ ) with a value of more than 0.50 (Hair et al., 2010). The results in Table 5 show the  $t$ -value for the factor loadings to all exceed 3.981 ( $p < 0.01$ ) and the standardized factor loading to all have values greater than 0.601. This shows good convergent validity for the constructs of this study.

**Table 2.** Distribution of Statistical Population and Sample

Classification of townships in province	Selected township	Cooperative members	Sample members
North (Andimeshk, Dezful, Lali, Andika, Gotvand, Shoushtar, Shoush, Izeh and Nasjed Suleiman)	Shoushtar, Shoush	479	91
Central (Ahvaz, Bavi, Karun, Ramhormoz, Haftkel, Baghmalek, Dashte Azadegan, Hoveyzeh and Ramshir)	Ahvaz, Ramhormoz	440	84
South (Behbahan, Omidieh, Hindijan, Mahshahr, Shadegan, Abadan and Khorramshahr)	Behbahan and Khorramshahr	911	174
Total		1830	349

**Table 3.** Characteristics of Respondents

Variables	Frequency	Percent	Cumulative Percent	
Age (years)				
20-30	67	19.19	19.19	Mean=43.53 SD=12.79
31-40	100	28.65	47.84	
41-50	76	21.77	69.61	
51-60	66	18.91	88.52	
61-71	40	11.46	99.98	
Educational Level				
Illiterate	55	15.6	15.6	
Primary	117	33.52	49.12	
High School	53	15.19	64.31	
Diploma	115	32.95	97.26	
Bachelor of Sciences	4	1.15	98.41	
Master of Sciences	5	1.43	100	
Gender				
Male	309	88.54	88.54	
Female	40	11.46	100	

**Table 4.** Current Situation of Open Innovation, Knowledge Management and Innovation Capacity in Khouzestan Agricultural Cooperatives

Constructs	Dimensions	Mean*	SD	CV	Rank
Innovation capacity	Catalytic Leadership	3.381	0.815	0.241	1
	Diverse Teams	2.987	0.972	0.325	5
	Idea Pathways	3.026	0.852	0.282	2
	Porous Boundaries	3.119	0.963	0.309	3
	Ready Resources	2.989	1.062	0.355	6
	Curious Culture	3.082	0.962	0.312	4
KM system	IT infrastructures	3.219	0.906	0.281	1
	Collaborative technologies	3.671	1.043	0.284	2
	ICT adoption	2.712	1.107	0.408	3
Open innovation	Openness variety	2.806	0.917	0.327	1
	Readiness to collaborate	2.916	0.972	0.333	2
	Partner intensity	2.810	0.971	0.346	3

\*Scale: 1=very low, 2=low, 3=moderate, 4=high, 5=very high

**Table 5.** Summary of Goodness of Fit Indices for the Measurement Model

Fit indices	X <sup>2</sup>	P	X <sup>2</sup> /df	GFI	CFI	TLI	IFI	RMSEA
Value in study	712.312	0.000	2.012	0.92	0.97	0.94	0.96	0.065
Suggest value	-	>0.05	<3	>0.80	>0.90	>0.90	>0.90	<0.08

**Construct reliability (CR)**

For the composite or construct reliability to be adequate, a value of CR= 0.70 or higher is recommended (Jamshidi et al., 2018). As shown in Table 3, all of the constructs had construct reliabilities which were greater than the recommended 0.70. The results also show the AVE estimate for all of the constructs to be above or close to the recommended threshold of 0.50 (Fallah Haghghighi et al., 2018). This shows good composite or construct reliability for the constructs of this study.

**Discriminant validity (DV)**

According to Khoshmaram et al. (2017), discriminant validity is confirmed if the square root of the AVE estimate for each construct is greater than its correlations with all other constructs in the model. As shown in Table

4, the square root of each AVE exceeds its correlations with other constructs, indicating that the indicators share more variance with their respective constructs than with others. Therefore, the constructs in the measurement model demonstrate discriminant validity.

**Assessment of the structural model**

The first step involved obtaining a satisfactory measurement model. The second step, including SEM, tested the structural model, which encompasses the hypothesized relationships among the constructs in the research model. The overall goodness-of-fit statistics indicated that the structural model fits the data well. After assessing the fit indices for both the measurement and structural models, the estimated coefficients of the causal relationships among constructs were examined (Table 6).

**Table 6.** Results of Confirmatory Factor Analysis for the Measurement Model

Constructs	Dimensions	Standardized factor loading	t- value	CR	AVE	Sqrt AVE
Innovation capacity	Catalytic Leadership	0.654	4.128	0.85	0.88	0.94
	Diverse Teams	0.615	4.057	0.81	0.83	0.91
	Idea Pathways	0.721	5.612	0.79	0.84	0.92
	Porous Boundaries	0.601	4.067	0.91	0.91	0.96
	Ready Resources	0.812	5.381	0.86	0.79	0.89
KM system	Curious Culture	0.634	6.786	0.83	0.82	0.91
	IT infrastructures	0.649	3.981	0.89	0.83	0.91
	Collaborative technologies	0.827	5.128	0.95	0.91	0.95
Open innovation	ICT adoption	0.798	7.192	0.89	0.86	0.93
	Openness variety	0.764	6.548	0.91	0.92	0.96
	Readiness to collaborate	0.732	6.153	0.83	0.91	0.95
	Partner intensity	0.816	8.624	0.78	0.94	0.97

**Table 7.** Means, SD and Correlations with Square Roots of the AVE

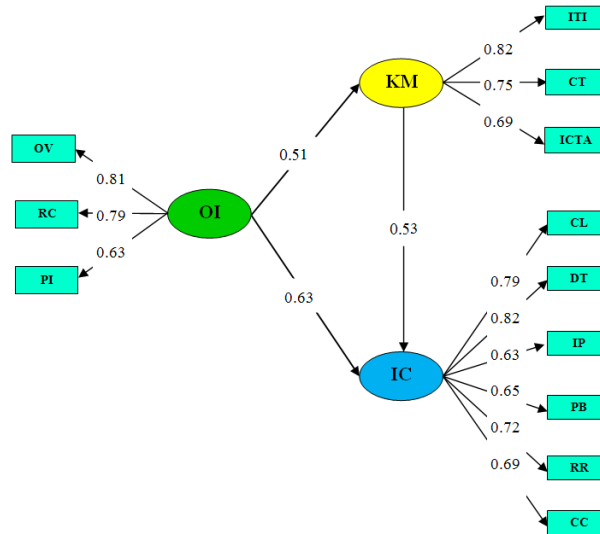
Dimensions	Mean*	SD	1	2	3	4	5	6	7	8	9	10	11	12
Catalytic leadership	3.381	0.815	0.94 <sup>a</sup>											
Diverse teams	2.987	0.972	0.81	0.91 <sup>a</sup>										
Idea Pathways	3.026	0.852	0.78	0.81	0.92 <sup>a</sup>									
Porous boundaries	3.119	0.963	0.69	0.78	0.61	0.96 <sup>a</sup>								
Ready resources	2.989	1.062	0.72	0.74	0.58	0.48	0.89 <sup>a</sup>							
Curious culture	3.082	0.962	0.76	0.63	0.64	0.51	0.63	0.91 <sup>a</sup>						
IT infrastructures	3.219	0.906	0.63	0.75	0.59	0.88	0.59	0.56	0.91 <sup>a</sup>					
Collaborative technologies	3.671	1.043	0.54	0.45	0.78	0.58	0.81	0.62	0.69	0.95 <sup>a</sup>				
ICT adoption	2.712	1.107	0.76	0.61	0.72	0.60	0.58	0.89	0.71	0.82	0.93 <sup>a</sup>			
Openness variety	2.806	0.917	0.81	0.79	0.52	0.64	0.60	0.54	0.87	0.68	0.67	0.96 <sup>a</sup>		
Readiness to collaborate	2.916	0.972	0.82	0.78	0.41	0.51	0.64	0.59	0.74	0.82	0.75	0.69	0.95 <sup>a</sup>	
Partner intensity	2.810	0.971	0.80	0.81	0.62	0.67	0.51	0.74	0.59	0.70	0.83	0.67	0.72	0.97 <sup>a</sup>

\*1 represents low importance and 5 represents high importance

<sup>a</sup>The square roots of AVE estimates

**Table 8.** Direct, Indirect and Total Effects

Factor	Factor	Direct	Indirect	Total	t-value	p-value	R <sup>2</sup>
Open Innovation	Innovation Capacity	0.63	0.27	0.90	4.09	0.000	
Open Innovation	Knowledge Management	0.51	-	-	3.85	0.000	0.78
Knowledge Management	Innovation Capacity	0.53	-	-	3.97	0.000	



**Figure 4.** Path Model with Standardized Factor Loadings

**Innovation Capacity (IC):** Catalytic Leadership (CL), Diverse Teams (DT), Idea Pathways (IP), Porous Boundaries (PB), Ready Resources (RR), Curious Culture(CC)

**Knowledge Management (KM):** IT Infrastructures (ITI), Collaborative Technologies (CT), ICT Adoption (ICTA)

**Open Innovation (OI):** Openness Variety (OV), Readiness to Collaborate (RC), Partner Intensity (PI)

From Table 8 and Figure 4, it can be seen that the predictive positive effect of open innovation to innovation capacity is supported ( $\beta=0.90$ ,  $t\text{-value}=4.09$ ,  $p<0.001$ ). In addition, that is the open innovation has a positive effect on knowledge Management ( $\beta=0.51$ ,  $t\text{-value}=3.85$ ,  $p<0.001$ ). Also knowledge management has a significant impact on innovation capacity ( $\beta=0.53$ ,  $t\text{-value}=3.97$ ,  $p<0.001$ ).

**Hypotheses testing**

All relationships between manifested endogenous and exogenous variables were measured using a path analysis and bootstrap approach to conduct hypothesis testing. The direct and indirect effects of the factors were tested to identify the most influential factor on innovation capacity (Palese et al., 2019). Specifically, the direct effect is represented by the path coefficient, while the indirect effect is calculated by multiplying each path coefficient from one latent factor to a target factor (Santoro et al., 2018). Finally, the total effect of each factor is the sum of its direct and indirect effects (see Table 5).

All path coefficients were significant at the 1% level. As shown in Figure 1, open innovation has a positive and direct influence on innovation capacity ( $\beta = 0.63$ ;  $p <$

$0.001$ ), confirming Hp. 1. Regarding Hp. 2, open innovation positively and indirectly influences innovation capacity through knowledge management (total effect = 0.90), as shown in Table 4. This hypothesis is also supported.

The third result indicates that knowledge management has a positive and significant effect on innovation capacity ( $\beta = 0.53$ ;  $p < 0.001$ ), supporting Hp. 3. Similarly, Hp. 4, which is based on the relationship between open innovation and knowledge management, is positively significant ( $\beta = 0.51$ ;  $p < 0.001$ ), confirming Hp. 4 as well.

**DISCUSSION**

In fact, open innovation is so widespread that it enables organizations to operate in a new way—a way that empowers colleagues, community members, stakeholders, and supporters to meet challenges and improve the organization by building innovation capacity. In open innovation, organizations must leverage both internal resources and external resources obtained through collaboration (Sivam et al., 2019).

Open innovation allows organizations to develop new products (goods or services) through partnerships, utilizing the expertise of each collaborator and creating

new innovation capacity. This ensures that the end result benefits both the internal and external contributors of ideas (Coelho, 2016). In this regard, our findings indicate that open innovation positively and directly influences innovation capacity in agricultural cooperative organizations. This result aligns with the findings of various researchers, such as Sivam et al. (2019), Ye and Kankanhalli (2013), Vanhaverbeke et al. (2008), and Wallin and Von Krogh (2010). Additionally, our findings suggest that knowledge management (KM) plays a crucial role in creating innovation capacity. Open innovation, indirectly through knowledge management, can significantly enhance innovation capacity. This finding is supported by Santoro et al. (2018), Soto-Acosta and Meroño-Cerdán (2008), and Lopez-Nicolas and Soto-Acosta (2010). Although open innovation alone has a significant effect on innovation capacity building, knowledge management greatly amplifies this effect indirectly. This finding is consistent with the results of research by Audretsch et al. (2020) and Santoro et al. (2018).

## CONCLUSION AND RECOMMENDATION

Therefore, considering the role of agricultural cooperatives in agricultural development and, ultimately, the economic development of the country, it is necessary to focus on creating innovation capacity as a key principle in a competitive market. In this regard, attention to open innovation and its proven impact on fostering innovation capacity, along with the strengthening role of knowledge management in increasing this impact, should be prioritized by planners and policymakers.

Based on the results, open innovation positively and directly influences innovation capacity. Openness variety, readiness to collaborate, and partner intensity were the most important dimensions in this effect, playing a direct role in developing innovation capacity. Therefore, it is recommended that, to develop innovation capacity in agricultural cooperatives in Khuzestan province, attention should be given to utilizing open innovations through the dimensions of openness variety, readiness to collaborate, and partner intensity. Managers and planners of agricultural cooperatives in Khuzestan province should adopt open innovation-based strategies, such as strengthening the interaction and cooperation of multiple partners within a business ecosystem, to deliver innovative products or solutions.

Additionally, open innovation positively and indirectly influences innovation capacity through knowledge management. IT infrastructures, collaborative technologies, and ICT adoption were the

most important dimensions in this effect, directly contributing to the development of innovation capacity. To create the necessary platform for the development of innovation capacity in agricultural cooperatives in Khuzestan province, it is essential to focus on utilizing open innovations through knowledge management by developing IT infrastructures, collaborative technologies, and ICT adoption. Knowledge management (KM) refers to information systems designed to manage organizational knowledge and improve the creation, storage, transfer, and application of knowledge. From a knowledge-based perspective, a KM system can be seen as an enabler, as it facilitates the capture of individual knowledge for broader organizational dissemination.

Furthermore, the main limitation of the present study was the lack of proper access to the study population due to the spread of the Coronavirus, which caused significant difficulties in data collection and limited the generalizability of the research results to other communities in the field of social science research.

## ACKNOWLEDGMENTS

I hereby express my gratitude to all those who helped us collect the information and data needed to design the model and conduct this research.

### Authors Contribution

Manoochehr Alizadehnia: Writing original draft, Formal analysis

Ahmad Reza Ommani: Writing original draft, Review and editing, project administration.

Azadeh Noorollah Noorivandi: Validation, Methodology, Formal analysis

Tahmasb Maghsoudi: Visualization, Formal analysis

### Availability of data and materials

The data that support the findings of this study are available from the corresponding author, upon reasonable request.

### Conflict of interests

The authors declare that there is no conflict of interest regarding the publication of this paper.

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