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INVESTIGATING THE IMPACT OF DUAL NETWORK EMBEDDING AND DUAL ENTREPRENEURIAL BRICOLAGE ON KNOWLEDGE-CREATION PERFORMANCE: AN EMPIRICAL STUDY IN FUJIAN, CHINA

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ABSTRACT

Aim/Purpose	This study investigates the relationship between dual network embedding, dual entrepreneurial bricolage, and knowledge-creation performance.
Background	The importance of new ventures for innovation and economic growth has been fully endorsed. Establishing incubation organizations to help new startups overcome constraints and dilemmas has become the consensus of various countries. In particular, the number of Chinese makerspaces has rapidly increased. Startups in the makerspaces form a loosely coupled dual network to cooperate and share resources, especially knowledge.

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Methodology	By convenience sampling, 400 startups in the makerspaces in Fujian Province, China were selected for the questionnaire survey study. In total, 307 valid responses were collected, yielding a response rate of 76.8%. The survey data were analyzed for hypothesis testing, using the PL-SEM technique with the AMOS20.0 software.
Contribution	At the theoretical level, this research supplements the exploration of the influencing factors of the entrepreneurial bricolage of startups at the network level. It deepens the research on the internal mechanism of the dual network embeddedness affecting the knowledge-creation performance. In practice, it provides a theoretical basis and management inspiration for startups in makerspaces to overcome the inherent disadvantage of being too small and weak to explore innovative paths.
Findings	First, relational embedding of startups in makerspaces directly affects knowledge-creation performance. Second, dual entrepreneurial bricolage plays a mediating role in diversity. Selective entrepreneurial bricolage plays a partial mediating role between relationship embedding and knowledge-creation performance. Parallel entrepreneurial bricolage plays a complete intermediary role between structural embedding and knowledge-creation performance. Dual entrepreneurial bricolage plays a complete intermediary role between knowledge embedding and knowledge-creation performance.
Recommendations for Practitioners	Enterprises in the makerspaces should make dynamic adjustments to the network embedded state and dual entrepreneurial bricolage to improve knowledge-creation performance. When startups conduct selective entrepreneurship bricolage, they should strengthen relational and knowledge embeddedness to improve their relationship strength and tacit knowledge acquisition. When startups conduct parallel entrepreneurship bricolage, structural and knowledge embedding should be strengthened to improve the position of enterprises in the network to acquire diversified knowledge to explore and discover new business opportunities and project resources.
Recommendations for Researchers	The heterogeneity of industries and regions may impact the dual network embedding mechanism of startups. Researchers can choose a wider range of regions and industries for sampling.
Impact on Society	This study provides a theoretical basis and management inspiration for startups to overcome the inherent disadvantage of being too small and weak to explore innovative paths. It provides a basis to support startups in unleashing innovation vitality and achieving healthy growth.
Future Research	Previous studies have shown that network relationships and bricolage behavior have a certain relationship with the enterprise life cycle. Future research can adopt a longitudinal research design across time points, which will increase the explanatory power of research conclusions.
Keywords	makerspace, network embedding, dual entrepreneurship bricolage, startups, knowledge-creation performance

INTRODUCTION

The importance of new ventures for innovation and economic growth has been fully evidenced and endorsed (Marcon & Ribeiro, 2021; Urbano et al., 2020). However, due to factors such as insufficient resources (Zhang & Li, 2010), high market uncertainty (Elfring & Hulsink, 2003), and a lack of organizational legitimacy (Hager et al., 2004) from external stakeholders, the vast majority of new

startups generally face "liability of newness" and "liability of smallness" when starting up (Gimenez-Fernandez et al., 2020). According to the resource dependency theory (RDT), enterprises cannot independently obtain all the resources they need, and must interact with their external environment to obtain external resources (Hillman et al., 2009; Shane & Cable, 2002). Establishing incubation organizations to help new startups overcome dual constraints and dilemmas has become the consensus of various countries (Ebbers & Stam, 2019). The "makerspace" that has emerged globally in recent years is a typical incubation platform to support the development of new startups. In particular, the number of Chinese makerspaces has rapidly increased. According to the statistical data of the "China Torch Statistical Yearbook (2020)," by the end of 2019, there were approximately 8,000 makerspaces in China; Moreover, the maker movement has been described as "the precursor of the next industrial revolution" (Browder et al., 2019). Incubation platforms for makers have adopted various strategies to help new startups build social networks (Ebbers & Stam, 2019), gain legitimacy (Fisher et al., 2016), and access various resources that can be directly or indirectly mobilized (Van Burg et al., 2022). This allows for the transformation of the growth environment of "liability of newness" and "liability of smallness."

Based on the internal demand for heterogeneous resources (especially knowledge), enterprises in makerspaces establish multi-level interactive relationships with various enterprises and organizations in their internal and ecosystem networks. Through formal or informal interaction mechanisms, they create a loosely coupled dual innovation network that aims to achieve dynamic resource-sharing, cooperation and division of labor, and collaborative innovation (Y. S. Dai et al., 2018; Pei & Wang, 2018). Compared to a single network, the dual network contains various enterprises and organizations internal and external to makerspaces. The network subject identity is heterogeneous and the relationship between organizations is more diversified, which can better provide startups with rich, diversified, and heterogeneous external knowledge, promoting their ability to acquire, absorb, integrate, and create knowledge, thus achieving the optimal allocation of knowledge resources (Pei & Wang, 2018). Although the existing literature has mentioned the maker movement, few empirical studies have discussed how the dual network embedding of the makerspace affects the knowledge-creation performance of new startups, which results in a gap in the explanation of how a large number of incubation activities affect entrepreneurial growth.

In the context of diverse network relationships in the makerspace and insufficient resources, startups have begun to shift from resource-seeking to entrepreneurial bricolage through network relationships. Baker and Nelson (2005) discovered two types of bricolage behaviors: continuous and repetitive "parallel bricolage" conducted simultaneously in multiple projects and fields, and discontinuous "selective bricolage" conducted in individual projects and fields. According to the latest research findings (Han, 2021; Huang et al., 2020) of the resource bricolage theory, whether networks and resources can truly transform into knowledge-creation performance for enterprises depends on whether they promote the effective "utilization" of resources by enterprises; that is, whether they encourage new startups with insufficient resources to carry out "entrepreneurial bricolage" activities to create, seize, and realize entrepreneurial opportunities. Therefore, the realization of knowledge-creation performance by new ventures can be further defined as the relationship between "dual networks, dual entrepreneurial bricolage, and knowledge-creation performance."

Predicated on existing research, this study builds a structural equation model based on the analysis framework of dual network embeddedness, dual entrepreneurship bricolage, and knowledge-creation performance. It explores the relationship between dual network embeddedness and knowledge-creation performance in more detail, and provides useful inspiration for the knowledge management practice of enterprises in makerspaces.

The remainder of this paper is organized as follows. Section 2 is a literature review. Theoretical background, hypotheses, and the research model are explained in Section 3. The research methodology based on questionnaire survey of 307 makerspaces in China is presented in Section 4. Section 5 provides the results and findings of the structural equation modeling and hierarchical regression analysis.

The findings and discussion are presented in Section 6. The implications of these findings are discussed in the subsequent section. Finally, we present our concluding remarks.

LITERATURE REVIEW

Looking back at existing literature, scholars have paid more attention to the structural characteristics of corporate social networks (Sandström & Carlsson, 2008; H. Wang et al., 2015; W. K. Wang et al., 2021), as well as the impact of relational characteristics on corporate performance (Lin & Lin, 2016), with few studies considering the knowledge embedding dimension of networks (Liang & Chen, 2015). Knowledge embedding is the main characteristic that distinguishes knowledge networks from other networks. Knowledge embedding focuses on the impact of the richness and heterogeneity of knowledge resources in the network on the economic behavior and performance of actors (Rodan & Galunic, 2004), which can be measured through indicators such as knowledge diversity and heterogeneity (Liang & Chen, 2015; Rodan & Galunic, 2004). The richer and more heterogeneous the knowledge of the connected network nodes, the more likely the enterprise is to obtain high-value information and knowledge resources, thereby improving the knowledge-creation performance (Cummings, 2004). Considering the dimension of knowledge embedding helps to have a more comprehensive understanding of the impact of multi-level networks on entrepreneurial behavior and knowledge creation performance.

On the other hand, Baker and Nelson (2005) found that in resource scarce environments, selective bricolage of startups has a promoting effect on corporate growth, while parallel bricolage does not contribute to corporate growth. Chinese scholars have supported this conclusion through case studies and empirical research (Yangmei et al., 2019; Yu et al., 2017b). Huang et al. (2020) found that parallel bricolage in Baker and Nelson's (2005) study does not contribute to the growth of startups, as it embeds locked and impoverished community business networks, isolating them from richer, high-quality markets and networks with specialized resources, thereby hindering the growth and development of startups. However, incubating platforms for startups like makerspace not only help them embed a richer network, but as described by Browder et al. (2019), the material, human, skill, and institutional resources provided by the platform have diverse and specialized characteristics, thereby promoting the openness, sharing, and knowledge creation of online communities (Huang et al., 2020). It can be seen that the network and resources of startups in the incubation scenario described by Browder et al. (2019) are completely different from the low-end locked closed network and non-professional resources described by Baker and Nelson (2005). The mechanism of how the two types of resource bricolage strategies triggered by such network relationships affect the knowledge-creation performance of startups has not yet received empirical research attention.

In summary, whether and how the dual network embedding in the incubated context affects the knowledge-creation performance of startups through bricolage strategies is a "black box" that needs to be explored through empirical research. This article integrates social capital theory and resource bricolage theory to construct a conceptual framework model of "dual network embedding, dual bricolage, and knowledge-creation performance". Taking enterprises settled in makerspaces as samples, a more detailed analysis is conducted on the mechanism of network incubation and resource incubation activities on incubation platforms, providing more detailed theoretical guidance for incubation practice.

THEORETICAL BACKGROUND AND HYPOTHESES

DEFINITION OF RELATED CONCEPTS

Dual network embedding of startups in makerspaces

To cope with uncertainty of the environment and complexity of knowledge creation, knowledge activities in makerspaces must rely on the innovation ecosystem, which can form a network organization

of multi-party cooperation and interdependence (Y. S. Dai et al., 2018; Marcon & Ribeiro, 2021; Pei & Wang, 2018). In an innovation ecosystem, startups in makerspaces form an internal knowledge network based on spatial agglomeration and interaction. In addition, startups and relevant organizations in the innovation ecosystem, such as the government, scientific research institutes, universities, financing institutions, and intermediaries, conduct knowledge activities, such as knowledge dissemination, integration, and creation through contact and interaction, and form an ecosystem knowledge network (Huo & Zhao, 2019; Marcon & Ribeiro, 2021). The dual network embedded in startups integrates the functions and advantages of different levels of networks inside and outside the makerspaces. The network relationship presents the characteristics of strong and weak connections; the network structure presents the attributes of dense and sparse coexistence, and the network knowledge presents richness and heterogeneity owing to the diversification of the subjects (Han & Chen, 2016; Liang & Chen, 2019). To comprehensively measure the above characteristics, this study measures a dual network from multiple dimensions, such as relational embeddedness, structural embeddedness, and knowledge embeddedness, and analyzes the relationships between each embedded dimension and knowledge-creation performance.

Dual entrepreneurship bricolage

Entrepreneurial bricolage is an effective way for startups to overcome resource constraints (Baker & Nelson, 2005; Desa & Basu, 2013; Han, 2021). The concept of "bricolage," often described as making do with "whatever is at hand" (Baker & Nelson, 2005; Desa & Basu, 2013). Research on entrepreneurial bricolage basically follows the viewpoints of scholars such as Baker, who believed that entrepreneurial bricolage is the improvisation and integration of resources at hand and immediate action to carry out entrepreneurial activities to solve new problems and take advantage of new opportunities (Baker & Nelson, 2005). Baker proposed selective and parallel bricolage from the perspective of the frequency and scope of resource bricolage. Between them, the parallel bricolage refers to the continuous and repetitive bricolage that is carried out simultaneously in multiple projects and fields with larger bricolage scope. The selective bricolage refers to discontinuous and selective bricolage carried out in individual projects and fields with smaller scope of bricolage (Han, 2021; Senyard et al., 2014). This study follows this binary classification of entrepreneurial bricolage by scholars, dividing entrepreneurial bricolage into two dimensions: selective and parallel bricolage.

Knowledge-creation performance

At present, there are three kinds of understanding of knowledge creation in academia: first is that knowledge creation is included in the process of knowledge innovation; the second understanding equates knowledge creation with knowledge innovation; the third one is that knowledge innovation is included in knowledge creation (Yan, 2010). This study adopts the third view, which defines knowledge creation as proposing new ideas, focusing on the "creation and application" of knowledge and transforming it into new products, processes, and services. From this definition, knowledge innovation is a subset of knowledge creation (Liang & Chen, 2019). Based on Fahey and Prusak's (1998) viewpoints, this study measures knowledge-creation performance from the perspective of transforming knowledge creation into productivity to achieve economic benefits.

HYPOTHESES

The relationship between dual network embedding of startups and knowledge-creation performance

The knowledge activity network startups embedded in is a multilevel, multi-gradient, and dynamically connected knowledge-interaction network. Through the integration of knowledge in the original market domain and new market domain and that of the original technical domain and new technology domain (Rubin et al., 2015), an efficient process of knowledge element fusion is formed, and knowledge activities between knowledge subjects are further promoted.

From the perspective of relational embeddedness, startups in makerspaces build relationship networks with other companies inside and outside the spaces, university research institutes, governments, industry associations, and investment and financing institutions, and have abundant network resources (W. Q. Dai et al., 2011). Strong and weak connections coexist in a dual network. Strong connections improve the efficiency of knowledge-sharing among innovation subjects and the value-added effect of knowledge. Weak connections help acquire fresh and heterogeneous knowledge (Liang & Chen, 2015). From the perspective of structural embedding, a dual network has the characteristics of node density and sparseness, which helps enterprises in makerspaces form a stable communication mechanism and maintain opportunities to obtain heterogeneous knowledge and development (Liang & Chen, 2019; Zhuang & Chen, 2017). From the perspective of knowledge embedding, dual network embedding provides a wealth of knowledge resources for startups. With the continuous integration of knowledge chains in makerspaces and external knowledge subjects, diversified knowledge sources have improved the success rate of innovation in startups (Cummings, 2004). Therefore, this study proposes the following hypotheses:

> H1: Dual network embedding of startups in makerspaces (relational embedding H1a; structural embedding H1b; knowledge embedding H1c) positively affects knowledge-creation performance.

The relationship between dual network embedding and dual entrepreneurial bricolage

Existing research has confirmed that social networks have an important influence on the bricolage behavior of startups in makerspaces (Desa & Basu, 2013; Q. J. Wang et al., 2020). It is believed that the relationship network provides an important channel for startups to obtain bricolage resources and is also the trigger of bricolage behavior (Desa & Basu, 2013; Q. J. Wang et al., 2020). However, different levels of network relationships have different knowledge, information, and resources, which have a heterogeneous impact on startups' opportunity discovery and resource use, thereby affecting bricolage behavior (Huang et al., 2020).

For startups in makerspaces, dual-network embedding enriches knowledge sources. Startups can better acquire and integrate various resources and capabilities by being embedded in a dual network and can collect and filter relevant knowledge information from different sources (Han & Chen, 2016). The connection of structural holes and bridges expands the diversity of knowledge that entrepreneurial enterprises share and provides favorable conditions for the integration and reconstruction of knowledge. Strong connections enable members to trust each other, thus enhancing their willingness to exchange and share resources and promoting knowledge and information exchange/sharing (Du et al., 2011; Xi et al., 2017). The interactive relationship in the dual network helps startups discover new business opportunities and project resources and prompts enterprises to carry out the bricolage behavior of multiple new business opportunities at the same time, which stimulates the parallel bricolage behavior of startups (Huang et al., 2020). In addition, the heterogeneous knowledge and information resources in the dual network help startups explore opportunities outside existing market areas, prompt enterprises to selectively integrate resources in key areas, and trigger selective bricolage behavior (Huang et al., 2020). To summarize, we propose the following hypotheses:

> H2: Dual network embedding positively affects the dual entrepreneurial bricolage of startups in makerspaces.
>
> H2a, H2b, H2c: Relational, structural, and knowledge embedding positively affect startups' selective bricolage, respectively.
>
> H2d, H2e, H2f: Relational, structural, and knowledge embedding positively affect startups' parallel bricolage, respectively.

The relationship between dual entrepreneurial bricolage and knowledge-creation performance

Entrepreneurial bricolage is an active strategy for enterprises in makerspaces to utilize, restructure, and improvise existing resources under resource constraints. This is a powerful way to help enterprises in makerspaces make creative use of existing resources and explore new ways to solve resource constraints (Baker & Nelson, 2005; Zhenduo & Fei, 2017). As a part of it, the parallel bricolage emphasizes that enterprises should adopt multiple bricolage and try multiple possibilities in multiple fields at the same time to avoid missing opportunities. Through parallel bricolage, startups can adjust their behavior and directions in learning and trial and error (Baker & Nelson, 2005; Senyard et al., 2014; Welter et al., 2016). Startups acquire rich knowledge, resources, and capabilities based on dual network relationships. The entrepreneurial mentors provided by makerspaces, the internal network among platform members, and formal and informal communication in the ecosystem network of makerspaces bring about collaboration within the project team and cross-team exchange of knowledge and experience (Salvador, 2011). This expansion of business opportunities that enterprises are exposed to may trigger startups to use the resources at hand to find an achievable and appropriate patchwork (Senyard et al., 2014), thus helping enterprises integrate, create, and apply knowledge and further transform the knowledge created into economic benefits. In contrast, the selective entrepreneurial bricolage refers to the bricolage activities that startups focus on in areas critical to their survival (Senyard et al., 2014). Startups adopting this bricolage approach will selectively give up some opportunities, achieve "from scratch" (Baker & Nelson, 2005) in fewer areas, and pay more attention to the use of comparative advantages, thus reducing opportunity costs, improving the efficiency of utilizing limited resources (Fisher, 2012), and promoting the transformation of knowledge created by enterprises into economic benefits. To summarize, this study proposes the following hypothesis:

H3: Dual entrepreneurial bricolage (selective bricolage H3a; parallel bricolage H3b) positively affects startups' knowledge-creation performance in makerspaces.

The mediating role of dual entrepreneurial bricolage

The above analysis preliminarily discusses the logical effect of the dual network embedding of enterprises in makerspaces on improving knowledge-creation performance by affecting selective and parallel bricolage. By integrating and creating the rich and heterogeneous knowledge resources in the dual network, startups can form a new knowledge system (Liang & Chen, 2019), improve their understanding of the existing market and projects, and also provide new market opportunities for enterprises, which will promote startups to carry out selective and parallel bricolage activities (Z. Huang et al., 2020) to improve their knowledge-creation performance. Huang et al. (2020) confirmed that business and supportive network relationships play an intermediary role in the growth of Chinese enterprises through ambidextrous entrepreneurship bricolage. Yangmei et al. (2019) showed that entrepreneurial bricolage has a partial mediating effect on the relationship between social capital and the performance of Chinese enterprises. Based on the above analysis, this study proposes the following hypotheses:

> H4: Dual entrepreneurial bricolage plays a mediating role between dual network embedding and knowledge-creation performance.
>
> H4a, H4b, and H4c: Selective bricolage plays a mediating role in the effect of relationship, structural and knowledge embedding on firms' knowledge-creation performance in makerspaces, respectively.
>
> H4d, H4e, and H4f: Parallel bricolage plays a mediating role in the effect of relationship, structural and knowledge embedding on firms' knowledge-creation performance in makerspaces.

The theoretical model of this study is shown in Figure 1.

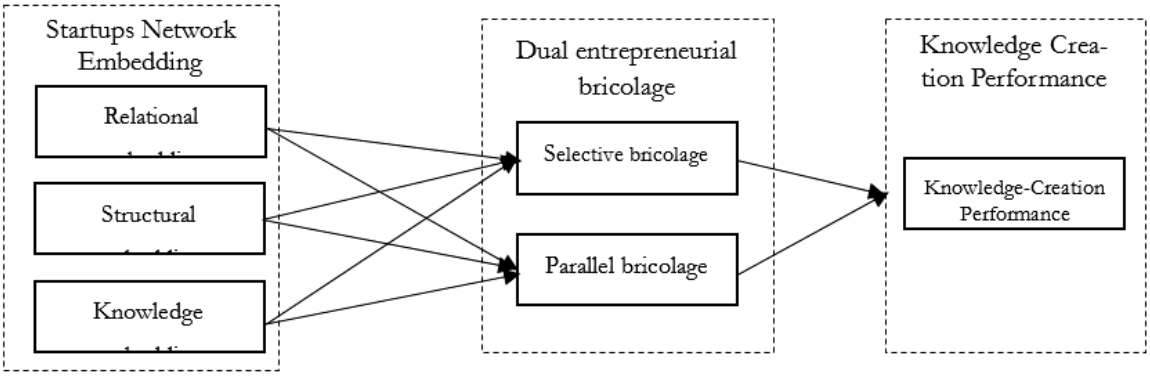

Figure 1: Theoretical model

METHOD

DATA COLLECTION AND SAMPLE

In this study, startups in makerspaces in the Fujian Province were sampled by convenience and surveyed to collect research data. The convenience sampling method was employed because it involves minimal time and cost and allows for easy generalization of the results due to its flexibility (Franzosi, 2004). With the help from the Fujian Makerspaces Industry Association, 10 makerspaces were identified and then 10 startups were selected from each of the chosen makerspaces, yielding a sample of 100 startups in total, including those with various natures and characteristics.

An initial pilot study with completion of 65 questionnaires established the feasibility, reliability, and validity of the survey instrument and process. Then, the questionnaire was distributed online to all the participating startups. A special group was established to ensure it reach each subject and urge all members in the makerspaces to participate in the survey. If one forgot to complete the survey or a question/item got omitted or marked incorrectly, the participant would be contacted by telephone. Thanks to the follow-up effort, of the total of 400 questionnaires distributed, 307 responses were collected for this study, all valid, yielding an overall response rate of 76.7%.

MEASURING INSTRUMENTS & QUESTIONNAIRE

Before designing the initial questionnaire, the research team interviewed the principals of the makerspaces. The questionnaire was designed based on the interview results of the person in charge of the makerspaces, domestic and overseas mature scales, and the opinions of senior scholars.

Table 1: Measurement scales of variables in this study

VARIABLE	MEASUREMENT	MEASURE INDEX
Relational embedding	RE1: the intensity of knowledge and information exchange between the company and other partners in the makerspace	Cronbach'α=0.926 CR=0.786 AVE=0.550
	RE2: the frequency of contact between the company and other partners in the makerspace	
	RE3: the closeness of ties between the company and other companies in the makerspace	

VARIABLE	MEASUREMENT	MEASURE INDEX
Structural embedding	SE1: the stability of the company's relationship with suppliers	Cronbach'α=0.946 CR=0.947, AVE=0.816
	SE2: the stability of the company's relationship with customers	
	SE3: the stability of the company's relationship with sellers/agents	
	SE4: the stability of the relationship between the company and its peers	
Knowledge embedding	KE1: whether the company can share knowledge, technology, or R&D results with other partners in the makerspaces	Cronbach'α=0.904 CR=0.834 AVE=0.558
	KE2: whether new information and new knowledge acquired by the company can be quickly integrated within the company	
	KE3: whether other partners in the makerspaces have a strong desire to exchange knowledge and technology with the company	
	KE4: whether there are many opportunities for informal communication and learning between the company and other partners in the makerspace	
Selective bricolage	SEV1: whether the company can make full use of the new knowledge and new technologies acquired in the makerspace to effectively solve the problems arising from the operation process	Cronbach'α=0.942, CR=0.800, AVE=0.502
	SEV2: whether the company can improve its working methods by communicating with other companies in the makerspace	
	SEC3: whether the company can communicate with other companies in the makerspace to improve related technologies	
	SEC4: whether the company can solve problems/create opportunities through communication with other companies in the makerspace	
Parallel bricolage	PEV1: whether the company seeks products/market information to enter new fields through the makerspace	Cronbach'α=0.903, CR=0.817, AVE=0.598
	PEV2: whether the company continuously seeks information on potential market demand through the makerspace to develop new projects	
	PEV3: whether the company continues to seek product/market information through the makerspaces to address high-risk issues	

VARIABLE	MEASUREMENT	MEASURE INDEX
Knowledge-creation performance	KCP1: whether the company has a high success rate of innovative products	Cronbach'α=0.868 , CR=0.852 AVE=0.657
	KCP2: whether the company often launches new products and services earlier than its peers	
	KCP3: whether the company reduces production costs through technological innovation and technology learning	

The survey questionnaire consists of numerous measuring items on a five-point Likert scale, with 1 indicating strongly disagree and 5 indicating strongly agree, and all measuring items were from previous instruments published in the literature. Specifically, this study drew on: (1) the scales developed by Tsai and Ghoshal (1998), Lester (2013), and Liang and Chen (2019) to measure the three dimensions of dual network embedding; (2) the scale by Baker and Nelson (2005) and Yu et al. (2017a) to measure the selective and parallel bricolage; and (3) the scales used by Liang and Chen (2019) and Li et al. (2008) to measure knowledge-creation performance. In addition, based on Han (2021), this study considered the startups' age, annual income, and industry as control variables for accuracy purposes. The specific measurement scales are listed in Table 1.

EMPIRICAL RESEARCH AND RESULT ANALYSIS

RELIABILITY AND VALIDITY ANALYSIS

In this study, SPSS 20.0 was used to test the reliability of each dimension. The test results are listed in Table 1. It can be seen that the Cronbach's α values of the variables used in this paper were all greater than the recommended level of 0.7, indicating that each variable met the reliability requirements. In the exploratory factor analysis results for each influencing factor, the KMO value was 0.934 and the Bartlett sphericity test significance level was 0.000, which is suitable for factor analysis. We calculated the average variance extracted (AVE) and combined reliability (CR) of each variable. Each AVE was higher than 0.5 and each CR was higher than 0.7, indicating that the measurement data had good convergent validity.

HYPOTHESIS TESTING

In this paper, AMOS21.0 was used to construct the structural equation, and the maximum likelihood estimation method was used to fit the proposed theoretical model. The model fitting results are presented in Table 2. As shown in Table 2, all fitting indicators met the requirements, indicating that the overall framework model among dual network embedding, dual entrepreneurial bricolage, and knowledge-creation performance fitted the data well. The theoretical model test results are shown in Figure 2.

Table 2: Model fitting results

FIT INDEX	X2 /DF	RMSEA	NFI	RFI	IFI	CFI	TLI
Fit value	2.876	0.078	0.924	0.908	0.949	0.949	0.938
Conclusion	Satisfy	Satisfy	Satisfy	Satisfy	Satisfy	Satisfy	Satisfy

Analysis of the Impact of Dual Network Embedding, Dual Entrepreneurial Bricolage, and Knowledge-Creation Performance

It can be seen from Table 3 that the direct influence path of relational embedding on knowledge-creation performance was significant, which supports Hypothesis H1b. The direct influence paths of structural and knowledge embedding on knowledge-creation performance were not significant, so Hypotheses H1a and H1c are not supported. Structural and knowledge embedding had significant direct impacts on parallel bricolage. So, Hypotheses H2e and H2f are supported and Hypothesis H2d is not. Relational and knowledge embedding had significant direct impacts on selective bricolage. So, Hypotheses H2a and H2c are supported and Hypothesis H2b is not. Both selective and parallel bricolage directly affect knowledge-creation performance. Thus, Hypotheses H3a and H3b are supported.

Table 3: Research hypothesis path test

PATH	ESTIMATE	S.E.	C.R.	P	SUPPORTIVE
relational embedding→ Parallel bricolage	0.088	0.071	1.247	0.213	Unsupported
Structural embedding→ Parallel bricolage	0.098	0.031	3.115	0.002	Supported
knowledge embedding→Parallel bricolage	0.604	0.080	7.562	***	supported
knowledge embedding→Selective bricolage	0.402	0.071	5.652	***	supported
relational embedding→Selective bricolage	0.572	0.069	8.287	***	supported
Structural embedding→Selective bricolage	0.018	0.029	0.631	0.528	unsupported
Selective bricolage→Knowledge creation performance	0.334	0.091	3.686	***	supported
Parallel bricolage→Knowledge creation performance	0.509	0.084	6.061	***	supported
relational embedding→Knowledge creation performance	0.171	0.083	2.056	0.040	supported
Structural embedding→Knowledge creation performance	-0.033	0.030	-1.105	0.269	unsupported
knowledge embedding→Knowledge creation performance	-0.162	0.084	-1.937	0.053	unsupported

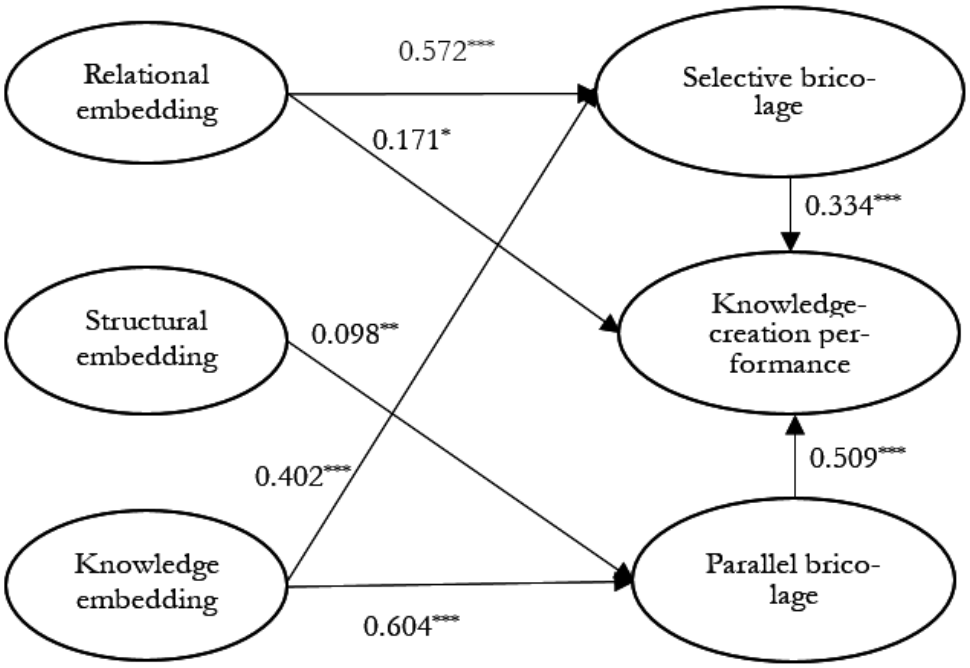

Figure 2: The theoretical model test results

Test of the Mediation Effect of Dual Entrepreneurial Bricolage

MacKinnon et al.'s method (2007) was used to test the mediation effect of dual entrepreneurial bricolage. The test results are shown in Table 4. The confidence intervals of the intermediary selective and parallel bricolage did not include zero points, indicating that the null hypothesis that a mediating effect does not exist can be rejected. Specifically, selective bricolage has a mediating effect between relational and knowledge embedding and knowledge-creation performance. Parallel bricolage has a mediating effect between structural and knowledge embedding and knowledge-creation performance.

Table 4: Mediation Effect Test Table

DEPENDENT VARIABLE	INTERMEDIARY TO BE TESTED	PATH A		PATH B		CONFIDENCE INTERVAL	
		COEFFICIENT	STANDARD ERROR	COEFFICIENT	STANDARD ERROR	LOWER	UPPER
Relational embedding	Selective bricolage	0.572	0.069	0.334	0.091	0.0829	0.32000
Knowledge embedding		0.402	0.071	0.334	0.091	0.06082	0.21821
Structural embedding	Parallel bricolage	0.098	0.031	0.509	0.084	0.01831	0.08663
Knowledge embedding		0.604	0.080	0.509	0.084	019725	0.43032

This further supports Hypotheses H4a, H4c, H4e, and H4f, and Hypotheses H4b and H4d are not supported. Thus, there is difference in the mediating effects of dual entrepreneurial bricolage between dual network embedding and knowledge-creation performance. Startups should dynamically adjust their entrepreneurial bricolage methods according to actual needs.

FINDINGS AND DISCUSSION

This study provides an overall explanation framework for dual network embedding, dual entrepreneurial bricolage, and knowledge-creation performance of startups in makerspaces. At the theoretical level, this research enriches the exploration of the factors influencing the entrepreneurial bricolage of startups at the network level and deepens the research on the internal mechanism of dual network embeddedness affecting knowledge-creation performance. In practice, it provides theoretical basis and management inspiration for companies in makerspaces to overcome the inherent disadvantage of being too small and weak to explore innovative paths. Through the empirical test, the following conclusions are obtained.

(1) The impacts of the different dimensions of the dual network of new ventures on ambidextrous entrepreneurship bricolage vary. In makerspaces, for startups, relational and knowledge embedding positively affected selective bricolage, while structural and knowledge embedding positively affected parallel bricolage. Many previous studies have verified the positive impact of social networks on entrepreneurial performance. While most studies are based on the relational and structural dimensions of social networks, few studies consider the dimension of knowledge embedding. Knowledge embedding is the main characteristic that distinguishes knowledge networks from other networks. Considering the dimensions of knowledge embedding can help to more comprehensively understand the impact of multi-level networks on entrepreneurial behavior. In addition, previous studies have mostly considered the impact of social networks on entrepreneurial performance (Huang et al., 2020), while few studies have explored the impact of different dimensions of multi-level networks on dual entrepreneurial bricolage. Entrepreneurship bricolage provides new ideas for new ventures with insufficient resources. This study not only provides an explanation of the mechanism of network construction and incubation activities in makerspaces, but also enriches the literature on the relationship between networks and entrepreneurial performance of new ventures in incubation scenarios.

(2) Selective bricolage and parallel bricolage can significantly promote the knowledge-creation performance. This conclusion proves the initial assumption of this article, stating that the incubation scenario brings more open, diverse, and professional network relationships, as well as specialized and standardized material, skills, human, and institutional resources, enabling startups to improve knowledge-creation performance. It is inconsistent with previous scholars' conclusions that parallel bricolage does not contribute to the growth of startups (Baker & Nelson, 2005). At the same time, selective bricolage has a greater impact on the knowledge creation-performance of startups than parallel bricolage. Which is consistent with the conclusion in previous studies that selective bricolage is more conducive to the growth of startups (Baker & Nelson, 2005; Browder et al., 2019; Huang et al., 2020).

(3) Dual-entrepreneurial bricolage plays a mediating role in diversity. Selective bricolage partially mediates the relationship between relational embedding and knowledge-creation performance. Parallel bricolage mediates the relationship between structural embedding and knowledge-creation performance. A complete mediating effect exists between knowledge embedding and knowledge-creation performance. The difference in the mediating effects of the two types of bricolage validates the viewpoint of the resource dependence theory (Hillman et al., 2009; Huang et al., 2020). That is, the environment of the enterprise has an important impact on the resource bricolage. Enterprises not only rely on the network to obtain different resources, but also determine how these resources are combined and creatively applied. At the same time, the conclusions of this article further enrich the scope of the application of resource dependence theory.

IMPLICATIONS

First, the dual network embedding in the makerspace is of great significance for the entrepreneurial bricolage of startups. The startups should establish a relationship mechanism, including communication, trust, commitment, and tolerance in the process of communicating with other entities in the dual network, which can promote the free flow of knowledge, information, and other resources to improve enterprises' awareness and understanding of these social resources. Therefore, these social resources can be regarded as resources at hand and can be creatively utilized and pieced. In addition, when enterprises in makerspaces are in a structural whole position in the dual network, network heterogeneity brings different types of knowledge and information, which provides conditions for enterprises to try multiple business opportunities and new resource combinations simultaneously, and avoid missing opportunities. Parallel bricolage enables enterprises to learn and adjust behavior and directions in trial and error. Therefore, under dual network embedding, startups need to fully leverage the impact of relational embedding, structural embedding, and knowledge embedding on the different types of entrepreneurial bricolage.

Second, startups in makerspaces should clarify the difference in the intermediary paths of dual entrepreneurial bricolage in the transformation of dual network resources into knowledge-creation performance. Enterprises in makerspaces should make dynamic adjustments to the dual network embedded state and dual entrepreneurial bricolage to improve knowledge-creation performance. On the one hand, when startups conduct selective entrepreneurship bricolage, it means that enterprises selectively integrate and use resources in key areas of existing opportunities. Therefore, enterprises in makerspaces must acquire and integrate knowledge from networks. They should strengthen relational and knowledge embeddedness to improve their relationship strength and tacit knowledge acquisition. When startups conduct parallel bricolage, the enterprises need more heterogeneous knowledge in different fields and new resource combinations. Therefore, structural and knowledge embedding should be strengthened to improve the position of enterprises in the network and to acquire multi-party and diversified knowledge to explore and discover new business opportunities and project resources.

CONCLUSION AND LIMITATIONS

This study uses survey data collected from 307 startups in makerspaces in Fujian Province, China. Through structural equation modeling, this study assessed the relationships among dual network embeddedness, dual entrepreneurship bricolage, and knowledge-creation performance. The results show that the embedding of enterprise relationships in makerspaces directly affects the knowledge-creation performance. Dual entrepreneurial bricolage plays a different intermediary role; selective entrepreneurial bricolage plays a mediating role between relational embedding and knowledge-creation performance; parallel entrepreneurial bricolage plays a complete intermediary role between structural embeddedness and knowledge-creation performance; dual entrepreneurial bricolage plays a complete intermediary role between knowledge embedding and knowledge-creation performance. This research enriches the exploration of the influencing factors of entrepreneurial bricolage at the network level in makerspaces in theory, deepens the research on the internal mechanism of the multilevel network embedding of enterprises in makerspaces, which affects the knowledge-creation performance, and provides the basis and management inspiration for startups in makerspaces to overcome the double congenital disadvantages of "newborn weakness" and "small and weak" when exploring innovation paths.

Our study had several limitations. First, in this study, the makerspace in Fujian Province, China was taken as a sample. The heterogeneity of industries and regions may impact the dual-network embedding mechanism of startups. Therefore, it is necessary to select a wider range of regions and industries for sampling. Second, previous studies have shown that network relationships and bricolage behavior have a certain relationship with the enterprise life cycle. Longitudinal studies should be conducted to increase the robustness of these conclusions.

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