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EXPLORING SOCIAL NETWORKS, COMPETITIVE ACTIONS AND DYNAMIC CAPABILITIES IN ORGANIZATIONS

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Editorial: Exploring social networks, competitive actions, and dynamic capabilities in organizations

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Editorial on the Research Topic
Exploring social networks, competitive actions and dynamic capabilities in organizations

The COVID-19 pandemic has significantly changed workplace relations (Stewart, 2021). For instance, employee relationships have weakened, while working at home has become the norm. Consequently, employee networks are continually changing firms' dynamic capabilities and competitive actions. Organizational network competitive actions and dynamic capabilities are crucial for understanding how to effectively manage internal and external organizational networks, especially when many employees are working in a hybrid or offline environment. Integrating social networks, competitive actions, and dynamic capabilities is important to address the growing crises in our natural, social, economic, and political environments since many decisions made are based on self and collective interests through networks and dynamic capabilities in organizations. Furthermore, there is scant literature that examines social networks, competitive actions and dynamic capabilities together. In order to address this important and under explored area in the literature, the editors submitted this Research Topic. We accepted 9 manuscripts that cover social networks and dynamic capabilities with a strong focus on trust and collaboration, followed by competitive advantage. The contributions to this Research Topic and to the literature point to a number of key insights within mechanisms and structures of dynamic capabilities, social networks, and competitive advantage/actions.

Mechanisms in dynamic capabilities

The articles from Zhang et al., Zhou and Li, Thiel, and Eshel et al. highlight the important role of mechanisms in driving dynamic capabilities within social networks and competitive advantage/actions (Zhou et al., 2019). Zhang et al. suggest there is an

urgent need to examine the mechanism effect of dynamic capabilities across a firm's boundaries within a bottom of the pyramid context. The authors' empirical research findings indicate trust and information sharing mechanisms facilitate collaborative network problem solving, develop new technologies, and enhance exploratory learning which enrich competitive advantage in organizations. Overall, the authors' research study enriches our understanding of the dynamic capabilities' antecedents and the black box of the embeddedness paradox in the bottom of the pyramid market context. The paradox shows that social embeddedness can have not only positive, but also negative effects on economic activity. Moreover, moderate relational embeddedness could promote dynamic capabilities, while overembeddedness inhibits dynamic capabilities. Zhao and Li introduce financial literacy as a mechanism for generating social capital and competitive advantage in rural entrepreneurship. The authors' empirical study findings show rural households with greater social networks and a higher level of information communication technology adoption tend to become entrepreneurs. Rather than merely focus on competitive intensity in the market (Wilden et al., 2013), Liu et al.'s research study found that both work and social network tasks conducted within an enterprise's social network media have a positive impact on work exuberance with different mechanisms that drive dynamic sharing capabilities, and in turn, could improve an enterprise's competitive advantage. The empirical study findings show that using social media for social tasks is a positive force rather than negative force within employees' work and engagement. Thiel's theoretical framework shows how employee social network strategies emerge from group entitativity and flow in a reciprocal manner from the organizational level to society at large. Specifically, group entitativity is a competitive mechanism that gives employees strategic advantage over other employees within the organization and influences other actors within the firm and across organizations and communities. Eshel et al.'s research provides new insights for understanding the mechanisms underlying the impact of COVID-19 on student mental health. The authors' empirical research study found that students adapted through the COVID-19 crisis within coping responses as a dynamic capability within the student social networks.

Networks and organizational structures

The articles from Santana, Igarashi and Hirashima, and Estevez and Takacs show network and organizational structures are the foundation of dynamic capabilities. Santana's empirical research findings have important implications for network industry knowledge, membership and stratification. The author examines competitive reactions as dynamic capabilities, rather than network responsiveness within the content of the network tie (Kleinbaum and Stuart, 2014). The author's empirical findings contribute directly to the theorization of social exchange commitment, remedial boundary work, social capital, and knowledge production in virtual communities of practice, including the methodological study of remedial and discursive boundary work in porous or semi-anonymous communities. Overall, Santana's research work demonstrates that while the boundary worker's position in the sociocentric network may negatively influence their boundary work, the boundary work itself may positively influence the network by retaining members and strengthening their ties to the virtual community. Igarashi and Hirashima conducted a four-wave longitudinal survey to test whether individuals high in generalized trust actively switch ties and form open triads in dynamic social networks. Stochastic Actor-Oriented Models were employed to analyze structural changes in advice and personal discussion networks among first-year undergraduates. The authors' research findings showed the predicted patterns of social selection processes are based on generalized trust when the dynamics of the two networks were analyzed simultaneously. However, in the advice network, individuals high in generalized trust tend to terminate existing ties, create new ties, and show a decreasing trend toward forming close triads when the degree of local clustering was large. Individuals high in generalized trust play a key role in establishing Teece et al.'s (1997) novel knowledge assets because they will get better access to valuable resources embedded within organizational contexts and become popular and advantageous among coworkers owing to their rational tie-formation and dissolution strategies to integrate and reconstruct the value of the resources. Overall, the authors are the first to demonstrate the applicability of the emancipation theory of trust to the process of multiple network dynamics. Taken together, Estevez and Takacs's empirical research results demonstrate that structural aspects beyond the relationship network ties in the gossip triad matter for dynamic capabilities such as workplace gossip. In studying various organizational and network structures, the authors gained further insights into the specific contexts where negative gossip is more likely to promote sustainable cooperation within network ties. Importantly, the authors' findings suggest that brokers can use their structural position to control social information in the organization. However, brokers are also subject to negative evaluations from their colleagues.

Another strength of the articles that form part of this special topic on social networks, competitive actions and dynamic capabilities is the broad international scope of the authors and the study contexts. The authors come from 5 countries (China, Sweden, Israel, USA and Japan) and 13 universities (Aichi Shukutoku University, Beijing Institute of Technology, Beijing Normal University, Linköping University, Nagoya University, Southwestern University of Finance and Economics, Tel Aviv University, Tel-Hai College, University of California, University

of Haifa, University of International Business and Economics, Xidian University and Yanshan University). Each contribution highlights the key role played by organizational networks and dynamic capabilities that are crucial for understanding how to effectively manage organizational competitive advantage and performance in specific social and cultural contexts.

Author contributions

All authors listed have made a substantial, direct, and intellectual contribution to the work and approved it for publication.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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Generalized Trust and Social Selection Process

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Generalized trust relieves individuals in a socially uncertain situation from dyadic constraints of existing ties and helps them change ties with other individuals to acquire better resources. However, much evidence in the emancipation role of generalized trust as a booster of new relationship formation has been limited to laboratory experiments or cross-sectional surveys. We conducted a four-wave longitudinal survey to test whether individuals high in generalized trust actively switch ties and form open triads in dynamic social networks. Stochastic Actor-Oriented Models were employed to analyze structural changes in advice and personal discussion networks among first-year undergraduates. Results showed the predicted patterns of social selection processes based on generalized trust when the dynamics of the two networks were analyzed simultaneously: only in the advice network, individuals high in generalized trust tended to terminate existing ties, create new ties, and show a decreasing trend toward forming close triads when the degree of local clustering was large. Effective tie-formation strategies of individuals high in generalized trust in a multiplex network structure are discussed.

Keywords: social networks, generalized trust, social selection process, multiplex networks, stochastic actor-oriented model

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INTRODUCTION

Emancipation Theory of Trust

Trust in others is fundamental to sustaining social life. Individuals in social networks, often called *actors*, can overcome social difficulties by trusting other individuals to share and exchange diverse resources. Trust is an important basis for increasing social capital (Coleman, 1988; Sampson et al., 1997; Putnam, 2000) and results in new encounters in a situation where a social network is changeable and expandable (Burt, 1993; Igarashi et al., 2008). Previous research has revealed that actors who trust other actors can cooperate with strangers in a social network to coordinate mutual benefits across diverse social settings, such as in laboratory experiments (Yamagishi, 2011), work organizations (Lusher et al., 2012), and online social networking sites (Valenzuela et al., 2009).

The primary goal of this study is to discover the way in which a social network is constructed and renewed based on the mechanism of trust in social relationships. In particular, this study focuses on the concept of generalized trust, or an unconditional expectation that people will be benevolent. According to Yamagishi and Yamagishi (1994), generalized trust refers to an expectation of the benign intentions of other people in general. In other words, no specific and existing interpersonal relationship is construed in the framework. The psychological concept indicates the "default" degree to which people trust others in general when no information about their cooperativeness is provided. Generalized trust at the attitude level is regarded as stable (Yamagishi et al., 1998) and has sufficient validity in the prediction of trustful behavior toward strangers (Yamagishi et al., 2015).

Trustful actors, or those high in generalized trust tend to judge strangers to be trustworthy (Yamagishi, 2011). However, this does not mean that individuals high in generalized trust are more gullible than those low in generalized trust. Trust is associated with a sort of *social intelligence*, or the ability to avoid risks of interacting with non-cooperative others. Social intelligence leads people to success in interpersonal communication under social uncertainty, defined as a situation in which little information is available for the assessment of others' intention to cooperate. In fact, generalized trust increases the possibility to detect others' trustworthiness from nonverbal cues (Bonnefon et al., 2013). This detection ability has its roots in the brain function related to mindreading (Watabe et al., 2011) and is also effective in facilitating cooperation in everyday social situations (Hashimoto et al., 2020). In a social network, generalized trust works as a significant psychological characteristic enabling one to actively create new social relationships with strangers beyond existing relationships.

Using terminology borrowed from economics, the emancipation theory of trust (Yamagishi and Yamagishi, 1994; Yamagishi, 2011) assumes that individuals high in generalized trust employ a tie-selection strategy based on the careful consideration of *opportunity costs* provided by the existing social ties that surround them. Under a condition where social networks are changeable, individuals high in generalized trust are motivated to search for the social tie that is the most valuable one in which to "invest" their own resources to achieve mutual cooperation through that tie. The resources can be diverse from economic to psychological (Foa and Foa, 1976), and the investment includes looking for the best possible partners to support them and finding collaborators with joint interests. To maximize their resources, individuals high in generalized trust always compare the rewards received from an existing tie to potential rewards from an available alternative tie. If the latter exceeds the former, then individuals high in generalized trust may disengage from the existing tie and develop a new connection to the alternative tie due to the limited time available to spend on communication (Dunbar et al., 2009).

According to Yamagishi et al. (1999), the greater the cognitive cost individuals high in generalized trust pay for detecting others' trustworthiness, the greater the returns they can expect from a more cooperative partner they can find in their social network. They are sensitive to the possibility of being exploited by spiteful strangers and exercise the detection ability to avoid harmful scenarios. Therefore, individuals high in generalized trust are emancipated from commitment relationships in the sense that they can disengage from existing social ties when they find alternative ties that may provide better outcomes in exchange for their cognitive investment to detect others' trustworthiness.

In contrast, individuals low in generalized trust are vigilant and avoid the risk of being left high and dry by others. Even so, external factors such as attendance at social events would help them form new relationships. Once they are connected with someone with whom they can build a "comfort zone," they are not strongly motivated to expand their social circle outside it and are less sensitive to the trustworthiness of strangers. Consequently, they are likely to insist on remaining in commitment relationships, even if they will miss an opportunity to get better rewards outside their existing social ties.

The emancipation theory of trust has been validated by 1) game-theoretical approaches, including repeated interactions among a relatively small number of game players (Yamagishi et al., 1998) and selective tie-formation and termination processes in an uncertain situation (Hayashi and Yamagishi, 1998), 2) a correlational study of the relationships between a generalized trust score and psychological scales measuring well-being and interpersonal orientations among undergraduates (Yoshimoto and Hasegawa, 2017), and 3) nation-level large cross-sectional research on social support exchange (Ishiguro and Okamoto, 2013). Nevertheless, no empirical support for the theory has been obtained in a framework of longitudinal social network dynamics. There is a consistent tendency for individuals high in generalized trust to be free from the burden of existing social relationships and motivated to maximize their resources by forming new connections. Thus, this study predicts that generalized trust promotes the termination of existing ties and the creation of new ties in social networks over time.

Social Selection Process

To examine the patterns of tie formation in social networks, it is helpful to introduce the concept of social selection processes. Social selection processes refer to the ways in which actors' characteristics (i.e., attributes and attitudes) affect network formation and changes in a given social structure (Erickson, 1988).

The current study predicts that individuals high in generalized trust pursue the formation of *open triads* in social networks. Open triads are intransitive triangles where actor A has connections to actors B and C, but actors B and C have no direct connection. Empirically, open triads are not frequently observed because triads tend to converge on closure, in which actors connect with each other in small steps as a reflection of commitment and order. Although the closure principle in triads is grounded in their social nature (Davis, 1970), open triads are still observed in networks where actors are tied through weak emotional bonds (Granovetter, 1973), which enable them to access diverse information or advice in a more efficient way (Burt, 1993; McEvily and Zaheer, 1999). The selective tie formation strategy would be observed only in those who have strong motivation to be autonomous in the network, like individuals high in generalized trust. If individuals high in generalized trust try to maximize their efficiency in accessing resources, they will be selective in tie formation, while avoiding redundant tie formation with those who are located at a two-step distance from them. Being embedded in open triads provides not only personal benefits to actors who are able to gain access to a variety of knowledge but also collective benefits to the network as a whole in terms of efficiency in resource flow. These benefits would work as strong incentives for individuals high in generalized trust to retain the local open structure.

A dyadic selection process also involves the mechanism of *homophily*, a tendency for similar actors to have ties to each other. Homophily is a tie-formation process among those who have similar status (status homophily: the same role in a group) or

attitudes (value homophily: similar interests in a topic) (McPherson et al., 2001). Previous findings of the homophily of generalized trust in the field of economic game experiments are controversial. Yamagishi (2011) argues that trustfulness, or generalized trust, is a trait for "selecting" other actors to acquire better resources, whereas trustworthiness is a trait for being "selected" by other actors for the sake of the goodness of the actor (p. 70). On the one hand, trustfulness and trustworthiness do not perfectly overlap. Actors regarded as being trustworthy by other actors do not always behave in a trustful manner (Snijders and Keren, 2001). We could therefore draw a prediction that no tendency of homophily is found for generalized trust. On the other hand, individuals high in generalized trust are selective in communicating with other individuals high in generalized trust. Several studies have shown that trustful behavior is associated with trustworthiness (also Yamagishi and Yamagishi, 1994; Bravo et al., 2012) and that cooperators tend to form groups based on reciprocal nominations in dynamic social networks in which actors are allowed to change ties (Rand et al., 2011). These findings could verify another prediction about homophily in generalized trust: the selection process of individuals high in generalized trust fosters the creation of circles among individuals high in generalized trust, and as a sequel to this, individuals low in generalized trust are constrained to forming ties with other individuals who are also low in trust. Considering the incompatible evidence, the current study explores whether the tie-formation process based on generalized trust follows the principle of homophily.

Types of Sample and Networks

The current research measured advice and personal discussion networks in a first-year undergraduate sample to test the theory. Adopting a first-year undergraduate sample is a common practice to find significant psychological and interpersonal factors that affect tie-formation processes in the field of social network research (van de Bunt et al., 1999). At the beginning of the first semester, first-year undergraduates are faced with separation from intimate friends and need to develop new social networks with strangers at the university in order to adjust to their surroundings. There is no doubt that university enrollment is one of the most significant opportunities for individuals to reconstruct social networks in accordance with their personal attributes and attitudes.

The application of advice and personal discussion networks in the current research directly follows Yamagishi's (2011) notion about Granovetter's (1973) classification of weak ties (casual relationships with less frequent contacts) and strong ties (stable and close relationships) and their proximity to low- and high-commitment relationships, respectively (p. 70). A group of individuals gathered to seek a wide range of advice/information would regard their relationships not as mutually controlling but as open and autonomous, whereas those close to each other would regard their relationships as loyal and conscientious. Based on the emancipation theory of trust, it is reasonable to assume that the role of generalized trust in tie formation is more likely to be prevalent in advice/information networks than in personal discussion networks, the former of which is supposed to be changeable and contain common valuable resources in their structure, while the latter is supposed to be stable over time and give access to resources unique to specific exchange partners.

At the time of school transition, first-year undergraduates are faced with a matter of socialization, or an individual-level process of internalizing attitudes, customs, and knowledge that are commonly shared in a given group or society (Weidman, 1989). To access information in an efficient way, it could be beneficial for them to form a greater number of advice-seeking ties and avoid redundancy in the network in order to maintain a diversity of information. It is therefore predicted that generalized trust is useful to create ties to acquire better advice/information for academic success.

Meanwhile, people deemed close friends are well known to each other, linked through frequent contact and strong emotional bonds. One of the basic communication behaviors widely found in intimate relationships is self-disclosure. Self-disclosure is generally reciprocal in close ties and functions not only to increase closeness with a friend but also to decrease the risk of betrayal by the friend after exchanging and sharing secrets. In this context, commitment to particular others (i.e., loyalty and devotion with feelings of safety and assurance; Yamagishi and Yamagishi, 1994) works as a glue in social ties with strong emotional bonds in lieu of generalized trust. For the fulfillment of the need to belong (Baumeister and Leary, 1995), it is wiser for people to stabilize close ties through self-disclosure based on commitment than to frequently seek opportunities to meet better friends based on generalized trust. Hence, we can draw a prediction that generalized trust does not contribute to the formation of personal discussion ties.

Taking into account the multiplexity of advice and personal discussion networks, it is often the case that people seek advice from those with whom they have already become intimate, and vice versa. However, the supposition would be less important for individuals high in generalized trust because they can be free from being bound to existing relationships and can seek better opportunities for advice outside a given social circle. A decreased impact of personal discussion ties on the formation of advice-seeking ties in the same dyads is thus expected to be found among individuals high in generalized trust.

Hypotheses

To summarize, the current research examines the following hypotheses to elaborate the dynamics of tie formation based on generalized trust:

Hypothesis 1: Generalized trust is positively related to the tendency to terminate existing ties for advice seeking.

Hypothesis 2: Generalized trust is positively related to the tendency to create new ties for advice seeking.

Hypothesis 3: Generalized trust is positively related to the tendency to form open triads for advice seeking.

Hypothesis 4: Generalized trust is positively related to the tendency to diminish the importance of personal discussion ties when forming advice-seeking ties in the same dyads.

The first three hypotheses should be confirmed not in the personal discussion network but in the advice network.

Hypotheses 1 and 2 are directly drawn from Yamagishi's original theory (Yamagishi, 2011). Hypothesis 3 includes the interaction between actor disposition and network position. Hypothesis 4 is drawn from the multiplexity of advice and personal discussion networks, each of which represents a low- and high-commitment relationship. Led by the homophily principle, the current study also explores the possibility that individuals high in generalized trust show a preference for other individuals high in generalized trust.

MATERIALS AND METHODS

Data

The research was approved by the Ethical Review Board of the Graduate School of Education and Human Development, Nagoya University (#15-735). The data was collected in Japan as part of a longitudinal research project. This year-long survey was conducted in 2016 to measure psychological and social network characteristics of first-year undergraduates in an education department of a university located in Aichi prefecture (central Japan). All 73 first-year undergraduates in the department agreed to participate in the study (23 males and 50 females; M_{age} = 18.2 years old). The survey was conducted at four points in time: the 3rd (the beginning of the spring [first] semester: Wave 1), the 12th (the end of the spring semester: Wave 2), the 28th (the beginning of the fall [second] semester: Wave 3) and the 41st (the end of the fall semester: Wave 4) weeks of the participants' first academic year after matriculation.

Procedure

A research assistant attended a new student orientation at the beginning of the spring semester and asked attendees to take part in the survey *via* LINE (a popular social networking service in Japan) in exchange for a meal voucher (JPY 300) as remuneration at each wave. The electronic consent form was obtained from all participants at that time. Participants were informed that their responses were treated confidentially and that they could discontinue participation in the survey at any time. Participants used their smartphones to answer questions set up on an online platform (Qualtrics) when they had time. The research assistant sent a regular reminder to participants at each wave *via* LINE to increase response rates. In the survey, demographic and individual measures (generalized trust and personalities) were presented first, followed by network measures.

Measures

Advice and Personal Discussion Networks

Advice and personal discussion social networks were collected through survey questions to differentiate between the two types of ties in the same dyad. The advice-seeking network was measured by the question, "Of persons in the department, from whom do you receive information about the department's course subjects, such as teachers' personalities, the content of subjects, details for coursework, and how to complete homework assignments?" The personal discussion network was measured by the question, "Of persons in the department, with whom can you discuss personal matters?" At each of the four waves, participants listed as many names of other students in the same department as possible (i.e., open-ended nominations). The order of presenting the questions was randomized across participants.

Generalized Trust

Generalized trust was measured at Wave 1 as a continuous variable by the General Trust Scale (Yamagishi and Yamagishi, 1994). The scale consists of six items ("Most people are basically honest," "I am trustful," "Most people are basically good and kind," "Most people are trustful of others," "Most people are trustworthy," and "Most people will respond in kind when they are trusted by others") to assess the degree of expectation of others' trustworthiness in general. Participants answered each item on a 5-point Likert scale (1: strongly disagree to 5: strongly agree). The score was summed over the six items, ranging from 6 to 30 (α = 0.88; M = 18.91, SD = 4.74). A higher score indicates a stronger expectation of others' trustworthiness. Previous literature has revealed that connections through social networks are not associated with the change in generalized trust over time (Sturgis et al., 2015). We followed the empirical finding and regarded generalized trust as stable in a year-long period.

Control Variables

In order to purify the effect of generalized trust on social selection processes, it is necessary to control the actor- (individual-) and dyad-level effects as extraneous variables on network formation (Snijders, 2017). This study includes sex and personalities at the actor-level control variables and acquaintanceship and renown networks at the dyad-level control variables. The measures of all control variables are reported in Supplementary Material.

Analytic Plan

This study uses the stochastic actor-oriented model (SAOM) for network dynamics (Snijders, 1996) to capture these tendencies of social network formation among individuals high in generalized trust. SAOM is a powerful statistical tool for analyzing longitudinal data to understand the dynamic processes of network formation. In SAOM, actors are assumed to make changes to their outgoing ties sequentially, resulting in the network changing incrementally. The model is defined by the rate function (modeling the frequency of an actor's opportunity to make a change to the network) and the objective function (modeling the types of changes). The times at which actors are given opportunities to change their ties are modeled using independent exponential distributions with rates that may depend on network properties and actor attributes (e.g., generalized trust). Conditional on an actor being given the opportunity to change one outgoing tie, the preferences for different options are modeled using a conditional logistic model with probabilities proportional to (the exponentiated) objective functions evaluated for each alternative change. The objective function incorporates the current state of ties based on actor attributes and network structures included in the model. In other words, the dependent variable of SAOM indicates the change of ties in a whole social network, such as 0 (tie

TABLE 1 | Descriptive statistics of advice and personal discussion networks.

	Advice networks				Personal discussion networks			
	Period 1	Period 2	Period 3		Period 1	Period 2	Period 3	
	Wave 1	Wave 2	Wave 3	Wave 4	Wave 1	Wave 2	Wave 3	Wave 4
Density	0.051	0.053	0.061	0.056	0.025	0.034	0.035	0.041
Outdegree indices								
Average degree	3.71	3.84	4.41	4.05	1.79	2.48	2.51	2.98
Standard deviation	5.45	3.40	3.91	3.53	2.05	2.27	2.44	2.79
Min	0	0	0	0	0	0	0	0
Max	38	15	16	19	9	13	13	13
Indegree indices								
Average degree	3.71	3.84	4.41	4.05	1.79	2.48	2.51	2.98
Standard deviation	2.22	2.24	2.26	2.42	1.45	1.53	1.54	1.66
Min	0	0	0	0	0	0	0	0
Max	9	9	9	10	6	5	5	6
Number of ties	241	242	269	247	116	156	153	182
Missing fraction	11.0%	13.7%	16.4%	16.4%	11.0%	13.7%	16.4%	16.4%
Mutual dyads	37	50	58	51	27	39	38	46
Asymmetric dyads	167	142	153	145	62	78	77	90
Tie changes								
Creating tie (0 → 1)		154	102	61		80	44	44
Dissolving tie (1 → 0)		149	72	80		38	36	27
Stable tie (1 → 1)		81	152	171		67	96	120
Jaccard index		0.21	0.47	0.55		0.36	0.55	0.63

These statistics are reported in RSiena outputs, except for outdegree/indegree indices, mutual dyads, and asymmetric dyads calculated by the igraph *package in R. Period refers to time between two waves (Periods 1 and 3 describe the transition during the semester and Period 2 describes the transition during the semester break). The total number of undergraduates who agreed to participate in the study and put their name in the roster is 73. The missing fraction indicates the percentage of unit non-response at each wave.*

absence) to 1 (tie presence) or vice versa (1–0) over time (Snijders et al., 2010). Modeling tie creation and maintenance (dissolution) has also become common in this framework (Sadewo et al., 2020).

SAOM allows us to directly examine the attribute and network effects on multiplex tie formation processes while controlling each effect. In addition, the examination of social network dynamics in cost-reward contexts is suitable for the assumptions of SAOM (Block et al., 2019). This study implemented the possible characteristics of individuals high in generalized trust described above within a framework of SAOM as a set of testable hypotheses. Details of the analysis are reported in Supplementary Material.

RESULTS

Descriptive Statistics

Two sets of four 73 × 73 adjacency matrices of directed graphs were created based on answers to questions for the advice and personal discussion networks across the four waves. A total of 42,048 cells in the full matrices (= 73 actors × 73 actors × 2 networks × 4 waves—584 diagonal elements) were objects of analysis. **Table 1** presents the structural characteristics of the advice and personal discussion networks (for graphical depictions of each network, **Supplementary Figures 1, 2**; for the structural characteristics of the acquaintanceship and renown networks, **Supplementary Table 2**). Missing fractions were lower than 20% across the survey, which satisfied the minimum requirements of longitudinal network research to achieve reasonable parameter estimations (Huisman and Steglich, 2008). The average degree of ties did not drastically change across the four waves in these networks, indicating that actors maintained a similar number of ties in the networks.

In order to check the stability of successive networks, we calculated the Jaccard indices at each period by dividing the number of stable ties (i.e., ties that existed during the period) by the sum of the numbers of creating/dissolving ties (i.e., ties that changed during the period). For the application of SAOM to relatively small- or medium-sized network data, the Jaccard index should be larger than 0.20 (Ripley et al., 2019), and the current dataset satisfied that criterion. In both types of networks, the indices were low at Period 1 and rapidly increased at Period 2, and this trend corresponded with the increase in the number of mutual dyads. These tendencies indicate that the networks involved substantial changes in structure at the early stage of network evolution.

Figure 1 presents the average proportion of changes in network compositions from the first wave (Wave 1) to the subsequent waves (Waves 2–4) in the advice and the personal discussion networks. Individuals low in generalized trust showed relatively higher stability of advice ties across the waves than those middle or high in generalized trust. The patterns were similar in the advice and the personal discussion networks, probably due to the overlap of the two networks. This indicates the necessity of multiplex network analysis to examine the effect of generalized trust on tie formation in one network under controlling for the effect of the other network.

Parameter Estimation

Generalized Trust and Cross-Network Effects

Parameter estimates of the models for two uniplex networks (advice and personal discussion) and one multiplex network were

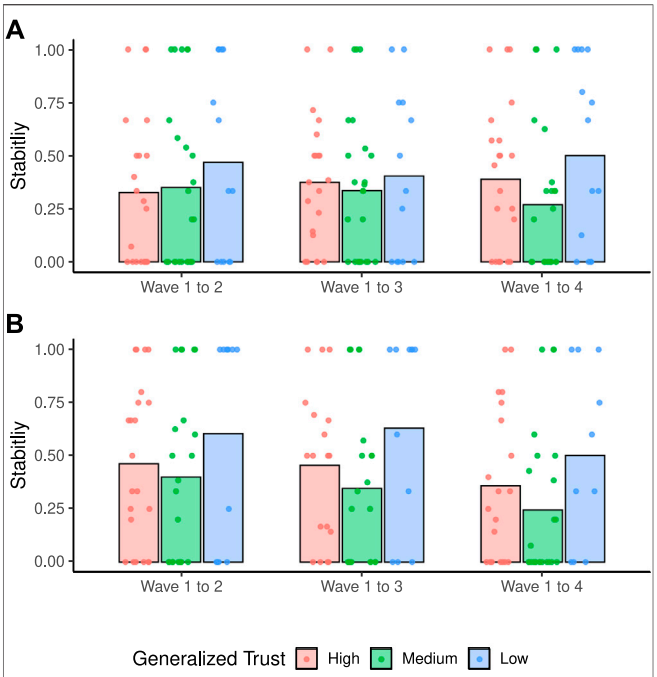

FIGURE 1 | Generalized trust and changes in network compositions across the waves. **(A)** Advice network. **(B)** Personal discussion network. In both networks, stability indicates the proportion of ties at Wave 1 remained at the subsequent waves (Waves 2–4). Bars represent mean values and scatter plots represent the distributions of observed values. Individuals are classified into three groups according to their levels of generalized trust scores (ranging from 6 to 30; M = 18.91, SD = 4.74). High: individuals high in generalized trust (scores 22 to 30 (larger than M + 0.5SD); N = 24); Medium: individuals medium in generalized trust (scores 17 to 21 (within $M \pm 0.5SD$); N = 28); and L: individuals low in generalized trust (scores 6 to 16 (smaller than $M-0.5SD$); N = 18).

separately conducted using RSiena (Ripley et al., 2019). All models satisfied convergence criteria (i.e., overall maximum convergence ratios <0.25 and mean absolute individual t-statistics for each parameter <0.10; Ripley et al., 2019), so the current estimated values were reliable and interpretable to understand network dynamics. The estimation results of trust-related variables in the uniplex and multiplex analyses are shown in **Table 2**. The results of the models, including all variables, are presented in **Supplementary Tables 3,4**.

The effects of generalized trust in advice and personal discussion networks substantially varied in the forms of analyses. The uniplex analysis revealed that the following effects were significant only in the advice network: the negative endowment effect of generalized trust ego revealed that individuals high in generalized trust were more likely to terminate (i.e., not to maintain) existing advice ties than those low in generalized trust. The negative interaction effect between generalized trust ego and transitive closure (geometrically weighted edgewise shared partners; GWESP) had a diminishing weight on additional indirect paths for individuals high in generalized trust, indicating that individuals high in generalized trust were less likely to belong to closed triads than those low in generalized trust. The alter effect of generalized trust was positive and significant in the advice network. This indicates that actors high in generalized trust were more likely to be nominated by others who sought advice.

Meanwhile, generalized trust also showed significant influences on the creation of new ties not only in the advice-seeking network but also in the personal discussion network. The positive creation effect of generalized trust ego indicates that individuals high in generalized trust were more likely to create outgoing ties than those low in generalized trust. The resemblance of the trust-related tie-creation effects in both networks seems to be contradictory to the original predictions.

However, when the tie-formation processes across advice and personal discussion networks were taken into consideration in the multiplex analysis, the trust-related effects were significant only in the advice network, not in the personal discussion network. These findings give support to Hypotheses 1, 2, and 3, in which the effects of generalized trust were expected to be found only in the advice network. No significant ego × alter effect of generalized trust means that homophily in generalized trust is not essential to explain tie changes in the current networks.

We create two figures to further understand the underlying patterns of advice tie formation in relation to generalized trust. **Figure 2** shows the ego-alter selection plots for A) tie creation and B) endowment tendencies in the advice network. Individuals high in generalized trust were more likely to create new ties and less likely to maintain existing ties than those lower in generalized trust. The positive slope observed in both plots also indicates that individuals high in generalized trust were likely to be nominated by other individuals. **Figure 3** shows the linear combinations of the trust-related transitive closure effect in the advice network. A) When the degree of local clustering (represented as the number of edgewise shared partners in the GWESP parameter) was small, generalized trust increased the likelihood of forming closed triads for advice seeking. In contrast, B) when the degree of local clustering was large, generalized trust decreased the weight to form closed triads.

In terms of cross-network effects, the interaction effects of generalized trust and the cross-network effects were incorporated in the model to test the possibility that individuals high in generalized trust are inclined to turn more to strangers than to friends for advice seeking, but none of the effects were significant. Therefore, Hypothesis 4 was not supported. In the meantime, positive trends were observed in the outgoing personal-discussion-to-advice effect for tie creation and endowment. Personal discussion ties were likely to induce and stabilize advice-seeking ties in the same dyad.

Extraversion-related effects were not significant (**Supplementary Table 4**), confirming that the aforementioned networking processes stemmed from the characteristics of generalized trust.

Wald-type Tests

To check if the trust-related effects are substantial in the model in the multiplex analysis, we performed multi-parameter Wald-type tests for the objective function effects of generalized trust (creation ego, endowment ego, alter, ego × alter, generalized

TABLE 2 | Parameter estimates of generalized trust in stochastic actor-oriented models.

	Uniplex network		Multiplex networks	
	Advice	**Personal discussion**	**Advice**	**Personal discussion**
Actor-level effects				
Trust alter	0.035 (0.011)**	0.033 (0.018)	0.032 (0.012)**	0.007 (0.031)
Trust ego (endowment)	−0.498 (0.097)***	−0.276 (0.174)	−0.509 (0.104)***	−0.770 (0.912)
Trust ego (creation)	0.669 (0.107)***	0.415 (0.153)**	0.640 (0.112)***	1.200 (1.161)
Trust ego × trust alter	−0.001 (0.002)	−0.001 (0.004)	−0.001 (0.003)	0.005 (0.006)
Trust ego × GWESP closure	−0.075 (0.033)*	−0.092 (0.052)	−0.069 (0.035)*	−0.100 (0.127)
Network effects				
Reciprocity	2.755 (0.262)***	3.887 (0.465)***	2.417 (0.304)***	3.994 (0.854)***
GWESP closure	2.201 (0.174)***	2.514 (0.255)***	2.055 (0.184)***	2.205 (0.488)***
GWESP × reciprocity	−0.520 (0.312)	−0.572 (0.505)	−0.914 (0.342)**	−0.332 (1.002)
Cross-network effects				
Outgoing personal discussion to advice (endowment)			1.711 (0.571)**	
Outgoing personal discussion to advice (creation)			1.089 (0.390)**	
Outgoing advice to personal discussion (endowment)			−0.801 (1.013)	
Outgoing advice to personal discussion (creation)			6.931 (3.584)	
Trust ego × outgoing personal discussion to advice (endowment)			−0.007 (0.169)	
Trust ego × outgoing personal discussion to advice (creation)			0.239 (0.155)	
Trust ego × outgoing advice to personal discussion (endowment)			0.277 (0.313)	
Trust ego × outgoing advice to personal discussion (creation)			−0.681 (0.651)	

****p < .001, **p < .01, *p < .05; Standard errors are presented in parentheses; GWESP = geometrically weighted edgewise shared partners; Overall maximum convergence ratios = 0.09 (uniplex advice network), 0.13 (uniplex personal discussion network), and 0.24 (multiplex advice and personal discussion networks). Complete results including other variables are available in Supplementary Material.*

trust × transitive closure, and cross-network effects of generalized trust) in the advice and personal discussion networks, respectively. The result was significant in the advice network (χ^2 [8] = 63.1, $p < 0.001$), but not in the personal discussion network (χ^2 [8] = 5.59, $p = 0.69$), suggesting that the dynamics of the former network substantially depend on generalized trust.

Goodness of Fit

The goodness-of-fit statistics for the multiplex analysis were reported in **Supplementary Figures 3, 4** separately for the advice and personal discussion networks. Overall, the model fit well to the data, ps > 0.10, indicating non-significance of the Mahalanobis distance between the observed and the simulated data, except for the outdegree distribution in the personal discussion network ($p < 0.05$). Although the finding is not precise enough to ensure the equality of the outdegree distributions between the simulated and observed data, the violin plots do not show a considerable discrepancy between the two. We therefore conclude that the current model is generally acceptable in that the network statistics simulated from the estimated model do not substantially deviate from those found in the observed data.

DISCUSSION

Based on the emancipation theory of trust, this study investigated the role of generalized trust in the social selection processes among first-year undergraduates. The multiplex analysis in SAOM revealed that individuals high in generalized trust tended to terminate existing ties, create new ties, and form open triads more in the advice network than in the personal discussion network. The findings provide empirical support for the initial predictions, positing that generalized trust is negatively related to the tendency for the maintenance of existing advice ties (Hypothesis 1), positively related to the tendency for the creation of outgoing advice ties (Hypothesis 2), and negatively related to the tendency for the formation of closed triads (Hypothesis 3), respectively. We also made a prediction at the cross-network level that individuals high in generalized trust tend to diminish the weight of personal discussion ties when creating advice-seeking ties in the same dyads (Hypothesis 4), but this was not supported. Homophily in generalized trust was not verified.

The multiplex analysis also yielded several unanticipated trust-related effects in the advice network. Individuals high in generalized trust were likely to receive more nominations from others than those low in generalized trust. They were also likely to form closed triads when the degree of local clustering was small (**Figure 3A**). Considering together with the findings mentioned above, individuals high in generalized trust may be not lone wolves who care little about groups and pursue only their own interests but great strategists who excel in networking. They use different networking strategies depending on the degree of local clustering. They do take account of being embedded in small clusters for seeking advice, but at the same time, they prefer not to take part in large clusters and try to expand their advice ties outside the boundary so that they can get access to valuable information. Their balanced positioning in the advice network would make them more resourceful and attract others.

Initially, trust-related effects were observed in both the advice and personal discussion networks in the uniplex analysis. To understand the logic behind the networking strategy of individuals high in generalized trust, we should first mention the indistinctiveness of the role of generalized trust in the advice and personal discussion networks in that analysis. This would be elucidated in terms of the ambiguity of relationship commitment

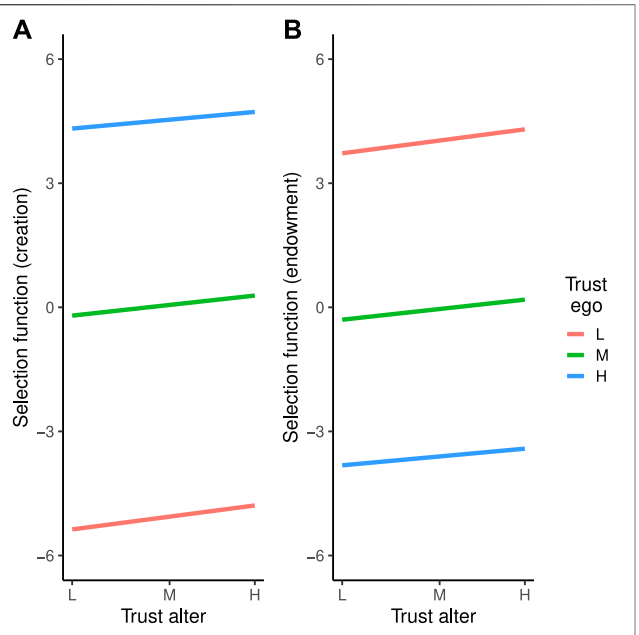

FIGURE 2 | Ego-alter selection plot for the effect of generalized trust on **(A)** the creation and **(B)** the endowment of advice ties for the model in **Table 2** [including Trust ego (creation or endowment), Trust alter, and Trust ego × alter]. The lines indicate social selection functions for three levels of ego's generalized trust [high (score = 26), medium (score = 19), and low (score = 11)] as a function of alter's generalized trust (on the *x*-axis).

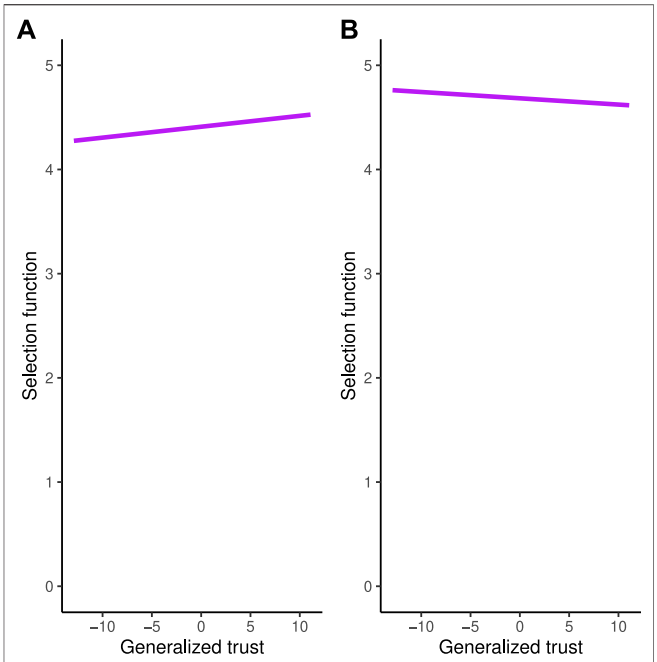

FIGURE 3 | Linear combination plots of the effect of generalized trust on the formation of transitive closure for advice seeking for the model in **Table 2** (including reciprocity, GWESP closure, GWESP closure × reciprocity, Trust ego × GWESP closure). **(A)** The degree of local clustering (the number of outgoing two-path) = 3. **(B)** The degree of local clustering = 8. GWESP = geometrically weighted edgewise shared partners. α = 0.69 in GWESP closure effects.

in the current research. This study used communication content (advice seeking and self-disclosure) to distinguish between low- and high-commitment relationships. However, the level of relationship commitment is determined not only by the context of communication but also by the duration of relationships. For example, a nation-level survey on the impact of generalized trust on social support exchange (Ishiguro and Okamoto, 2013) operationally defined the length of time a relationship was maintained as an index of relationship commitment and found that the longer the duration of relationships among non-kin, the larger the amount of social support provision for the relationships. In this study, most of the personal discussion ties would be developed and maintained only for a short term after matriculation. This propensity may weaken commitment to the ties for personal discussion and promote individuals high in generalized trust to create new ties in order to find better conversation partners in the network. If this were the only case, we could have argued the validity of the emancipation theory of trust in low commitment relationships.

However, when considering the findings of the multiplex analysis, the mechanism is more complicated than originally expected. Remember that the parameters of SAOM describe patterns of possible tie changes explicitly provided to each actor in a network. We found a tendency to have personal discussion ties to induce advice seeking in the same dyads in the multiplex analysis when the parameters of cross-network tie formation were included in the model. This means that resources for personal discussion become embedded in advice-seeking social circles through the dynamics of network evolution. The process is interpreted as backward relationship reinforcements after close ties are established.

In order to understand the findings of the multiplex analysis, it is helpful to reconceptualize tie multiplexity as a valid indicator of high-commitment relationships (Verbrugge, 1979; Burt, 1980; Kadushin, 2012) based on the strong convergent trend toward the tie overlap between the advice and personal discussion networks. It is natural for first-year undergraduates to be strongly incentivized to find safe haven in their new community through the construction of social ties connected in multiple ways. The prevalence of tie multiplexity would make actors in a network feel hesitant to cut and renew their existing advice ties due to psychological closeness built through the same ties. The lack of evidence in cross-network tie-formation effects triggered by generalized trust indicates that even individuals high in generalized trust value tie multiplexity once such relationships are established.

In this research, we measured generalized trust by Yamagishi's psychological scale. Some may think that an experimental approach, such as the trust game, is a better alternative with the attitudinal measure. However, a recent extensive review on the measurement of trust (Alos-Ferrer and Farolfi, 2019) points out the limitations of the trust game paradigm due to its confounding with prosocial and risk orientations and low stability. In other words, the abstract concept of generalized trust can be captured by various behavioral/survey indicators,

and no specific methodology covers all aspects of the intuitive notions of trust. There is also research reporting a risk-trust confound in the trust game (Chetty et al., 2020), so controlling risk aversion would be important to adjust the power of trust-related variables on the prediction of trust-related behavior.

The findings also provide significant implications for organizational management. In organizations with dynamic capabilities (Teece et al., 1997), establishing novel knowledge assets is essential to facilitate innovation for survival in an uncertain social world. Individuals high in generalized trust would play a key role in the process: they would get better access to valuable resources embedded in organizational contexts and become popular and advantageous among coworkers owing to their rational tie-formation and dissolution strategies to integrate and reconstruct the value of the resources. It would also be helpful if stakeholders understand the importance of social network dynamics driven by generalized trust to break the bonds of convention in established organizations.

The current research is the first to demonstrate the applicability of the emancipation theory of trust to the process of multiple network dynamics. Meanwhile, we could also point out several limitations in the current study. This study analyzed complete network data where the network boundary was set to a department of a university. However, such a specific focus on a network boundary excludes different groups and contexts and narrows the coverage of each actor's personal discussion activity. This may cause a potential lack in capturing the entire process of social selection. The personal/egocentric network approach allows respondents to nominate anyone who has direct connections with them both inside and outside a specific boundary of a reference group to which they mainly belong. Applying this method through snowball sampling makes it easy for researchers to manipulate social selection processes in consideration of the diversity of network composition across different social contexts. Future research should test the validity of the emancipation theory of trust from the personal/egocentric network perspective.

It is also important to emphasize that the emancipation theory of trust focuses on a de-personalized concept of generalized trust rather than a sociometric assessment of interpersonal trust (e.g., "Who do you trust?") that has been more common in the social network domain (Burt and Knez, 1996; Levin and Cross, 2004; Shakya et al., 2020). The former represents an actor's default expectation of trustworthiness of people in general based on positive belief and knowledge about humans, whereas the latter represents an actor's expectation of trustworthiness of particular others based on their positive attitudes and feelings toward the actor. Although interpersonal trust is beyond the scope of the current study, Yamagishi (2011) suggests that the process of social network formation based on interpersonal trust is the exact opposite of that based on generalized trust. Actors having many ties with interpersonal trust would have secure feelings with relational embeddedness, but these existing ties would also work like a ball and chain, preventing them from moving on to new ties that could offer better benefits. Therefore, it is predicted that actors having many ties based on interpersonal trust do not show a strong tendency to switch ties. More concretely, actors nominating a greater number of other particular actors as trustworthy might be less likely to create new ties and terminate existing ties and to hold open triads in their advice and personal discussion networks due to their preference for relational embeddedness in their existing social circle (also see Yosano and Hayashi, 2005 for more discussion). Future research should consider the dynamic interplay between dispositional (generalized) and sociocentric (interpersonal) trust in a framework of network evolution.

There is the fact that individuals high in generalized trust are not a majority in the overall population. A descriptive summary of the World Values Survey database 2010-2014 (World Values Survey Association, 2015) reports that the mean percentage of survey respondents who chose "Most people can be trusted" over "Need to be very careful" is only 24.5% (SD = 15.7) across 59 nations (N = 86,274), and 35.9% in Japan (N = 2,443). Given this, the opportunity for those low in generalized trust to increase their trustfulness through encounters with others high in generalized trust is limited. Future research should examine effective ways to establish benevolence across a whole social network.

DATA AVAILABILITY STATEMENT

The raw data supporting the conclusion of this article will be made available by the authors, without undue reservation.

ETHICS STATEMENT

The studies involving human participants were reviewed and approved by the Ethical Review Board of the Graduate School of Education and Human Development, Nagoya University. The patients/participants provided their written informed consent to participate in this study.

AUTHOR CONTRIBUTIONS

TI and TH designed and performed research; TI analyzed data; and TI and TH wrote the paper.

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SUPPLEMENTARY MATERIAL

The Supplementary Material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fcomm.2021.667082/full#supplementary-material

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Social Capital, Financial Literacy, and Rural Household Entrepreneurship: A Mediating Effect Analysis

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In rural areas, entrepreneurship helps lift households out of poverty by alleviating unemployment and increasing income, and financial literacy plays an important role in promoting entrepreneurship. Social capital is a resource embedded in social relationships, the boundaries of which have been expanded by the development of information communications technologies (ICTs). This article aims to link social capital, financial literacy, and rural entrepreneurship through a partial mediating effect analysis. Using data from the 2015 China Household Finance Survey (CHFS), we analyze how social capital affects rural entrepreneurship and the role of local ICTs development in this effect while also accounting for reverse causality. We construct a social capital indicator, mainly referring to bridging social capital, and two financial literacy indicators to make the conclusions robust. The empirical results show that social capital promotes rural entrepreneurship by sharing financial literacy. Furthermore, the spread of ICTs enhances this mediating effect. Our study provides empirical evidence for encouraging entrepreneurship and promoting knowledge sharing and implies the importance of ICTs in promoting entrepreneurship in rural areas.

Keywords: social capital, household entrepreneurship, financial literacy, mediating effect, information communications technologies, rural China

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INTRODUCTION

Rural areas are facing the challenges of slow development and population decline. Rural development is a vicious cycle in which a lack of a critical mass of services and infrastructure leads to a lower rate of business creation, and fewer job opportunities cause out-migration and aging (Paniagua, 2013; Pato and Teixeira, 2016). Consequently, more rural families are migrating to cities considering better public services and employment opportunities, which brings congestion, corruption and poverty to urban areas (Musemwa, 2010; Boohene and Agyapong, 2017). Rural entrepreneurship or self-employment (hereafter, entrepreneurship) has become part of the agenda of some governments and institutions (e.g., OECD, FAO, and UN) as an important factor in promoting rural development. Entrepreneurship refers to the conversion of existing opportunities to create future goods and services (Rindova et al., 2009). Rural entrepreneurship contributes to creating jobs and increasing income by enabling households to participate in income-generating activities (Kijima et al., 2006; Naminse and Zhuang, 2018). In this sense, ways of encouraging rural entrepreneurship have become an extremely important issue. The literature has found that households' financial knowledge is positively correlated with entrepreneurial activity. Financial knowledge is a measure of the ability to understand and use economic and financial information.

Delavande et al. (2008); Jappelli and Padula (2013), and Lusardi et al. (2017) argue that financial knowledge is a type of human capital and that it is one of the indicators of an individual's ability. A lack of financial knowledge makes it difficult to identify and understand information about returns, risks, and financial products and to process such information. This difficulty explains household financial decision-making behaviors such as asset allocation, retirement planning (Lusardi et al., 2017, 2018), and limited participation in the stock market (Van Rooij et al., 2011). The entrepreneurial behavior of households includes the stages of identifying entrepreneurial opportunities, integrating entrepreneurial resources and operating a business. Each of these stages requires a great deal of time and effort to search for information, analyze the collected information effectively and use it wisely to make entrepreneurial decisions. These steps inevitably involve financial issues. Therefore, entrepreneurs need to be financially literate, and financial literacy has a positive effect on business development (Garg and Singh, 2018; Abad-Segura and González-Zamar, 2019; Xu et al., 2020; Burchi et al., 2021). Improving rural households' financial literacy is an effective way to promote entrepreneurship.

Studies have shown a positive link between social capital and entrepreneurship, with social capital helping in developing entrepreneurial motivation, identifying business opportunities, and accessing entrepreneurial resources (Fuentes-Fuentes et al., 2015; Liu et al., 2019; Trigkas et al., 2020). Social capital is considered to be a resource embedded in social relationships (Lin, 2002). Land limits the relationships between households, especially in rural areas. Relationship-based social capital has important effects on rural household production, such as accelerated responses to climate change (Carter and Maluccio, 2003), the diffuse application of new technologies (Munasib and Jordan, 2011) and land management (Nath et al., 2010). Social capital also helps individuals find a job (Ge and Wu, 2020), increase their income (Yuan, 2016) and enhance life satisfaction (Lim and Putnam, 2010). In rural areas where physical and human capital are relatively scarce, social capital becomes an important resource for rural households. Additionally, social capital is an important channel through which rural families share knowledge (Kadushin, 2012; Martini et al., 2017). However, few studies have attempted to link social capital, financial literacy, and rural entrepreneurship. Furthermore, the usage of information communications technologies (ICTs) changes the way people communicate and may affect the role of social capital. ICTs shorten the distance between people, and this compressed world facilitates the flow of people, capital, and culture (Burnett and Marshall, 2003). In rural areas in particular, remote locations and inconvenient transportation hinder people's interactions. Using ICTs, individuals can communicate remotely and online, which greatly contributes to the creation of new social networks. However, ICT-based connections lack social trust (Townsend et al., 2016). The impact of ICTs on social capital has not been well understood. This article attempts to explore how rural households use social capital with the support of ICTs.

Social capital is an important resource for rural households, and how rural households use social capital to start their own businesses has been a hot topic in current research (Evansluong and Ramírez-Pasillas, 2019; Liu et al., 2019; Trigkas et al., 2020). Different from them, we focus on the impact of social capital on rural entrepreneurship and introduce financial literacy into the mechanism study. We construct a social capital indicator that is mainly based on bridging social capital, which provides more advantages in terms of access to information. We also construct a financial literacy indicator based on households' answers to financial questions. We then evaluate how social capital affects entrepreneurship and the partial mediating effect of financial literacy on this relationship. We find that social capital promotes rural entrepreneurship by sharing financial literacy. Furthermore, by dividing the level of ICTs adoption across regions, we also find that ICTs enhance this mediating effect.

Endogeneity issues may occur and lead to biased results when entrepreneurship inversely affects household social capital. We thus adopt the average social capital of households in the same community as an instrumental variable because entrepreneurship does not affect the social capital of other households in the community. Our result is robust after considering reverse causality.

This paper contributes to the existing literature in two ways. First, our study enriches the literature about the impact of social capital on rural entrepreneurship. Previous studies in this field have mainly focused on addressing households' liquidity constraints (Cai et al., 2018; Sun et al., 2018) and the identification of entrepreneurial opportunities (Shu et al., 2018; Evansluong and Ramírez-Pasillas, 2019), while this paper finds that social capital promotes entrepreneurship through sharing financial literacy from the perspective of knowledge sharing. This explanation has important implications for understanding rural knowledge-sharing mechanisms and achieving sustainable development in rural areas. Second, we extend the impact of ICTs on social capital to rural entrepreneurship. Previous literature has found that ICTs enrich social capital networks, which makes it easier for people to access information in social networks (Townsend et al., 2016; He and Li, 2019). In this paper, we apply this positive effect to encourage rural entrepreneurship. This implies the important role of ICTs in promoting entrepreneurship in rural areas.

THEORETICAL BACKGROUND AND HYPOTHESIS DEVELOPMENT

Social Capital and Rural Entrepreneurship

Social capital is a sociological concept that refers to "social networks, trust and norms that can improve economic efficiency through coordinated action" (Putnam and Leonardi, 1994). In a traditionally relational society (Bian, 1997), social capital has been pivotal in determining the socioeconomic status of households. Social capital is considered to be one of the most important factors influencing household economic activity, as it can share risks, smooth consumption, promote employment, and reduce income inequality (Grootaert, 1999; Munshi and Rosenzweig, 2006, 2009; Kinnan and Townsend, 2012). In rural areas, widespread social capital is an important resource

for entrepreneurs. For private enterprises, the social capital formed through political relations helps enterprises obtain policy resources, such as a larger proportion of government subsidies or entry into a regulated industry. Despite comprehensive economic reforms and the establishment of a modern market economy, doing business still requires business connections (Putnam and Leonardi, 1994). The positive role of social networks in household entrepreneurship has been discussed by most of the literature.

The literature has argued that social capital promotes rural entrepreneurship through financial availability and information accessibility. When private enterprises are in the earliest stages of existence, it is difficult for them to obtain support from formal institutions, while informal culture and tradition are particularly important (Xin and Pearce, 1994; Casson and Giusta, 2007) because rural households lack collateral, which reduces the possibility of rural household loans (Ahlstrom and Bruton, 2010; Schmalz et al., 2017; Sadeghloo et al., 2018). Rural households rely more on private financing (Jia et al., 2013; Hu and Zhang, 2014). Social networks can effectively alleviate information asymmetry in the financial market (Ghatak, 1999; Karlan, 2007). Because the members of social networks are often linked based on blood, geography and kinship ties, and the cost of supervision is low. Borrowers with higher risk can be easily identified and excluded from the private lending market (Karlan, 2007; Sun et al., 2018). Social networks can also act as an implicit guarantee mechanism so that defaulters suffer reputational damage, thus greatly reducing the likelihood of default in the private lending market (Karlan and Morduch, 2010).

In addition to financing channels, social capital can also influence entrepreneurship through information channels. An important part of the process of identifying entrepreneurial opportunities is the process of acquiring and screening entrepreneurial information. Based on this information, potential entrepreneurs need to measure benefits and costs in advance. Hence, the ability to access market information is a necessary skill for entrepreneurs (Simon et al., 2000). Social capital helps entrepreneurs broaden their information sources and improve the quality, accuracy, and timeliness of the information obtained (Coleman, 1988; Lin, 2002; Uzzi and Gillespie, 2002). Daily communication maintains the social relationships of independent individuals in social networks and provides entrepreneurial information resources (Evansluong and Ramírez-Pasillas, 2019). When potential entrepreneurs deliberately seek entrepreneurial opportunities, social capital can also help reduce search costs because it entails corresponding reciprocity and obligation (Granovetter, 2005).

TABLE 1 | Composition of the social capital.

Variable	Definition
Communication expenditure	The average monthly expenditure on mobile phones, telephones and other communications used by the household members last year
Transportation expenditure	The average monthly local transportation expenditure for the family last year
Dining expenditure	The average monthly expenditure on dining out last year
Entertainment expenditure	The average monthly expenditure on TV, the Internet, and other entertainment-related activities last year
Gift expenditure	Transfers to non-family members last year, including spending on holidays and at weddings and funerals

TABLE 2 | Questions in the 2015 CHFS related to financial literacy.

Given a 4% interest rate, how much would you have in total after one year if you have 100 yuan deposited?
1. Under 104
2. 104
3. Over 104
4. I cannot figure it out
With an interest rate of 5% and an inflation rate of 3%, the stuff you buy with the money you have saved in the bank for 1 year is:
1. More than last year
2. The same as last year
3. Less than last year
4. I cannot figure it out
Which one do you think is riskier, stock or a fund?
1. Stock
2. A fund
3. I haven't heard about stock
4. I haven't heard about funds
5. I haven't heard about either stock or funds

Social Capital and Financial Literacy

From the perspective of network strength, social networks play a role in sharing knowledge. Strong ties can bring more high-quality information. Long-term and stable relationships can greatly reduce the cost of information acquisition, but individuals obtain convergent information from strong ties. With the establishment and development of enterprises, weak ties help entrepreneurs access specific knowledge and necessary information that is not available in closed social networks. And weak ties provide opportunities to communicate with people with relevant knowledge, and mutual trust promotes the correct interpretation of others'

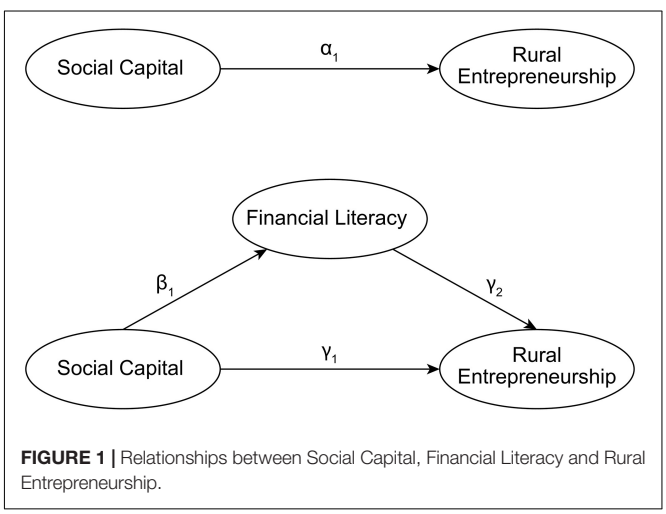

FIGURE 1 | Relationships between Social Capital, Financial Literacy and Rural Entrepreneurship.

knowledge (Akhavan and Hosseini, 2016; Ganguly et al., 2019). Especially when enterprises enter the early stage of development, weak ties act as a bridge between different groups and promote the flow of information. Personal social networks can provide access to knowledge that is not currently available (Arenius and De Clercq, 2005).

As special knowledge, financial literacy has a positive impact on entrepreneurship (Rugimbana and Oseifuah, 2010; Wise, 2013; Abubakar, 2015; Calcagno et al., 2020). Social capital can affect household financial literacy in two ways. First, the "peer effect" exists in social networks. Intervention and reinforcement from friends can lead to the development of appropriate behavioral habits (Gioia, 2017). Individuals usually imitate and learn from the behavior of other individuals in the social network, and the larger the social network in which the family is located, the more financial information it receives passively and actively, and the greater the probability of learning to acquire financial knowledge. For example, social networks influence investors' motivation to learn financial knowledge and their willingness to invest (Xia et al., 2014). Second, the "Matthew effect" exists in social networks. When financial events occur, households will actively learn from the logic and analytical skills of financially literate individuals in social networks to form their own opinions (Gao et al., 2019). These findings lead to the following hypotheses:

Hypothesis 1: Social capital promotes entrepreneurship by sharing financial literacy in rural areas.

TABLE 3 | Variable definitions, 2015 CHFS data.

Variable	Definition
Dependent variable	
Entrepreneurship	A dummy variable equal to one if any family member chose to be an entrepreneur and zero otherwise
Financial literacy score	The number of financial literacy questions that the respondents answered correctly
Financial literacy index	The financial literacy index that we construct
Variable of interest	
Social capital	The sum of expenditures on developing relationships (one thousand Yuan)
Community social capital	The average social capital of the community except the focal household
Control variables	
Individual characteristics	
Gender	A dummy variable equal to one if the household head is male and zero otherwise
Age	The age of the household head
Age^2	Age squared
Education	The number of years of schooling of the household head
Married	A dummy variable equal to one if the household head is married and zero otherwise
Residence	A dummy variable equal to one if the household head holds local hukou and zero otherwise; hukou is the residence registration system related to individuals' social status, and under the hukou system, rural residents have limited access to numerous types of public welfare goods and services
Servant	A dummy variable equal to one if the household head or the spouse is a servant and zero otherwise
Risk appetite	The risk preference of the household head equal to five if the household head prefers projects with low risk and low returns and equal to one if the household head prefers projects with high risk and high returns; based on the question "Which of the options below do you want to invest in the most if you have adequate money?"
Household characteristics	
Asset	Household net assets per capita last year (one thousand Yuan)
Income	Household net income per capita last year (one thousand Yuan)
Family Size	The number of family members
Seniors	The number of seniors (>60 years old) in the family
Kids	The number of kids (<12 years old) in the family
Provincial characteristics	
ICTs adoption	Proportion of Internet users to total population in the province

Effect of ICTs on Social Capital

Information communications technologies provide new ways to develop social capital by removing the time and space barriers to communication (Galloway and Mochrie, 2005; Hansson et al., 2007; Wallace, 2012). Individuals are limited by geographic location and transportation in rural areas, and social networks face the barrier of distance, which limits individuals' ability to access information through social capital. Individuals use digital technologies to bridge time and distance through phone, e-mail and websites. Although some studies have argued that ICTs are not as effective as face-to-face communication, individuals are still able to establish initial relationships through ICTs and then take the next step to off-line communication (Kujath, 2011). Some studies found low levels of ICTs adoption in rural areas, considering the cost of time needed to change habits and learn skills (Warren, 2007; Townsend et al., 2013). As ICTs become more widespread, individuals will enjoy the benefits. ICTs provide social media to encourage entrepreneurs to interact and thereby broaden their social networks (He and Li, 2019; Yin et al., 2019). Thus, ICTs enrich social networks and enhance the ability of social capital to provide information. These findings lead to the following hypothesis:

Hypothesis 2: The mediating effect of social capital promoting rural entrepreneurship through financial literacy is stronger in regions with higher levels of ICTs adoption.

MATERIALS AND METHODS

Sample and Data Collection

The data come from the China Household Finance Survey (CHFS) conducted in 2015. This survey was developed by Southwestern University of Finance and Economics to create a database to investigate the financial behavior of Chinese households. The survey targeted 37,263 households in 29 provinces excluding Tibet, Xinjiang, Hong Kong, Macao and Taiwan. The data were collected from 29 provinces, 353 cities/counties, and 1,373 villages in all areas of China in 2015.

The sampling was performed according to the principle of uniform sample selection in three stages and using the probability proportional to size (PPS) sampling method. The primary units of interest were 2,585 cities/counties in China (excluding Tibet, Xinjiang, Inner Mongolia and Hong Kong and Macao). The first stage was to select 353 cities/counties from 2,585 cities/counties in China following the principle of uniform geographical distribution and uniform economic development. The second stage was to randomly select the neighborhood committee/village committee from the city/county directly. Finally, households that were interviewed were randomly selected from the list of residents of a given neighborhood committee/village committee. The head of the household, as the respondent, was asked to answer a questionnaire including items related to demographic characteristics, assets and liabilities, insurance and social security, household expenditures and income, and views on family, marriage, and community governance. The head of the household is the owner of the property of the house and is the family member who knows the most about the household's financial situation. The sample was divided into urban and rural areas according to administrative regions. We only use observations in rural areas, so the final sample consisted of 11,654 households. In addition, the ICTs adoption data come from the 2014 industrialization and informatization development level assessment report released by China's Ministry of Industry and Information Technology.

Variables and Measures

Social Capital

The main variable is the social capital held by a family. Previous studies give us guidelines on selecting variables to construct the social capital index. Social capital can be divided into bonding capital and bridging capital (Woolcock, 1998). Bonding capital refers to resources contained in small groups between blood relations, neighbors, and close friends. It emphasizes obligatory relationships and may lead to the exclusion of wider relationships. Bridging social capital refers to resources contained in wider groups and is not limited by geographic location. The difference between bonding capital and bridging capital is similar to that between strong ties and weak ties. Bonding social capital and bridging social capital may not be mutually exclusive but instead simply two aspects of social capital (Anderson and Jack, 2002; Phillipson et al., 2006). The social capital indicator we constructed refers to bridging capital, which offers advantages over bonding capital in accessing information (Coleman, 1988). Households obtain bridging social capital by creating and maintaining new relationships. Developing relationships requires a certain amount of expenditure, which can be seen as a cost or an investment in relationships. A common method of developing and maintaining relationships is to give gifts or to host recreational activities (Hwang, 1987). Different relationship bases correspond to different principles of interaction. An unconditional protective relationship between individuals with close kinship ties is provided without reciprocity. However, individuals in long-distance relationships usually consider the costs and expected rewards when offering help (Farh et al., 1998). Thus, we considered five household expenditure variables: expenditures on communication, transportation, dining, entertainment and gifts. The definitions of the selected variables are shown in **Table 1**. We choose the sum of these expenditures as a proxy for social capital.

Financial Literacy

The 2015 CHFS asked respondents three questions about interest rates, inflation, and risk awareness (see **Table 2**). We construct two measures of financial literacy. First, a financial literacy score is generated based on the number of questions that the respondents answered correctly. Second, we consider wrong answers and indirect answers (such as "I do not know" or "I cannot figure it out") to represent different levels of financial literacy. Therefore, we construct two binary variables for each question. The first binary variable indicates whether the question was answered directly. The second binary variable indicates whether the question was answered correctly. As a result, we generate six binary variables. Following Van Rooij et al. (2011), we use principal component analysis to construct the financial literacy index.

Entrepreneurship

The dependent variable is household entrepreneurship. It is a dummy variable equal to 1 if any family member chose to be an entrepreneur. We defined this variable using the head of the household responses to the question "Is your family engaged in production and operation of industry and commerce, including individual business, leasing, transportation, online stores, and enterprises?" The dependent variable is equal to 1 if the respondent answered "Yes" and 0 otherwise if the respondent answered "No." In this paper, we focus on non-farm entrepreneurship.

TABLE 4 | Descriptive statistics of the variables.

Variable	Obs	Mean	S.D.	Max	Min
Entrepreneurship	11,654	0.108	0.31	1	0
Financial literacy score	11,654	0.545	0.757	3	0
Financial literacy index	11,654	−0.491	0.855	1.326	−1.282
Social capital	11,654	2.759	4.303	120.85	0
Community social capital	11,654	2.779	1.787	15.068	0.106
Gender	11,654	0.619	0.486	1	0
Age	11,654	54.128	13.59	83	19
Age^2	11,654	3,114.561	1,451.706	6,889	361
Education	11,654	6.709	3.701	16	0
Married	11,654	0.955	0.207	1	0
Residence	11,654	0.987	0.111	1	0
Servant	11,654	0.007	0.084	1	0
Risk appetite	11,654	4.313	1.057	5	1
Asset	11,654	205.92	335.833	2,166.417	−49.29
Income	11,654	26.031	38.517	212.953	−7.077
Family size	11,654	1.819	1.521	7	1
Seniors	11,654	0.834	0.864	3	0
Kids	11,654	0.498	0.774	3	0
ICTs adoption	29	62.874	10.193	85.21	49.24

TABLE 5 | Correlation coefficient matrix of the variables.

	Entrepreneurship	Financial literacy score	Financial literacy index	Social Capital	Community Capital	Gender	Age	Age^2	Education	Married	Residence	Servant	Risk Appetite	Asset	Income	Family Size	Seniors	Kids	ICTs adoption
Entrepreneurship	1.00																		
Financial literacy score	0.09*	1.00																	
Financial literacy index	0.12*	0.81*	1.00																
Social capital	0.15*	0.18*	0.21*	1.00															
Community social capital	0.07*	0.24*	0.30*	0.28*	1.000														
Gender	0.01*	0.02*	0.01*	0.00	−0.06*	1.00													
Age	−0.20*	−0.29*	−0.31*	−0.13*	−0.10*	0.06*	1.00												
Age^2	−0.20*	−0.27*	−0.30*	−0.13*	−0.09*	0.06*	0.98*	1.00											
Education	0.08*	0.45*	0.53*	0.23*	0.31*	0.07*	−0.39*	−0.37*	1.00										
Married	−0.02*	−0.11*	−0.12*	0.00	−0.06*	−0.04*	0.31*	0.26*	−0.17*	1.00									
Residence	−0.11*	−0.12*	−0.14*	−0.09*	−0.20*	0.01*	0.23*	0.21*	−0.15*	0.13*	1.00								
Servant	−0.01*	0.08*	0.09*	0.07*	0.08*	−0.02*	−0.05*	−0.05*	0.15*	0.00	0.00	1.00							
Risk appetite	−0.12*	−0.29*	−0.30*	−0.15*	−0.12*	−0.08*	0.34*	0.32*	−0.28*	0.16*	0.11*	−0.06*	1.00						
Asset	0.15*	0.23*	0.27*	0.28*	0.28*	−0.00	−0.04*	−0.03*	0.28*	−0.01*	−0.03*	0.07*	−0.15*	1.00					
Income	0.15*	0.25*	0.28*	0.29*	0.21*	0.01*	−0.13*	−0.13*	0.31*	−0.01*	−0.07*	0.10*	−0.19*	0.56*	1.00				
Family size	0.07*	0.01*	0.01	0.06*	0.08*	0.02*	−0.10*	−0.11*	0.02*	0.05*	−0.06*	0.00	−0.03*	−0.19*	−0.23*	1.00			
Seniors	−0.12*	−0.14*	−0.16*	−0.10*	−0.10*	0.08*	0.56*	0.59*	−0.22*	0.12*	0.14*	−0.06*	0.18*	−0.00	−0.06*	−0.03*	1.00		
Kids	0.10*	−0.00	−0.02*	0.01*	−0.06*	−0.00	−0.21*	−0.21*	−0.03*	0.13*	−0.02*	−0.01*	−0.06*	−0.03*	0.01*	0.19*	−0.07*	1.00	
ICTs adoption	0.01*	−0.05*	−0.07*	−0.00	−0.02*	0.01	0.02*	0.01*	−0.07*	0.00	0.01	0.01*	0.00	−0.03*	−0.00	−0.07*	0.01*	0.05*	1.00

*$p < 0.01$.

Method of Analysis

To identify the mediating effect of financial literacy on the influence of social capital on household entrepreneurship, we follow the approach from Taylor et al. (2008). First, to identify the relationship between social capital and entrepreneurship, the model is specified as in Equation (1). Second, we identify the relationship between social capital and financial literacy, and the model is specified as in Equation (2). Third, we add financial literacy as an explanatory variable to Equation (1), and the model is specified as in Equation (3). We use a probit model for estimation when the dependent variable is entrepreneurship, an ordered probit model when the dependent variable is the financial literacy score and an ordinary least squares (OLS) model when the dependent variable is the financial literacy index. To alleviate heteroscedasticity, we use White robust standard deviation estimation. If social capital contributes to rural entrepreneurship, then $\alpha_1 = 0$; if Hypothesis 1 holds, then $\beta_1 = 0$ and $\gamma_2 = 0$. If $\gamma_1 = 0$, then we verify a partial mediating effect. The relationships of the main variables verified by our model are shown in **Figure 1**. The model is specified as follows:

$$P\left(Etrepreneurship = 1\right) = \Phi\left(\alpha_0 + \alpha_1 Social\ Cpital + \alpha_2 Control + FE + \mu_1\right) \quad (1)$$

$$Financial\ Literacy = \beta_0 + \beta_1 Social\ Capital + \beta_2 Control + FE + \mu_2 \quad (2)$$

$$P\left(Entrepreneurship = 1\right) = \Phi(\gamma_0 + \gamma_1 SocialCapital + \gamma_2 Financial\ Literacy + \gamma_3 Control + FE + \mu_3) \quad (3)$$

Where, *Control* represents a vector of characteristics of the head of household and characteristics of the household. The characteristics of the head of household include gender, age, educational level, marital status and risk appetite. The characteristics of the household include family size, the number of seniors and kids in the family, a servant dummy, household net assets, and household net income. In addition, we control for provincial fixed effects to capture factors such as local policy and social conventions. The definitions of the variables are shown in **Table 3**. It is necessary to clarify that we focus on household entrepreneurship rather than individual entrepreneurship because entrepreneurial decisions are often household decisions and that the core variable social capital is the household's social capital rather than the individual's social capital. The personal characteristics in the control variables refer to the personal characteristics of the head of the household (the respondent).

We test the assumptions that the model depends on. First, the sample is randomly selected. The sampling is performed according to the principle of uniform sample selection and using the probability proportional to size (PPS) sampling method. Second, we check for normal distribution. These statistics are found to be in the acceptable range. Third, we use robust standard errors in our estimation to control the heteroscedasticity. Fourth, we calculate the correlation coefficients to assure that there is no

TABLE 6 | Comparison of the variables between different groups.

Variable	Entrepreneurship = 1		Entrepreneurship = 0		
	Mean	S.D.	Mean	S.D.	T-statistics
Financial literacy score	0.78	0.837	0.517	0.742	11.7***
Financial literacy index	−0.158	0.897	−0.531	0.841	14.75***
Social Capital	4.895	6.906	2.501	3.792	18.9***
Community social capital	3.162	2.001	2.733	1.754	8.05***
Gender	0.647	0.478	0.615	0.487	2.2**
Age	49.25	12.55	54.717	13.593	−13.55***
Age^2	2,582.99	1,262.92	3,178.65	1,459.86	−13.85***
Education	7.962	3.342	6.558	3.713	12.8***
Married	0.959	0.199	0.955	0.208	0.6
Residence	0.978	0.145	0.989	0.106	−3.05***
Servant	0.01	0.101	0.007	0.081	1.5
Risk Appetite	4.061	1.194	4.343	1.035	−8.95***
Asset	500.726	595.625	170.373	268.129	34.55***
Income	48.304	57.683	23.346	34.562	22.15***
Family Size	2.103	1.809	1.785	1.479	7***
Seniors	0.668	0.842	0.853	0.864	−7.2***
Kids	0.629	0.814	0.482	0.768	6.4***
ICTs adoption	63.371	9.794	62.814	10.239	1.85*
Observations	1,254		10,400		

$^{***}p < 0.01$; $^{**}p < 0.05$; and $^{*}p < 0.1$.

serious multicollinearity. Overall, the results based on the data and models used in the study are robust.

Based on the regression results, we can calculate the values, standard deviations and 95% confidence intervals of the mediating effects as follows:

$$Mediating\ Effect = \beta_1\gamma_2 \tag{4}$$

$$S_{ME} = \sqrt{\beta_1^2 S_{\gamma_2}^2 + \gamma_2^2 S_{\beta_1}^2} \tag{5}$$

$$95\%CI = \beta_1\gamma_2 \pm 1.96 S_{ME} \tag{6}$$

When we divide the sample into different groups, we can compare the mediating effects.

The model setting may face endogeneity issues from two sources. The first is omitted variables. Families with more social capital may have some inherent qualities, such as the characteristics of successful people. In addition to family characteristics, regional culture cannot be ignored. However, these variables are very hard to quantify. We consider the problem of omitted variables when we select the independent variables. Thus, we add more control variables (Xiao and Wu, 2020). The cost is that there are some invalid regression variables that will make the variance of the estimated coefficients larger. The second source of endogeneity is reverse causality, which implies that entrepreneurship affects family social relationships in turn. To address this endogeneity issue, we use the average social capital of households in the same community (586 communities in rural areas) except the focal household as an instrumental variable. The community is the most basic unit of residence in China. A community is a neighborhood with clearly distinguishable psychological, economic, and geographical boundaries. The average social capital of the community can be used as an instrumental variable of households' social capital for three reasons. First, a community has clear geographical boundaries. The lives of family members are linked to various social structures and are defined by the community in time and space. The social activities between families in a certain space are interactive (Lin, 2002). Second, the community is currently the most densely populated carrier of various grassroots organizations (e.g., homeowners' committees, residents' recreational organizations). Frequent interactions and close relationships among households are usually formed in the community. Third, households have a strong psychological identification with the regional unit, forming a collective identity and even prompting collective actions. We then use two-stage least squares (2SLS) regression to alleviate endogeneity.

Descriptive Statistics

As shown in **Table 4**, the proportion of entrepreneurship among rural households is 10.8%. The average financial literacy score is 0.545, and the average financial literacy index is −0.491. We explain the economic meaning of the financial literacy index as follows. Respondents do not know how to calculate interest rate. Only 35% of respondents know about interest rate and only 16% are correct. Respondents also fail to understand inflation. Only 39% of respondents know about inflation and the proportion of correct answers is lower (13%). Similarly, respondents display difficulty in grasping the concept of risk awareness. Less than 30% of them heard about stock and funds and only 27% know the difference between stock and funds. The mean value of social capital indicates that the household spends an average of 27,590

TABLE 7 | Estimation of the effect of social capital on entrepreneurship and financial literacy.

Dependent Variable	(1) Entrepreneurship	(2) Financial literacy score	(3) Financial literacy index	(4) Entrepreneurship	(5) Entrepreneurship
Social capital	0.023***	0.008***	0.012***	0.022***	0.022***
	(0.004)	(0.002)	(0.002)	(0.004)	(0.004)
Financial literacy score				0.060***	
				(0.023)	
Financial literacy index					0.088***
					(0.022)
Gender	−0.013	0.056***	0.078***	−0.016	−0.019
	(0.037)	(0.014)	(0.015)	(0.037)	(0.037)
Age	0.008	−0.015***	−0.015***	0.009	0.009
	(0.008)	(0.003)	(0.003)	(0.008)	(0.008)
Age^2	−0.000**	0.000**	0.000	−0.000**	−0.000**
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Education	0.021***	0.038***	0.051***	0.018***	0.015***
	(0.005)	(0.002)	(0.002)	(0.005)	(0.005)
Married	0.111	0.005	−0.001	0.110	0.110
	(0.092)	(0.034)	(0.037)	(0.092)	(0.092)
Residence	−0.192	0.035	0.040	−0.191	−0.194
	(0.128)	(0.060)	(0.061)	(0.128)	(0.128)
Servant	−0.173	0.025	0.181*	−0.173	−0.186
	(0.206)	(0.081)	(0.095)	(0.206)	(0.207)
Risk appetite	−0.029*	−0.099***	−0.124***	−0.023	−0.017
	(0.016)	(0.007)	(0.007)	(0.016)	(0.016)
Asset	0.001***	0.000***	0.000***	0.001***	0.001***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Income	0.003***	0.001***	0.001***	0.003***	0.003***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Family size	0.126***	0.018***	0.015***	0.125***	0.125***
	(0.011)	(0.005)	(0.005)	(0.011)	(0.011)
Seniors	0.018	0.007	0.021**	0.017	0.015
	(0.024)	(0.009)	(0.010)	(0.024)	(0.024)
Kids	0.020	−0.006	−0.022**	0.020	0.022
	(0.023)	(0.009)	(0.009)	(0.023)	(0.023)
Province fixed effect	YES	YES	YES	YES	YES
Observations	11,654	11,654	11,654	11,654	11,654
Pseudo/R-squared	0.160	0.167	0.241	0.161	0.163

*Estimated marginal effects are reported. Standard errors are in parentheses. ***p < 0.01; **p < 0.05; and *p < 0.1.*

CNY on developing relationships. The sample shows that 61.9% of household heads are male, and most of them have a primary educational level. In rural areas, 95.5% of household heads are married, and they are extremely risk averse. The average net asset is 205,920 CNY, and the average net income is 26,031 CNY.

RESULTS AND DISCUSSION

We provide the correlation coefficient matrix of the variables in **Table 5** as a preliminary analysis. The results show that there is a significant positive correlation between the core variables social capital, financial literacy and entrepreneurship, which implies that further regression analysis is necessary. The correlation coefficient between the financial literacy score and the financial literacy index is 0.81 and significant at the 1% level. This indicates that each one can be used as a robustness test. Social capital and community social capital are significantly and positively correlated, indicating that the instrumental variable is valid.

Table 6 shows the results of comparing the variables between groups. Entrepreneurs have significantly higher levels of financial literacy than non-entrepreneurs (0.78 vs. 0.51), which indicates the important role of financial literacy in entrepreneurship. The mean value of social capital differs significantly between entrepreneurs and non-entrepreneurs. Entrepreneurs have significantly more social capital than non-entrepreneurs (4.895 vs. 2.501). After merging ICTs adoption data with household data, we find that provinces with higher ICTs adoption rates are more conducive to entrepreneurship (63.371 vs. 62.814).

Regarding other control variables, entrepreneurs are more likely to be male and younger than non-entrepreneurs. In

TABLE 8 | IV estimation of the effect of social capital on entrepreneurship and financial literacy.

Dependent variable	(1) Entrepreneurship	(2) Financial literacy score	(3) Financial literacy index	(4) Entrepreneurship	(5) Entrepreneurship	(6) First-stage social capital
Social capital	0.054**	0.033***	0.059***	0.053**	0.050**	
	(0.025)	(0.011)	(0.012)	(0.025)	(0.025)	
Financial literacy score				0.052**		
				(0.024)		
Financial literacy index					0.078***	
					(0.024)	
Gender	−0.008	0.059***	0.084***	−0.012	−0.015	−0.075
	(0.037)	(0.014)	(0.016)	(0.037)	(0.037)	(0.079)
Age	0.006	−0.017***	−0.018***	0.007	0.007	0.070***
	(0.009)	(0.003)	(0.004)	(0.009)	(0.009)	(0.014)
Age^2	−0.000*	0.000***	0.000**	−0.000*	−0.000*	−0.001***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Education	0.018***	0.036***	0.047***	0.016***	0.014**	0.079***
	(0.006)	(0.002)	(0.002)	(0.006)	(0.006)	(0.011)
Married	0.085	−0.014	−0.038	0.084	0.087	0.780***
	(0.093)	(0.035)	(0.038)	(0.093)	(0.094)	(0.137)
Residence	−0.192	0.034	0.037	−0.192	−0.194	0.070
	(0.127)	(0.060)	(0.063)	(0.127)	(0.128)	(0.306)
Servant	−0.215	−0.007	0.120	−0.214	−0.222	1.238
	(0.215)	(0.085)	(0.108)	(0.215)	(0.215)	(0.949)
Risk appetite	−0.023	−0.095***	−0.116***	−0.018	−0.013	−0.170***
	(0.016)	(0.007)	(0.008)	(0.016)	(0.016)	(0.041)
Asset	0.001***	0.000***	0.000***	0.001***	0.001***	0.002***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Income	0.003***	0.000	0.000*	0.003***	0.003***	0.013***
	(0.001)	(0.000)	(0.000)	(0.001)	(0.001)	(0.002)
Family size	0.113***	0.009	−0.003	0.113***	0.114***	0.329***
	(0.016)	(0.006)	(0.007)	(0.016)	(0.016)	(0.028)
Seniors	0.027	0.014	0.034***	0.026	0.024	−0.220***
	(0.024)	(0.009)	(0.010)	(0.024)	(0.024)	(0.046)
Kids	0.025	−0.002	−0.015	0.025	0.026	−0.111**
	(0.023)	(0.009)	(0.010)	(0.023)	(0.023)	(0.048)
Community social capital						0.441***
						(0.035)
Province fixed effect	YES	YES	YES	YES	YES	YES
Observations	11,654	11,654	11,654	11,654	11,654	11,654
Pseudo/R-squared	0.156	0.166	0.240	0.107	0.109	0.180

*Estimated marginal effects are reported. Standard errors are in parentheses. ***p < 0.01, **p < 0.05, and *p < 0.1.*

addition, entrepreneurs are more educated (7.962 vs. 6.588 years), and they prefer to take more risk (4.061 vs. 4.343), suggesting that entrepreneurship is risky and requires knowledge. Entrepreneurs are significantly wealthier than non-entrepreneurs.

Table 7 shows the estimation results of the relationships between social capital, financial literacy and entrepreneurship. The first part of the table (column 1) refers to the results of the effect of social capital on entrepreneurship. The second part of the table (columns 2–3) refers to the results of the effect of social capital on financial literacy. Finally, the third part of the table (columns 4–5) refers to the results of the partial mediating effect of financial literacy. The regression results show that the effect of social capital on entrepreneurship is significantly positive. Similarly, social capital significantly affects financial literacy. Furthermore, after adding financial literacy to the regression, we find a partial mediating effect: social capital promotes household entrepreneurship through sharing financial literacy. Therefore, Hypothesis 1 holds.

We interpret the results as follows. Due to the scarcity of human capital and the immature market mechanism in rural areas, households pay more attention to the role of social relationships. Social networks among friends play a significant role in entrepreneurship, serving as an informal information source. By increasing expenditures on developing relationships, rural households interact more frequently with individuals in their social networks. They learn knowledge about entrepreneurship, such as financial knowledge, through increased social interactions. Thus, social capital becomes an important way to share the financial knowledge needed to start a business.

Regarding the control variables, households with a higher level of education are more likely to become entrepreneurs. Entrepreneurship is a creative activity and entails various

TABLE 9 | Mediating effects at different levels of ICTs adoption.

Variable	Financial literacy score			Financial literacy index		
	Value	S.D.	95% CI	Value	S.D.	95% CI
Full sample (Obs = 11,645)						
Basic estimation	0.0004	0.0002	(0.0000, 0.0008)	0.0010	0.0003	(0.0004, 0.0016)
IV estimation	0.0017	0.0010	(−0.0002, 0.0037)	0.0029	0.0016	(−0.0001, 0.0061)
Low (Obs = 3,821)						
Basic estimation	0.0000	0.0001	(−0.0002, 0.0003)	0.0003	0.0004	(−0.0005, 0.0013)
IV estimation	0.0005	0.0005	(−0.0004, 0.0014)	0.0009	0.0010	(−0.0010, 0.0028)
Medium (Obs = 3,613)						
Basic estimation	0.0006	0.0003	(0.0000, 0.0012)	0.0012	0.0006	(0.0000, 0.0024)
IV estimation	0.0010	0.0006	(−0.0001, 0.0021)	0.0023	0.0012	(−0.0000, 0.0046)
High (Obs = 4,220)						
Basic estimation	0.0007	0.0003	(0.0000, 0.0013)	0.0013	0.0005	(0.0003, 0.0023)
IV estimation	0.0025	0.0024	(0.0005, 0.0044)	0.0057	0.0025	(0.0008, 0.0106)

difficulties. A certain level of knowledge helps entrepreneurs find business opportunities and overcome challenges (Lussier and Pfeifer, 2001). At the same time, in the process of entrepreneurship, continuous learning is a necessary quality for successful entrepreneurs (Vakili et al., 2016). In addition, risk appetite has a direct impact on entrepreneurial behavior, and families who are risk takers are more likely to accept the uncertainty of self-employment. They are adept at using various financial instruments to mitigate financial problems (Fang and An, 2017). Financial literacy can also change households' risk appetite; thus, the coefficient of risk appetite in columns 4–5 is not significant. Household net assets and income can increase the probability of starting a business, which is consistent with other studies. A lack of capital is a common obstacle faced by entrepreneurs worldwide (Lelarge et al., 2010). Due to adverse selection and moral hazard, the capital market does not provide enough capital to entrepreneurs, who still need their household's accumulated wealth to realize entrepreneurship (Moskowitz and Vissing-Jørgensen, 2002; Fairlie and Krashinsky, 2012).

Entrepreneurship affects household consumption and saving behavior (Cai et al., 2018). Entrepreneurs reduce their saving rate while increasing their social spending, which in some ways expands their own social network. Therefore, it is necessary to find a suitable instrumental variable for social capital. We choose average community social capital as an instrumental variable for household social capital. Average community social capital is correlated with household social capital but not with household entrepreneurship. **Table 8** presents the instrumental variable regression results of the effect of social capital on entrepreneurship and financial literacy. In the first-stage regression, community social capital is significantly and positively related to household social capital. In the second-stage regression, social capital significantly promotes entrepreneurship and shares financial literacy, which is consistent with the previous results.

Next, we divide the sample into three groups according to the ranking of the provincial level of ICTs adoption. The grouping criterion was a cutoff of 55 and 64% to have as many samples as possible in each group. For each group, we calculate the value of the estimated mediating effect and provide 95% confidence intervals (see **Table 9**). We find that the mediating effect increases as ICTs adoption increases. In the provinces with the lowest level of ICTs adoption (below 55%), the mediating effect is not even significant at the 5% level. The application of ICTs expands the boundaries of social networks, and rural households can use social capital more efficiently to obtain the financial literacy needed for entrepreneurship. Therefore, Hypothesis 2 holds.

CONCLUSION

Encouraging rural entrepreneurship lifts rural households out of poverty. A certain level of financial literacy is a necessary skill for entrepreneurs. For rural households, social capital is an important resource for achieving entrepreneurship. Using 2015 CHFS data, we analyze the effect of social capital on rural entrepreneurship and the mediating effect of financial literacy with the help of ICTs.

In this study, we select household expenditures on developing relationships to construct a social capital index, as this is a widespread form of bridging social capital. We then construct two indicators to measure financial literacy based on households' responses to financial knowledge questions. The empirical results show in rural areas that households with more social capital tend to become entrepreneurs. Social capital promotes rural entrepreneurship through different mechanisms. One of them is that social capital shares financial literacy. It also shows that rural households learn knowledge from their social networks. Furthermore, this mediating effect is stronger in regions with a high level of ICTs adoption.

Rural entrepreneurial conditions are poorly supported by local resources. Tangible assets are relatively easy to acquire, but intangible assets, such as knowledge, are not easily transferred to proper places. Rural households rely on their social networks to obtain knowledge. Engaging in social interactions and communicating with others in their social networks help rural households improve their financial literacy and thus start a business. Therefore, the role of social capital in promoting

rural entrepreneurship cannot be ignored. ICTs enable rural households to interact online, broadening social networks, which allows them to learn more efficiently through social capital. The results imply the positive effect of ICTs adoption on rural entrepreneurship.

RECOMMENDATIONS

The results suggest the following recommendations. First, the government should pay attention to the role of social capital in knowledge sharing and encourage individuals with special knowledge to share it. The empirical analysis shows that rural households acquire financial knowledge through social interaction to achieve entrepreneurship. The government can establish an incentive mechanism to reward individuals or organizations that contribute to financial and entrepreneurial knowledge sharing. The knowledge sharing incentive mechanism facilitates knowledge sharing in social networks, thus promoting rural entrepreneurship. Second, establishing specific interactive contexts can improve the efficiency of knowledge sharing. The government can hold regular or irregular lectures on financial literacy and provide timely training on entrepreneurship, which prepares rural households for knowledge sharing and improves their literacy level. Third, the government can play a role by ensuring that ICTs infrastructure constraints do not limit the progress of rural entrepreneurship. Due to the low quantity and low quality of rural infrastructure supply, entrepreneurial activity in rural areas could be limited by communication infrastructure. To achieve high knowledge acquisition efficiency, potential entrepreneurs in rural areas must have access to ICTs. Through investment and policy, the government can build communication infrastructure in rural areas to create an environment where entrepreneurship can thrive.

LIMITATIONS

There are some limitations in this study. First, this study does not use a cross-country sample for empirical analysis. Social capital has the attributes of culture and tradition, and the way of developing social relationships differs among countries. Therefore, whether the social capital index in this paper is applicable to other countries remains to be studied. Further research using cross-country data for the analysis modifies the bias caused by culture and tradition. Second, we group the sample according to provincial ICTs adoption level in the heterogeneous analysis of ICTs adoption, which does not represent the specific situation of ICTs usage among households. Unfortunately, we do not have data related to household use of ICTs. Our conclusions about the development of regional ICTs are still credible. Third, the issue of individual heterogeneity is not well addressed. The current empirical analysis is based on cross-sectional data, and the conclusions are reliable based on the assumption that the sample is homogeneous. However, the assumption of a homogeneous sample is not realistic. Although we add many levels of control variables to measure household heterogeneity in the empirical analysis, this only alleviates the problem of individual heterogeneity. Panel data are needed because panel data capture the dynamics of rural entrepreneurship (i.e., the process by which non-entrepreneurial households turn into entrepreneurial households). By using panel data, the results would become more convincing.

DATA AVAILABILITY STATEMENT

The original contributions presented in the study are included in the article/**Supplementary Material**, further inquiries can be directed to the corresponding author/s.

ETHICS STATEMENT

Ethical review and approval was not required for the study on human participants in accordance with the local legislation and institutional requirements. Written informed consent for participation was not required for this study in accordance with the national legislation and the institutional requirements.

AUTHOR CONTRIBUTIONS

JZ and TL designed and performed the research and wrote the manuscript. TL analyzed the data. Both authors contributed to the article and approved the submitted version.

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SUPPLEMENTARY MATERIAL

The Supplementary Material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fpsyg.2021.724605/full#supplementary-material

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Falling in Love With Work: The Effect of Enterprise Social Media on Thriving at Work

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Using a survey of 300 employees in different types of enterprises and different positions, this study verified that the use of enterprise social media has a positive effect on employees' work exuberance. The study separately examined the effects of social media applications for work tasks and social tasks. Both types of applications had a positive impact on employees' work exuberance. The study also identified the mediating role of challenge and obstructive stressors in this relationship. Work-related social media applications enhanced employees' exuberance by reducing obstructive stressors, and social-related social media applications enhanced employees' exuberance by reducing challenge stressors. The implications of these findings are that managers should pay attention to the use of enterprise social media, especially for social tasks, as this can enhance employees' sense of exuberance.

Keywords: enterprise social media, thriving at work, challenge stressors, obstructive stressors, the social embeddedness model

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INTRODUCTION

More and more enterprises are using social media. Between 2020 and 2021, more than 30 million enterprises used social media for the first time. Social media platforms in work contexts have both social and work applications (Luqman et al., 2021). Studies have shown that social media can expand people's social relations and networks and reduce social tension; however, it may also increase anxiety and impair people's rational thinking (Cheng et al., 2021). Therefore, the impact on employees of enterprise social media platforms is unclear. Will social media make us love our work more?

Enterprise social media has created new behavior patterns. Social media technology can further improve the efficiency of information transmission within an enterprise and promote communication between management and frontline employees. The use of social media breaks the bottlenecks in information dissemination that frequently occurs in offline offices and makes it possible to spread organizational decisions to the grassroots level quickly, which helps enterprises create an open and transparent organizational atmosphere, break through the internal barriers that characterize traditional organizations, share resources, open processes, reduce communication costs, enhance organizational vitality, and influence turnover intentions (Murad et al., 2020). Within an organization, transparent resources and information provide employees with multiple

channels to share knowledge and more opportunities to learn and grow (Paul et al., 2013). As the use of enterprise social media becomes more common, its impact on employees has gradually become of interest to scholars. Some studies have examined the different effects of using social media for work tasks and for social tasks (Patroni, 2016). Their results have shown that social media can improve employees' organizational commitment, but using social media for work tasks mainly affects normative commitment, whereas its use for social tasks mainly affects emotional commitment. Studies (e.g., Eliane et al., 2013) of the impact of enterprise social media on employee job satisfaction have found that work-related social media has no significant impact on employee job satisfaction, but social-related social media has a favorable impact on job satisfaction.

Scholars have begun to pay more attention to the concept of thriving at work, which measures two dimensions of employees' enjoyment of work: maintaining vitality at work and learning (Demerouti and Bakker, 2011). Thriving at work is not only an important manifestation of individuals' sustainable development but is also of great importance for organizational performance and for the overall well-being of society (Sigala and Chalkiti, 2015). Therefore, there have been many studies of the personal and organizational strategies that enhance individuals' sense of exuberance. According to the social embeddedness model, work resources and work situations affect individuals' initiative behavior, which in turn shapes their experience of thriving at work (Lesener et al., 2018). The use of enterprise social media enhances internal information sharing, creating an atmosphere of mutual trust and respect. If this changes employees' access to knowledge, relationships, and other resources at work, the employees' sense of thriving at work will also change (Tucker and Goodings, 2017). However, there have been very few theoretical and empirical studies of the mechanism through which enterprise social media affects thriving at work. In particular, there have been no studies of how stress affects the relationship between social media use and thriving at work. Only a few studies (e.g., Yu et al., 2018) have considered the impact of social media use on employees' stress or on employees' work status.

Therefore, whether the use of social media in enterprises promotes employees' exuberance remains an empirical question. Can the use of social media make employees love their work more? This paper studied this problem from the perspective of stress.

THEORETICAL BACKGROUND

Enterprise Social Media

The use of social media in enterprises allows employees to release, transmit, search, and receive information through social media platforms. As a tool for the internal management of enterprises' needs, enterprise social media functions somewhat differently than non-enterprise social media. Within enterprises, social media is mainly used for communication among employees or to a specific employee. Users can edit and revise documents with colleagues and everyone can view the posted information and files (Lepine et al., 2004).

Paul et al. (2013) divided enterprise social media into three types based on common social media tools. The first type is public social media, which includes platforms such as WeChat and QQ. For enterprises, public social media platforms have become channels for external publicity and after-sales service for external customers. As such platforms also have non-work social functions for employees (Permatasari et al., 2013), their application in work settings will have an impact on employee behavior. The use of public platforms can promote information transfer among employees and enhance mutual understanding (Parnin and Garg, 2007). However, it is also accompanied by problems, such as blurring the boundary between work and home life, privacy leakage, and extension of work into non-working hours, among others. The second type of enterprise social media is private platforms, which may operate with either commercial proprietary software or open-source software, but are only for internal employees' use (Kuegler et al., 2015). Private platforms usually have a range of functions, including dynamic sharing, chat, and document sharing. The third type is social media tools independently developed by an enterprise's internal technical team to meet the specific needs of the enterprise (Kwon and Wen, 2010). In general, these tools are not limited to communication functions and provide various functions based on the actual work needs of employees, such as live broadcasting, online document editing, announcement releases, and so on.

Boyd and Ellison (2010) developed an alternative two-dimensional classification of enterprise social media: those with social applications and those with work applications. Work-related social media tasks focus on workflow, work cooperation among employees, work plan arrangement, and work progress follow-ups, all of which can promote the integration and innovation of organizations' internal and external resources. The social applications of enterprise social media involve tasks that contribute to a harmonious working atmosphere in an organization (Hayes and Carr, 2021), help managers better understand the mood and state of employees, provide timely organizational support, and cultivate team cohesion.

Studies of the work attributes of enterprise social media have focused on the increased efficiency of information transmission associated with the use of social media, and the resulting improvements in an open and transparent organizational atmosphere (Paul et al., 2013), employee knowledge management and sharing, employee performance, enterprise communication, and relationship management.

Enterprise social media can act as a "social lubricant" simplifying connections and communication (Saeed and Ilkhanizadeh, 2021). When employees share private information on this type of media, it creates a harmonious organizational atmosphere and cultivates a sense of belonging among new employees. Enterprise social media can help the growth of social capital within the organization. The social activities of colleagues become resources for establishing connections with unfamiliar colleagues and making more informal contacts. Such media can also make it easier to adapt to the working environment and increase employees' feelings of psychological safety, which helps introverted or self-effacing people to form relationships (Paul et al., 2013). However, enterprise social media is a double-edged

tool. Although a variety of relationships can be established through this type of media, they are generally not strong relationships, and some cannot even be classified as interpersonal relationships (Boyd and Ellison, 2010). In addition, the use of social media for work can blur the boundary between employees' private and public lives and between private and public relations. The group communication mode of such media also combines social relations of varying strength, which increases complexity of the interpersonal relations.

Challenge and Obstructive Stressors

Cavanaugh et al. (2000) developed the challenge-obstructive stressor model. A challenge stressor is a stressor that can create challenges but may also lead to positive outcomes (Hase et al., 2018). It can have a positive impact on career development and produce positive work results. A common challenge stressor is time stress, which occurs when the amount of work or its complexity makes finish the work on time a challenge (Hsu and Fan, 2008). An obstructive stressor is a stressor generated by restrictions that hinder personal development goals. Common obstructive stressors include bureaucracy, organizational politics, job insecurity, and career stagnation (Boswell et al., 2004).

Challenge stressors usually have a positive impact, because although they create short-term stress for individuals (Cavanaugh et al., 2000), individuals believe that overcoming the challenge will lead to promotions, salary increases, and other positive returns. Therefore, challenge stressors generally have a positive influence on behavior. In contrast, obstructive stressors usually have a negative impact on employees, as obstructive stress consumes employees' own resources without any expectation of future returns and benefits. Therefore, obstructive stressors generally promote negative coping strategies, such as resignations and strikes (Hobfoll, 1989).

In this study, challenge and obstructive stressors were not considered mutually exclusive (Hase et al., 2018). According to the theory of cognitive interaction, stress is neither a stable personal trait nor a situational stimulus, but a product of the interaction between situations and individuals' processing abilities. Thus, in a complex situation, individuals may make different evaluations of challenge and obstructive stressors and may even experience both types of stressors at the same time (Zhang Y. et al., 2015).

Thriving at Work

Thriving at work is a state in which an individual is motivated to learn and grow at work. Such employees are full of vigor and vitality at work and experience a sense of self-development. It is a positive subjective experience and feeling (Niessen et al., 2012), and it is a temporary psychological state rather than a stable personal characteristic.

There are two dimensions of thriving at work: vitality and learning. Vitality is the positive feeling of being full of energy and learning is the desire to acquire knowledge and skills (Porath et al., 2012). The social embeddedness model is a widely accepted theoretical model for explaining the mechanisms of the formation of thriving at work. According to the social embeddedness model, thriving at work is largely shaped by the characteristics of the work situation and the social support system. Studies Porath et al. (2012) have identified some of the characteristics that affect thriving at work. The departmental characteristics that affect the sense of thriving at work are independent decision-making, extensive information sharing, respect, and trust. The main resources provided by the social support system are positive significance, positive emotional resources, and relationship resources.

When an individual's department provides an environment that allows for independent decision-making, information sharing, trust, and respect and provides the individual with knowledge, positive significance, positive emotional resources, and relationships, the individual is more likely to engage in active work behaviors, such as concentrating on work, exploring, and establishing better relations within the enterprise. Employees' proactive work behavior can also promote thriving at work, creating a positive cycle (Xu et al., 2019). As employees' vitality increases, it promotes learning, which in turn increases employees' thriving at work. Exuberant employees are more likely to be physically and mentally healthy and are more likely to achieve long-term personal development.

Both personal and organizational factors affect thriving at work (Xu et al., 2019). The personal factors include mental health, physical health, employees' recognition of work, and self-determination. Porath et al. (2012) identified four organizational factors that promote a pluralistic and inclusive organizational climate as follows: giving employees decision-making power; open and transparent information, especially the communication of the company strategy and other related information; low levels of uncivil behavior within the organization; and feedback on performance.

Porath et al. (2012) argued that social media can act as a social lubricant by increasing the daily contact between employees and thus enhance employees' sense of belonging to a team. Increasing the contact opportunities between employees may also help employees to thrive at work. Social media can also help employees to obtain organizational information more efficiently and help management to provide timely performance feedback and support, improving employees' work environment.

RESEARCH DESIGN AND HYPOTHESIS DEVELOPMENT

Social Media Usage and Thriving at Work

According to the social embeddedness model, work resources and work situations affect individuals' active work behavior, which in turn affects individuals' sense of thriving at work. The use of enterprise social media is conducive to the internal sharing of information and the formation of an atmosphere of mutual trust and mutual respect (Luqman et al., 2021). Such work situations are conducive to the generation of a sense of exuberance. Furthermore, enterprise social media applications provide employees with access to more organizational information and more organizational team members, which is also conducive to the generation of thriving at work.

Enterprise social media allows employees to work online with colleagues; for example, they can write online documents together, make queries, and share relevant information and knowledge. Extensive information and knowledge sharing help to build a more trusting and respectful organizational atmosphere (Sun et al., 2019). This type of media also gives employees opportunities to establish relationships with more people in the organization. Rich relationship resources allow employees to obtain more knowledge resources, which are conducive to individual learning. The use of social media for work tasks can promote information and knowledge sharing (Lepine et al., 2004), accelerate the flow and precipitation of knowledge resources within the organization, and stimulate knowledge innovation. Its use for social tasks can enhance the atmosphere of trust and respect and increase relationship resources. Both types of users have a positive impact on departmental characteristics and individuals' resource pools. Based on the above discussion, this study made the following hypotheses.

> Hypothesis 1(a): The use of enterprise social media for work tasks has a significant positive impact on thriving at work.
> Hypothesis 1(b): The use of enterprise social media for social tasks has a significant positive impact on thriving at work.

Enterprise Social Media Usage and Challenge and Obstructive Stressors

According to the conservation of resources theory, individuals facing a potential or actual loss of resources or having difficulty obtaining returns on resources they have invested in will experience stress (Hobfoll, 1989). Many personal traits such as self-esteem and self-efficacy provide individuals with protection from stressors (Lesener et al., 2018). Social support is also an important resource because social contacts can reduce individuals' perception of stress, thus helping to preserve and reduce the loss of personal resources.

Both challenge and obstructive stressors consume an individual's resources, but a challenge stressor generally involves a complex work problem and an urgent deadline. When employees believe that completing the tasks or taking on the heavy workload will bring benefits that will replace the individual resources consumed by the work, they will regard the stressor as a challenge stressor. Obstructive stressors include obstacles such as bureaucratic barriers, cumbersome procedures, or job insecurity. When employees think that the work they are expected to do will consume their resources and give them none in return, they will regard the stressor as an obstructive stressor.

The use of enterprise social media can be regarded as both use of work resources and consumption of work resources and may produce both positive and negative outcomes (Westman et al., 2004). Work-related applications of social media can increase the transparency and fairness of an office environment, as all employees can query all public information in the organization. Knowledge sharing and work coordination can be conducted on social media, which is conducive to reducing bureaucratic procedures and organizational politics, improving work efficiency, and enhancing employees' sense of work security, thus reducing the obstructive stressors in the workplace. However, its use extends the temporal and spatial boundaries of the office, making it possible to work anytime and anywhere. This means that employees need to invest more energy and resources in their work and the boundaries between personal life and work become blurred, which creates challenging stressors for employees. The use of social media enriches emotional communication between employees and increases the scope of employees' social interactions. This provides employees with more social support and networking resources, thus reducing both challenges and obstructive stressors. Based on the above insights, the authors made the following hypotheses.

> Hypothesis 2(a): The use of enterprise social media for work tasks has a significant positive impact on the strength of challenge stressors.
> Hypothesis 2(b): The use of enterprise social media for work tasks has a significant negative impact on the strength of obstructive stressors.

> Hypothesis 3(a): The use of enterprise social media for social tasks has a significant negative impact on challenge stressors.
> Hypothesis 3(b): The use of enterprise social media for social tasks has a significant negative impact on obstructive stressors.

Effects of Challenge and Obstructive Stressors on Thriving at Work

According to the social embeddedness model (Spreitzer et al., 2005), the availability of the resources required by individuals to complete their work will affect the employees' vigor. The resources required to overcome the challenges and obstructive stressors can be considered job requirements (Wang et al., 2020). If individuals have to wait for the resources they spend overcoming stressors to be replaced, they will feel anxiety, depression, anger, and other negative emotions, which will have an adverse impact on their emotional, physical, and mental health. Therefore, by exhausting employees' resources, challenging and obstructive stressors have a negative impact on their sense of job exuberance.

However, studies have shown that challenging stressors can also have a positive impact on individuals. Podsakoff et al. (2007) found that the two common types of challenge stressors, time limits, and learning demand, can positively affect the learning dimension of thriving at work while negatively affecting the vitality dimension of thriving at work. By definition, to thrive at work employees need both learning opportunities and vitality. Therefore, challenge stressors have a negative impact on thriving at work.

> Hypothesis 4(a): Challenge stressors have a significant negative impact on thriving at work.

Hypothesis 4(b): Obstructive stressors have a significant negative impact on thriving at work.

Mediating Roles of Challenge and Obstructive Stressors

Job requirements such as time limits, task overload, or role conflict are sources of job stress. Job control is regarded as an outlet for job stress, and it generally consists of the ability to make independent decisions at work (Ito and Brotheridge, 2003). Therefore, social support may mediate the relationship between job requirements and job stress.

The use of enterprise social media has changed work environments and the requirements, processes, and level of employees' decision-making authority. Employees can use social media at work to search for internal information, thus enhancing their control over their work. When employees carry out social activities on this type of media, they can more easily get work support from colleagues and leaders in the organization, which improves their sense of social support. When the job requirements are high but employees have control over the work and strong social support, they will have a more positive attitude toward work. Even when there are many job requirements, they will be happy to improve their work skills through learning and to successfully complete their work tasks, which is the definition of thriving at work. Based on the above insights, the authors made the following hypotheses.

Hypothesis 5(a): Challenge stressors mediate the relationship between the use of enterprise social media for work tasks and thriving at work.
Hypothesis 5(b): Obstructive stressors mediate the relationship between the use of enterprise social media for social tasks and thriving at work.

Hypothesis 6(a): Challenge stressors mediate the relationship between the use of enterprise social media for work tasks and thriving at work.
Hypothesis 6(b): Obstructive stressors mediate the relationship between the use of enterprise social media for social tasks and thriving at work.

MATERIALS AND METHODS

Study Design

This study took work-related and social-related social media use as independent variables, work exuberance as the dependent variable, and challenge or obstructive stressors as the intermediary variable. The model is shown in **Figure 1**.

Enterprise social media usage was measured using the scale developed by Leidner et al. (2010). It has 13 items, including 8 items for work-related enterprise social media usage and 5 items for social-related enterprise social media usage. Challenge and obstructive stressors were measured using the scale developed by Cavanaugh et al. (2000). It has 11 items, of which 6 items measure challenge stress. Work vitality was measured using the scale developed by Porath et al. (2012). It has 10 items, which are divided into two dimensions: learning and vitality.

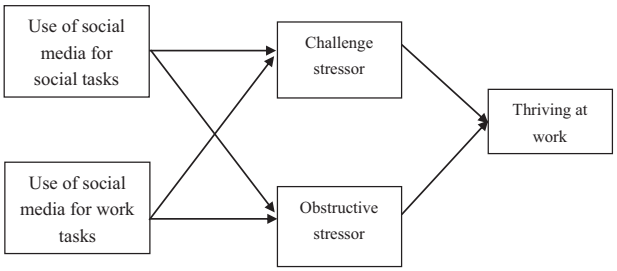

FIGURE 1 | The relationship between social media usage and thriving at work.

The sample collection strategy targeted people with work experience. A paid questionnaire on the Credamo network platform was used to collect sufficient data. Credamo questionnaires offer eight functional settings: release channel, release quantity, quality control, sample feature setting, response sets, conclusion setting, questionnaire compensation, and expense setting, and forwarding reward. These settings can be used to set demographic characteristics and accurately locate a survey population that meets your research needs. Quality control and answer settings can further control the subjects' answering conditions, further realize quality control, and fully ensure the reliability and effectiveness of the data.

Invalid questionnaires were eliminated, and the following three criteria were used to ensure that the results were not biased by participants not completing the questionnaires carefully: (1) the questionnaire was provided with reverse scoring questions to eliminate answers that are obviously inconsistent; (2) specified option questions were set, and questionnaires with answers that were inconsistent with the specified options were eliminated; and (3) questionnaires with the same answers to 10 consecutive questions were eliminated.

SPSS and Amos software programs were used to analyze and process the results.

Data Collection

Of the 303 questionnaires distributed on the network platform, 300 were returned and 270 were valid, giving an effective return rate of 90%. Among the participants, 52.2% were men and 47.8% were women. Most of the participants (98.1%) were between 21 and 40 years old. The majority of the participants had high educational achievements: 261 (88.5%) had a Bachelor's degree or above. In terms of work experience, 0.7% of them had worked for 1–3 years, 43.3% have worked for 4–6 years, 20.7% have worked for 7–10 years, and 9.3% have worked for more than 10 years. The job types were distributed among finance (12.6%), technology (40%), marketing (7.8%), human administration (21.1%), and production (17%).

Ethics

All of the participants understood the purpose of the study and agreed to participate in the study. The researchers used codes to

TABLE 1 | Confirmatory factor analysis.

	Model	$\frac{x^2}{df}$	CFI	IFI	RMSEA	RMR
1	**Five-factor model** (Xa, Xb, Ma, Mb, Y)	1.683	0.906	0.907	0.049	0.052
2	**Four-factor model** (Xa + Xb, Ma, Mb, Y)	2.197	0.808	0.811	0.067	0.056
3	**Three-factor model** (Xa + Xb, Ma + Mb, Y)	2.624	0.739	0.741	0.078	0.074
4	**Two-factor model** (Xa + Xb + Ma + Mb, Y)	3.441	0.606	0.610	0.095	0.095
5	**One-factor model** (Xa + Xb + Ma + Mb + Y)	4.529	0.429	0.435	0.115	0.120

Xa—work-related enterprise social media use; Xb—social-related enterprise social media use; Ma—challenge stressor; Mb—obstructive stressor; and Y—a sense of thriving at work.

replace the personal information of specific participants to ensure the security of the participants' private information.

RESULTS

Amos 26.0 was used to conduct confirmatory factor analysis on five variables: work-related use of enterprise social media, social-related use of enterprise social media, challenge stressors, obstructive stressors, and thriving at work. The results, presented in **Table 1** [$^2/df$ = 1.683, composite fit index (CFI) = 0.906, incremental fit index (IFI) = 0.907, root mean square error of approximation (RMSEA) = 0.049, root mean square residual (RMR) = 0.052], indicated that the five-factor model had a better fit than the other models, with good structural validity among the variables, a simple fit, and an overall goodness of fit. Overall, the results of our confirmatory factors' analysis showed that the five-factor model, composed of work-related enterprise social media use, social-related enterprise social media use, challenge stressors, obstructive stressors, and thriving at work, had a better fit than any of the other factors' models.

The means, standard deviations, and correlations are presented in **Table 2**. There were positive correlations between thriving at work and the use of enterprise social media for social tasks (r = 0.548, $p < 0.01$), thriving at work and the use of enterprise social media for work tasks (r = 0.285, $p < 0.01$), the use of enterprise social media for work tasks and obstructive stressors ($r = -0.14$, $p < 0.05$), and the use of social media for social tasks and challenge stressors ($r = -0.152$, $p < 0.05$). Thriving at work was negatively correlated with challenge stressors and obstructive stressors.

As shown in **Table 3**, the bootstrap analysis also showed that there were some mediators between work-related enterprise social media use and job exuberance, with the direct effect accounting for 93.87% and the indirect effect accounting for 6.13% of the outcomes. The mediating effect of challenge stressors on the relationship between work-related enterprise social media use and job exuberance was not significant, and there was no side-by-side mediating effect of challenge or obstructive stressors. Therefore, H5a was not supported, but H5b was supported. As shown in **Table 4**, when the use of enterprise social media for social tasks was the independent variable, the bootstrap analysis showed that challenge and obstructive stressors partially mediated the effect of the use of enterprise social media for social tasks on work exuberance, with the direct effect accounting for 93.83% and the indirect effect accounting for 6.17% of the variation. However, the mediating effect of obstructive stressors on the relationship between the use of enterprise social media and job satisfaction was not significant. Therefore, Hypothesis 6a was supported and Hypothesis 6b was not supported. Overall, the final hypothesis test results of this paper are shown in **Table 5**.

DISCUSSION

This study profoundly reveals the impact of enterprise social media use on employees. Three aspects are verified.

First, it verifies the impact of social media on employees' stress perception. Enterprise social media has brought faster information dissemination and instant communication (Al-Oraiqat et al., 2021). According to the theory of the cognitive interaction of stress, individuals' understanding and evaluations of stress are influenced by external variables (Evan et al., 2014). Therefore, future research on work stress should

TABLE 2 | Descriptive statistical analysis and correlations (N = 270).

Variable	*M* (*N*)	*SD*	1	2	3	4	5	6	7	8	9	10	11	12
Sex	1.48	0.5	1											
Age	2.4	0.53	0.08	1										
Education	3.09	0.39	0.06	0.03	1									
Work experience	4.12	0.93	0.11	0.649**	0.01	1								
Company type	2.8	1.46	0.1	0.01	−0.121*	−0.05	1							
Company size	2.61	0.96	0.06	−0.04	0.11	0.08	−0.195**	1						
Position	2.36	1.39	0.273**	0.02	−0.01	−0.04	0.1	−0.156*	1					
Xa	4.35	0.33	−0.06	−0.01	0.02	0.05	0.07	−0.04	0.03	1				
Xb	3.91	0.7	0.04	0.06	−0.02	0.04	−0.02	0.145*	−0.04	0.293**	1			
Ma	3.35	0.84	0.05	−0.11	−0.02	−0.142*	−0.06	−0.05	−0.01	−0.04	−0.152*	1		
Mb	2.62	0.85	0.01	−0.07	−0.05	−0.222**	0	−0.150*	−0.01	−0.140*	−0.11	0.500**	1	
Y	4.32	0.46	−0.179**	0.06	0.04	0.165**	−0.03	0.09	−0.11	0.548**	0.285**	−0.194**	−0.371**	1

*Xa, work-related enterprise social media use; Xb, social-related enterprise social media use; Ma, challenge stressor; Mb, obstructive stressor; Y, a sense of thriving at work. *correlation is significant at the 0.05 level, **correlation is significant at the 0.01 level.*

TABLE 3 | Mediating effect of the use of enterprise social media for work tasks.

	Coeff	BootSE	BootLLCI	BootULCI	
Total effect	0.7438	0.069	0.607	0.88	
Direct effect	0.74	0.0768	0.586	0.8862	99.49
Challenge stressors	0.0039	0.0138	−0.0242	0.032	0.53
Direct effect	0.6982	0.0741	0.5518	0.8438	93.87
Obstructive stressors	0.0456	0.0261	0.001	0.103	6.13

TABLE 4 | Mediating effect of stressors on social media use.

	Coeff	BootSE	BootLLCI	BootULCI	
Total effect	0.7438	0.069	0.607	0.88	
Direct effect	0.6982	0.0741	0.5518	0.8438	93.87
Challenge stressors	0.0456	0.0261	0.001	0.103	6.13
Direct effect	0.1658	0.0394	0.0912	0.2443	89.67
Obstructive stressors	0.0191	0.0131	−0.004	0.0473	11.52

focus on clarifying the boundary conditions of these effects (Jose et al., 2021). There is no empirical study that considers the use of enterprise social media as a situational variable that affects individuals' perception of stress, and it is unclear whether enterprise social media use increases or decreases individuals' perception of stress (Liu and Bakici, 2019). This study confirmed that the use of social media can significantly reduce employees' challenges and obstructive stressors. This study shows that using social media for work tasks can improve employees' sense of exuberance by reducing obstructive stressors. To promote this effect, enterprises can establish an open and transparent environment and encourage employees to share knowledge and post information on social media (Ma et al., 2020). To improve employees' sense of exuberance, enterprises can reduce challenge stressors by creating a stress-free office atmosphere with harmonious interpersonal relationships as the goal (Skade et al., 2020). This will provide a foundation for better cooperation and support in the future.

Second, it expands the research perspective of the impact of social media use on employees' stress perception and proves that the social function of corporate social media has a positive impact on employees' stress relief. So far, most researches on enterprise social media have focused on work-related tasks conducted on such media, ignoring other types of enterprise social media usage (Liang et al., 2020). Many enterprises think that using social media at work negatively affects office efficiency and organizational performance, and some organizations even prohibit it. In contrast to this one-sided view, our findings show that social media can alleviate employees' stress and promote their sense of exuberance. The authors found that both work and social tasks conducted on enterprise social media have a positive impact on work exuberance, but the mechanisms are different. Using enterprise social media for work tasks improves work exuberance by reducing the strength of obstructive stressors, whereas using it for social tasks, which is related to social communication, improves employees' sense of exuberance by reducing the strength of challenging stressors. Therefore, enterprises should develop social media applications that provide employees with resources, including not only information and knowledge resources for work. Also emotional and networking resources for building social support, which will enhance employees' sense of control over their work (Leidner et al., 2010).

Third, our findings indicate that the use of enterprise social media helps employees to thrive at work. The authors verified the relationship between social media use and employees' thriving at work and found that even social media applications with social attributes still have positive impacts on the improvement of employees' work efficiency. Previous studies have focused on the negative impact of such social attributes (Liang et al., 2020). It is undeniable that they can affect employees' concentration and interrupt their normal working state (Skade et al., 2020). These social attributes have been seen as having a negative effect on employees' work efficiency. However, our findings suggest that enterprise social media can provide employees with social support, enhance organizational socialization and the social embeddedness of employees, reduce challenge stressors, and moderate negative emotions caused by heavy workloads or responsibilities. Together, as a key indicator of employees' sustainable development and physical and mental health, thriving at work occurs when employees have high vitality and are learning new things, as well as having positive impacts on the sustainable development and organizational performance of enterprises. Therefore, both organizations and employees need to take certain measures to enhance employees' sense of exuberance.

Our research hypotheses that the impact of work-related social media use on challenging stress, the impact of social-related social media use on obstructive stress, and its impact on job exuberance have not been proved. This may occur because work-related social media use provides basic work support rather than support for employees' further development. For social-related attributes, it is difficult to play a role in the organizational environment with a disharmonious organizational atmosphere (Hase et al., 2018). This can be further studied as an important research direction.

LIMITATIONS AND FUTURE DIRECTIONS

First, at the methodological level, the questionnaire survey method used in this study only collected data at a certain time point and did not test employees' stress over time. This is a particular limitation for assessing challenge stressors; although challenge stressors consume employees' psychological resources in the short term (Boswell et al., 2004), in the long term, employees may be compensated for their resource loss. Therefore, in the long term, a challenge stressor may also have a positive impact on employees and enhance their sense of exuberance. In future research, the authors will explore the impact of the use of enterprise social media on thriving at work from a dynamic perspective. Future studies could also include cross-level research that comprehensively considers the team level and organization level factors that affect work prosperity. For example, future research could focus on the influence of team characteristics and organizations' operations on work prosperity and will improve and enrich the overall theoretical framework.

TABLE 5 | Hypothesis test results.

	Hypotheses	Status
H1a	The use of enterprise social media for work tasks has a significant positive impact on thriving at work.	Established
H1b	The use of enterprise social media for social tasks has a significant positive impact on thriving at work.	Established
H2a	The use of enterprise social media for work tasks has a significant positive impact on the strength of challenge stressors.	Not established
H2b	The use of enterprise social media for work tasks has a significant negative impact on the strength of obstructive stressors.	Established
H3a	The use of enterprise social media for social tasks has a significant negative impact on challenge stressors.	Established
H3b	The use of enterprise social media for social tasks has a significant negative impact on obstructive stressors.	Not established
H4a	Challenge stressors have a significant negative impact on thriving at work.	Established
H4b	Obstructive stressors have a significant negative impact on thriving at work.	Established
H5a	Challenge stressors mediate the relationship between the use of enterprise social media for work tasks and thriving at work.	Not established
H5b	Obstructive stressors mediate the relationship between the use of enterprise social media for social tasks and thriving at work.	Established
H6a	Challenge stressors mediate the relationship between the use of enterprise social media for work tasks and thriving at work.	Established
H6b	Obstructive stressors mediate the relationship between the use of enterprise social media for social tasks and thriving at work.	Not established

Second, the samples of this study have limitations. Research shows that social media users with different cultural backgrounds have different usage habits and focus on social media (Huang et al., 2015). The use of corporate social media may have similar impacts (Xu et al., 2019). For example, different cultural backgrounds may make different employees feel different when using social media, and then affect their feelings of stress. However, in this study, all samples are from China, so it is difficult to study the impact of cross-cultural differences on corporate social media applications. At the same time, the applications of social media also have an impact on employees' work behavior. Different occupations may also have an impact on employees' social media use (Zhang J. et al., 2015). This study cannot further explore the influence of different occupations on the relationship between social media use and thriving at work due to the limitations of the sample collection. Therefore, whether the findings are restricted to science and technology enterprises or not is worthwhile to study further.

Third, this study does not effectively explore the impact of different regulations and policies and enterprise policies on the use of social media. In addition to culture, laws of different countries, especially privacy protection policies, may also have an impact on the use of different social media (Costello et al., 2016). Under different privacy protection systems, whether employees' social media use habits are different, and whether it will have an impact on the results of this study. The research on policies and regulations based on this different impact also has very strong practical significance. Overall, the limitations of the research study could provide further research on thriving at work through social media.

CONCLUSION

At present, research on thriving at work is still in its infancy. Although there are models in related fields, such as the social embeddedness model and the personal growth integration model, there are obvious gaps in the literature. However, empirical studies are continuously contributing to the development of theoretical frameworks. This paper not only identified new components of the social embeddedness model, including the use of enterprise social media but also explored the mediating role of stressors on personal growth at work.

This study explored the impact of the use of enterprise social media on employees' thriving at work. The results showed that both social and work-related applications of social media improve employees' working conditions. In particular, the authors found that social networking applications can play a positive role in reducing employee stress and improving their work status. This contradicts the consensus that using social media for social tasks negatively affects employees' work and engagement. Accordingly, if the authors expect employees to love their work, the authors should pay attention to the social functions of enterprise social media, and even encourage employees to make full use of these social functions during work hours.

DATA AVAILABILITY STATEMENT

The original contributions presented in the study are included in the article/supplementary material, further inquiries can be directed to the corresponding author/s.

AUTHOR CONTRIBUTIONS

DL: mainly responsible for writing the article. BH: responsible for data analysis. YL: responsible for providing ideas. PL: responsible for topics and resources. All authors contributed to the article and approved the submitted version.

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Employee Social Network Strategies: Implications for Firm Strategies and Performance in Future Organizations

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Employee social network strategies play a key role in firm strategies and organizational performance. Currently, scholars underestimate the contributions of employee social strategies in firm strategies. Little is known how informal employee social networks, group entitativity and competition could shape and direct firm strategies and organizational performance. The article examines social network theory and strategic management's content, process and open schools of thought to propose a new interpretation for managing firm strategies. More specifically, the author examines alternate causal paths, underlying processes and structures as mechanisms in employee social network strategies within a theoretical framework. The article proposes 4 theoretically driven propositions and makes two contributions. First, the article contributes to organizational behavior literature by focusing on the literature gap in network dynamics and competitive actions through employee social networks. Second, although there is immense literature on positive and negative employee competition in business, the article makes a contribution to the strategic management literature by moving beyond formalized structures and roles within an organization to focus on the multilevel informal workplace social interactions and processes that impact strategizing activities. Overall, the article extends strategy research in relation to how employee social networks operate through competition and group entitativity in firm strategies.

Keywords: strategy, group entitativity, competition, organizational performance, employee social networks

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INTRODUCTION

Employee social networks warrant significant consideration in firm strategies and performance. Previous research shows sparse literature and theory on the "network dynamics of competitive action" and "competitive behavior" (Swab and Johnson, 2018, p. 157). The article contributes to prior literature and theories on social networks to reveal competition is a process of securing productive relationships (Burt, 1992), rather than merely being a player in competitive advantage and strategic positioning between firms, industries, states, and countries (Porter, 1980). Social context plays an increasingly important role in a firm's strategy formulation and implementation because competitiveness is often associated with and evaluated by social aspects (Thiel, 2017). Moreover, economic action is driven by social networks and relationships in a firm (Gulati, 1998). Firms are not paying adequate attention to employee social structures and social network strategies because unquantified knowledge and information is often dismissed by leadership for objective and quantifiable knowledge and information to govern an organization (Michaud, 2014).

Moreover, analyzing competition is difficult due to invisible social structural holes (Burt, 1992) in employee social networks that are not directly observed by employees in a firm or within interorganizational networks and market competition. Therefore, serious and more robust employee evaluation in a firm's social structures, organizational structures and network structures is warranted from human resource management to gage positive and negative behaviors in organizations, especially through hybrid office structures and increasing network platforms due to COVID-19. New key strategic roles are necessary for human resource, marketing and information technology departments that can partner with each department manager in the firm and externally with other firms and organizations.

The article aims to challenge strategic management literature assumptions by moving beyond a focus on organizational resources and firms' environments as given and detached entities within firms' relationships and quasi-universal fixed causal laws that apply across time and space (Rabetino et al., 2021). Moreover, the theoretical development in the article challenges key assumptions (Alvesson and Sandberg, 2011; Cornelissen et al., 2021) in firm strategies and deviates (Höllerer et al., 2020) from the existing strategic management literature toward continual turbulent transformation in the social environment (Teece, 2020) that has not been adequately addressed within firm strategies. Hence, scholars and practitioners underestimate the contributions of employee social strategies in firm strategies. Through a literature review, the article introduces a new interpretation for understanding firm strategies through "configurational theorizing" (Cornelissen et al., 2021, p. 7) and 4 theoretically driven proportions. The article is motivated by a cross-disciplinary approach of organizational behavior literature and strategic management literature to examine how employee negative behavior operates through relational and governance structures within the firm to reshape and redirect firm strategies. For instance, Zhong and Robinson (2021) research findings indicate that misbehaving or negative behavior has the potential to incur employee resource gains and positive results such gaining control over others, that in turn could decrease organizational performance.

There is scant literature in strategic management that examines the problem of negative individual and social behavior through employee social networks in firm strategies. Rather than a focus on social networks and *market competition,* the article examines *social competition* and the use of informal network ties to manage employee relations that span from the firm to the market. Employees do not leave their individual and collective interests at home apart from work. Rather, individual and self interests are part of the relational and governance structure in firms and are a strategic mechanism for managing who gets hired, promoted and governed for social reputation, resource constraints and social/professional status. For instance, Westphal et al. (2006) propose "despite limited prior evidence that resource dependence determines the formation of formal board ties, corporate leaders may nevertheless reconstitute informal (i.e., friendship) ties to leaders of other firms that have the power to constrain their firms' access to needed resources when those ties have been disrupted (e.g., due to turnover of the CEO's friend)" (p. 425). The article makes two contributions. First, the article contributes to the organizational behavior literature by focusing on the largely unexplored network dynamics of competitive action (Swab and Johnson, 2018, p. 157) through employee social networks, competition and group entitativity. Second, although there is immense literature on positive and negative employee competition in business, the article makes a contribution to the strategic management literature by moving beyond formalized structures and roles within an organization to focus on the multilevel informal workplace social interactions (Winslow et al., 2019), "alternate causal paths" and "underlying processes and structures as mechanisms" (Cornelissen et al., 2021, p. 7) that impact strategizing activities. Hence, the article extends strategy research in relation to how employee social networks operate through group entitativity in firm strategies. Entitativity is defined as pure group solidarity (Campbell, 1958) through physical, goal, behavior, similarity, and extent of interactions (Lickel et al., 2000). Entitativity operates through a cohesive group that shares static traits such as appearance in ethnicity and background in education and dynamic traits such as goals (Campbell, 1958). Therefore, the behavior of a high entitativity group's perception of group members will most likely align with the group's goals (Gergen et al., 1973) when the group shares similar appearance, behavior and outcomes. Social network theory in organizations suggests formal and informal social relationships form positive, neutral (supportive) and negative ties or relationships (Marineaua et al., 2018). Hence, employee social networks often operate within multiplex networks that are defined as signed networks or signed graphs (Harrigan et al., 2020).

Definitions and concepts of competition and competitiveness vary based on different research frameworks (Swab and Johnson, 2018). Individual and social competition often operates within absorptive capacity (Zou et al., 2018). The article defines individual and social competition as personal and collective competitiveness to undermine and win control over others that do not share the same behavior similarity, interests, values, and goals. Although, competitive interactions between employees could be decreased and prevented through trust and cooperation, the definitional assumption of competition fails to recognize how group entitativity could foster and increase competitive interactions between employees and increase employee invisibility behavioral practices (Anteby and Chan, 2018) through network structure cooperation and fragmentation. The article begins with a discussion of relevant strategic management literature, employee social networks, a theoretical framework, followed by a discussion, main limitations and future research with concluding comments.

STRATEGIC MANAGEMENT

Strategic management approaches are highly dependent on the changing environment (McGrath, 2013). Molina-Azorin (2014) suggests the literature in the knowledge-based view of the firm has been dominated by a macro orientation that considers constructs at the level of the firm rather than the skills, efforts,

knowledge and behaviors of individuals operating within rapidly changing uncertain environments. Moreover, theories of strategy and organization often depict organizations as unitary actors, rather than collections of individuals (Felin and Zenger, 2009). On the contrary, individual routines play an integral role in how a firm competes (Barnard, 1938; Aime et al., 2010). Despite disagreement among some scholars about the role of the individual to explain phenomena on a micro-level (Hodgson, 2012), social regularities vary and change, and require consistent re-evaluation of how individual order shapes and drives social order, especially within the failure of "economics imperialism" (King, 2012).

Previous research indicates that employees could become disloyal and resistant to an organization's identity and pursue identity-inconsistent strategies (Ravasi and Phillips, 2011) that in turn redirect firm strategies through an "identity–strategy misalignment" (Wenzel et al., 2020, p. 212). Moreover, employee coping strategies and tactics could dismantle firm strategies through misalignment of firm strategies through revised employee strategies. For instance, management could pursue market-oriented strategies to remain competitive rather than the firm's technology-focused identity and strategies (Nag et al., 2007). Examining the micro-level analysis of a firm's strategies and performance provide revitalization to bridge strategic management's theory-practice gap where social systems, scientific knowledge and professional practice operate interdependently (Dobusch and Kapeller, 2013; Cornelissen and Durand, 2014; Fisher and Aguinis, 2017; Drnevich et al., 2020). Furthermore, Lehmann-Willenbrock and Allen (2018) propose actual behavior is significantly understudied in psychology, despite psychology's scientific aim to explain human behavior because psychology often provides scientific evidence through actual behavior and temporal interaction data within student samples. Therefore, examining behavioral micro-processes in the real world of firm strategies could help to improve and advance understanding of actual temporal interaction data and analyses that occur within organizations and shape and drive employee social interactions and competitive actions in networks over time. Firm growth could be usefully studied as a social dynamic process (Pisano, 2016) of management interacting with resources. However, the firm level as a driver for firm growth, competitive advantage and collective productive resources prevents the firm from achieving stronger individual and organizational performance because the firm level ignores and minimizes the capacity and resources that individuals possess to shape and redirect the firm's resources and capabilities. Individuals could act *ad hoc* and irrational within different contexts. Hence, the determinants of firm performance require dynamic and static analysis at the individual level. For instance, Arain et al. (2018) found that knowledge hiding can spread from supervisors to subordinates.

Competitive analysis approaches in strategic management analyze major forces acting on an industry, such as the power of buyers and suppliers, the prospects for substitute products, and competition in its markets (Porter, 1985). Firms establish strategies to gain competitive advantage over their competitors through differentiation and selecting the segments of an industry in which a firm should compete (Porter, 1998). Content placed strategy making in planning (Ansoff, 1965) and positioning (Porter, 1980) traditionally focused on top management to formulate and implement strategies secretly through a macro-level perspective. Strategy process opened the door to a more comprehensive strategic plan of beliefs, goals and priorities (Dobusch and Kapeller, 2013) that is shared with select stakeholders actively participating in the strategy making process (Yunus et al., 2010; Castells, 2015). Process strategy has led to more open strategies (Whittington et al., 2011) due to increasing transparency and participation across sectors and industries with inclusion and collaboration of stakeholders in strategy practice.

Content and process schools reinforce the micro-macro link between networks, firm strategy and performance. However, both schools permit employees to continually operate informally through employee interactive networks that reshape firm strategies with select stakeholder networks that redirect firm performance in market competition. Open strategies that emphasize transparency and inclusion within open practices require careful consideration managing dilemmas on the organizational level and individual level (Hautz et al., 2017) due to employee social networking strategies. Inclusion of employees through the active process of strategy making, commenting and evaluation of ideas offers (a) opportunities for employee social networks to decrease or disregard organizational transparency and inclusion and (b) opens the door to increase the opportunities for employee social network strategies rather than merely relying on firm strategies. Overall, strategy making through content, process and open schools of thought is a social process (Hautz, 2017). Due to strategic management's value and significance to improve organizational performance, it should not be surprising that individual and social competition is easily embedded into the social processes of strategy making. Neither, is it surprising that firm strategies could be undermined by individual employees prominent in social networks, but are invisible to corporate hierarchy (Burt and Ronchi, 1990).

EMPLOYEE SOCIAL NETWORKS

Real World Networks

Networks of interconnected organizations and networks of individuals, leadership and teams will be managed in future organizations within "complex systems that produce chaotic outcomes such as emergent properties that are prone to large changes in outcome as a result of small changes in the relevant variables" (Teece, 2018, p. 362). Therefore, current and future organizations that operate in high uncertainty and constant change require a more "granular level of analysis that allows organizations to tap into the informal communication networks that determine how work in organizations really gets done" (Eisenberg et al., 2015, p. 152). Clearly, employee social network strategies have a strong potential to become deeply embedded within an organizational culture through sub-groups that act against firm-wide rules with or against others' consent (Thiel, 2020). Moreover, authority in an organization does not follow merely from a leadership position because a simple diagram of an organization do not show the full activity of all the leaders.

Often, the most influential employees are those with the least formal authority that may govern an organization autonomously. For instance, an employee can take the vision and idea from another co-worker or leader and publicly depict the vision and idea as the employee's original conception. Hence, Ghawi and Pfefer (2022) propose "The increasing need for handling real-world networks requires a deeper investigation of a multilayer network" (p. 1). Organizational network research in informal employee networks is challenging. There are an increasing number of scholars searching social networks in business and management settings (Cronin et al., 2021). However, real-world networks are constrained due to employees' concerns of privacy, sensitive issues, job security and management impact of employees' relationships that are considered outside of management purview.

Organizational and Social Structure in Employee Social Networks

Organizational structures are shaped through individual and social competition that operate within social interactions between individuals. Consequently, firms require shifting human capital to a more equal footing with financial capital for managing and improving organizational performance rather than disregarding the employee social processes that drive organizational performance. Moreover, the emphasis on financial capital to drive organizational performance permits wide gaps for employee discretion of employee valuation and abuse in the workplace. Hence, performance is a continually evolving social interactive process and construct (Thomas, 2006).

The continual emergence of new technologies require continual reassessment of firm strategies and employee social network strategies in changing organizational structures such as platforms. Cennamo (2016) proposes "platform value and ecosystem structures co-evolve *via* complex feedback effects" (p. 3061). Moreover, the structure of ecosystems-based platforms "explicitly extends the strategic view to include activities and actors over which the focal organization may have no control, and with whom they have no direct contact" (Adner, 2017, p. 44). Thus, individual and social competition can drive or constrain value creation-capture dynamics within and across competing ecosystems. This requires changing the way organizations examine and understand how employee social networks drive the value-creation process. In addition, platforms foster innovation and efficiency across diverse sectors requiring coordination, strategy and performance integration across organizational units and firms within conflicting interests or requirements. Therefore, competitive and cooperative behavior in organizational platform structures necessitate re-evaluating broader sets of capabilities and processes for redesigning market competition within parts of one organization to another organization, especially in asymmetric and hierarchical forms of organizing that do not disappear in new multinational network forms (Clegg et al., 2018).

There is growing emphasis from scholars on new collaborations across sectors and industries in responsible innovation (Owen et al., 2012) and open innovation. Digital platforms and interactions with artificial intelligence can change the way employees collaborate and compete through autonomous behavior in social network dynamics, making strategy formulation and implementation more challenging. In addition, human capital is not homogenous (Barney and Felin, 2013; Ostroff and Bowen, 2016). Therefore, the focus should be on capturing adaptation and value rather than merely static forms of organizing for determining individual and group preferences over others (Thiel, 2016). The rise of decentralized hybrid teams working through business innovation that reshapes the authority of an organization's structure and generates an employee network culture have access to a wider variety of skills and people, making dissemination of disinformation about individual employees and individual firms more likely to occur. Therefore, firms must (a) become strategically decisive to monitor and control employee social networks and their influence with competitors and (b) develop organizational strategies and performance internally through its employees, rather than poach from other firms to develop competitive capabilities. Hence, formulating and implementing strategies in organizations require examining systemic employee social networks with formal (Graen and Cashman, 1975) and informal planning systems for improved strategic control.

Although most information exchanges and mobility events may occur at short socio-metric distances (Sin et al., 2009; Othman et al., 2010; Dulebohn et al., 2012; Joseph et al., 2015; Sheer, 2015; Liao et al., 2017) the article focuses on short, medium and long-range structures located in the network as a whole. Employee social networks consist of both positive and negative reciprocated and non-reciprocated ties (Pauksztat and Salin, 2020). It is not uncommon for employees to enact "invisibility strategies" or "coercive surveillance" to resist workplace surveillance (Anteby and Chan, 2018, p. 1 and p. 13). Thiel et al. (2019) suggest it is important to examine an organization's culture with social structure linkages consisting of individual and social competition between the firm, within the firm, and connections through stakeholder interactions because employee social network strategies derive from relational networks, and human capital and cognition (Oliveira Correa et al., 2018). Many firms do not evaluate employee social networks and may be blind to where the most critical employees sit within a network. Hence, there is an unnoticed capacity (Holz and Miller, 2001; Kellogg, 2009; Kelly, 2014) from management based on how employee social networks control firm strategies. This is important because employee networks could work to downgrade another employee's skills and knowledge for personal gain. For instance, employees working and living in geographic areas with high corruption and high risk communities connect with their community peers that are working and living in low corrupt and low risk geographical areas. The employees and community peers monitor and control the work relations, social identity and reputation of community outsiders that become aware and learn how informal deviant behavior is sustained from the employees working and living in geographic areas with high corruption and high risk communities and from community peers that are working and living in low corrupt and low risk geographical areas. Moreover, since employee networks

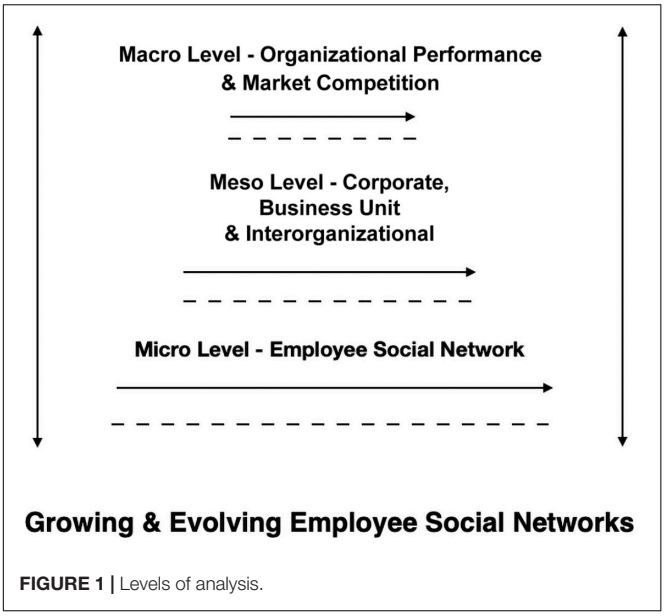

FIGURE 1 | Levels of analysis.

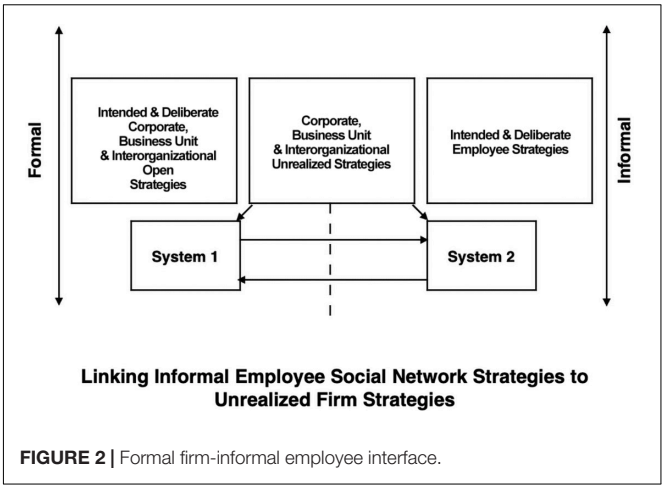

FIGURE 2 | Formal firm-informal employee interface.

operate across networked organizations, social control is easy for employees collaborating with community peers because they could persuade human resources staff and leadership (Liden and Antonakis, 2009) to accept their evaluation of an employee that previously was a community outsider. Hence, employee networks are not confined to the business environment. Rather, employee networks generate nodes within society at large that connect into firm networks and ecosystems.

Levels of Analysis in Employee Social Networks

Employee social network strategies operate through three levels of analysis (micro, meso and macro). **Figure 1** highlights the connected micro-meso-macro levels beginning with the foundation of employee social networks at the micro level, corporate, business unit, and interorganizational strategies at the meso level and organizational performance and market competition at the macro level. Employee social networks derive from informal individual employee strategies that evolve and merge with formal firm strategies through the connected micro-meso-macro levels and in turn, could improve or decrease organizational performance.

Employee social networks consist of strategic interactions that form multilevel networks and intertwine with existing networks worldwide to secure individual and collective interests within the foundation of an institution, a community and its ecosystem. Employees communicate within centralized, decentralized, and distributed networks (Vergne, 2020). Consequently, network multiplicity occurs within multilevel employee social networks that share market knowledge and employee reputations to industry stakeholders operating and communicating with market actors in market competition.

Mirabeau et al. (2018) identify six manifestations of strategy namely, intended, deliberate, unrealized, realized, emergent, and ephemeral strategies. Informal employee social network strategies evolve and grow from individual and social competition and reconfigure the network paths of formal firm intended and deliberate corporate, business unit and interorganizational open strategies. Employee informal intended and deliberate social strategies could thwart a firm's formal strategies into unrealized strategies (**Figure 2**). Consequently, informal employee intended and deliberate strategies may be considered merely insignificant ephemeral strategies, but in fact are constructed social strategies (Suominen and Mantere, 2010). It is important to highlight the strong potential of employee autonomous behavior that could work to reconfigure effective firm performance. For instance, a CEO's unsuccessful visionary strategy may implicate the cause to poor emergent firm strategies rather than informal employee strategies within the organization. Moreover, Maritz et al. (2011) findings indicate "emergent strategy making is associated with quick response and adaptation to environmental changes, more autonomous decisions and actions, less control and higher intangibility" (p. 101). Consequently, employees could have multiple simultaneous strategies that coexist and align with a CEO's strategy.

THEORETICAL FRAMEWORK

Individual and Social Competition Typology

Employees strategize through day-to-day activities (Jarzabkowski, 2005) and day-to-day relationships. Competition is not always about winning or assessing how an individual employee compares to her or his peers. Rather, competition is dynamically shaped through strategic interests and interactions within networks. Bilancini et al. (2019) suggest competition often involves strategic interactions such as a strategic quotient test to determine abilities and rationality for strategic success. Strategic interactions are difficult to measure because it is a deviant form of behavior in that it takes place without organizational approval. Evidence provided by Bilancini et al. (2019) collected data indicate success is dependent on understanding of others'

preferences and understanding of others' cognitive skills. In addition, Thye et al. (2011) found evidence for competitive networks that are structurally more cohesive tend to "promote group formation among self-interested actors who pursue those interests through dyadic exchanges" (p. 409). Thus, individual and social competition is often driven by a mechanism of mentalization (Wang et al., 2018) in strategic interactions. The authors, Wang et al. (2018) propose two new psychological measures namely, competitive attitude and competitive behavior to show competitive behavior is driven by some internal psychological characteristics that can be changeable and adaptable under different environments. Moreover, the authors' findings indicate cooperation can coexist with other strategies (Deutsch, 1949; Nowak, 2006; Krueger, 2013; Gnyawali and Charleton, 2018).

The typology shows the potential antecedents that initiates informal employee strategic interactions through self, shared, collective, or relational interests. For instance, a new employee may be perplexed on whether to listen and follow a supervisor exclusively regarding beliefs and values. In turn, beliefs and values may often play a role on whether the supervisor will like an employee or not (Blair et al., 2017). If the new employee maintains a neutral position or favors the values and beliefs of another employee rather than the supervisor, the staff will work more closely together informally, rather than formally with the supervisor and other employees. Hence, proposition 1 proposes informal employee social network strategies are driven by strategic behavior and interactions within individual and social competition. Individuals make latent decisions about employees that begin from individual and social competition and widen in scope through multilevel social networks. Moreover, these social networks often work in protective ways to ensure that employees are selected and promoted according to the individual and social interests of the network. Therefore, informal employee individual and social competition could easily reconfigure firm strategies and performance.

Individual and social competition in **Table 1** specifies the initial conditions for group entitativity to develop and grow. The typology begins with personal self-interest followed by shared self-interest, collective self-interest, and lastly relational self-interest. The interest type characteristics indicate increasing satiation of interests that move from the micro level to the meso level and onto the macro level. Individual and social competition could be utilized within person-to-person or organization-organization interactions. In the typology, value related factors (Felin et al., 2015) are mechanisms for self, shared, collective and relational interests that aggregate, develop, and grow within informal employee socialization in the organization and externally with stakeholders and market competition. For instance, power in **Table 1** could be represented in both formal and informal self-interest forms. Formal power could be exercised through the leadership in a firm as formal routine tasks. Informal power occurs within social and cultural interactions between individuals and organizations and how they relate to each other (Huxham and Beech, 2008). Marineaua et al. (2018) research study findings indicate "individuals with power can indeed be more accurate about social network ties; however, we also found that when the person with power is directly involved, accuracy increases" (p. 156).

Group Entitativity

Group entitativity is a mechanism in network formation and in the selection of relational and governance structural processes that encompass "reciprocity," "popularity," "activity," "triad closure," and "brokerage" "endogenous structural processes" (Kim et al., 2016, p. 25) in varied and combined network structures. It is important to examine group entitativity because employees' can easily obtain social control in a firm through employee autonomy such as generating open and innovative strategies, and problem solving (Hautz et al., 2017). Entitative groups form a coherent entity. Groups perceived with significant entitativity through high degrees of interactions and goals will become more intimate (Vock et al., 2013) and may provide greater need fulfillment than less intimate groups (Crawford and Salaman, 2012). Group entitativity is driven through focused impression management of individual and group efforts because employees are treated by others in the organization and within society at large in terms of both their shared individual qualities and their group affiliations for work and social status. Adelman et al. (2018) propose "perceptions of entitativity may also be influenced by motivation and are adapted in self-serving ways to create the necessary conditions for holding other groups responsible or not" (p. 37). Group entitativity is appropriate for determining useful predictions that are sustainable and forward looking causal mechanisms rather than merely relying on professional experience (Anand et al., 2016) as a source of a firm's capability because employees frequently makes implicit decisions based on personal and collective interests through social networks in the workplace. Hence, proposition 2 suggests individual and social competition develops and grows group entitativity.

Managing the true impacts of a business can improve performance and competitiveness, making it better and less costly for a firm than doing nothing (Griffin and Freeman, 2016). Clearly, who contributes to strategy variation, selection and

TABLE 1 | Typology of individual and social competition.

Interest type	Self interest	Shared interest	Collective interest	Relational interest
Value factors	Personal choice; self-attributed traits; self-worth; emotional satisfaction; individual comparison; reputation; knowledge; skill development; freedom; indifference; age; gender; first place; power	Social purpose/cause	Pre-determine others; social control; social comparison; social evaluation; similarity of traits and values; social identity; social interaction rules/norms; cooperation; identity governance	Specific friends and family members

retention (Arndt and Norbert, 2015) as well as who realizes when employees such as leaders and subordinates unite in group entitativity requires rethinking employees' discretionary impacts in firm strategies and performance because group entitativity is easily hidden in firm strategies and performance. Previous research in entitativity suggests it is common for individuals to describe organizations as separate entities (Koivunen, 2009) and foster group-like thinking and practices (van Vuuren et al., 2012). Within social competition, outgroup entitativity increases fear and negative responses from the entitative group because a competent out-group opponent is more dangerous than an incompetent out-group opponent (Frauen et al., 2020). Stollberg et al. (2015) research study indicates "some groups are better suited to fulfill a need for control than others: when multiple in-groups are salient in a situation, people respond to control threat by increasing identification only with those groups that are both highly entitative and agentic" (p. 10). Likewise, Insko et al. (2013) empirical research findings indicate

> fear and greed flow from perceptions of entitativity, and entitativity perceptions, in turn, are strongly influenced by the group's decision-making rule— whether group members' choices are aggregated following a simple majority rule. On the basis of these results, we would advise managers and employees to be mindful of the decision rules they employ in organizational settings. Inter-departmental cooperation within organizations can be undermined by decision-making rules, like majority-vote, that increase greed within a particular group (or department) and decrease trust from other groups (p. 179).

Group types vary in level of perceived entitativity (Lickel et al., 2000). Employees may actively seek to cooperate with other members for benefits from knowledge sharing (Lee and Yang, 2014). However, group entitativity displays a unified entity that flourishes through individual and collective interests. Moreover, patterns of group entitativity can rise and fall. Hence, weak employee social network ties do not imply group entitativity is absent. Empirical evidence reveals entitativity increases with group size and decreases with variability and diversity due to how meaningful a stimulus pattern is (McCarthy et al., 1995). Group entitativity is significant in shaping the social identity of members and the internalization of group norms such as shared norms, mutual acceptance, attraction to the group and the resistance to disruptive influences through psychological processes (Hogg and Reid, 2006). It is a form of authoritarian governance that is strategic through prospering as an organic process, rather than through command and control. In addition, complex social environments could make employee social networks invisible in an organization. For instance, employee social networks can hide informal practices through dispersed teams operating in network infrastructures and swarm work because the employees are unlikely to charge each other.

Personal and group interests and values form the strategic competitive actions through employee interactions in social networks. Firat et al. (2018) suggest "value priorities act as more than a personal moral compass; they constitute the basis of shared group moral understanding" that create a bond for group entitativity (p. 1). One example of group entitativity is Chinese guanxi's social networks and family relationships that take precedence and preference over other individuals and groups. A second example is networked cartels, organizations and communities that work to contain and monitor transformation threats with individual employees in networked organizations and markets across the globe. A third example is entitative group members in a "platform ecosystem can influence the behavior and outcomes of other members and the outcomes for the ecosystem overall" (Rietveld and Schilling, 2020, p. 24) in positive and devious ways. For instance, "despite the ability of networks to provide opportunity, networks can also close opportunities or reproduce inequities in employment access" (Jabbar et al., 2020, p. 1489). Moreover, employees may be ignorant and unaware of group entitativity operating in a firm because there may be merely a few individual employees that connect with employees from other networked organizations that form group entitativity. Hence, proposition 3 proposes group entitativity fosters protective employee interorganizational network interactions that span across industry stakeholder connections and market competition.

Interlocking Personal and Work Ties as Interorganizational Networks

The social process and network formation could easily begin with "prior interlocking ties" (Kim et al., 2016, p. 31) from an employee working in a firm that connects with known external actors to make new ties within interorganizational networks. An entitative group could be culturally normalized through networked employees, organizations and markets. The group forms through employees' social network of workplace rules, how tasks are done, and employee skill and value expectations within interorganizational networks. For instance, an individual interviews for a position with the marketing director of a firm. The interviewee finds the marketing director questioning why the interviewee is not interacting and behaving in the way the director was informed by the marketing director's interorganizational social networks where the interviewee previously worked. The marketing director's interorganizational social networks depicted the interviewee as having negative social interactions to downgrade the interviewee's future employability and undermine the interviewee's ability and skills to succeed in future employment. However, the interviewee is interacting naturally with the marketing director during the interview. The interviewee follows up with the marketing director about the position. The marketing director hired someone else. The example shows the marketing director is an external employee social network member with the interviewees' previous employer. The internal employee social networks know the marketing director because the marketing director is from the same ethnic group. It is common for employees to form social networks through group entitativity based on ethnicity or physical appearance (Lickel et al., 2000) to protect and stick together for collective interests. The marketing director was given false information about the interviewee because the interviewee resigned from the previous position due to hidden

unethical business practices. The marketing director could be unaware of the hidden unethical business practices that are occurring within the network members or the marketing director is aware of the unethical practices and is simply protecting the concerns and issues of outsiders from network members. Nevertheless, group entitativity is formed through the internal and external employee networks' social control in both firms. The interorganizational impacts operate through informal and formal "density, paths, reciprocity, activity, and popularity spreads" (Zappa and Lomi, 2015, p. 555) across sectors, industries, and stakeholders that connect into market competition. Hence, interorganizational networks have strong potential to decrease employee value creation and organizational performance. Interlocking networks tend to take similar stances on a wide variety of issues that overlap with other forms of information and resource sharing (Messamore, 2021). Since employee networks often lead toward groups of mutual exclusivity in organizations, it will be a complex challenge to determine the key network actors. Therefore, managers should take advantage of the firm's embedded social relations and social structures (Wolff et al., 2021) to determine the direction of the firm's strategies and to better evaluate and measure organizational performance.

Informal social status plays a key role on how an employee is treated by the actors in the organization. Low social status in a network provides benefits in the networks and little cost to an employee that spreads negative information about another employee (Ellwardt et al., 2012). By focusing on negative influence to decrease the social status of an employee in an organization, personal and work ties within interorganizational networks are likely to accept the spreading of the negative influence and information on the employee, including reinforcing the belief among internal and external network ties that the employee deserves low social status. Employee social networks flow firm resources and capabilities to make judgments about each actor's status within the organization and externally to other organizations. Although network nodes and links in the real world are embedded in a physical space, whereby the interactions between the nodes depend on the geometrical distance between nodes (Braha et al., 2011), the theoretical framework is addressing employee social networks that are not dependent on the network physical space, but rather the preference of members through group entitiativity and within the initiating conditions of individual and social competition in the typology.

The predominant approach to studying social networks assumes that the network exists independent of each actor (Marineaua et al., 2018). However, in this article the network is not independent of each actor due to the embeddedness of group entitativity. Hence, the signed graph network (Harrigan et al., 2020) is formed and sustained through group entitativity. Group entitativity is a mechanism that gives the employees strategic advantage over other employees within the organization. The employees influence other actors within the firm and across organizations and communities. In **Figure 3**, individual and social competition specifies the initial conditions in employee social networks.

Step-by-Step Process of Connecting Informal Employee Social Network Strategies to Formal Firm Strategies

Employees located at the corporate level (remote/industry) engage in informal self, shared, collective and/or relational interest that join group entitativity with employees at the formal business unit (remote, industry, market) levels. The informal employee networks merge formal corporate and business unit strategies within interorganizational networks and industry stakeholder connections in market competition at the community, regional, national, and global levels. In turn, unrealized formal corporate and business unit strategies and decreasing organizational performance flourish. In addition, it is important to pay attention to how informal employee networks' culture and context could change the strategic activities' environmental fit as well. Overall, **Figure 3** reveals how closed homogenous network ties work through open heterogenous network ties to reconfigure different levels of strategies from different involvement of employee networks.

General Background Summary of Connecting Informal Employee Social Network Strategies to Formal Firm Strategies

Utilizing configurational theorizing (Cornelissen et al., 2021, p. 7), employees are tangible assets that generate multilevel informal workplace social interactions (Winslow et al., 2019) through "alternative causal paths" (Cornelissen et al., 2021, p. 7) such as positioning the marketplace of firms within unproductive relationships and prevent partnering with other successful firms. Alternate causal paths operate through informal employee social interactions within group entitativity as the mechanism and the firm's resources and capabilities as an inviting structure for group entitativity to flourish within the firm and externally to other organizations as well. Group entitativity within employee networks could produce differing social interactions due to local and national cultural factors such as individualism, collectivism, masculinity, work attitudes, status, time orientation, power distance (strict/flexible boss-subordinate relationships), and face-saving. Attention to contextual cultural factors operating within group entitativity is important due to how group cultures may be obscured within the formal organizational culture. Contextual factors such as national, state, local, and organizational policies, community norms, practice culture, legal environment, historical factors, and recent events may change employee network group entitativity over time. Furthermore, employee networks could easily transcend national boundaries into global communities that are obscure to firm strategy activities. Overall, a parent company that directs other subsidiaries located in different countries require contextual and cultural views of group entitativity within employee networks. The "underlying processes and structures as mechanisms" (Cornelissen et al., 2021, p. 7) include individual and social competition, and group entitativity. Hence, informal employee network strategies shape and redirect a firm's core competencies

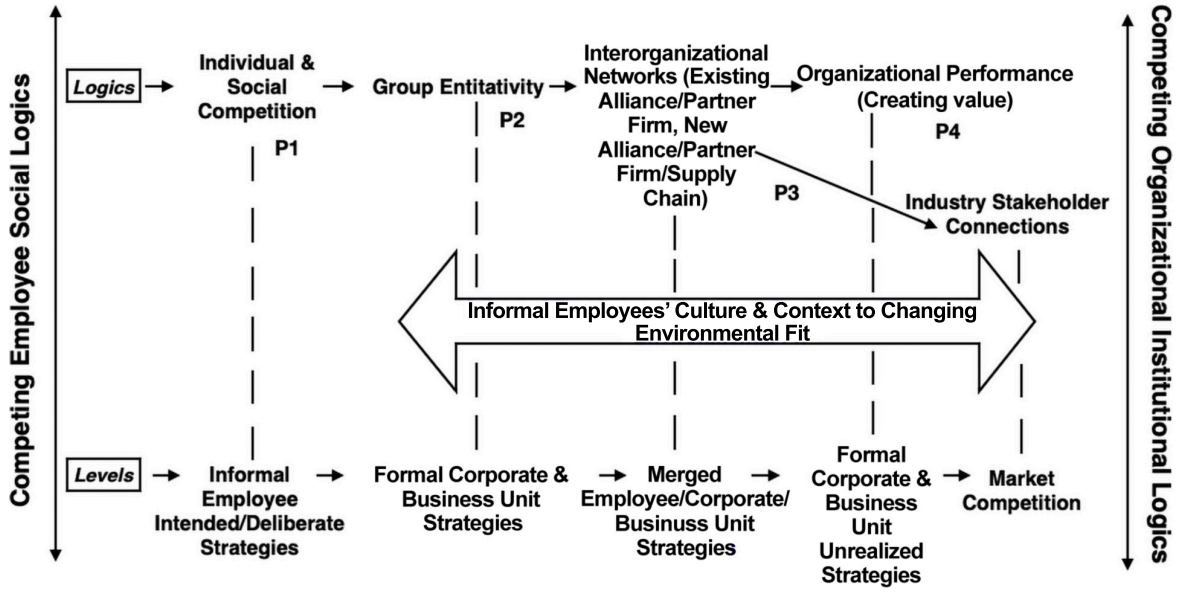

FIGURE 3 | Connecting informal employee social network strategies to formal firm strategies.

and capabilities, which in turn impacts the firm's strategic activities, environmental fit, market competition and ability to create value through organizational performance.

Group entitativity plays a key role within interorganizational networks. The personal and work tie interlocks in the logics and levels act as pipes that spread information through unequal opportunity structures (Heemskerk, 2013) within organizations and position key network actors' negative and positive influence across dyads and within internal and external network ties. Informal employee strategic interactions between internal employee networks and external employee networks become formally integrated within job-related tasks and workplace rules (Graen and Scandura, 1987) that shape and drive formal firm strategies and performance throughout the hiring and talent management processes. The interorganizational networks are embedded and sustained into firms and are interconnected through networked employees, organizations and markets. Firm strategies and performance will decrease due to unobserved or invisible mismanagement in business practice and people. Clearly, "intentional human action and interaction causally produce strategic phenomena" (Abell et al., 2008, p. 492) that reconfigure a firm's strategy and performance.

Few firms possess and hold all the resources needed to implement a strategy. In an ideal sense, the organization's culture should encourage strategic thinking at every level of the organization. Employee networks could easily shape and constrain partnerships, value creation, and value capture in a business model. Many multi-business firms operating within a remote environment will evaluate the influence of certain developments such as political, social, economic, technological, and environmental factors on a specific business unit. However, no attention is paid to the influence of informal employee social network strategies that could easily reshape and redirect corporate perceived remote and industry environment developments. For instance, employees could easily influence the marketplace of firms within unproductive relationships that prevent partnering with other successful firms. Consequently, informal employee social network strategies impact market competition through power relationships among suppliers, buyers, entrants, substitutes and rivalry that influence current and future levels of prices, investment in the industry and firm performance and profitability. Furthermore, interorganizational open strategies require firms to develop their strategies collaboratively through a strategy process with other organizations. In addition, firms will formulate strategies for improving supply chain efficiency and decrease working capital within increasing market competition among networked relationships with organizations that must jointly share information to derive benefit from the interorganizational arrangement. Firms can develop differential advantage through employee networks due to changes in the competitive environment which in turn, lead toward sustainable competitive advantage because competitors will find them difficult to emulate (Clark and Collins, 2010). Since firms are dependent on employee social networks to drive and shape organizational strategies, employee social network management should be prioritized and integrated within a firm's financial management. Supervisors must learn to manage subordinates learning and task performance not merely through data analysis, but rather in a socially connected world (Lee et al., 1999). The theoretical framework shows how employee social network strategies emerge and flow in a reciprocal manner from the organizational level to society at large. Knowing how to compete and cooperate

(Rodriguez and Bharadwaj, 2017) from employee relationships to market competition is an imperative for managing organizational performance. Hence, proposition 4 suggests employee group entitativity within interorganizational networks decrease organizational performance.

DISCUSSION

Managing Informal Employee Social Network Strategies

The article demonstrates how and why employee social networks could influence firm strategies and organizational performance. The article's research findings show some similarity to previous empirical evidence that reveal people will develop relationships with individuals that have similar interests and goals to themselves and negotiate control through informal freedom rather than formal absolute control and power (Burt, 1992). However, this research study does not focus on the value buried in structural holes through social capital (Burt, 2001). Rather, the article brings to light multilevel informal employee social dynamics that operate through simultaneously closed and open networks within firm strategizing activities. Group entitativity and value factors in the typology are mechanisms for self, shared, collective and relational interests that aggregate, develop and grow within informal employee socialization processes in the organization and externally with stakeholders and market competition. The underlying processes, mechanisms and alternate causal paths in social, relational, governance, network and organizational structures provide new insights and implications for firm strategies and organizational performance. Organizational strategy analysis pays attention to the external changing environment and market competition for potential impacts in business processes, organizational learning and growth, financial and stakeholder needs and firm specific resources and capabilities. Since routines and managerial decisions play a critical role in firm strategies and organizational performance, understanding the firm's core competences through complex systems that evolve unpredictably is essential (Graen, 1976). For instance, Triggs and Leigh (2019) propose there is a growing body of research and experience that shows the "Chicago School's faith in the ability of markets to self-correct and deliver competitive outcomes was misplaced" (p. 1). Therefore, firms must analyze formal firm strategies and formal environment strategies with informal employee social network strategies to improve firm strategies, resources, capabilities and the industry environment (**Figure 4**).

Since employee social network strategies are geographically dispersed, it is important for management to acknowledge network connections among market competitors, the firm's employees and firm alliances for managing and improving firm strategies and organizational performance. Management should take into consideration informal employee social network strategies in the strategy making process for firm market positioning and when building and sustaining competitive advantage. It is common for strategists in the organization to fill the role of supervisor and staff in strategy. However, without considering informal employee social networks strategies there are unrealized strategies, missed opportunities and increasing risk. New strategies often require a new organizational culture, structure, and tasks that create a triggering event for accelerating informal employee invisible practices that span interorganizationally from the firm to market competition. Since competitive networks operating in a firm are an important and positive source of a firm's competitive advantage (Wang and Gao, 2021), management should pay particular attention to how informal employee social networks obtain social control from firms. Likewise, Ramai et al. (2018) suggest some social networks can be socially non-conducive that raise questions over behavioral intensity, bullying, social distance, boundedness and exclusivity, and situations where members are mutually or reciprocally negative. This could happen through crossing closed homogenous network ties through open heterogenous network ties. Therefore, open strategies and open innovation will require critical examination of networked business professionals that operate and communicate in nebulous support networks across sectors, industries and communities worldwide.

Invisible deficiencies in organizations are never found on the risk register. Employees generally know and could predict the demise of their organization's strategies well before organizational performance decreases, but the reasons are rarely discussed with managers, leaders and subordinates due to complex issues that are too sensitive to raise openly. Depicting employees as a tangible resource in an organization tends to mask the actual invisible individual and social activities involved (Cropanzano and Mitchell, 2005). Dark social networks (Grant, 2016) are not confined to the internet and cartels. Rather, dark networks are intertwined with positive or neutral social networks. Organizations will not benefit from strategy implementation if the employee small-scale actions are not examined. In addition, stakeholders in the external environment may be connected in routine small actions with employee social network strategies that could deceptively reconfigure firm decision-making and strategies, organizational performance, industry stakeholders and market competition.

Implications for Firm Strategies and Organizational Performance

Research studies indicate knowledge spillovers and misappropriation are prevalent because of inter-firm competition, colocation, alliances, as well as employee mobility (Hamel et al., 1989; Shaver and Flyer, 2000; Berry, 2014; Inkpen et al., 2019). Unsurprisingly, permitting these type of actions and activities to foster and grow into and over other organizational goals and strategies generates systemic disruptions to firm strategies and organizational performance. Moreover, similar to formal firm strategies, informal employee social network strategies include a system of rules, sanctions and laws for individual and social cooperation within employee interactions that are inadequate and necessitate monitoring of self-interest (Peachey and Lerner, 1981; Liao et al., 2010). A key driver of improved individual performance may be cumulative experience (Neffke, 2019). Nevertheless, the value of experience can generate

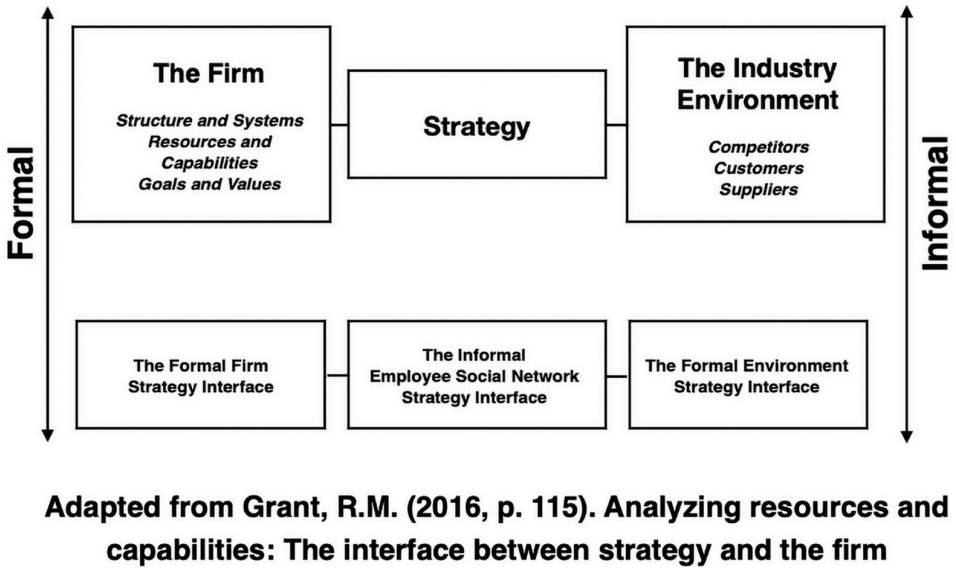

FIGURE 4 | Analyzing informal employee social networks in formal strategy formulation.

competency traps or core rigidities (Leonard-Barton, 1992) in strategy formulation through social network connections of small scale employee actions within day-to-day job routines in the organization that connect through employee-stakeholder social networks within market competition. Therefore, informal employee social network strategies require examination of "tight interlinkages between preferences, culture, and institutions" (Demeritt and Hoff, 2018, p. 2) for improving strategy formulation, implementation, organizational performance (Guiso et al., 2015), and market competition.

Main Limitations and Future Research

A limitation of the theoretical framework is the particular culture and environmental context. Since cultures and characteristics in group entitativity may affect firm strategies and performance differently, future research could examine the network characteristics and cultures that are most likely to positively and negatively affect firm strategies and performance in their particular environmental context. Network size could be a limitation due to dense and sparse networks within differing organizational structures. Future research could conduct a comparative analysis of network size and organizational structures. A third limitation stems from network structures that predict similarity between attitudes and behaviors indirectly rather than directly (Burt, 1992) that could change over time. Longitudinal studies could help to shed more light on indirect changing group entitativity and competitive actions in employee social networks. In addition, future research could randomly select participants from the population to evaluate variation within firms' departments, divisions and unit level network interactions to understand the static and "temporal dynamics" (Lehmann-Willenbrock and Allen, 2018, p. 326) that surround group entitativity within networked organizations and markets.

The theoretical framework could be operationalized quantitatively by using dynamic social interaction analysis techniques (Sekara et al., 2016) or social network analysis (Tichy et al., 1979; Marsden, 2005; Domínguez and Hollstein, 2014; Molina et al., 2014). Future research could investigate comparative micro-meso-macro links through the theoretical framework within different firm strategies across sectors and industries. Moreover, future research could compare small and large organizations to identify potential moderators of the relationship among employee networks, firm strategies and performance. Lastly, future research could investigate formal firm strategies in technology clusters (Speldekamp et al., 2020) within the theoretical framework to determine how dark networks could develop through employee social network strategies in organizational platforms and social media that connect with industry stakeholders and market competition to improve firm cybersecurity initiatives.

CONCLUSION

Due to COVID-19, many firms are operating within networks of interconnected organizations and networks of individuals. Firms must evaluate informal employee social networks *with* firm strategies to improve strategy formulation, implementation and organizational performance. The propositions highlight the importance of informal employee social network strategies within individual and social competition and group entitativity could easily generate protective employee interorganizational network interactions that span across industry stakeholder connections and market competition, and in turn decrease organizational performance and market competition. The theoretical framework

and key concepts, namely group entitativity, individual and social competition, and informal employee social networks provide a new interpretation that is distinct and bounded from other ways of theoretically framing firm strategies to improve strategy formulation, implementation and monitoring through corporate strategies, business unit strategies, functional strategies and operations level strategies. Overall, the article contributes to understanding how informal employee social network connections influence strategic activities, cybersecurity, diversity, equity and inclusion, and employee management.

DATA AVAILABILITY STATEMENT

The original contributions presented in the study are included in the article/supplementary material, further inquiries can be directed to the corresponding author.

AUTHOR CONTRIBUTIONS

MT formulated the idea, conducted the research, and wrote the manuscript.

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Components of Unrealistic Optimism of College Students: The Case of the COVID-19 Pandemic

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College students are among the most strongly affected populations by the coronavirus disease-2019 (COVID-19) pandemic because of uncertainty regarding academic success, future careers, and social life during their study period. Their mental health and behavior may dramatically be impacted. The study examined an unrealistic optimism of Israeli college students in assessing the health, security, and economic risks during the pandemic, and the contributions of these perceived risks to the prediction of psychological coping responses, such as well-being, and coping suppressing response of anxiety, expressed during this pandemic. Using social networks, a questionnaire was disseminated to students during the third lockdown that was implemented in Israel because of the pandemic. Depressive and anxiety symptoms, perceived threats, resilience, well-being, hope, and morale were measured using a structured quantitative questionnaire. First, we hypothesized that the three perceived risks would be inversely rated, so perceived health risk would be rated lowest, and perceived economic risk would be rated highest. The second and third hypotheses claimed that psychological coping responses articulated along this pandemic would be predicted by all these perceived risks, as well as the observance of pandemic precaution rules. The fourth hypothesis suggested that the three investigated perceived risks will positively and significantly correlate with each other. The results generally supported the hypotheses and indicated that the unrealistic optimism process was employed quite consistently by the participating students.

Keywords: COVID-19, perceived risks, unrealistic optimism, distress symptoms, individual resilience, well-being, college students

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INTRODUCTION

The coronavirus disease-2019 (COVID-19) pandemic has a dramatic impact on the mental health and behavior of people. Studies on COVID-19 risk perception and perceived cognitive and emotional dimensions found that it was associated with higher levels of frustration, confusion, inadequacy, uncertainty, anxiety, anger, and loneliness (Lanciano et al., 2020), as well as lower levels of coping, well-being, and finding meaning in life (Krok and Zarzycka, 2020). A comprehensive study on the antecedents of this risk perception, conducted in 10 countries around the globe (Dryhurst et al., 2020), found that this perception was significantly influenced by cognitive, emotional, social, and cultural factors, as well as direct and indirect experiences with the virus.

The study was conducted at the beginning of the year 2021, after a peak of the COVID-19 pandemic, during which an overall lockdown policy was directed, requiring the entire Israeli population, except for employees in vital services, to remain at home 24/7. The decrease of this pandemic was most likely achieved due to a national COVID-19 vaccination campaign (Leshem and Wilder-Smith, 2021). Vaccinations were widely available from December 2020, according to a prioritization schedule determined by the Israeli Ministry of Health (MOH). During the early phases of the distribution process, individuals considered as being at high risk for COVID-19 were prioritized for vaccination, such as those older than 60 years, nursing home residents, healthcare workers, and those with severe comorbidities. Later on, the vaccination campaign was gradually expanded until all individuals aged 16 years and older were eligible to receive the vaccine. The national vaccination campaign has led Israel to have one of the highest rates of vaccinated individuals per capita. As of February 24, 2021, 68.7 and 48% of the eligible population was vaccinated with one or two doses of vaccine, respectively (Rossman et al., 2021). This successful campaign did not prevent the immediate effects of the crisis on the Israeli economy, in the form of rising public expenditure and levels of unemployment (Bental and Shami, 2020a,b). In a breakdown by sector, expenditure in gas stations declined by about half during the first lockdown and by 21% during the second. Expenditure in the restaurant section was reduced to one-third its normal level, and in the hotel and leisure industries, expenditure was reduced to one-quarter and one-half its normal level, respectively. In grocery store chains, expenditure rose by more than one-third during the first lockdown. Additionally, many Israelis became unemployed or were put on unpaid leave because of the COVID-19 crisis. After declining between the lockdowns, the rate of unemployment insurance recipients rose again during the second lockdown and reached 240,000 additional recipients.

College students are among the most strongly affected populations by this pandemic because of additional uncertainties regarding academic success, future careers, and social life during their study period, among other concerns (Son et al., 2020). Furthermore, college students feel increased stress levels, anxiety, and depressive symptoms as a result of the uncertainty of university education, technological concerns of online courses, social isolation, decreased family income, and future employment. These impacts have been observed in universities across the world (Aristovnik et al., 2020). Among the most commonly reported effects were lack of motivation, anxiety, stress, and isolation, as well as social distancing (Browning et al., 2021). Efforts to reduce these worries and anxieties by psychological means often employ unrealistic optimism (Breznitz, 1983).

Unrealistic Optimism

Research has found that under threatening and uncertain conditions, individuals tend to falsely reduce the perceived threat of adversities faced by them. This tendency is called "optimism bias" or "unrealistic optimism" (Shepperd et al., 2015). Such personal risk reduction relies on the belief concerning the likelihood that an adverse event will hurt the individual and the severity of that event (Floyd et al., 2000; Milne et al., 2000). Unrealistic optimism is defined as the "tendency for people to believe that they are less likely to experience negative events and more likely to experience positive events than are other people" (Shepperd et al., 2002, p. 65). Another mode of unrealistic optimism refers to an unjustified belief that a personal outcome, such as exam grades, will be more favorable than it should be according to some quantitative objective standards (Shepperd et al., 2017). This "better than average effect" of unrealistic optimism has been previously found in students' belief that positive events are more likely to happen to them while negative events are less likely to happen to them, compared to the average student (Campbell et al., 2007). A cross-cultural research presents a more complicated phenomenon: unrealistic optimism as a form of self-enhancement is shaped by status (Sissons Joshi and Carter, 2013). The health belief model (HBM) investigates unrealistic optimism in relation to the risk of occurrence of selected health problems, and the extent to which it leads the failure of people to engage in positive behaviors that will promote their health and well-being (e.g., Peterson and de Avila, 1995). Studies on cancer threats, conducted on members of the general public, have, thus, found an optimistic bias pertaining to prostate cancer, for all HBM variables: risk and severity of prostate cancer and barriers to and benefits of screening (Clarke et al., 2000). An interplay of culture and socioeconomic circumstances was identified; for example, Indian participants have shown higher levels of optimism than English partakers in rating bad events. No such comparative unrealistic optimism has been found for English participants in good events and in the Indian sample it appeared only among members of higher socioeconomic conditions (Peterson and de Avila, 1995; Clarke et al., 2000). Similar unrealistic optimism has been found in a study on fraudulent transactions occurring *via* the Internet or automatic teller machines (ATMs). Results indicate that users have typically felt safe and secure while conducting financial transactions with the ATM, and that their behavior has reflected components of the HBM. They perceived the level of threat as low, mainly because they thought it unlikely that they would be victims of fraud and because of reduced sense of responsibility for any negative outcomes. Despite being aware of such fraudulent activities, they were not sure about the efficacy of behaviors designed to counteract fraud, and their potential efficacy (Davinson and Sillence, 2014).

Furthermore, security concerns among ATM users were not as high as concerns among Internet users, with Internet users appearing to take higher individual responsibility of their personal technologies in more private spaces. Thus, it was shown that unrealistic optimism can determine beliefs on health, romantic relationships, and professional success (Scheier and Carver, 2008).

It has been argued that these beliefs are, in many cases, genuinely unrealistic and irrational, since they are often based on information that is less than rational (Jefferson et al., 2017). However, it is also claimed that although unrealistic optimism includes systematic tendencies to form beliefs that are biased and often false, it involves significant benefits as well

(Taylor and Brown, 1994): it increases well-being, contributes to mental and physical health, and supports productivity and motivation (Bortolotti and Antrobus, 2015).

Three major potential explanations were offered by Shepperd et al. (2015) for unrealistic optimism: first, impression management or self-enhancement goals; second, belief of people that they are unlikely to experience unfavorable outcomes; third, people judging their likelihood of experiencing an event on the basis of how well they match their stereotype of the people who experience the relevant event. The explanation of these authors for unrealistic optimism claims that people tend to transform a comparative judgment into a personal judgment, so their perception of a personal risk is sometimes based merely on their personal feelings.

Two major general explanations have been offered for the persistence of unrealistic optimism in the face of contrary information. The first emphasizes on attention processes. Sharot et al. (2011) claim that it perseveres through selective attention for new information that confirms positive beliefs and disregards information that contradicts these beliefs. Moreover, these beliefs are accepted as truth by the individual (Jefferson et al., 2017). The phenomenon of unrealistic optimism is widespread and is applied in many situations, ranging from health to perceptions of different risky situations (Reyes-Velázquez and Sealey-Potts, 2015). It appears that unrealistic optimism is so persistent because of its positive psychological contribution to the individual. Research has shown that such optimism can promote resilience and motivate adaptive responses to adversity (McKay, 2009; Johnson and Fowler, 2011; Kleiman et al., 2017). Thus, it was found that individuals who are unrealistically optimistic about their future success tend to cope with stressful conditions better (Colombo et al., 2020).

The second explanation for unrealistic optimism argues that it represents a partial denial of a dangerous situation, in which a life-threatening risk is rated lower than less risky threats (Kirscht et al., 1966; Solomon and Prager, 1992). An extensive review of this issue concludes that partial denial is a very common phenomenon in the case of illness (Livneh, 2009, II). New patients may deny their cardiac illness (Covino et al., 2011), and chronic patients, who are well aware of their physical condition, may be partly reluctant to acknowledge health-related information and its effect on their lives (Kortte and Wegener, 2004). The prevalence of lowering the perceived COVID-19 health risk seems to support the claim that this partial denial of threats is an emotional focused process, aimed at supporting individual adjustment to harmful and traumatic external events, which contributes toward supporting the resilience of Horowitz (1986). Breznitz (1983) and Lazarus (1983) have argued further that the advantages of partial denial are successful reduction of anxiety, stress, and other psychological symptoms, and raising life satisfaction and adjustment among most people who fear a serious illness.

We assume that despite the heightened public awareness of the potential negative health impacts of the COVID-19 pandemic, people will often use partial denial of its risks, in the form of unrealistic optimism, in order to reduce anxieties and foster goal persistence, positive affect, and hope (Shepperd et al., 2015). The prevalence of lowering the perceived COVID-19 health risk seems to support the claim that rather than being a pathological response, the partial denial of threats is an emotional focused process, aimed at supporting individual adjustment to harmful and traumatic external events, which contributes toward an adaptive behavior, supporting the resilience of people (Horowitz, 1986).

The effect of unrealistic optimism on the perceived risk of the COVID-19 pandemic was demonstrated, for instance, by a recent study in which an Italian and Swedish sample rated the pandemic risk lower than secondary risks associated with work and the institutional economy (Lanciano et al., 2020).

These findings raise an interesting question: are there realistic or rational components in unrealistic optimism, pertaining to the COVID-19 pandemic? By the same token, it should be expected that in ratings of three dangers, such as perceived risks of health, security, and economy, the deadliest perceived health risk will be rated lowest, and the perceived threatening but not lethal economic risk will be rated highest.

Previous research concluded that a lower rating of perceived health risk, as compared to lesser threats, is aimed at reducing the anxiety raised by a life-threatening adversity (Kirscht et al., 1966). Therefore, we assume that, facing a dangerous and uncertain condition that threatens their health, academic studies, and, perhaps, their professional future, students will probably attempt to reduce their level of anxiety by adopting the unrealistic optimism attitude that this pandemic is not as dangerous as it is presented by the media to the public.

An additional issue pertains to the predictors of psychological coping and coping suppressing responses expressed during the COVID-19 pandemic, such as well-being, resilience, and anxiety and/or depression. These responses were generally attributed mostly to the effects of the perceived health risk (e.g., Gautam et al., 2020).

Predictors of Coping Responses

Research found that external circumstances and other risk sources that concern the general public are likely to impact adversity and pandemic risk perceptions (Ferrer and Klein, 2015). We claim, therefore, that the psychological coping responses expressed during the COVID-19 pandemic will be predicted concurrently by perceived health, security, and economic risks. These three perceived risks are supposed to positively and significantly correlate with each other.

We assume further that symptomatic psychological coping suppressing responses, such as anxiety, depression, and perceived academic stress, will be positively predicted by all the three perceived risks, since these responses are enhanced in anticipation of aversive events (Grupe and Nitschke, 2013). A different prediction pattern will characterize the positive psychological coping responses. A recent Israeli study (Gesser-Edelsburg et al., 2020) claimed that the two major perceived threats that currently concern the Israeli public are health and economic risks (Huynh, 2020). As the health risk perceptions increase, the evaluation of economic threat also tends to increase, and vice versa. Furthermore, the National Security Index of Israel shows that similar to the past few years, in 2020, the majority of

the public believed that national security situation of Israel was fairly good (Israeli and Pines, 2021). In line with these findings, we assume that positive psychological coping responses like well-being and individual resilience will be negatively predicted by perceived health and economic risks, but not by perceived security risk. Because of the process of unrealistic optimism, the health risk will not be the major predictor of most of the psychological coping or coping suppressing responses expressed during the COVID-19 pandemic.

Psychological Coping Responses

Distress Symptoms

The COVID-19 pandemic was negatively associated with psychological distress responses of grief, hopelessness, post-traumatic symptoms, panic attacks, stress, anxiety, depression, loneliness, ambivalence, fear, stigma, and concern regarding socioeconomic status (e.g., Gautam et al., 2020; Mukhtar, 2020). Such coping suppression responses were negatively correlated with the sense of well-being and individual, community, and national resilience (Eshel et al., 2020; Kimhi et al., 2021).

Individual resilience constitutes a stable trajectory of healthy functioning after a highly adverse event (Bonanno et al., 2011). Masten (2018) defines it as "the potential of the manifested capacity of a dynamic system to adapt successfully to disturbances that threaten the function, survival, or development of the system," (P. 187); whereas Seligman and Csikszentmihalyi (2000) regard individual resilience as a process of achieving psychological growth after difficult experiences, and adapting well in the face of adversity. Research has found that individual resilience is positively associated with mindfulness and empathy, and that it is negatively associated with repeated negative thinking (Mathad et al., 2017). Under threats of adversities, such as terror, individual resilience was found to be positively correlated with a sense of coherence and well-being (Eshel and Kimhi, 2016).

Well-being is "an umbrella term for different valuations that people make regarding their lives, events happening to them, their bodies and minds, and circumstances in which they live" (Diener, 2006, p. 400). It is a sense of complete physical, mental, and social well-being and not merely the absence of disease or infirmity (Ryff and Keyes, 1995). One study has concluded that "psychological well-being stands as an important personal resource to favor adaptive coping strategies for academic stress" (Freire et al., 2016).

Well-being is positively associated with individual resilience (Eshel and Kimhi, 2016) and is negatively associated with level of distress (Branson et al., 2019).

Hope is defined as a primarily cognitive, goal-oriented pattern of thought in which people come up with different "pathways" to achieve their goals, remain motivated to follow these pathways, and actively look for alternative pathways to achieve these goals when necessary (Snyder, 2002). Other researchers claimed that hope should be regarded as an experience rather than as an action, since hope is aimed at gaining control over emotions rather than over external circumstances (Herth, 1992). Pleeging et al. (2019) reported moderate to strong correlations of hope measures with overall happiness, life satisfaction, and positive affect measures.

Morale

The concept of morale originated in a military context (Sabitova et al., 2020).

According to Weakliem and Frenkel (2006), morale is a general term for positive feelings about prescribed activities of a group. According to Garrett and McNolty (2020) morale is a multifaceted, longitudinal, and relational experience that individuals share when they identify with and contribute to certain kinds of collective activities.

Perceived Risks and Observance of Precaution Directives

The required public health preventive behaviors during the COVID-19 pandemic generally involve some sacrifice of personal freedom, and people need to be motivated in order to observe them. Most studies find that health risk perception is significantly correlated with reported adoption of preventative health behaviors such as washing hands, wearing a face mask, and maintaining physical distancing (Dryhurst et al., 2020). We assume that the perceived health and economic risks will positively and significantly predict observing these rules. The perceived importance of health and economic risks in the context of the present plague were compared by international organizations that have found that the probability to get infected with the virus is considered low to moderate by the general population (European Centre for Disease Prevention and Control, 2020), whereas the perceived probability of suffering economic losses is nearly 50% for the global workforce (International Labor Organization, 2020).

The following hypotheses are studied:

1. Contrary to their levels of objective risks, the perceived COVID-19 health risk will be rated by the present student sample as lower than either the perceived security or economic risk, and the perceived security risk will be rated as lower than the perceived economic risk.
2. Levels of perceived health, economic, and security risks will positively and significantly predict the psychological coping suppressing responses of students to anxiety and depression, as well as to perceived academic threats expressed during the COVID-19 pandemic.
3. Levels of perceived health and economic risks will negatively and significantly predict positive psychological responses, such as a sense of well-being, expressed during the COVID-19 pandemic, as well as observance of the required pandemic precaution rules.
4. The three investigated perceived risks will positively and significantly correlate with each other.

PROCEDURE

Data collection for the student sample took place during the third lockdown in Israel (January 2021) and continued for a period of 2 weeks. A link to the research questionnaire that was prepared

by means of the Qualtrics platform was distributed through social networks.

The presentation of the questionnaire indicated that it only aimed at students, and that respondents should indicate the type of academic institution, faculty, and department in which they learned. A single un-reusable link was used in order to avoid multiple participations. The instructions were as follows: "The present questionnaire is aimed at examining students' attitudes and feelings concerning the current COVID-19 pandemic. Please respond to the following items. This anonymous questionnaire will strictly serve research purposes only. In responding to this questionnaire, you confirm your participation in this research. You may stop responding at any point of time without any consequences." Although this sample has been distributed across the country and included a wide range of departments and faculties of Israeli colleges and universities, it constitutes, in fact, a convenience sample rather than a representative sample of Israeli students. The sample only included students of recognized Israeli academic institutions.

PARTICIPANTS

The student sample (N = 723) was composed of participants of different ages, most of them were between 18 and 26 years of age. It included more females than males, and mainly secular individuals whose families represented a wide range of income levels. About half of them were first year students. The demographic characteristics of this sample are presented in **Table 1**.

TABLE 1 | Distribution of the characteristics of the participants (N = 723*).

Variable	Group	Number	%	M (SD)
Age	18–25	475	66	26.08 (6.73)
	26–30	160	22	
	31–35	32	5	
	36–40	12	2	
	40 +	35	5	
Gender	Men	193	27	
	Women	525	73	
Religiosity	Secular	498	69	1.42 (0.68)
	Traditional	153	21	
	Religious	69	9.6	
	Very religious	3	0.4	
Political attitudes	Very left	46	6	2.92 (0.91)
	Left	168	23	
	Center	327	46	
	Right	154	22	
	Very right	23	3	
School year	First	373	52	
	Second	197	28	
	Third	104	14	
	Forth and above	39	6	
Faculty	Humanities	379	53	
	Sciences	160	22	
	Did not answer	179	25	
Nationality	Jewish	598	83	
	Arab	94	13	
	Other	26	4	
Family income compare to average in Israel	Much below	132	18	3.18 (1.54)
	Below	124	17	
	Average	156	22	
	Above	176	25	
	Much above	52	7	
	Don't know	78	11	
Economic support from parents	1. not at all	178	25	2.89 (1.49)
	2. a little	155	22	
	3. medium	103	14	
	4. much	131	18	
	5. very much	150	21	
Economic difficulties due to COVID-19	1. not at all	139	19	2.87 (1.36)
	2. a little	168	23	
	3. medium	179	25	
	4. much	104	15	
	5. very much	126	18	
Employment	1. not employed	367	51	2.27 (1.81)
	2. about 1/3 of time	172	24	
	3. about 1/5 of time	84	12	
	4. about 3/4 of time	42	6	
	5. full time	53	7	

Because of few partial responses, N varies between 713 and 723.

Measuring Tools

All the questionnaires on which we based this study were used and validated by us in previous studies. The first eight scales constitute the predicted variables and the last three are the predictors.

Depressive and Anxiety Symptoms

Two subscales of the Brief Symptom Inventory (BSI) scale (Derogatis and Melisaratos, 1983; Derogatis and Savitz, 1999) were employed in this study: depression (five items) and anxiety (three items). Because of ethical reasons, the item regarding suicidal thoughts was removed from the scale. The respondents reported the extent to which they are currently suffering from any of the problems presented on the scale. The response scale ranged from 1 = not at all to 5 = to a very large extent, and the internal reliability of this study was high: depression $\alpha = 0.86$ and anxiety $\alpha = 0.71$. Adawi et al. (2019) have significantly validated these scales against the level of nomophobia in a sample of healthy Italian volunteers.

Perceived Academic Threats

Previous studies have employed detailed questionnaires delineating the academic threats felt by college students because of the COVID-19 pandemic (e.g., Aristovnik et al., 2020; Browning et al., 2021). We asked the respondents to respond to the following single item: "How much do you feel threatened by the academic demands imposed on you while studying under

the COVID-19 pandemic conditions?" Responses were rated by a five-point Likert scale in which 1 = very low threat and 5 = very high threat. Previous studies have supported the validity of assessing a distinct threat by a single item (e.g., Levkovich and Shinan-Altman, 2020; Kimhi et al., 2021).

Individual Resilience

Individual resilience was measured by the 10-item Connor-Davidson (CD-RISC 10, Campbell-Sills and Stein, 2007) scale portraying individual feelings of ability and power in the face of difficulties (Alarcón et al., 2020). Examples of questions are as follows: "I am able to adapt when changes occur"; "I am not easily discouraged by failures." This scale was rated on a five-point Likert scale ranging from 1 = not true at all to 5 = generally true. The Cronbach's alpha reliability of this scale in this study was high, $\alpha = 0.88$. A recent validation showed that, as expected, CD-RISC-10 was positively connected with mental well-being, positive affect, self-esteem, and authentic living, and that it was negatively connected with depressive symptoms, negative affect, acceptance of external influence, and self-alienation (Nartova-Bochaver et al., 2021).

Well-Being

The present well-being scale (Kimhi and Eshel, 2009) consisted nine items concerning the perception by individuals of their present lives in various contexts, such as work, family life, health, free time, and others. Responses to these items ranged from 1 = very bad to 6 = very good. This scale has been validated in previous studies. Kimhi et al. (2020a,b) have found in a longitudinal study that level of well-being was positively correlated with individual resilience and hope, and that it was negatively correlated with distress symptoms and sense of danger. The reliability of the scale in this study was found to be high, $\alpha = 0.85$.

Level of Hope

This tool is based on an earlier scale (Jarymowicz and Bar-Tal, 2006; Halperin et al., 2008) that was designed to measure the level of hope for peace among Israel, the Arab nations, and the Palestinians. Its two dimensions are personal and collective hope. The current scale of hope, in the context of the coronavirus crisis, included five items. Two of them refer to the personal level (e.g., "I hope that I will emerge strengthened from the coronavirus crisis"), and three items refer to the collective level (e.g., "I hope that the Israeli society will emerge strengthened from the coronavirus crisis"). The response scale ranged from 1 = very little hope to 5 = high hope. The internal reliability of the scale in this study was high, $\alpha = 0.91$. A recent study has found that hope, in the context of the COVID-19 pandemic, has been predicted positively by subjective well-being, as well as by individual, community, and national resilience (Kimhi et al., 2021).

Morale

The level of personal morale was examined by a single item: "How would you define your morale these days?" The response scale ranged from 1 = not good at all to 5 = very good. Morale level significantly and positively predicted well-being and individual resilience in the COVID-19 pandemic (Eshel et al., 2021).

Current Threats

A sense of threat represents the extent to which an individual feels endangered by objects or events from different domains, such as physical, social, psychological, and economic (Kimhi and Eshel, 2009).

The respondents responded to three questions pertaining to the three current potential threat sources: health, security, and economy (e.g., "To what extent do you feel that the current health/security/economic condition personally threatens you?"). The five-point response scale ranged from 1 = not threatening at all to 5 = threatening very much. The path analysis employed for validating the investigated threats in the context of the COVID-19 pandemic showed that both the health and economic threats positively predicted anxiety and depression levels and negatively predicted well-being. Health threat negatively predicted individual resilience as well, and economic threat negatively predicted national resilience (Marciano et al., under review[1]).

Compliance With the Pandemic Precaution Rules

Compliance with these precaution rules was assessed by a single question: "To what extent do you comply with the rules aimed at immediately restricting the spread of the pandemic?" Responses to this item ranged from 1 = not at all to 5 = very much.

RESULTS

The means and standard deviations of the investigated variables are presented in **Table 2**.

Hypothesis 1 stated that the assessment of the three perceived risks by the investigated student sample will reflect the unrealistic optimism effect, in which the higher the objective risk (i.e., the health risk), the lower will be the rating of the perceived risk. This hypothesis was examined by a repeated measures one-way ANOVA, and was found to be significant [$F(2, 717) = 108.16$, $p < 0.0001$, $\eta p2 = 0.13$]. The results presented in **Figure 1** clearly support this hypothesis: The deadliest perceived health risk was rated lowest, next to it was the perceived security risk, whereas the perceived economic risk was rated highest.

[1]Marciano, H., Eshel, Y., Kimhi, S., and Adini, B. (2021). Hope and fear of threats as predictors of coping with two major adversities, the COVID-19 pandemic and an armed conflict (under review).

TABLE 2 | Means and standard deviations of the investigated variables.

Variable (Cronbach's Alpha)	Mean	Std. Deviation
IR ($a = 0.88$)	3.4716	0.73627
NR ($a = 0.90$)	2.8609	0.84547
Hope ($a = 0.91$)	3.3101	0.96599
Wellbeing ($a = 0.85$)	3.9248	0.87064
danger ($a = 0.84$)	2.8725	0.76979
Anxiety ($a = 0.71$)	2.7610	0.94315
Depression ($a = 0.86$)	2.6142	1.0648
Threat of academic demands	3.19	1.2570

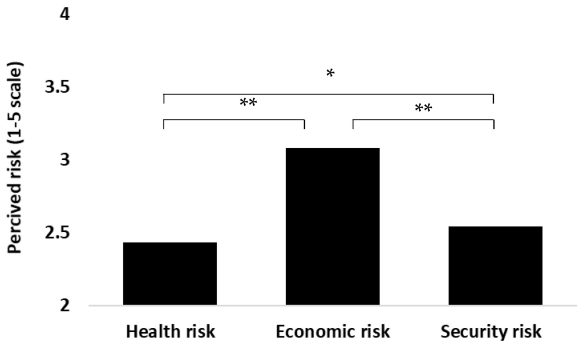

FIGURE 1 | One-way repeated measures analysis of variance (ANOVA) of the three perceived risks. *$p < 0.05$, **$p < 0.0001$.

Hypotheses 2 and 3 on the predictors of the psychological coping responses by the three threats of health, economy, and security were examined by means of path analysis/Amos Structural Equation Modeling (IBM, SPSS[2]; Arbuckle, 2011). We used maximum likelihood estimates and examined a saturated model, as we did not find any studies that supported an alternative model. It is important to note that in a saturated model, there is no need to examine the fit of the model, as the default and saturated models are the same (Arbuckle and Wothke, 2004). The first saturated model (all paths are examined), which examined hypothesis 2, contained three psychological predictors (perceived health, economic, and security risks) and three coping suppressing indicators: anxiety, depression, and academic threat.

The first path analysis indicated the following (see **Figure 2**): (a) all paths were significant and positive ($p < 0.008$–0.001); higher threats were associated with higher levels of distress responses. The three predictors explained 21% of the anxiety variance, 12% of the depression variance, and 19% of the academic threat variance. (b) The strongest predictor of level of anxiety was the health risk, whereas the depressive symptoms and the academic threat were more strongly predicted by the perceived economic risk. Security risk was the weakest prediction of these distress reactions. These results fully supported our second hypothesis, and they show further that according to the unrealistic optimism process, the most dangerous health threat is not the best predictor of all the three investigated responses.

The second path analysis, which examined hypothesis 3, included the same three predictors and five predicted responses: well-being, individual resilience, hope, morale, and observance of the caution rules. The results indicated the following (see **Table 3**): (a) in partial agreement with hypothesis 3, perceived health risk negatively and significantly predicted individual resilience and observance of the caution directives. (b) In full agreement with this hypothesis, perceived economic risk negatively and significantly predicted all the five coping responses. Higher perceived economic risk was associated with lower levels of positive coping responses. (c) In further agreement with hypothesis 3, perceived security risk, significantly and positively predicted well-being but negatively predicted hope. Security risk did not predict significantly individual resilience, morale, and observance of the rules. The three predictors explained 3–9% of these variables. The path analyses also supported hypothesis 4, indicating that the three investigated perceived risks correlated positively and significantly with each other.

As indicated above, the investigated students tended to play down the health danger of COVID-19. A regression analysis examined the extent to which this denial of threat reflected specific demographic characteristics of the participants. The results showed that five of these characteristics (age, religiosity, employment of student, family income, and parental help) had no significant effect on the level of this perceived danger. Gender was the only feature that predicted this tendency: females regarded this threat as more serious than males ($B = 0.355$, SE = 0.094, Beta = 0.14, $t = 30.765$, Sig. = 0). These results replicate in a way the finding of Dolinski et al. (2020) that unrealistic optimism is observed more readily in men than in women.

DISCUSSION

Unrealistic optimism constitutes a mental process, according to which the level of risk of a major adversity is perceived as less dangerous than the risk of a lesser adversity. According to Shepperd et al. (2013), unrealistic optimism refers to unrealistically positive expectations when compared to an objective criterion, such as an actuarial risk assessment or actual outcomes (e.g., the actual immediate risks of the COVID-19 pandemic compared with the potential future economic and security risks). This study demonstrated a clear case of unrealistic optimism in ratings of the perceived lethal risk of COVID-19 (currently termed as "health risk"). This health risk was perceived as lower than the perceived security risk, and both these risks were rated below the non-lethal perceived economic risk. It has been argued previously that high level of education may protect students from a rather irrational fear of being infected or dying while permitting them to realize the devastating economic, political, and institutional scenarios resulting from the pandemic (Gerhold, 2020). The present respondents were not asked to compare the three perceived risks, and most probably were unaware of the relative ratings assigned by them to these risks. However, in fact, they followed the unrealistic optimism rule that in coping with a highly dangerous threat one should inversely rate the objective risks and assign the lowest rating to the highest risk.

This response is defined as unrealistic optimism. This mode of optimism differs from dispositional optimism, which constitutes a personality trait, or a generalized tendency to expect positive outcomes (Carver et al., 2010). It has been claimed that unrealistic optimism represents a systematic tendency to form beliefs that are biased and often false but have significant benefits, because they increase well-being, contribute to mental and physical health, and support productivity (e.g., Taylor and Brown, 1994; Bortolotti and Antrobus, 2015). Furthermore, Hughes and Zaki (2015) presented evidence that unrealistic optimism is a form of motivated cognition. People process information that is available to them in a way that favors a certain kind of subjectively desirable

[2]https://www.ibm.com/il-en/marketplace/structural-equation-modeling-sem

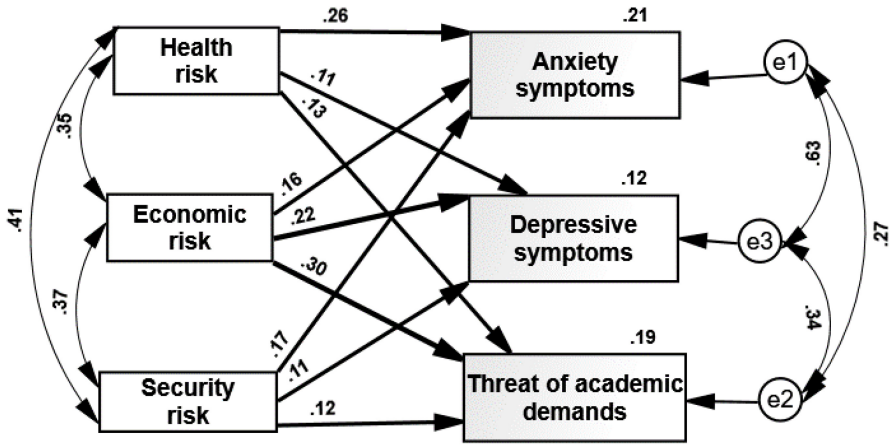

FIGURE 2 | Path analysis for three threats predicting anxiety and depressive symptoms and threat of academic demands. All the paths are significant ($p < 0.01$).

conclusion. Regarding positive illusions as patterns of beliefs is largely shared in the psychological literature and compatible with common assumptions on how positive illusions work (e.g., Makridakis and Moleskis, 2015; Collard et al., 2016).

We suggest that this process involves partial denial, which was regarded by several researchers (Kirscht et al., 1966; Lazarus, 1983; Horowitz, 1986) as contributing positively to psychological adjustment. Partial denial is very common among patients with physical chronic diseases who are sometimes reluctant to observe health requirements despite being aware of their condition (Livneh, 2009, II). Breznitz (1983) argued that such partial denial may successfully reduce anxiety, stress, and other psychological symptoms, and play a part in raising life satisfaction and adjustment of most people who fear a serious illness. In the present case, the investigated students could have gained psychologically from a less-than-rational response.

The idea that unrealistic optimism perceptions included realistic elements and did not represent the understanding by the respondents of the actual risk of this pandemic was expressed by the retained impact of health risk on some of the investigated psychological responses in this study, which was conducted during the third and most lethal lockdown in Israel due to the COVID-19 pandemic. This impact was not totally impaired despite the low rating, which was assigned to this risk, compared to the economic and security risks.

It is important to note that the perceived health risk was the strongest predictor of level of anxiety but not of depression and academic threats responses, which were best predicted by the perceived economic risk. By the same token, perceived health risk was the best negative predictor of individual resilience, whereas perceived economic risk predicted well-being, hope, and morale better. The high ratings of the perceived economic risk, and its major role in predicting the investigated coping responses could have indicated the poor economic condition of the Israeli students.

A further examination of the present data seems to disagree with this explanation. A large percentage (56.7%) of the investigated students indeed claimed that they were concerned about potential economic difficulties. However, 53.4% of them came from well-to-do families, 53.4% were actually helped economically by their families, and 24.9% of them were employed for half a position or more. It appears that the perceived economic risk indeed reflected unrealistic optimism.

Furthermore, indicators of psychological distress are expected to increase in the face of additional external stressors (Grupe and Nitschke, 2013). Therefore, as expected, perceived anxiety, depression, and academic threats were found to be significantly and positively predicted by all the three perceived threats (health, security, and economic risks). However, only threats that were regarded as actual and realistic risks, that is, health and economic risks, significantly and negatively predicted the positive psychological responses. Well-being and its derivatives, hope and morale, were not significantly predicted by perceived health risk. The COVID-19 vaccination has begun around the time this study was conducted. It is possible that this vaccination campaign has not proven itself yet, and did not reduce the level of the perceived health risk.

In line with hypothesis 4, greater observance of the COVID-19 precaution directives was indeed positively predicted by the level of the perceived health risk. Consistent with the findings of Dolinski et al. (2020), those who regarded health risk as higher more readily adhered to these directives. However, contrary to this hypothesis, perceived economic risk negatively predicted

TABLE 3 | Standardized estimates of path analyses for three perceived risks predicting five beneficial reactions.

	Well- being	Individual resilience	Hope	Morale	Observing rules
Health risk	0.09*	−0.16***	−0.08*	−0.08*	0.12**
Economic risk	−0.16***	−0.15***	−0.16***	−0.22***	−0.14***
Security risk	0.11**	−0.06	−0.09*	−0.02	0.03
Explained variance (R^2)	0.03	0.09	0.07	0.07	0.02

*$p < 0.05$, **$p < 0.01$, ***$p < 0.001$.

the observance of the rules. As conjectured by Rosman et al. (2020), our study revealed that individuals who fear economic losses to a greater extent were less stringent in observing the closure instructions of staying at home, refraining from work, and maintaining social distancing. This finding may makes sense thinking about the inherent conflicting interests between the precaution rules limitation and making a living, especially for young students.

The COVID-19 pandemic constitutes a collective stressor effect involving health danger with uncertainty, misinformation, and social isolation, which are likely to affect well-being, cause stress, and result in mental disorders (Le et al., 2020; Tran et al., 2020). This pandemic has negatively impacted mental health (Holingue et al., 2020; Wang C. et al., 2020) and caused posttraumatic stress symptoms (Liu et al., 2020). Healthline Mental Health Index (Healthline Media, 2021) indicates further that up to 45% of adults in the United States have elevated levels of depression and anxiety throughout the COVID-19 pandemic (Rettew et al., 2021). Research on the psychological and behavioral effects triggered by the COVID pandemic has found that personality traits are related to the mental health of an individual in association with this plague. High levels of agreeableness and conscientiousness showed particularly strong associations with better mood during the COVID epidemic period, while higher levels of neuroticism were prominently related to higher levels of perceived stress (Rettew et al., 2021). In particular, in regard to the cascade of psychological and behavioral effects triggered by the COVID pandemic, it has been shown that the negativity of the psychological effects of the lockdown was further modulated by personality traits, alexithymia, and resilience (Osimo et al., 2021). It has also been found that higher alexithymia scores were associated with increased emotional and binge eating as well as higher self-reported physical conditions (Cecchetto et al., 2021).

Research concentrating on coping with major adversities, such as this pandemic, has claimed that the goal of coping research and understanding the relationship between coping processes and long-term adaptational outcomes require an interindividual approach that compares the coping of different individuals with diverse stressful encounters over time (Folkman et al., 1986). Two major theoretical perspectives have analyzed coping styles that are associated with better mental health: the first viewpoint reflects a positive psychology perspective, according to which coping is aimed at developing a reframing strategy, which will re-evaluate a stressful event in positive terms. Coping, according to this position, is aimed at maintaining meaning and purpose in life (Stanislawski, 2019). Research indicates that positive reframing constitutes an effective strategy for reducing both depression (Folkman and Lazarus, 1988; Horwitz et al., 2018) and symptoms of anxiety and stress (Moccia et al., 2020; Wang H. et al., 2020). This coping style seems to reflect the theory of Frankl (1969) that the creation of meaning is crucial for people to transcend tragic circumstances. His influential ideas have earned empirical support, showing that finding meaning has an important role in the psychological recovery from an adversity (Updegraff et al., 2008). A second theoretical position (Folkman et al., 1986) has claimed that emotion-focused coping is any strategy used to reduce stress and tension by regulating the state of emotion. This definition agrees with the claim of stress theories that the major function of coping is to reduce fear and anxiety, raised by a stressful condition, and restore adjustment (Breznitz, 1983; Lazarus, 1983). Research has shown that individuals who have used more often emotion-focused coping in the first phase of the COVID-19 pandemic were likely to experience less anger and sadness throughout this pandemic (Malesza, 2021).

Unrealistic optimism, which constitutes a form of emotion-focused coping, is aimed at reducing the fears raised by the COVID-19 pandemic by changing its perceived risk. This coping mode follows the analysis of Breznitz, which indicates that anxiety and fear may be reduced by seven aspects of partial denial: denial of information, denial of threatening information, denial of personal relevance, denial of urgency, denial of vulnerability/responsibility, denial of affect, and denial of affect relevance (Breznitz, 1983). This partial denial is used in a process of restructuring perceived threats. The prevalence of unrealistic optimism (Shepperd et al., 2013) seems to support the claim that rather than being a pathological response, it is an emotion-focused process aimed at supporting individual adjustment to harmful and traumatic external events, and may be considered as an adaptive behavior, supporting the resilience of people (Horowitz, 1986; Alloy, 2017). This study indicates its meaningful role in coping with the COVID pandemic. A major claim could have been that age influenced the three perceived investigated threats, and especially the health threat, which supposedly endangers older individuals to a greater extent. An examination of this issue shows no significant correlation between age of the participants and their perceived health, economic, and security threats. A further examination of the present data indicated that, in agreement with previous findings (European Centre for Disease Prevention and Control, 2020; International Labor Organization, 2020), economic threat should not be regarded as a secondary danger in the context of the COVID-19 pandemic compared to health risk. On the contrary, our data show that economic threat (mean = 3.08, SD = 1.221) was regarded by the present sample as higher than the health threat (mean = 2.43, SD = 1.118). The difference between these means is highly significant (t = 12.999).

Limitations

The main limitation of this research and other studies based on questionnaires is the lack of objective measures in terms of health, economic, and safety risks, since these studies are based on perceptions of the respondents. The second limitation pertains to sampling by means of an internet sample. Even though the sample is large and includes a wide variety of demographic variables and a wide range of Israeli academic institutions, there is no guarantee that it is a representative sample of Israeli students.

CONCLUSION

Several conclusions can be derived from the present findings. First, unrealistic optimism should be expected in perceived assessments of the health risk of COVID-19 pandemic, as

well as in coping with other related risk conditions. This unrealistic optimism represents perceptions of college students as well as those of the general public, as indeed was found by a large number of studies (e.g., Lanciano et al., 2020). Second, psychological coping responses expressed during the COVID-19 pandemic did not represent only the health threat of the pandemic, as was hypothesized by previous research (e.g., Krok and Zarzycka, 2020; Lanciano et al., 2020). They reflected concurrently other threats sensed by the general public. Third, these perceived threats predicted differentially varied psychological coping responses: perceived health risk was not always the stronger predictor of all the psychological responses, and perceived security risk predicted negative responses but not beneficial responses. Fourth, unrealistic optimism was often regarded as an irrational way of assessing threats, while the present data show that this type of optimism also includes logical and realistic elements. The inverse ratings of the perceived risk levels compared to the objective risk levels were not necessarily an unreasonable judgment. It is quite possible that this inversion was motivated by a kind of adaptive partial denial of risks that provided a valuable contribution to reducing anxieties and supporting the resilience of individuals in the face of an extensive threat. Fifth, college students, much the same as the general public, encountered a substantial number of stressful events because of the COVID-19 pandemic, which is still raging in different countries. These students must cope with a host of difficulties and face many concerns pertaining to their ability to complete their studies and achieve an academic degree. Further studies are required in order to examine two additional research directions: (a) Identifying additional risks that may increase the anxiety of students, as well as motivational elements that will enhance their sense of well-being and increase their coping abilities. (b) While the responses of the investigated student were not significantly affected by most of their demographic characteristics, it should be examined whether such attributes influence the responses of other age groups in different cultural settings. In more general terms, understanding the mechanisms underlying the impact of the COVID-19 on mental health is essential to developed novel interventions to protect mental well-being from stressful conditions involved, to diminish a potential mental health epidemic associated with the current COVID-19 pandemic, and to promote more effective coping styles across populations.

Further research is recommended to substantiate the role of optimistic bias in explaining the reduced perceived jeopardy of the COVID-19 pandemic. Bottemanne et al. (2020) have delineated several alternative explanations that have been offered to decrease the perceived danger of this pandemic, which do not include unrealistic optimism. Research shows that people tend to underweight the probable consequences of the pandemic when adopting precautionary behaviors (Barron and Yechiam, 2009). Furthermore, people vary on how much they discount risks, whenever they perceive them as still temporary or distant (Peake, 2017). Putting in place strict mandatory measures of social distancing may involve psychological, social, and economic costs. Avoiding these short-term risks could come at the expense of long-term health benefits of containing the pandemic (Thaler et al., 1997).

DATA AVAILABILITY STATEMENT

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

ETHICS STATEMENT

The studies involving human participants were reviewed and approved by Ethics Committee, Tel Aviv University. The patients/participants provided their written informed consent to participate in this study.

AUTHOR CONTRIBUTIONS

SK and BA: conceptualization and supervision. SK and YE: methodology, formal analysis, and data curation. BA and HM: validation. YE, SK, HM, and BA: investigation and resources. YE: preparation and writing of original draft and visualization. SK, HM, and BA: writing review and editing. SK: project administration. All authors contributed to the article and approved the submitted version.

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Remedial Boundary Work and Gatekeeper Centrality in a Virtual Entrepreneur Community

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Virtual communities of practice invoke novel forms of boundary work that are newly visible via publicly recorded discourse and failure narratives. This boundary work has critical implications for occupational knowledge, membership, and stratification. Building on social exchange theorization of network gatekeeping, the author tests the assumption that centralized peers are more competitive gatekeepers, in that they react more negatively to remedial narratives. The author tests this theory using empirical data from a virtual entrepreneur community on Reddit. The author finds that a peer's tenure in the community network is directly related to exclusive, competitive boundary work of remedial members. However, by looking beyond the network structure to the content of the tie, the author finds that exclusive boundary work is not as impactful as inclusive, collaborative boundary work in this open network setting. The author builds on relational cohesion and exchange commitment theory to explain how remedial practitioners circumvent central community gatekeepers through failure narratives that provoke empathy from peripheral peers who experience higher uncertainty than core peers. Understanding these dynamics is critical to promoting recovery from failure and vitality of the community of practice.

Keywords: virtual communities of practice, discursive boundary work, remedial narratives, exchange commitment, network analysis, entrepreneurship

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INTRODUCTION

> "I've tried and failed two startups. I'm in no position to find a job. I'm looking for business ideas."[1]
>
> "Feel free to reach out to me anytime . . . I would love to be a part of the project."
>
> "This is fantastic! Yay for Reddit making connections!"

The above exchange took place among a 25-year-old electrical engineer in India, a software developer in New York, and a 59-year-old cuckoo clock designer in Georgia. The 18-min conversation was made possible by Reddit, an online discussion forum that calls itself "the front page of the internet" and "a network of communities," including the "Entrepreneur" community quoted above. Over 430 million people from around the globe are active on Reddit each month.

[1]The author thanks Karen Cook, Dan McFarland, Jesper Sorensen, Mark Granovetter, and Paul Leonardi for their invaluable feedback on earlier drafts of this paper. Thank you also to Kyle Lewis, who fought to give me the teaching relief to complete this paper during a global pandemic. Finally, thank you to the entrepreneurs who were willing to share their failure experiences with me.

Networked learning (Powell 1990; Kogut and Zander 1996; Powell et al., 1996) is not new to organizational theory. But the virtual convergence of previously isolated communities of practice permits entrepreneurs and other practitioners to organize on a scale and at a pace never seen before (Kuhn and Galloway 2015). The factors that make virtual communities unique alter social behavior in ways that test existing organizational theory.

This study addresses the scientific problem of how remedial members in a virtual community recover lost reputation. Previous research describes virtual communities as predominantly open (c.f. Kane and Ransbotham 2016; Faraj and Johnson 2011; Shaw 2012), and boundary work as a process of closure (c.f. Freidson 1988; Lin et al., 2001, 1999; Bourdieu, 1984; Bourdieu, 1986), leaving unanswered the question of how virtual communities manage membership boundaries. Those that do explore boundary work in virtual communities tend to focus on newcomer claims to membership (c.f. Yeshua-Katz 2016; Silva et al., 2009; Lampe and Johnston 2005; Arguello et al., 2006; Choi et al., 2010; Honeycutt 2005; Kraut and Resnick 2012). It is less clear, however, how existing members of the community who have transgressed community norms regain lost reputation.

In this study, the author shows how virtual communities invoke newly visible forms of boundary work (Langley et al., 2019; Comeau-Vallée and Langley 2020) and social capital in response to remedial work, such as failure narratives. The study specifically evaluates the role of network structure as a mechanism for discursive boundary work in a virtual community of practice, where demarcations and identities are ambiguous. In this context, the resource that is gated is social capital, including community membership, network ties, and reputation. Here, the author tests the social network theory that central peers engage in more gatekeeping, hypothesizing that a peer's centrality in the community network influences the sentiment of their response to a failure narrative. The author tests this theory using empirical data from a virtual entrepreneur community on Reddit. Virtual entrepreneur communities are an ideal context for this study, because failure is common in entrepreneurship. Failed entrepreneurs must be able to recover lost reputation in order to start a new venture.

This study finds that a peer's tenure in a virtual entrepreneur community is directly related to negative, exclusionary boundary work of remedial members. However, by looking beyond the network structure to the content of the tie, the study also finds that exclusive boundary work is not as impactful as inclusive, collaborative boundary work in this open network setting. This study builds on relational cohesion and exchange commitment theory to explain how remedial practitioners circumvent central community gatekeepers through failure narratives that provoke empathy from peripheral peers who experience higher uncertainty than core peers. Understanding these dynamics is critical to promoting recovery from failure and vitality of virtual communities of practice.

THEORY

Boundary Work in Virtual Communities

"Community" is an important organizational phenomenon because they explain how organizations can create knowledge without market incentive and diffuse knowledge without hierarchy (Adler et al., 2008; see also; Lee and Cole 2003; Lave and Wenger 1991; O'Mahony and Lakhani 2011). The paradox of community, however, is that they foster "closure and insularity" that can hinder knowledge creation and diffusion (Freidson 1988). Communities, even those that are virtual, are defined by "boundary work," or the "purposeful individual and collective effort to influence the social, symbolic, material, or temporal boundaries; demarcations; and distinctions affecting groups, occupations, and organizations" (Langley et al., 2019; see also; Gieryn 1983; Schwalbe et al., 2000; Glaser 2001; Rainie and Wellman 2012; Rheingold 1993; Faraj et al., 2011; Faraj et al., 2016; Autio et al., 2013; Marquis et al., 2011; Lamont and Molnar 2002; Vaisey 2007; Tonnies and Loomis 1957). Community behavior is motivated by "belonging" to a common identity. In this perspective, community is a "category of meaningful social relationships" that is not necessarily bound by geography (Marquis et al., 2011: xii). Community members define membership by continuously negotiating community boundaries (Lamont and Molnar 2002). As social groups driven by a shared identity, communities exhibit a preference for "in-group" members over "out-group" members (Sherif 1954, 1958; Sherif et al., 1961; Tajfel and Turner 1985). Boundary work separates insiders from outsiders (Fine and Kleinman 1979; Widdicombe and Wooffitt, 1990; Becker 2008; Fine 2019). Here, boundary work is defined as the act of distancing or embracing others using language, symbols, or other mechanisms with the intention of distinguishing in-group from out-group members.

In organizational theory, boundary work has been explored most thoroughly in professional communities such as medicine and law where boundaries become clearly demarcated through explicit, controlled symbols such as certifications (Starr 1982; Abbott 1995; Lamont and Molnar 2002). In many cases, however, boundaries are ambiguous or otherwise porous. Virtual communities, for example, are unencumbered by physical gates and boundaries (Faraj et al., 2011; Jones 1998:19; Jones 1997; Rheingold 1993; Marquis et al., 2011; Sproull and Arriaga 2007; Preece et al., 2004). In place of legal or similarly authoritative boundary demarcation, these communities rely on *identity-based* boundary work (c.f. Lamont and Molnar 2002; Tajfel and Turner 1985; Jenkins 1996; Snow and Anderson 1987; Vaisey 2007). This raises the question of how boundary work operates in virtual communities, where demarcations and identities are nebulous.

To understand how boundary work operates in loosely demarcated communities, we must understand its motivations. Lamont and Molnar (2002) state that "Symbolic boundaries . . . are an essential medium through which people acquire status and monopolize resources." Gieryn argued that it is motivated in the scientific community by the desire to "enlarge the material and

symbolic resources of scientists or to defend professional autonomy" (Gieryn 1983:782). Community members may engage in boundary work because they wish to reinforce an existing community structure or to steer the direction of the community's future structure. Founding members of the community generally establish the community with a vision in mind and use that vision as a guiding star as the community grows (c.f. Stinchcombe (1965), or legacy, of founding context onto present-day organizations). As a community grows and diversifies, sub-communities emerge with diverging interests (c.f. Tajfel and Turner 1985; Stets and Burke 2005 for a summary of inter-group dynamics in social identity theory). Charismatic leaders in these sub-communities who are new to the community and bring a new perspective or desire more status or power may assert a new defining vision for the broader community (Weber 1921; Philips and Zuckerman 2001; Podolny 2008; Granovetter 2017).

One form of boundary work in online communities is community moderation. Moderators are community members who have the ability to decide which content is allowed according to the community standards. Ley (2007) demonstrates how exclusionary boundary work by the moderator of an online pregnancy and mothering group led to the emergence of a splinter community. Smithson et al. (2011) show how participants in an online self-harm support forum engage in the process of setting boundaries between normative and deviant behavior in concert with moderators. Yeshua-Katz (2016) describes the process through which moderators of an online fertility support forum manually filter content from newcomers as well as from established members who have successfully become pregnant.

Yet, boundary work can be normative as well as authoritative. Newcomers must learn the norms of the community they wish to join. Silva et al. (2009) observed that established members of blogging community MetaFilter "warranted" "legitimate peripheral participation" of newcomers through ignoring posts, congratulatory comments, or ridicule. Similarly, Lampe and Johnston (2005) show how established members of Slashdot "teach" newcomers community norms through rating or ignoring posts. In a text analysis of eight Usenet newsgroups, Arguello et al. (2006) found that newcomers were more likely to be ignored than established members. Choi et al. (2010) observe how, in addition to ignoring and rating posts, established members socialize new members through welcome messages, task requests, assistance, positive feedback, constructive criticism, and personal comments. Honeycutt (2005) observed elite members of the X-Filesaholics discussion forum hazing newcomers in order to increase loyalty to the group (Aronson and Mills 1959). Community leaders also use these socialization methods to screen out unhelpful or harmful newcomers (Kraut and Resnick 2012).

Boundary work is not always supportive of newcomers. Yeshua-Katz (2013) observed how established members of an online support group for people with eating disorders engaged in "blocking," hate mail, and blacklisting members who were perceived as inauthentic. This exclusionary boundary work is particularly salient in social movements where the attributes that separate insiders from outsiders is contested. Dowling et al. (2020) operationalized boundary work between GamerGate supporters and opponents using shared hyperlinks and the hashtag #Gamergate discussion label on Twitter. Similarly, Buyukozturk et al. (2018) observe a diverse range of boundary work in the GamerGate movement on Reddit, including "offensive othering, defensive othering, boundary framing, adversarial framing, fleeing the sinking ship, internal solidarity, inciting member action, policing, rebranding, and movement space."

Boundary work can be inclusive or exclusive (Mackert 2014). One type of inclusive boundary work is membership outreach, in which an incumbent member activates a tie or builds a deeper relationship with the transgressive member to welcome them into the community. Conversely, a rejection of membership can entail an incumbent member publicly defaming the transgressive member to label them as unwelcome in the community.

Remedial Narratives, Reputation, and Gatekeeping

A variety of empirical studies have demonstrated that established, embedded, or otherwise elite members of a community engage in boundary work of *newcomers*. Yet, *remedial* members also present a case of class structuration that provokes boundary work. Remedial boundary work is distinct from newcomer boundary work because it is the process of attempting to *recover* social capital that has been lost. While newcomers must demonstrate that they *will not* fail, remedial members have indeed failed. The question is then how those remedial members can recover their reputation.

A dominant incentive for participation in virtual communities is social capital (Constant et al., 1996; Wasko and Faraj 2000; Lerner and Tirole 2002; Wasko and Faraj 2005; Faraj and Johnson 2011; Hwang et al., 2015). Lin et al. (2001) defines social capital as "investment in social relations by individuals through which they gain access to embedded resources to enhance expected returns of instrumental or expressive actions" (2001:19). One of the returns on social capital investment is reputation. Lin broadly defines reputation as "favorable/unfavorable opinions about an individual in a social network" (2001:19). Reputation is particularly important in virtual communities. Participants, by participating, have already demonstrated a motivation to belong to the community. While that motivation and the effort to belong vary by individual, the simple act of posting content strongly demonstrates value of the community and their reputation in it.

Virtual community members are not only incentivized by their community reputation, but also rely on reputational signals in their community interactions. In semi-anonymous, porous communities, legal mechanisms are not present to replace social trust (Cook and Santana 2020). In virtual communities, where members come and go freely under various identities, uncertainty is high. Members have less certain expectations of how other members will behave. Social capital is an exchangeable resource that reduces exchange uncertainty (Coleman 1990; Burt 1992; Lin 1999; Cook, 2009). Reputation is one product of social capital that reduces exchange uncertainty (Kollock 1994; Cook and Santana 2020). Network embeddedness is another form of social capital

that reduces uncertainty (Granovetter 1985; Cook and Santana 2020). In porous, semi-anonymous communities, reputations are malleable and networks are open rather than closed. In other words, there is more uncertainty. Any available social capital is thus of premium value to exchange in this setting. In knowledge networks, reputation signals information quality (Hwang et al., 2015; Faraj et al., 2016). The value and health of the community is only as good as the information shared in it. In this context, gatekeepers aim to exclude information and informants that are misleading. Gatekeepers rely on signals of quality to discern the worthy from the unworthy. Reputation is one of few signals of quality in virtual communities.

Social capital and reputation are particularly threatened when a member of the community violates local norms. In a community of practice (Lave and Wenger 1991; Wenger 1998), these norms can be intra-professional, between community members, or extra-professional, addressing clientele or society more broadly (Abbott 1983). To remediate a violation of these norms, community members engage in remedial work. Remedial work is an expressive attempt to re-affirm membership in a community following violation of community norms (Goffman 1971). When a member admits professional failure by publishing a remedial narrative, their reputation in the community should suffer (c.f. Lakhani and von Hippel (2003); Hwang et al., 2015).

To address a failure, make sense of it, and re-assert their membership in the community, remedial members present "failure narratives" to the peer audience. Failure narratives are stories or accounts about a failure experience narrated via text, audio, or some other manner (Orbuch 1997; Cardon et al., 2011; Mantere et al., 2013; Opperman and Spencer 2016). Often, failure narratives are attempts at acknowledging and repairing a transgression, whether perceived or actual (Goffman 1971). Failure narratives may include apologies, testimonies, confessions, redirection of blame, explanations and other information or behavior required to make sense of the failure and the narrator's role in it.

Failure narratives do not guarantee remediation. Peers can reject a narrative as insufficient, inaccurate, or otherwise unacceptable (Kibler et al., 2017). Inversely, peers may embrace a narrative as honorable, representative, or otherwise contributing to the community, affirming the narrator's membership in the process. Peers can also simply acknowledge a narrative, or ignore it. These responses are all examples of peer community boundary work. Peer affirmation is a form of "social credential" (Lin et al., 2001:7) that leads to community-specific social capital, including new ties, as well as maintenance of membership in the community. Lin et al. (2001) describes this social "reinforcement:" "Being assured of one's worthiness as an individual and a member of a social group sharing similar interests and resources not only provides emotional support but also public acknowledgment of one's claim to certain resources" (2001:7). This social capital should help the remedial member to heal a damaged reputation and recover from failure. Rejection leads to unacceptance of the narrator's remedial attempt and continued ostracization of the narrator. In the case of communities of practice, this implies delegitimation of the practitioner. This leads us to ask the conditions under which a peer will respond favorably, or critically, to a remedial narrative.

Centrality and Gatekeeping in Social Exchange Theory

Given that community membership and its inherent social capital are the object of exchange, boundary work and gatekeeping can be modeled as forms of social exchange. Social exchange theory models social interactions based on expected utility gained or lost through the interaction (Berger et al., 1972; Lovaglia 1994, 1995; Thye 2000; Thye et al., 2006; Karen and Eric, 2013). In the structural view of social exchange theory, structural position directly influences power and control of resources, including social capital. Gatekeepers occupy a powerful position in that they restrict access to a valued resource. The gatekeeper concept (Lewin 1947) unites social exchange theory with boundary work when the resource that is gated is community membership and the social capital it affords, including status and network ties (c.f. Gould and Fernandez 1989; Hamann and Beljean 2019; Merton 1973).

One's location in a social network is "the key element" of social capital functions (Lin et al., 2001:13), including reputational recovery from failure. Cook (1983) described centrality as "one of the most important characteristics of positions" in social networks (p. 283). Social exchange theory suggests that centrality may motivate boundary work (c.f. Corra and Willer 2002; Burt 1992; Granovetter 2017). A boundary worker can be more or less connected to other community members, and this variance may influence the valence of ties between boundary workers and their targets. Centrality can be associated with structural or non-structural properties. If a community is defined by interactions, centrality describes a member's engagement with the community. More concretely, highly central members interact with a larger proportion of the community than less connected members. Centrality entails significant advantages for community members. Connected members have more access to higher quality information, are less dependent on a single relationship, may be able to control resource access, and are more likely to be connected to other highly connected members (Cook and Emerson 1978; Granovetter 1985; Burt 1992; Uzzi 1999; Podolny 2008). This means that central members are generally more influential, more powerful, more popular, have more status, and are more successful in related endeavors (Bonacich 1987; Walker et al., 2000; Sutanto et al., 2011; Johnson et al., 2015).

Centrality renders two important attributes that facilitate gatekeeping: incumbency and influence. First, as members become more established, tenured, and connected, they become more central. Safadi et al. (2020) found that core members play a key role in the sustainability of the community and in its knowledge production. These members tend to take on leadership roles in their

community (O'Mahony and Ferraro 2007; Johnson et al., 2015). More established members also contribute more content than newer members (Kane and Ransbotham 2016). These incumbent members tend towards homophilic preference for similar members with similar values. Network closure promotes preservation of the status quo (Bourdieu, 1986; Lin et al., 2001). Those who enter the highly connected core of the community are members with similar preferences, similar values, and similar motivations. This homophily feeds the maintenance of the status quo in the community. Members who deviate from status quo norms face criticism by those who value the status quo. As privileged and committed members of the community, these core members are more likely to defend the status quo norms of the community. In a study of an online blogging community, Silva et al. (2009) show how established community members "ridicule and even insult newcomers who they felt deviated from the expected ways of making a contribution." This boundary work was more recently visible following the GameStop "short squeeze" of January 2021, where incumbent Reddit forum "wallstreetbets" users asked moderators to ban new members to the forum in order to retain the forum's former professionalism (Shifflett 2001). The quality of the community is important to those who established the community and regularly contribute to it.

Second, central community members enjoy structural positions of power. Network centrality can be a proxy (or mechanism) of status (Podolny 2008; Granovetter 2017). Wasko and Faraj (2005) found that the closeness centrality of members on Stack Exchange was positively associated with higher ratings of that member's posts, meaning that core members were perceived as providing higher value contributions. Core online community members contribute more valuable knowledge and status, as perceived by other members (Safadi et al., 2020). Central actors have more network ties to exchange and community status. This status discourages central members from deviating from the status quo in which they have prospered. From the social exchange theory perspective, gatekeeping is an ability of those actors with "structural power" (Schaefer and Kornienko 2009) or "positional advantage" in a network to control resource flow, meaning that others in the network are dependent on them. In this view, network exchanges accumulate to central actors on whom the network is most dependent (Cook 1977; Cook and Emerson 1978; Cook, 1983; Markovsky et al., 1988; Thye et al., 1997; Schaefer 2011).

THEORETICAL PROPOSITION

Centrality renders incumbency and influence, which positions central members as potential community gatekeepers. Prior research has demonstrated that central members engage in boundary work of newcomers. Because remedial members have violated the norms that central community members value, central members should engage in boundary work of remedial members. This dynamic is heightened in a virtual community, where members rely on reputational signals to interact with semi-anonymous members.

This study looks specifically at the relationship between peer centrality *in a virtual community network*, *where community membership and social capital are exchangeable resources, and where interactions are discursive,* and peer boundary work *in response to a remedial narrative*. Assuming, in this context, that boundary work ranges from negative (peer rejection) to positive (peer affirmation), this study tests the following hypothesis:

H1. Members that are more central in the virtual community will reject remedial narratives more often than less central members.

This expected relationship is modeled in **Figure 1** below. A failure event of individual i in domain m reduces individual i's reputation in domain m. Following the failure, individual i decides whether or not to present a failure narrative to a community c associated with domain m. This failure narrative influences individual i's membership in community c in the following manner. If peers in community c respond to the failure narrative by affirming, or maintaining, individual i's membership, then individual i will gain access to new social capital in community c (e.g., introductions to employees/investors/clients/partners) that will improve individual i's reputation in domain m. Hypothesis 1 states that the centrality of peer j in community c *negatively* moderates peer j's likelihood of affirming, or maintaining, individual i's membership in community c. By not affirming membership, peer j blocks individual i from access to social capital in community c. This is an instance of gatekeeping, where the decision of "peer affirmation" is the gateway to vital social capital, including "social credentials" and "reinforcement" (Lin et al., 2001:7).

RESEARCH SETTING

To test this hypothesis, the author empirically analyzes the relationship between peer centrality and response to failure narratives in r/Entrepreneur, a virtual community of global entrepreneurs on Reddit. Virtual entrepreneur communities are groups of entrepreneurs that interact *via* virtual technology such as a website. These communities are field sites in which behavioral data is collected at a level of detail and scale found nowhere else (Parigi et al., 2017). Through virtual entrepreneur communities on platforms like Reddit, we can observe both remedial discursive boundary work and network structure.

An entrepreneurial virtual community is an ideal research setting for this study because entrepreneurship exhibits high rates of failure and remedial work to recover lost reputation. Entrepreneurship is a context rife with failure narratives as well as discursive boundary work. As depicted in the quote introducing this paper, entrepreneurs turn to their peers to make sense of, recover from, and avoid failure. Peers can respond with support or criticism. Extreme examples of

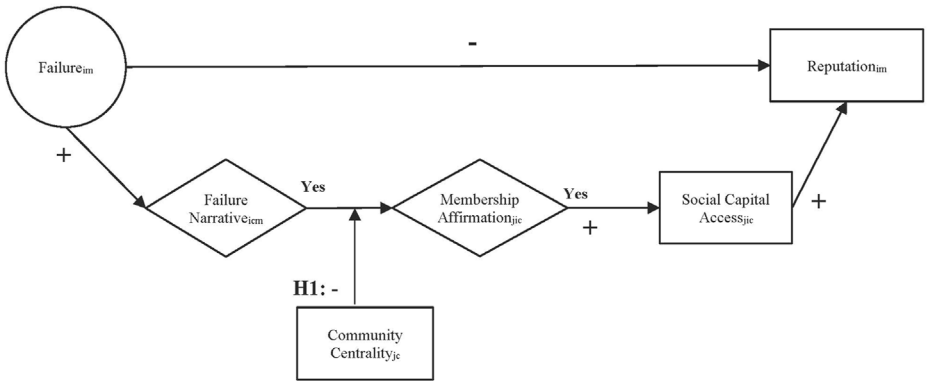

FIGURE 1 | Centralized Gatekeeping of Peer Affirmation of Community Membership as Exclusionary Remedial Boundary Work. Circles are events. Diamonds are decisions. Rectangles are resources. A failure event of individual i in domain m reduces individual i's reputation in domain m. Following the failure, individual i decides whether or not to present a failure narrative to a community c associated with domain m. This failure narrative influences individual i's membership in community c in the following manner. If peers in community c respond to the failure narrative by affirming, or maintaining, individual i's membership, then individual i will gain access to new social capital in community c (e.g., introductions to employees/investors/clients/partners) that will improve individual i's reputation in domain m. Hypothesis 1 states that the centrality of peer j in community c *negatively* moderates peer j's likelihood of affirming, or maintaining, individual i from access to social capital in community c. This is an instance of gatekeeping.

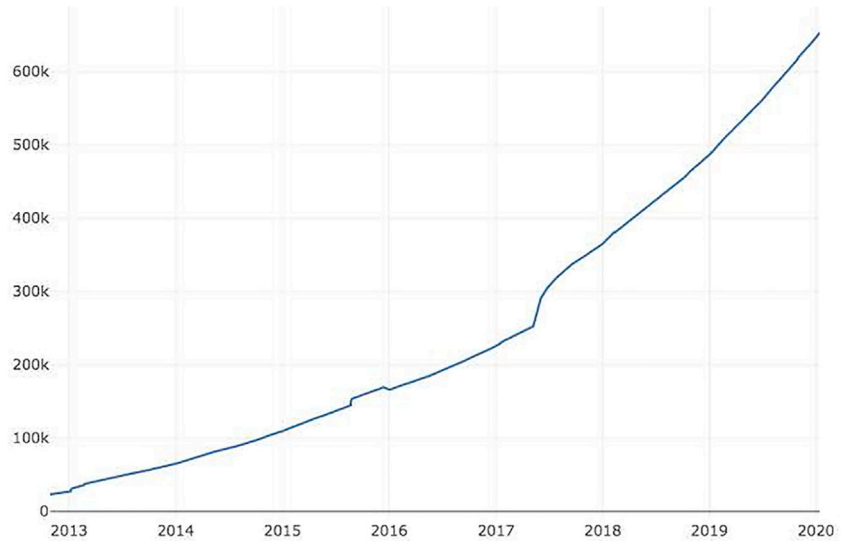

FIGURE 2 | Number Subscribers to/r/Entrepreneur Subreddit.

support include outreach for further interaction—"let's meet up," for example. And extreme examples of criticism include delegitimization of the author's identification as an entrepreneur—"you had no business starting a company," for example.

Entrepreneurship is a particularly interesting context for the study of peer community boundary work because such communities of peer entrepreneurs are informal communities of practice in which discourse-based boundary work fills the gap of legal or otherwise explicit demarcation. Unlike medicine or law, entrepreneurship does not rely on certifications to differentiate members from non-members of the profession. A teenager working on an idea in her parents' garage can call herself an entrepreneur without legal ramifications. Yet, boundary work does occur among entrepreneurs. Discursive boundary work can be observed and analyzed in virtual entrepreneur communities in which interactions are recorded and archived as "digital footprints" of the social phenomenon of interest (Golder and Macy 2014). This study analyzes the r/Entrepreneur community on the Reddit platform.

The r/Entrepreneur Virtual Community of Practice

In contrast to more geographically restricted online entrepreneurial forums like Hacker News, Reddit is an

internationally popular platform for discussions in any language. Composed of approximately 357,000 members at the time of study (see **Figure 2**), the r/Entrepreneur community describes its purpose as "giving and receiving advice on all aspects of Entrepreneurship. Help and encourage each other, it's hard enough out there!"[2]. The forum regularly posts comments on topics including "Accomplishments and Lessons Learned," "NooB" basic questions, startup jobs or internships, and product discounts. The first discussion thread was posted to the subreddit on August 21, 2008 with the comment "I hope that this subreddit brings together entrepreneurs who are interested in learning and partnering for new startups"[3]. Over 170,000 discussion threads have been posted to the forum since then. The r/Entrepreneur subreddit is a virtual community of practice, with a membership comprised of people identifying as "entrepreneurs." This community is porous - anyone can post a comment in the forum. The community is also semi-anonymous, as participants are identified by "usernames" instead of legal names.

DATA AND VARIABLES

Because Reddit currently limits scraping of its content via the Reddit API to a small, recent subset of discussions, this study relies on a pre-existing database of all Reddit comments that was collected and published on Google BigQuery by Jason Michael Baumgartner of Pushshift. io and Felipe Hoffa of Google BigQuery. From this database, the author exports all comments published on the/r/Entrepreneur subreddit before January 2017, including comment text, author, parent post, and timestamp. From this unprocessed comment data, the author creates conversational edgelists where the post author is the target and the comment author is the source. The author then processes the parent post data by removing whitespaces such as tabs and new lines, transforming text to lower capitalization, and reducing words to their word stem using Porter's stemming algorithm (Porter 1980). Using text mining algorithms that dissect documents into "term-document frequencies," or matrices of term frequency per document, the author identifies which posts use the stemmed term "fail" and are thus likely to be failure narratives. The validity of these posts as "failure narratives" is verified by viewing a random subset. The analysis of comments is restricted to these 1,408 fail posts (1.81% of all discussion threads in the dataset). Network attributes, however, are derived from the entire subreddit (77,710 unique threads).

Dependent Variable: Discursive Boundary Work

The construct of interest for this study is boundary work. Boundary work is the "discursive attribution of selected qualities to (a social category, their methods, and their claims) for the purpose of drawing a rhetorical boundary between (that category) and some less authoritative residual (non-category) (Gieryn p. 4–5). Put otherwise, boundary work is the public contestation of credibility (Gieryn p. 4). One indicator of such public contestation of credibility are sentimental expressions of approval and disapproval of the failure narrative. People tend to express more positive sentiments toward in-group than out-group members (Tajfel and Turner 1985). Based on assumptions of symmetry from structural balance theory (Heider 1946; Cartwright and Harary 1956), the sentiment of a dyad's discourse should reflect the sentiment of their relationship (c.f. West et al., 2014). In other words, the sentiment of a comment responding to a failure narrative post likely indicates acceptance or rejection of the failure narrative.

This study measures sentiment of comments using sentiment analysis (c.f. Wicke and Bolognesi 2021; Wang et al., 2021; Oz et al., 2018). The author compares the frequency of positive and negative terms in the comment against pre-existing dictionaries of terms associated with positive and negative sentiment (namely, the Quantitative Discourse Analysis Package, or QDAP, dictionary (Rinker 2020)). Words are not stemmed in this case, since this can alter the interpretation of sentiment [4]. By measuring sentiment by term frequency, this study measures the proportionality of positive and negative sentiment in each comment of the dataset. By using a continuous measure of sentiment, this study captures gradients of sentiment that are especially important given that the majority of responses in this dataset exhibit a positive QDAP score. Moreover, a continuous measure of sentiment more accurately reflects the nuances of human sentiment. As you can see in **Table 1** and **Figure 3** below, messages skew positive.

Independent Variable: Community Network Centrality

While online communities may have more ambiguous demarcations and exchange less tangible resources, they are observable *via* their interaction networks. A community of practice is often dispersed geographically and increasingly connected through online discussion forums. The public virtual forum is distinct from other types of social interaction, such as a closed office meeting, in that it is open to anyone and centrally visible. This structure has a distinct influence on community membership because, while interpersonal remediation builds relationships person-by-person, public remediation addresses the question of membership in the community at large.

The virtual public forum is an environment for interactions within the community. For large-scale communities, like those online, interactions are siloed. This is akin to classroom seminars across a large university campus. Most students are unaware of who participates more often in a given classroom discussion unless they are present in the class. Without accounting

[2]Reddit (2017). https://www.reddit.com/r/Entrepreneur/comments/74n42/welcome_to_the_entrepreneur_sub_reddit/.

[3]Reddit 2017a (n.d.). https://www.reddit.com/r/Entrepreneur/.

[4]Potts, C (2011). http://sentiment.christopherpotts.net/stemming.html.

TABLE 1 | Summary statistics of model variables.

Variable	Mean	Std. Dev	Min	Max	N
SentimentQDAP^	0.1025	0.1561	−0.5	1	1,408
Degree	8.497	29.447	1	3,176	74,021
Betweenness	99,907.20	1,028,229.96	0	100,994,598	74,021
Tenure+	12/18/2014 @ 1:33pm	43,911,895.23*	08/21/2008 @ 11:00pm	12/31/2016 @ 11:49pm	74,021
Author Degree^	56.19	91.52	2	702	180
Author Tenure+^	08/26/2014 @ 12:21am	47,472,439.40*	07/29/2009 @ 11:20pm	12/27/2016 @ 4:46am	180
Initiating Post Sentiment^	−0.13	0.21	−1.00	0.33	185
Commenter Sentiment Profile~	0.12	0.09	−0.33	1.00	1,281

*Note: Excludes "Automoderator" bot. +Measured as timestamp of first comment, UTC, in Unix Epoch Time. *Unix Epoch Time, or seconds since Jan 01, 1970 (UTC). ^From observations containing the stemmed term "fail". ~Lagged mean.*

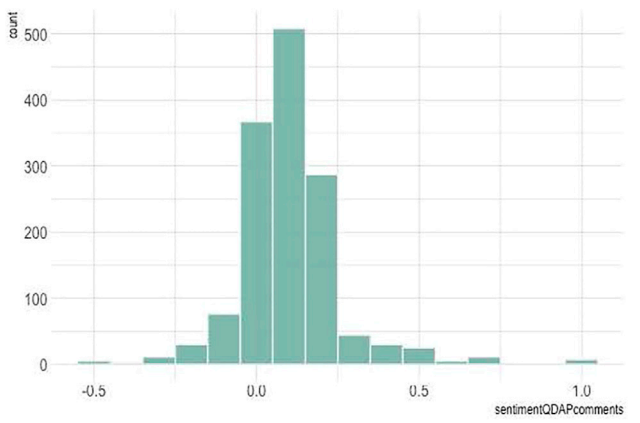

FIGURE 3 | Histogram of/r/Entrepreneur Message Sentiment.

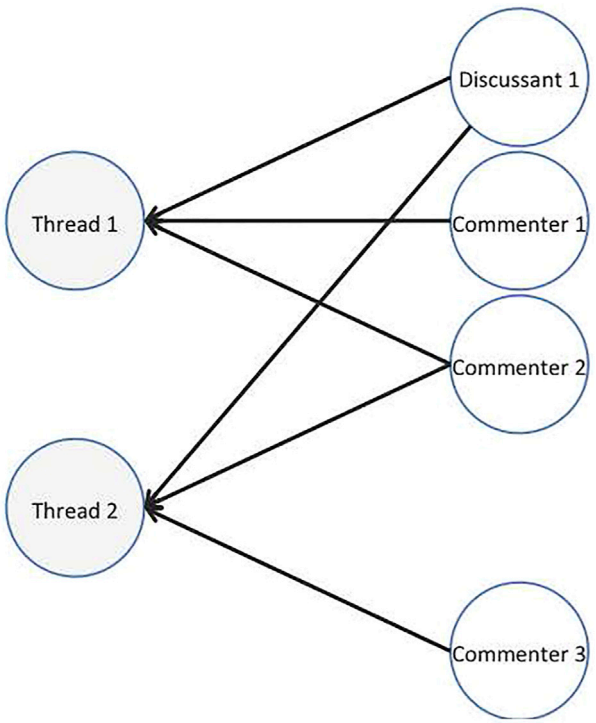

FIGURE 4 | Abstraction of Commenter–Thread Affiliate Network. Commenter and Thread nodes are two modes. Arrows indicate commenting on a discussion thread, excluding initial post authorship but including responses to comments on self-authored posts. Here, normalized degree is based only on discussion threads. To have the highest degree, a commenter must comment on every thread. Someone who comments on a single thread many times would have a lower normalized degree than someone who comments on several threads once. Note that discussants (i.e., post authors) are only included in this network if they comment on their own or another discussion thread.

for the nested structure here, a student who participates often in a single class, but in very few other classes, will have a similar degree centrality to a student that participates infrequently in any given class but does so across many classes. Thus, connectedness in such a community is more strongly reflected in cross-event, or cross-discussion, centrality.

If we think of the public forum as the intersection of many social circles rather than just one, we become interested in who intersects which circles. Discussions become events in which these circles are variantly represented. The well-to-do attend one set of discussion, the subversives another, and the intersections of these circles can make a discussion an explosive event not to miss. A common example of such affiliation networks is Davis et al. (1941) analysis of social event attendance by upper class women in the South. Using the society pages of local newspapers, the authors map which women attended which parties. The result is an affiliation network of parties and attendees (Borgatti and Halgin 2014). Transitive ties connect attendees into social circles or cliques, and highlight divisions within the community. In this affiliation network, member behavior is based on groups or cliques, where status and norms guide interactions.

In the case of affiliation networks, centrality is the number of events attended by attendees, or, in this study, the number of commenters "attending" a given discussion thread "event." The directed edges of the network are defined by the action of commenting on a thread, where the inbound set of nodes are the posts initiating a thread and the outbound set of nodes are people commenting on the post. The thread is thus encapsulated in the original post node and the edges to commenter nodes. This network is visually abstracted in **Figure 4** below.

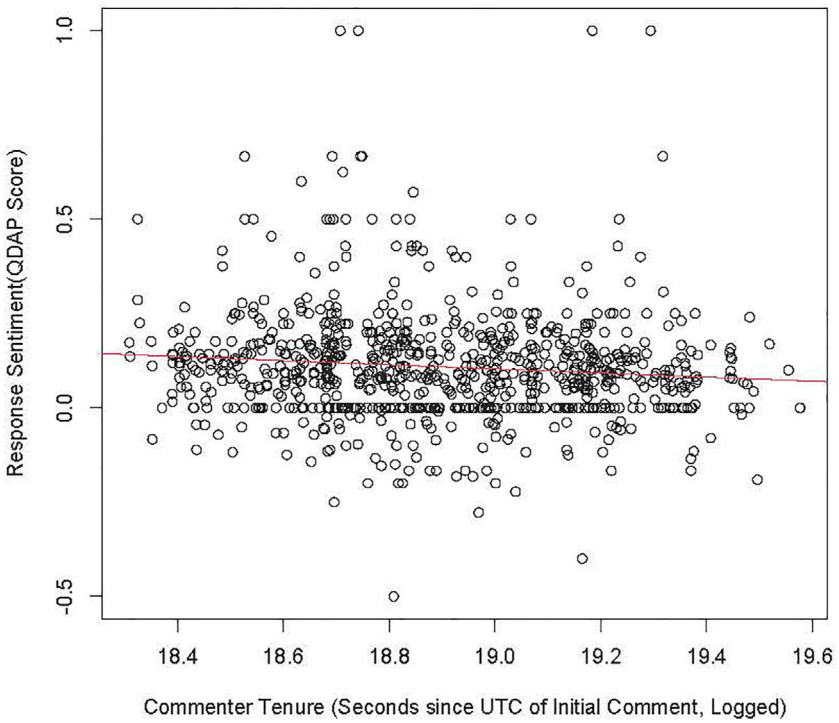

FIGURE 5 | Normalized degree distribution for commenters (by threads), log transformed.

There are many ways to measure network centrality, each indicating a different type of connectedness (Oldham et al., 2019). The simplest measure of local connectedness is degree centrality. Degree centrality is simply the number of edges leading from or to a node in a network. In our context, degree centrality measures the number of comments written on a discussion thread. To account for the bipartite structure of our network, commenter degree centrality is normalized by thread (Borgatti and Halgin 2014):

$$a^* = \frac{a}{n}$$

Where a = commenter-to-thread degree centrality, and n = number unique threads.

More than one degree indicates that a commenter has participated in more than one discussion thread. High thread-normalized degree means the member comments on many threads. As seen in the figure below, the distribution of thread-normalized degree in the "failure narrative" subset follows the typical power law found in most social networks (Albert and Barabasi 2002, see Broido and Clauset 2018 for exception), with a non-linear distribution for threads.

Most measures of centrality are collinear (Oldham et al., 2019). Oldham et al., 2019 find that the correlation of centrality measures is primarily based on the modularity of a network. In the event that the peer community is modular, meaning that it is composed of "walled gardens," or sub-communities that do not necessarily communicate with each other, *global* (community-wide) centrality becomes more likely to vary from *local* centrality measures. In such a case, global centrality measures, in contrast to local centrality measures such as degree centrality, better reflect community connectedness. The graph exhibits a modularity score of 0.519 (out of a range between −1:+1). This means that inter-module centrality is likely to vary from intra-module (i.e., degree) centrality. To measure inter-module connectedness, this study uses betweenness centrality.

Betweenness measures the number of shortest paths going through the node, i.e. the number of times the node bridges two other nodes (Freeman 1979). In the bipartite network of threads and commenters, betweenness measures shortest paths between threads as well as commenters. In other words, a commenter with a high betweenness may connect multiple threads or multiple commenters. High commenter betweenness in this bipartite graph indicates either a commenter commenting on a large *proportion* of threads in the graph or a commenter commenting on a thread that receives comments from a large *proportion* of commenters in the graph. For graphs with high modularity (i.e., many sub-communities), betweenness is a good measure of inter-module engagement.

Using Clauset et al.'s (2004) fast greedy community detection algorithm, this study finds that the commenter-thread network contains at least 3,435 sub-communities. One risk with the

Clauset algorithm is that it might settle on a local rather than global maximum. Moreover, because this commenter-thread network is a disconnected graph (White and Harary 2001), graph-level measures of centrality, such as closeness (Freeman 1979), may not be informative (Cornwell 2005). The author thus supplements graph measures of centrality with tenure in the subreddit. Tenure is based on the date of the commenter's first comment in the subreddit.

The directed network of/r/Entrepreneur commenters and threads is summarized in **Table 1**. There are 476,738 comments in this dataset, which define the edges in the network. In this two-mode affiliate network, there are 174,913 nodes, of which 74,021 are unique commenters (excluding the Automoderator bot) and 77,710 are unique threads. An edge is created in the affiliate network when a commenter comments on a discussion thread.

Controls

In the r/Entrepreneur online community, typical confounding demographic variables such as race and gender are not explicitly present. Instead, the author controls for structural and interactional factors that might influence the results, including the degree centrality of the discussant (the person creating the discussion thread), the tenure of the discussant, the sentiment of the original post, and the mean sentiment of the commenter.

It is possible that the connectedness of the discussant, i.e., their status within the network, influences boundary work. A higher status discussant might demand more authority and respect in the community. The tenure of the discussant captures founder effects, in which founders of the community are treated or behave differently than neophytes. Like connectedness, a higher tenure discussant should demand respect.

The author also controls for the sentiment of the original post. It is likely that the sentiment of the post that initiates the discussion thread sets the tone for the discussion.

Finally, the study controls for the mean sentiment of the commenter as a measure of the commenter's sentiment profile. This measure is the average sentiment score of all the commenter's comments excluding the current comment (i.e., lagged).

ANALYSIS

To test the hypothesis, the author regresses the sentiment score (using QDAP dictionary) of the comment on the commenter's 1) thread-normalized degree centrality as a measure of *local* module-specific connectedness, and 2) betweenness centrality and tenure as measures of *global* cross-community embeddedness. These measures of centrality should be inversely correlated with sentiment. Because the dependent variable is a continuous value between −1 and 1, the study uses an ordinary least squares regression model. In order to isolate the analysis to the failure narratives where boundary work should be salient, the observations are restricted to the 1,408 comments responding to posts that include the stemmed term "fail." The author log transforms the network values to account for their skewed distribution, and therefore restrict the analysis to those observations with centrality values greater than zero. Of the 1,408 comments to the 185 unique failure narratives, 576 (41%) have a betweenness value of 0. To include these isolated commenters in the analysis, the author uses the unlogged value of betweenness. The "AutoModerator," an automated bot that is programmed to respond to comments that transgress community rules, such as posting spam, is excluded from the analysis. In order to include the commenter's mean sentiment as a control, the analysis is restricted to commenters who have commented on at least two threads. Finally, observations with missing data are excluded (403 total, or 22% of failure narratives, excluded). The author uses clustered standard errors around discussion threads, given that many variable values will be interdependent at the thread level.

FINDINGS

Results

The results of the analysis are summarized in **Table 2** and **Table 3**. Robust standard errors are used to obtain unbiased standard errors under heteroskedasticity. Model 1 measures only the relationship between a commenter's thread-normalized degree centrality and the sentiment of the commenter's response to failure narratives. As hypothesized in H1, the normalized degree of the commenter is negatively related to comment sentiment. This relationship becomes statistically insignificant after including global measures of connectedness.

Model 2 includes two global measures of embeddedness: commenter betweenness centrality and tenure in the network. These results also support H1, indicating that a commenter's tenure (seconds since their initial comment in the network) has a negative relationship to their response to a failure narrative. This means that for a 10% increase in seconds of the commenter's tenure (i.e., current date minus date of their initial comment), their next comment should have a lower sentiment score by approximately −0.051 x log (1.1) or −0.002 points. In other words, the older the commenter's tenure is in the community, the more negative their response to the failure narrative is likely to be. This relationship is visualized in **Figure 5** below. In Model 2, betweenness is slightly negatively associated with message sentiment, but this relationship is not statistically significant and approaches zero.

Among the included controls, the strongest predictor of comment sentiment in the model is the commenter's sentiment profile, or mean sentiment of all their prior comments. Model 3 shows that, for each increase in the commenter's average sentiment profile, the commenter's next comment should have a higher sentiment score by an average of 0.481 points. Given that comment sentiment scores in the dataset have a standard deviation of 0.156, this increment would be significant. However, even with the inclusion of these controls, the negative relationship of commenter tenure remains statistically significant ($p = 0.013$).

The Strength of Peripheral Ties

Findings from the analysis of the r/Entrepreneur subreddit community support the hypothesis that connectedness is

TABLE 2 | Model predicting message sentiment (QDAP dictionary frequency score).

	Model 1	Model 2	Model 3
Local Centrality			
Commenter Degree Centrality (Log, Thread-Normalized)	–0.007[a]	–0.003	0.000
	(0.003)	(0.005)	(0.005)
Global Centrality			
Commenter Betweenness (Log)		0.000	–0.001
		(0.003)	(0.003)
Commenter Tenure in Network (Log)		–0.051[b]	–0.057[a]
		(0.018)	(0.023)
Controls			
Author Degree Centrality (Log)			0.002
			(0.005)
Author Tenure in Network (Log)			0.027
			(0.022)
Initiating Post Sentiment (QDAP)			0.026
			(0.028)
Commenter Sentiment Profile (Lagged Mean)			0.481[c]
			(0.101)
Intercept	0.076[c]	1.075[b]	0.629
	(0.011)	(0.343)	(0.360)
N	1,407	831[d]	831[d]
R^2	0.003	0.011	0.059

Note: Robust standard errors (in parentheses) clustered at discussion thread level. N excludes comments from "Automoderator" bot.
[a]p < *.05.*
[b]p < *.01.*
[c]p < *.001.*
[d]*Excludes comments with commenter betweenness value of 0.*

TABLE 3 | Correlation matrix of model variables.

	Message sentiment	Commenter degree	Commenter betweenness	Commenter tenure	Author degree	Author tenure	Initial post sentiment	Commenter sentiment profile
Message Sentiment	1.00	–0.04	–0.05	–0.10	0.03	–0.01	0.06	0.22
Commenter Degree	–0.04	1.00	–0.61	–0.43	0.04	0.34	–0.08	–0.03
Commenter Betweenness	–0.05	–0.61	1.00	–0.01	0.01	0.05	–0.25	–0.36
Commenter Tenure	–0.10	–0.43	–0.01	1.00	0.11	–0.77	0.12	0.16
Author Degree	0.03	0.04	0.01	0.11	1.00	–0.13	–0.22	–0.12
Author Tenure	–0.01	0.34	0.05	–0.77	–0.13	1.00	–0.14	–0.14
Initial Post Sentiment	0.06	–0.08	–0.25	0.12	–0.22	–0.14	1.00	0.28
Commenter Sentiment Profile	0.22	–0.03	–0.36	0.16	–0.12	–0.14	0.28	1.00

negatively associated with peer approval of a remedial narrative, particularly when connectedness is measured by tenure. The more temporally established the member is in the community, the more likely they are to engage in exclusionary boundary work. Inversely, the more recently the member joined the community, the more likely they are to react positively to failure narratives.

This implies that peripheral community members are more likely than core members to re-affirm a remedial member's membership. As **Figure 3** demonstrates, most responses to failure narratives in this community are positive. Qualitative content analysis of comments and interviews with entrepreneurs suggest that boundary work in such virtual peer communities is not predominantly negative policing, but positive bonding (see examples of positive comments in **Table 4**).

The large scale of Reddit provides insight into the sociocentric context of conversations amongst peer entrepreneurs. To learn more about the value and meaning of dyadic peer reactions to failure narratives, the author interviewed five failure narrative authors and one commenter. This selection was limited by the ability to contact individuals in a semi-anonymous setting. All interviews were conducted over the teleconferencing tool Skype. Interviewees signed a statement of consent and the interview protocol was approved by the university institutional review board.

From the qualitative content analysis and interviews, the author finds that peers indeed play a critical role in making sense of and recovering from failure. This is particularly so among peers that can empathize with the failure experience. Moreover, these interactions expand beyond the virtual to offline relationships. These interactions decay over time following the failure narrative, yet imprint both the narrator and the peer's subsequent entrepreneurial

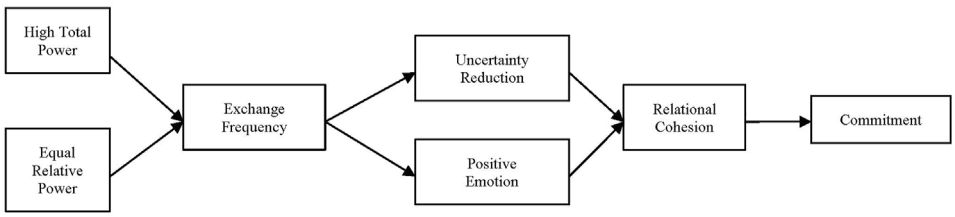

FIGURE 6 | Scatterplot of Commenter Tenure (Logged) and Sentiment of Response to Failure Narrative, with Fitted Linear Predicted Values in red.

TABLE 4 | Examples of positive comments from/r/entrepreneur subreddit.

"Great write up! thanks for this - as I am in the early stages of launching my first campaign. Did you have an email list before launch? How was your experience? Do you recommend it?"
"Scaling up is expensive because of the equipment that must be setup. It's a huge upfront investment. This capital equipment will be your main sticking point. If you need help, I would be interested. "
"Thanks for sharing this. You have to keep going brother."
"Brilliant post. Having recently closed my own company after more than 10 years, I agree with the lessons here, especially on blaming process."
"I'm 25 as well and testing stuff) Keep going, you will overcome the struggle. I could help you with your website."

Note: Paraphrased to protect subject privacy.

decisionmaking. While negative commentary in our virtual community may be generally perceived as "trolling" or otherwise inconsequential, positive commentary has a clear impact on failure narrative authors. The findings from interviews with fail post authors and commenters explain how failure narrators are able to circumvent negative gatekeepers and access community social capital to recover from failure.

Peers Empathize With Failure

Through the public failure narrative, authors connect with anonymous outreachers in addition to acquaintances. One author stated:

> "I got a lot of response from the postmortem. People from all over the world. People working on similar things and wanting help. And other post mortem victims, survivors. That was very cool. Talking to other people who went through the same thing."

Another author stated that:

> "There was a lot of online and sidebar discussion. It was surprising to me honestly. Founders reaching out in the backchannel who had similar stories. It was good to hear. Maybe their startup wasn't as well known, but it was similar emotions, similar pain. Shared catharsis. I got emails, phone calls from people asking, can we talk it over."

Another author exclaimed: "it was a full spectrum—folks you'd never heard of, and folks you had a casual or deep relationship with. Peers. Lots of folk." One failure narrative author described how he began reaching out to other failed entrepreneurs after his failure:

> "I will email people who I see go out of business and write them a note even if I don't know them. It happened a couple months ago, just say, I really liked what you were doing, just offering my support and if you need to talk, here's my number, call me. I usually get an email back. And I understand—most people don't want to talk about it, right at the beginning. But you feel like you're on this island, there's not a lot of people you can talk to. You can't really talk—I mean I guess you could, but, it's not something I feel comfortable talking to my family about because they're not in business, they're in healthcare and stuff like that. Same with my wife—at the time my girlfriend. . . . I remember the phone call from TechCrunch, when they were like, oh, we have to write about this closing. I was like, shit. I wished we could just go quietly, and we would be done. . . . But with that it feels like such a punch in the face. So it just sucks. Those are the people I usually reach out to, because I've been in those shoes and it just sucks."

A peer described how he followed up with a failure narrative author offline:

> "When (X) shared the postmortem, I had a beer with him and talked with him about winding down the company. His realization was that "we needed dollars or we were going to die." It was an "aha" moment—we

were facing the same problem (in the consulting inititative). It led me to be more curious about challenges in other industries—maybe there is a painkiller (rather than vitamin business model) out there."

Not all entrepreneurs wanted this attention:

"(After the failure, I received) a lot of emails and phone calls and texts and 'keep your head up' kind of thing. Which was really nice. In hindsight it's nice, but when it happens, it's like oh shit, they saw too. <chuckles> And they know, they were watching. I got a couple really great emails from some people that I knew, that were in the extended network, and then some people that I didn't know who just used the service and just said, hey, I used this and I loved it and it sucks that it's going away. And that was kind of cool."

Relationships develop between outreachers and authors:

"you build relationships out of postmortems. A few of them I've certainly kept up with over the years, followed their pursuits, their startups. There's a certain camaraderie that comes out of that. Shared battle scars. Whether it's a couple thousand or twenty million [dollars lost], pain is still the same."

Peer Affirmation Results in Social Capital and Persistence

These interactions impact entrepreneurs' careers, both of failure narrative authors and commenters. When asked how his own postmortem impacted his career, a peer commenter responded: "A lot. Besides friends saying 'I'm very sorry. By the way, would you like to come work with us?', people I've never met in my life, from different corners of the world, said 'hey, I read that, I found it interesting, do you want to chat." As one peer commenter described, these outreach gestures, which occurred over email, LinkedIn, Twitter, and skype calls, happened "more around the time of the postmortem. They changed my insights about generic stuff. It was mostly spontaneous." Another peer describes how the interactions ebbed over time, but had an impact on his career:

"I haven't chatted with him much since. I opened an office in (another region)—I go back and forth. He's good people. We are up for a loan in (the state). I reached out to him to get guidance on it. He's been really helpful with investor relations. His tactics helped us close a $500K round, helped us create a great pitch, how to get money from the state."

From the content of failure narrative discussion threads and interviews with narrative authors and commenters, it is clear that boundary work in this context is about support rather than exclusion. Entrepreneurs are often already stigmatized in broader society and face criticism for the risks they undertake. To secure support, entrepreneurs must be skilled optimists. They have learned to ignore criticism as noise.

Failure is generally stigmatized. Yet, through public peer-to-peer failure narratives, failed entrepreneurs are able to connect in an emergent peer support network. The interviews described above demonstrate the value of these peer support ties. Based on findings in other contexts, such as cancer patient and alcoholic peer support networks (c.f. Fowler and Christakis 2008; Zhang and Centola 2019), it is likely that peer support ties increase the retention and performance of failed entrepreneurs. Indeed, many outreachers in the dataset are actively involved in supporting entrepreneurship as event or community organizers.

DISCUSSION

The goal of this study is to understand how remedial boundary work operates in virtual communities of practice, where boundaries are ambiguous and resources intangible. In closed exchange networks, central actors are generally more likely to engage in gatekeeping. The relationship between network position and gatekeeping in open exchange networks, however, has not been as well understood. Thus, the goal of this study is to address the question of how network position, namely centrality, influences a community member's gatekeeping behavior in an open exchange network. To address this question, this study analyzed the relationship between peer network position and the sentiment of their response to failure narratives, assuming that remedial narratives provoke peer gatekeeping. The study finds that central peers, particularly more established members of the community with longer tenure, do indeed engage in more exclusionary boundary work. However, more importantly, the study shows that peripheral peers engage in more inclusive boundary work that is more impactful to remedial members. Through positive peer affirmation, remedial members are able to regain access to community-specific social capital and redress their reputation following failure. These findings contribute directly to the theorization of social exchange commitment; remedial boundary work, social capital, and knowledge production in virtual communities of practice; and the methodological study of remedial and discursive boundary work in porous or semi-anonymous communities.

Implications for Social Exchange Commitment

Remedial actions can result in exclusive boundary work that isolates the transgressor from the "flock." However, remedial action can also result in cohesion, as when a sub-community bonds over the shared remedial experience ("shared battle scars"). This study finds that both inclusive and exclusive boundary work occurs, and is associated with peer tenure in the community network. Inclusive boundary work is particularly prevalent (mean = 0.1025). By investigating the content of the discussion ties in this network, the author observes many instances of outreach for

empathy, relationship-building, and knowledge exchange (see **Table 4**).

Membership affirmation is a form of exchange commitment. Lawler and Yoon (1996) theorized that positive emotions generated from interactions can produce commitment to an exchange relationship. Relational cohesion theory identifies emotion as the mechanism for exchange commitment under suboptimal conditions, such as when an exchange partner fails to meet prior expectations (c.f. Uzzi 1997). Through positive emotion during prior exchange, partners come to associate the exchange relationship with positive affect (Lawler and Yoon 1996; Lawler and Yoon 1998; Thye et al., 2002; Lawler 2010). Through this "relational cohesion" process, the exchange relationship becomes an object of commitment.

The main drivers of relational cohesion, according to this theory, are power, exchange frequency, and positive emotion (see **Figure 6** below). Power and exchange frequency can manifest in network centrality. Critically, however, relational cohesion is distinct from structural cohesion. In relational cohesion, the value of the relationship is not based on structural dependencies, as in brokerage-based gatekeeping. Instead, the relationship is valued by its emotional content. The key driver of relational cohesion in this theory is emotion, or "relatively short-lived positive or negative feeling states" (Thye, Yoon, and Lawler 2002:15). In particular, Thye, Yoon, and Lawler assert that positive emotion, namely "pleasure/satisfaction and interest/excitement" will cause exchange partners to "partially attribute their (positive) emotions to their relation." In turn, "positive emotions induce a shift in cognitive awareness, such that actors come to see their relation as being more important, stable, and valued over time." The authors theorize that exchange frequency should induce such positive emotion, given that exchange frequency reduces uncertainty (Cook and Emerson 1984; Kollock 1994, 1999).

Failure may not induce positive emotions. It does, however, produce empathy. Like soldiers swapping war stories, these findings show that entrepreneurs bond and build camaraderie over failure narratives. As one peer responded to a failure narrative: "Thanks for sharing this, you have to keep grinding brother." Emotion does not need to be positive, and can indeed be negative, to stabilize a bond. The key is that the emotion is shared and produces empathy.

Given these findings, relational cohesion extends beyond positive emotion to include shared emotion, or empathy. Through failure narratives, and the empathy it provokes, remedial narrators are able to develop relational cohesion with empathizing members of the community and recover lost reputation following failure. This extension of relational cohesion explains why failure narrators are able to circumvent negative gatekeepers and re-establish themselves in the community. Relational cohesion theory also explains why peripheral community members are more supportive of failure narratives than centralized members. In 2000, Lawler, Thye, and Yoon extended relational cohesion theory to "productive exchange" contexts. In contrast to the dyadic nature of negotiated, reciprocal, and generalized exchanges, resources and benefits in productive exchanges flow between the individual and the group (Emerson 1976; Molm and Cook 1995; Thye et al., 2002). In their theorization of productive exchange, Lawler et al. (2000) introduced uncertainty reduction as a mechanism for commitment "distinct, yet complementary" to emotion (see **Figure 6** below). The authors theorized that uncertainty reduction, through frequent exchange, made an exchange "more familiar and predictable."

It is this uncertainty reduction mechanism that, the author theorizes, explains the relationship between peer centrality and peer affirmation. Peripheral peers should exhibit higher uncertainty than centralized peers. Peripheral peers are newer to the community, have less information, and are otherwise isolated from other practitioners. In contrast, central peers enjoy the benefit of not only their own knowledge but that of the other most connected peers in the community network, as a function of their central network position. Thus, peripheral peers have a higher state of uncertainty. Moreover, the failure narrative primes the relationship for uncertainty reduction. Failure is the manifestation of high uncertainty. Failure narratives are an artifact of the sensemaking process, an attempt to reduce uncertainty through collective and cognitive information seeking as well as to remediate the violation of practitioner norms through the sharing of the narrative (Weick et al., 2005).

Rather than decreasing exchange commitment, however, the author argues that this uncertainty 1) incentivizes peripheral peers to engage with remedial narrators and 2) amplifies their empathy and tolerance of failure and other remedial behavior. Peripheral peers are more incentivized to reduce their higher states of uncertainty than central peers, who enjoy lower perceived uncertainty. Peripheral peers are therefore more inclusive in seeking social relationships to reduce uncertainty (Cook and Emerson 1984; Kollock 1994; Karen and Eric, 2013).

Thus, peripheral peers, with higher uncertainty, bond with remedial narrators over a shared emotion exhibited in the failure narrative. This bonding circumvents the gatekeeper, effectively unlocking the community's network, giving the remedial member renewed access to the community's social capital, via the peripheral peer, and ultimately reviving the remedial member's reputation following failure. This relationship is modeled in **Figure 7** below, modifying **Figure 1** to incorporate and extend relational cohesion theory to include empathy (not just positive emotion) and peripheral peer uncertainty.

These findings make important contributions to social exchange commitment theory. Social exchange theory can be used to predict exchange relations in virtual communities given network structure and an assumed degree of rational action (c.f. Faraj and Johnson 2011). However, exchange relations persist despite more logical alternatives. When an exchange partner admits failure, for example, their reputation and desirability as an exchange partner should suffer. Relational cohesion theory (Thye et al., 2002) explains why actors commit to exchange relations even in the face of better options. This study extends relational cohesion theory to the boundary work

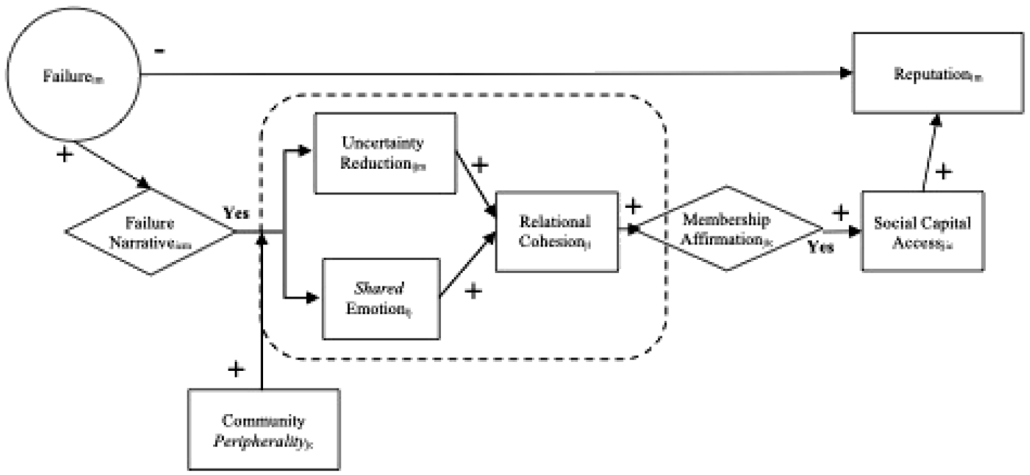

FIGURE 7 | Relational cohesion theory in productive exchange context (adapted from Thye, Yoon, and Lawler 2002).

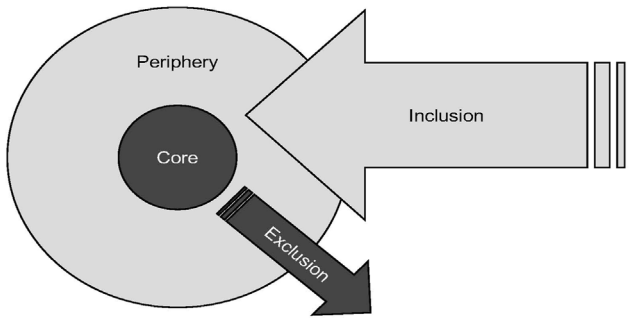

FIGURE 8 | Peripheralized Enabling of peer Affirmation of Community Membership as inclusionary Remedial Boundary Work. The less central (and more peripheral) the peer j in community c, the more likely they are to embrace a failure narrative and re-affirm the remedial member i's membership in community c. This is because the peripheral member j 1) experiences higher uncertainty than more central members and thus seeks to reduce uncertainty through the failure narrative as a part of the collective sense making process; and 2) bonds over the shared emotion expressed in the failure narrative. This produces relational cohesion, through which the peers mutually affirm each other's membership in community c.

context, in which membership and community social capital are the objects of exchange.

Relational cohesion theory identifies emotion as the mechanism that bonds actors into a united exchange relationship that is valuable beyond the transaction and against otherwise logically preferable alternatives. Emotion, however, is complex. As demonstrated by hazing and other painful initiation rites, it is not simply positive emotions that generate bonding, but also shared negative emotions (Aronson and Mills 1959). This study expands emotions as a mechanism for relational cohesion to include negative but empathetic emotions.

Social exchange theory recognizes that one benefit of relational cohesion is the reduction of exchange uncertainty. Thye et al. (2002) model uncertainty reduction as a complementary mechanism explaining commitment to underperforming relationships. Peripheral community members are also associated with higher uncertainty. This study leverages the association between network peripherality and exchange uncertainty to theorize the positive relationship between peripherality and inclusive boundary work.

Implications for Boundary Work in Virtual Communities

Local centrality does not appear to matter as much as global measures of connectedness and tenure in virtual peer community boundary work. Rather than tabloids on who is attending whose party, the virtual public forum is more like walled classrooms with open doors on a large university campus: anyone can enter, but your chance of being aware of every discussion is minimal. The virtual public forum is thus an open rather than closed network. Nan Lin (1999) summarized the distinct views of networks as social capital, including the benefits of closed or open networks (Bourdieu, 1986; Coleman 1990; Putnam 1993, 1995). In this view, closed networks generate a premium of

"collective capital" via closure, or exclusivity. Lin asserts that closed networks are beneficial for "preserving or maintaining resources," but are counterproductive for "searching and obtaining resources" (c.f. Granovetter 1974). From the initial description of our online entrepreneurial community (see above), posted by the community founder, it is clear that this community seeks the latter.

Entrepreneurs turn to their peers to make sense of and recover from failure, but these interactions are steeped in identity work. The virtual community of entrepreneurs is a resource for social capital, information, and other goods, but it is also an expressive forum for definition and development of the entrepreneurial identity. Wenger (1998) notes that communities of practice foster identity as well as learning. Communities of peers are simultaneously learning as a collective, fostering a shared identity, and competing over resources that include social capital. This analysis of the relationship between community centrality and boundary work identifies this tension between the peer community as both an instrumental and an expressive network, but finds that, as an open rather than closed network, community boundaries are more inclusively fostered rather than exclusively policed.

Boundary work is a process of separating in-group from out-group. Boundary work is a social force in two opposing directions: pushing out and pulling in. Prior scholarship has focused predominantly on only one of these forces: exclusion (Lamont and Molnar 2002). Hypothesis 1 describes the exclusion force of boundary work. This hypothesis is that the higher quality, higher status, embedded, even institutionalized, core generally push outsiders away from the group. These findings demonstrate the presence and the importance of the inclusion force. The findings show that *the core does exclude*. However, the author also finds that the *periphery includes*, and that this inclusion may be more influential to communal membership, social capital, and specifically reputation. This dynamic is visualized in **Figure 8**.

In this open network, where the object of exchange is information and social capital, and where members do not compete over resources, exchange follows reciprocity rather than preferential attachment (Faraj and Johnson 2011). While high-status core members with a stronger sense of certainty push out remedial members, lower-status, marginalized peripheral members with higher uncertainty pull remedial members back into the fold. While the core can be powerful gatekeepers, the periphery can be more pivotal in (inclusive) boundary work, at least in virtual communities of practice. In the r/Entrepreneur virtual community, the pull is more influential than the push. Because the network is open and semi-anonymous, negative reputations can be more easily replaced with new identities (Cook, 2009). However, building a positive reputation is more challenging in this context. Inclusive boundary work, therefore, is not only a bridge into the community, but more powerful.

This study directly contributes to the debated role of structural position in knowledge communities, namely whether network centrality is positively or negatively associated with knowledge creation and the mechanisms through which this knowledge creation occurs. Safadi et al. (2020), for example, describing the "core-periphery debate in knowledge fields," similarly find that marginal members contribute knowledge to the community, but explain this duality by distinguishing structural position in the virtual community from epistemic position. A related subset of this conversation is the tension between peripheral novelty and influence, often conceptualized as "boundary spanning" (c.f. Rosenkopf and Nerkar 2001). Vedres and Stark (2010), for example, theorize "structural folds" as the balanced position of enough marginality to access new ideas and enough embeddedness to enact those ideas. It is important to note that boundary spanning is distinct from community marginality and boundary work. Boundary spanning generally assumes that the boundary is set and even static, analyzing those who bridge communities rather than the formation and evolution of boundaries (Langley et al., 2019). In contrast, boundary work focuses on the ongoing negotiation of boundaries. The relationship between boundary work and knowledge management, and the capability of gatekeeping to control and inhibit knowledge, has received too little empirical analysis. This analysis is especially critical for communities of practice, where the practice and the legitimacy of practitioners are defined by community knowledge.

These findings show that 1) discursive boundary work occurs in virtual communities, 2) inclusive boundary work is more impactful (and thus circumvents exclusive gatekeeping), and 3) peripheral community members respond more positively to remedial narratives. Through empathy and collective sensemaking of the failure, peripheral community members bond with remedial members. This relational cohesion facilitates access to valuable resources like financial, labor, informational, or emotional support, which assist the remedial member in recovering from failure. This means that peripheral members are the key to a remedial member's recovery from failure.

This study also contributes methodologically to the study of remedial and discursive boundary work in porous or semi-anonymous communities. Boundary work is most commonly applied to newcomers who aspire to gain access to a community. But it is perhaps even more salient for remedial members who have demonstrated poor quality and have earned a reputational penalty that calls their community membership into question. In the case of aspirational membership, boundary workers must assess the quality of aspirational members under conditions of high uncertainty. Because remedial members have a history in the community and are confessed remedials, boundary workers have a more certain perception of quality of these members and can more certainly determine their belonging to the community. Thus, the boundary work of remedial members deserves theoretical attention.

Remedial boundary work is important for two reasons. First, remedial boundary work is a clearer signal of membership worth in a porous, semi-anonymous community in which boundary workers face a high degree of uncertainty about aspirational members' worth to the community. Second, remedial boundary work is theoretically important because, in a community context reliant on discursive interaction such as an online discussion forum, both the remedial narrative and the boundary work it provokes are observable in documented

discourse, namely the "remedial narrative." In virtual communities where semi-anonymous members rely on discussion boards, tweets, threads, and other text formats, boundary work is discursive (c.f. Honeycutt 2005; Shaw 2012). Rhetoric is a form of boundary work in a porous community where traditional status symbols are unavailable (e.g., online anonymity) or where legal barriers to entry do not exist (e.g., entrepreneurship).

The foundation of boundary work theorization is based in discourse and knowledge production (c.f. Gieryn 1983). As discursive boundary work is increasingly documented in digital settings, natural language processing and computational network analysis enable new empirical analyses and theorization of boundary work. This study takes advantage of the network and text data generated by virtual communities on the Reddit platform, and the statistical analyses this data makes possible. Using the network and text analysis methods introduced here, and the nuanced measures that these methods enable, scholars of boundary work can refine their understanding of the mechanisms behind boundary work in complex contexts, such as porous or semi-anonymous communities.

CONCLUSION AND FUTURE RESEARCH

This study tested a network argument for discursive boundary work in a virtual peer community. The author evaluated whether something about the network—not just dyads, but the aggregation of ties and shifting position that entails, might cause community members to police against failed members. The author proposed that exclusion and outreach, forms of community boundary work, may depend on the network structure, namely centrality, of the boundary worker. This is suggested by theories of network exchange and inter-group dynamics, and reflected in observations from failure narratives published online. These dynamics could have a critical impact on community vitality, including creativity and network learning, if excluders gatekeep and outreachers broker access between membership claimers and the community core. The study tests this theory using network and text data from discussions posted to the/r/Entrepreneur virtual community of practice. The author finds that connectedness and tenure do influence message sentiment. However, through interviews with entrepreneurs, the author learns that messages of inclusion are important to the entrepreneur's sense of belonging and commitment to the occupation. Thus, while the boundary worker's position in the sociocentric network may negatively influence their boundary work, the boundary work itself may positively influence the community network by retaining members and strengthening their ties to the virtual community. This is a clear example of why egocentric network analysis (Perry et al., 2018) cannot be devalued, and may be even more useful for uncovering behavior unseen at the sociocentric level of analysis.

Future research can address two important limitations in this study. Sentiment is incredibly complex (c.f. Scherer 1984). Accurately analyzing sentiment requires context about the narrator and the audience, such as their relationship, goals, preferences, history, norms, and restrictions. This study uses a simplified measure of boundary work: QDAP sentiment score. Sentiment is much more nuanced than this single measure affords. Future research should test a variety of measures of boundary work, including the separation of negative and positive responses into distinct variables. It is possible, for example, that a comment includes both negative and positive terms. Moreover, sentiment varies based on who is exhibiting or observing its expression. Future studies may capture boundary work more accurately by measuring sentiment directed at specific targets, rather than overall sentiment of the document.

Finally, these findings may be specific to the/r/Entrepreneur subreddit context. This empirical context restricts the generalizability of these findings in several ways. Entrepreneurial failure may be distinct from other types of failure. Entrepreneurial failure narratives might provoke distinct dynamics from other types of remedial narratives. This field site is an open network with unrestricted resources. Dynamics observed here may be different for closed networks in which members compete over resources. Finally, social capital and reputation may entail distinct dynamics for entrepreneurs in a virtual community in contrast to non-entrepreneurs or local entrepreneurs. In order to generalize these findings, the hypothesis should be tested in other virtual peer communities.

Connectedness influences boundary work. Exclusion and outreach are dyadic interactions influenced by ego network structures that have community-level implications. The vitality of the community relies on learning from remedial experiences like failure. Such learning hinges on community boundary work.

DATA AVAILABILITY STATEMENT

The raw data supporting the conclusion of this article will be made available by the authors, without undue reservation.

ETHICS STATEMENT

The studies involving human participants were reviewed and approved by the Stanford University IRB Protocol # 36569. The patients/participants provided their written informed consent to participate in this study.

AUTHOR CONTRIBUTIONS

The author confirms being the sole contributor of this work and has approved it for publication.

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The Curvilinear Relationships Between Relational Embeddedness and Dynamic Capabilities: The Mediating Effect of Ambidextrous Learning

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Dynamic capabilities are crucial to the survival and development of enterprises in the BOP (Base/Bottom of the Pyramid, hereinafter BOP) market. The research focuses on the double-edged sword impact of relational embeddedness on dynamic capabilities *via* ambidextrous learning, that is moderate embeddedness facilitates dynamic capabilities while overembeddedness inhibits them. Furthermore, this study investigates whether human capital moderates the relationships between relational embeddedness and ambidextrous learning. Selecting 264 samples for empirical research, firstly, the results show that the relational embeddedness in the BOP cooperation network has an inverted U-shaped influence on ambidextrous learning and dynamic capabilities. Secondly, exploratory learning and exploitative learning play a mediating role in relational embeddedness and dynamic capabilities. Thirdly, prior experience plays a positive moderating role in relational embeddedness and exploitative learning. The conclusions facilitate understanding the antecedents of dynamic capabilities and the black box of "embeddedness paradox," and provide empirical evidence for adjusting the human capital of enterprises, enhancing the exploratory learning capability and exploitative learning capability, and coping with the overembeddedness effects.

Keywords: relational embeddedness, exploratory learning, exploitative learning, dynamic capability, BOP

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INTRODUCTION

For a long time, companies have paid more attention to the high-end market in the pyramid composed of wealthy groups and the middle class (Top of the Pyramid, hereinafter TOP), and ignored the BOP groups living in the vast underdeveloped areas, which account for more than 2/3 of the world's population (Nakata and Weidner, 2012; Yurdakul et al., 2017). BOP strategy proposed by Prahalad and Hart (2002) believes that the enormous low-income people that are rarely included by business encompass huge potential wealth. Only by absorbing BOP groups into the market economy, can enterprises generate profits while simultaneously alleviating poverty (Hart and London, 2005). Due to the weak infrastructure, low educated workforce, and informal governance mechanisms (Webb et al., 2010; World Bank Statistics, 2019; Sun et al., 2020), different participants need frequent and direct interaction to ensure the smooth progress of production and trading activities. As Hart (2015) argued that most BOP ventures and corporate initiatives over

the past decades have either failed outright or dramatically underperformed against expectations at great cost. Being embedded in a BOP cooperation network (hereinafter BOP network) with specific relationships and structures established by non-traditional partners such as local government, non-governmental organizations (NGO), community organizations, and the poor themselves is critical to survival (Clarke and Fuller, 2010). Founding a diversified network relationship with non-traditional partners is a significant means for enterprises to deal with a dynamic environment (Døving and Gooderham, 2008). Concerning the particularity of the BOP market, enterprises call for adaptation to local norms and building on local conditions, and are also expected to radically change the context by introducing new products and services. Thus, how does relational embeddedness affect dynamic capabilities, managing their continuous adaptation to and shaping the environments to survive?

However, although scholars generally believe that an increase in uncertainty requires strong dynamic capabilities, including the capacities to explore, learn and adapt (Teece and Leih, 2016), there has still been criticized for offering only a limited understanding of how dynamic capabilities emerge and evolve (Peteraf et al., 2013). Existing research on dynamic capabilities has identified several antecedents, such as knowledge absorption capability (Saenz et al., 2014), relational management (Forkmann et al., 2016), relational learning (Smirnova et al., 2018), network resources (Alinaghian and Razmdoost, 2017), and relational embeddedness (Frasquet et al., 2018; Alinaghian et al., 2020). Dynamic capabilities beyond a single firm's boundaries are gaining more and more attention (Forkmann et al., 2018). Although the influence of relational embeddedness on firms' dynamic capabilities has been recognized by a plethora of research (e.g., Frasquet et al., 2018; Alinaghian et al., 2020), quantitative empirical evidence is still limited. Additionally, whereas previous studies often investigated the influence of relational embeddedness on innovation (Albis et al., 2021), firm performance (Mozumdar et al., 2019), firm growth (Bird and Zellweger, 2018; Zeevik et al., 2018), an increasing number of literature is now examining the impact of relational embeddedness on the dynamic capabilities to survive and grow in the face of uncertain environments (Frasquet et al., 2018; Alinaghian et al., 2020; Zhou et al., 2021). But these studies emphasized the positive effect of relational embeddedness (Zheng et al., 2011; Rodrigo-Alarcón et al., 2018; Ai and Peng, 2021; Zhou et al., 2021), and neglected the darkness of overembeddedness itself. Eriksson (2014) called for more comprehensive empirical research on dynamic capabilities. Second, an issue that the organizational learning and dynamic capabilities literature has addressed is that learning is a vital way for enterprises to build dynamic capabilities (Eisenhardt and Martin, 2000; Zollo and Winter, 2002; Pu and Soh, 2018). However, few scholars in the BOP market have noticed the relationship between knowledge, learning, and dynamic capabilities (Eisenhardt and Martin, 2000; Teece and Leih, 2016). In addition, a line of research has argued that relational embeddedness can also affect learning (Uzzi and Lancaster, 2003; Pu and Soh, 2018). We found few studies that connect the two. Noting this, investigating the possible mediating role of ambidextrous learning between relational embeddedness and dynamic capabilities has also become an important research direction because evidence of the mediating effects can prompt firms' attention to the issue of ambidextrous learning when improving dynamic capabilities. Taken together, the second goal of the current study is to investigate whether ambidextrous learning would positively mediate the relationship between relational embeddedness and dynamic capabilities. Finally, the effects of relational embeddedness on different themes of ambidextrous learning may vary, or even contradict, one another in their moderation by human capital (e.g., prior experience). This is because human capital may have a negative effect on ambidextrous learning by increasing cognitive inertia, and lock-in effects while promoting it by providing stronger cognitive capability, and communication capability. Considering this, the third goal of our study is to investigate whether and how prior experience, e.g., knowledge and resources from prior industry experience and BOP market experience, moderates the relationship between relational embeddedness and ambidextrous learning.

To close these gaps, we distribute the survey and collect 264 responses *via* a popular online platform in China named Credamo with a total of over 2.8 million registered samples, comprehensive coverage of all provincial administrative regions in China, and support for hundreds of user tags. For example, the questionnaires are accurately delivered according to the characteristics of the subjects such as gender, age, occupation, and region.

This paper tests its hypotheses by employing questionnaire survey data of different industries, where enterprises located in concentrated contiguous areas in the Qinba Mountains Shaanxi province. Adopting social embeddedness theory, dynamic capability theory, and ambidextrous learning theory to explore the influence of relational embeddedness and ambidextrous learning on the dynamic capabilities in the BOP context, as well as the moderating effect of prior experience. The contributions of this study are as follows: First, this study provides a new understanding of the dynamic capabilities' antecedents and the black box of the "embeddedness paradox" in the BOP context. The study empirically confirms the notion that the impact of relational embeddedness on dynamic capabilities is a curvilinear relationship. This is a complement to those of Rodrigo-Alarcón et al. (2018), and Ai and Peng (2021) who believe that relational capital may positively predict dynamic capabilities. Thus, our findings expand domains of the dynamic capabilities' antecedents and "embeddedness paradox." Second, the study consolidates support for the dynamic capabilities through the perspective of social embeddedness and ambidextrous learning. It advances the literature of dynamic capabilities by showing that as a mediation device, ambidextrous learning may transform useable resources from relational embeddedness into dynamic capabilities, expanding the previous point of view (Aranda et al., 2017; Yuan et al., 2021). Finally, from the perspective of human capital, we explore the boundaries of the double-edged sword impact of relational embeddedness on ambidextrous learning. That is to say, under what context, moderate embeddedness

brings positive effects and overembeddedness leads to negative effects. This study promotes understanding of the contextual factors that affect the inverted *U*-shaped relationship between relational embeddedness and ambidextrous learning and its contingency mechanism.

THEORETICAL BASIS

Relational Embeddedness

The enterprise network theory agrees that in addition to its own resources, enterprises can also obtain key resources through various forms of connections with external entities. Various connections between enterprises can bring considerable relationship rents and competitive advantages to enterprises (Dyer and Hatch, 2006). Relational embeddedness mainly studies the problem of binary transaction relationships between network participants, that is, the degree of mutual trust and commitment between transaction parties (Gulati, 1999). Uzzi (1999) research found that embedded connections through three aspects (trust, high-quality information sharing, and joint problem-solving mechanisms) enable companies to obtain benefits such as reducing transaction costs, acquiring scarce resources, reducing environmental uncertainty, and promoting organizational learning. First, trust is the most important aspect of relational embeddedness (Garcia-Villaverde et al., 2018). Inter-organizational trust can be regarded as a resource, which can alleviate the speculative behavior that may be caused by uncertainty and dependence in transactions. Trust also generates flexibility in coping with situations of uncertainty (Nonino, 2013), and helps reduce the costs of market transactions (Czernek-Marszaek, 2020a). Second, an information-sharing mechanism provides support and guarantee for the transmission and flow of information and emotions between organizations. Information sharing means that both parties are willing to share tacit knowledge that goes beyond the public information in the market. Information exchange, trust, and cooperation between enterprises make it possible for enterprises to obtain corresponding external resources by means of the Internet (Inkpen and Tsang, 2005; Boso et al., 2013). Third, joint problem-solving refers to the sharing of responsibilities between related companies, coordinating with each other, and jointly solving the problems that arise as the relationship deepens (Heide and Miner, 1992). By solving problems together, partners establish a common habit and language system, which is more conducive to the transfer of complex knowledge blocks. The flexibility of attitudes and actions of the partners enables them to solve problems with the use of the limited resource (Czernek-Marszaek, 2020a).

The paradox of relational embeddedness has existed for a long time. Granovetter (1973) divided social network relationships into strong ties and weak ties in his representative work "The strength of weak ties." He emphasized the role of weak connections in acquiring heterogeneous information and knowledge. Burt (1992) stated that weak ties are the advantage of corporate innovation. Weak connections are easy to enhance enterprises flexibility and achieve cross-organizational communication, and increase the breadth of knowledge. Weak ties can also greatly reduce the cost of acquiring knowledge. Hansen (1999) concluded that weak ties are good for searching and discovering useful knowledge while strong ties are good for transferring complex knowledge. Some scholars believed that strong ties are beneficial to the acquisition of corporate knowledge by enhancing trust and the improvement of innovation performance (Levin and Cross, 2005; Wang et al., 2020). Strong ties also can better regulate and restrict the behavior of partners, and promote learning and imitation between organizations (Tsai, 2009). However, too high a level of this embeddedness leads to the so-called "overembeddedness effect" bringing negative consequences for business activity. Czernek-Marszaek (2020b) identified possible negative consequences of social embeddedness for cooperation, such as lower adaptation abilities caused by adjusting to known partners, accusations of nepotism in cooperative relations, limiting the willingness to cooperate, and susceptibility to the opportunistic activities of a partner. The development and maintenance of strong ties can be associated with high costs in the form of time and resource allocation (Obukhova and Zhang, 2017). Enterprises may rely too much on their partners, creating a relationship lock-in risk (Uzzi, 1997; Rowley et al., 2000).

For small firms, like those in the BOP market, a network is more likely to be informal and consists of social links with individuals such as family, friends, and acquaintances. The connections within the BOP cooperation network are mostly highly personal and informal. London et al. (2010) proposed that relational embeddedness constructs a value chain or value network that adapts to BOP groups, and it can identify production and transaction constraints that restrict or hinder the resources and capabilities of low-income groups and release their value creation potential. Goyal et al. (2016) found that relational embeddedness enhances the socioeconomic impact and sustainability of the BOP market. Enterprises can only obtain high-quality knowledge and information by embedding it in the local network, improving operational efficiency, and accessing new markets (Sánchez and Ricart, 2010). While the positive effects of social embeddedness have been relatively more often discussed in the literature, the negative effects are rarely the subject of in-depth considerations (Mitrega and Zolkiewski, 2012). Meanwhile, relatively few empirical studies are available to verify this conjecture. To fill this gap, we test the curvilinear effect of relational embeddedness in the BOP market.

Dynamic Capability

In his seminal paper, Teece et al. (1997, p. 515) defined dynamic capabilities as "the key role of strategic management in appropriately adapting, integrating, and reconfiguring internal and external organizational skills, resources, and functional competencies to match the requirements of a changing environment." He found that dynamic capability is the ability to adapt to the external environment in nature. Meanwhile, the enterprises can not only passively adapt to the environment but also can change or even reshape the environment through corresponding activities (Teece, 2007). Teece (2007) divided it into sense, adaptation, and shaping capabilities from an environmental perspective. Environmental sensing capability

means that enterprises can explore and obtain sources from the external environment, helping them seize market opportunities. Adaptation relates to routines of resource exploitation and deployment focusing on external changes, which can identify and tap more market opportunities and can quickly adapt to a volatile environment (Dixon et al., 2014). Adaptation is critical to the evolution and survival of enterprises. Shaping capability takes advantage of innovation opportunities and transforms them into innovation results consisting of a series of routines and processes. Enterprises can generate or cultivate a local supply chain by, for example, training and educating raw material producers, financial institutions, and/or local labor (Ausrød et al., 2017), which would shape the context and create a more suitable environment in turn.

Scholars now increasingly recognize that fostering dynamic capabilities often extends beyond a single firm's boundaries (Forkmann et al., 2018). For instance, When O'Reilly and Tushman (2008) investigated how to solve the innovator's dilemma, in order to build and cultivate dynamic capabilities, firms must scan, search, and explore across technology and market boundaries. Tran et al. (2019) proposed that new dynamic capabilities mature over time through the integration of operational capabilities to adapt to changes in the environment with external partners. Working jointly toward the goal may also involve changing this goal to shape the environment (Artto et al., 2016). Dynamic capabilities can help companies reshape the environment in a complex external environment, change the rules of the game, and enhance their competitive advantage. In the process of adapting to and shaping the external environment across the firm's boundaries, dynamic capabilities realize the survival and sustainable competitive advantage of the enterprise.

The aforementioned research mainly focuses on non-BOP areas, and the availability of external resources is an important basic assumption for them. When faced with the BOP scenario, this assumption will undergo a fundamental change. Ansari et al. (2012) pointed out that the market environment in the BOP region is significantly different from the mature market, and companies cannot directly obtain resources from the BOP market (Mair et al., 2012). To promote the success of BOP-oriented business activity, companies are eager to attract potential partners who have the resources needed for business development. Empirical studies have, however, found that business strategies that adapt to impoverished environments by leveraging local institutional strengths tend to outperform those grounded in the business conditions of developed economies (London and Hart, 2004). Therefore, the mechanism of the dynamic capabilities at the BOP may be different from that of the non-BOP market. Few studies have analyzed the dynamic capabilities at the BOP. The BOP offers a suitable context in which to explore the dilemma concerning the adaptation to and shaping of the context because firms are advised to adapt to their context and build on local conditions (Hart and London, 2005). Emphasizing the adaptation to local norms and/or negotiating mutually acceptable practices, enterprises should focus on the dynamic long-term engagement between a lead firm and their BOP producers (Ramachandran et al., 2012). Managers should adapt their BOP strategies to an industry environment (Zhu et al., 2019). Simultaneously, firm activities are also expected to radically change the context in which they operate by introducing new products and services (Prahalad and Hammond, 2002), improving the dynamic capabilities of the enterprises in the local area. Tashman and Marano (2009) claimed that base of the pyramid dynamic capabilities targeting firm value chain and the business environment involve resource integrating, transforming, acquiring, and shedding capabilities cooperated with grassroots communities, the people experiencing poverty, local government and enterprises, adapting to and shaping local entity and environment. Although prior research has made many valuable contributions, several important issues remain understudied. In the context of BOP, the generation mechanism of dynamic capabilities is still vague. Thus, there arises an urgent need to examine the effect mechanism of dynamic capabilities across a firm's boundaries in the BOP context.

HYPOTHESIS DEVELOPMENT

Relational Embeddedness and Dynamic Capability

Concerning the environmental characteristics of the BOP market, relational embeddedness is an important means to reduce transaction costs, eliminate environmental uncertainty, and obtain scarce resources in the BOP market (London et al., 2010). Mutual trust established by frequent interaction promotes the effectiveness of sharing information and advances the accuracy of information obtained (Mcevily and Marcus, 2005). Enterprises can integrate and deploy internal and external resources, and perceive changes in the external environment earlier and timely. As the degree of embeddedness deepens, partners share information more actively and voluntarily (Uzzi, 1997). They tend to provide more specific and implicit information, such as information on possible problems and opportunities foreseen, market and technological developments and trends, all of which can improve the accuracy of enterprises' expectations, enhancing their environmental sensing capabilities. In the BOP market, many important strategic resources cannot be obtained through market transactions (Seelos and Mair, 2007). Only by maintaining the information sharing of network members can enterprises obtain high-quality tacit knowledge, improve operational efficiency, and access new markets (Sánchez and Ricart, 2010; Sun et al., 2021). Mutual trust can not only help enterprises gain recognition and acceptance but also fill the institution gaps through social interaction and cooperation, ensuring the effective implementation of informal agreements (Ansari et al., 2012) and reducing BOP opportunistic behaviors (Reficco and Márquez, 2012). Fainshmidt and Frazier (2017) held that mutual trust shows stronger adaptability, stress resistance, and durability in a dynamic environment, and provides enterprises with more flexible strategic choices. Non-profit organizations and BOP groups in the BOP market can reduce costs in all aspects of raw material supply, manufacturing, circulation, and sales, and the participation of government departments and community organizations can effectively resolve transaction risks in the BOP market and improve

transaction efficiency (Dahan et al., 2010). Solving problems together usually leads to joint action, making it easier to obtain local legitimacy. Then, they can acquire local scarce resources and skills, promoting the reconstruction of the corporate value chain and building business models. The efficiency of corporate environmental adaptation and shaping capabilities is improved.

On the contrary, excessive relational embeddedness brings a negative impact. Excessive trust easily leads to the reduction of cognitive effectiveness (Batjargal and Liu, 2004; Czernek-Marszaek and Czakon, 2016) and the illusion of control in the decision-making process of enterprises, thus underestimating the risk and quality of the enterprises in acquiring resources (Czernek-Marszaek, 2020b), which affects the perception of risks of enterprises and loses the ability of enterprises to flexibly respond to market changes. Excessive trust will also increase the risk of free-riding (Chowdhury et al., 2016). Excessive information sharing will cause the information to be locked and damage its dynamic capabilities. Its time consuming and resource-intensive will squeeze the possible ties with other network entities, inhibit the acquisition of non-redundant heterogeneous information and new opportunities from the external environment (Zhou et al., 2014), and reduce their adaptability to the external environment of the network (Burt, 1992). Path dependence caused by overembeddedness will restrict their thinking and flexibility in solving new problems, and limit the formation of their ability to solve problems independently. The resulting network inertia weakens the flexible response and processing capabilities of enterprises in the face of uncertain environments. Based on the above analysis, this article proposes the following research hypothesis:

Hypothesis 1. Relational embeddedness has an inverted U-shaped influence on dynamic capabilities.

Relational Embeddedness and Ambidextrous Learning

To adapt to the particularity of the BOP market, the firm must shift their focus of competition from within-firm to learn through relationships. Improving one's resources and abilities through cooperative learning has become an important motivation for cooperative relations (Alatwi et al., 2021). March (1991) proposed that there are ambidextrous learning behavior of exploratory learning and exploitative learning in organizations. Compared with previous learning, ambidextrous learning considers the impact of the external environment, involving the organization's communication and interaction with external stakeholders and the environment. Specifically, exploratory learning refers to pursuing new knowledge, which is mainly manifested in the enthusiasm of the organization to actively search for and create new technologies, new strategies, and new opportunities (Noni and Apa, 2015). Exploitative learning refers to the in-depth exploration of existing knowledge, including the refining, selection, implementation, and reuse of knowledge, and applying it to organizational management (Lichtenthaler, 2009; Yuan et al., 2021).

Relational embeddedness provides a bridge for the knowledge transfer and information exchange of network entities, thereby providing a diversified knowledge base for ambidextrous learning (Wang and Hsu, 2014). The role of relational embeddedness in exploratory learning is mainly manifested in the establishment channels for obtaining heterogeneous resources, especially local social capital and tacit knowledge at the BOP beyond its previous scope of experience and activities. Since the knowledge and skills of the BOP area focus on the accumulation of complex knowledge such as planting techniques, traditional crafts, folk secret recipes, and experience know-how. Their transfer in market relations would be too risky or impossible due to difficulty to codify (Davidsson and Honig, 2003; Phadungkiati and Connell, 2014). The application of new knowledge to production has also been accelerated. Joint problem-solving encourages learning and imitation among actors, and thus new knowledge can be faster applied to the innovation activities in a new setting.

The effect of strong ties on exploitative learning is mainly manifested in its ability to deepen relevant knowledge. Exploitative learning provides deeper knowledge and more skillful competencies and further ensures high efficiency and implementation of product development (Atuahene-Gima and Murray, 2007) as well as the optimization of organizational processes (Li et al., 2013). In the process of joint problem-solving between companies with strong relationships, the required knowledge can be well-transferred. It is conducive to the effective integration of local resources with the resources and capabilities that enterprises have accumulated to improve technologies and models so that the value creation potential of obtained local resources can be released completely.

However, excessive relational embeddedness leads to negative effects. For example, social relationships based on trust make individuals more vulnerable to opportunistic actions, increase the cost of management and maintenance of the relationship, which do harm to the acquisition and application of innovative resources or information by the enterprises (Goel et al., 2005). Excessive information sharing leads to path dependence and organizational inertia. The lock-in effect causes redundancy of resources and information between each other, forming an inert relationship in knowledge acquisition, weakening the motivation of continuous learning, and inhibiting knowledge transfer (Villena et al., 2011). Meanwhile, knowledge is the key to a firm's ability to maintain its dynamic capabilities. Excessive reliance on joint problem-solving will ossify the firm's thinking and affect the acquisition and application of new knowledge. Based on the above analysis, the paper proposes the following research hypotheses:

Hypothesis 2. Relational embeddedness has an inverted *U*-shaped influence on exploratory learning.

Hypothesis 3. Relational embeddedness has an inverted *U*-shaped influence on exploitative learning.

The Mediating Role of Ambidextrous Learning

Eriksson's (2014) research stated that organizational learning is one of the factors that promote the formation and improvement of dynamic capabilities. Exploratory learning has the characteristics of uncertain income and uncertain

learning direction. Trust and information sharing mechanisms established by relational embeddedness facilitate jointly solving new problems, developing new technologies, and enhancing exploratory learning. This process increases the number and types of organizational knowledge reserves and enhances awareness of opportunities and crises (Lichtenthaler and Muethel, 2012; Nieves and Haller, 2014). Exploratory learning enables enterprises to get rid of the strong "rigidity" of existing strategies, technologies, and business processes formed in the aspects of existing experience and practices as well as overcome corporate inertia and path dependence, thereby adjusting respond to the external environment themselves promptly. Additionally, relational embeddedness can not only establish channels to obtain scarce resources but also poses opportunities for exploratory learning to develop a native capability suitable for the BOP market (Hart and London, 2005), and change organizational routines, improving environmental adaptation capability. Exploratory learning also affects the firm's ability to adapt to an environment full of uncertainties and the speed of decision-making. Extensive search and experimental learning behavior in communication and cooperation with other enterprises and institutions identify new technologies in the environment and create new opportunities to develop unique products, services, and business models (Prahalad, 2012; Zhao et al., 2020), improving environmental shaping capability. Joint problem-solving mechanism can also strengthen learning behavior in network relationships, permitting companies to adopt innovative thinking and adjust strategies to respond to market opportunities (Mcevily and Marcus, 2005).

Trust and cooperation enhance the willingness of organization members to exchange and absorb relevant knowledge as well as expand the content and depth of knowledge resources, promoting dynamic capabilities (Liao et al., 2009). The relevant resource accumulated in the BOP market helps to enrich knowledge and experience within the organization, enhancing the enterprises' capability to perceive opportunities and threats in the BOP market (Lichtenthaler and Muethel, 2012; Li and Lee, 2015). Through exploitative learning, enterprises update their knowledge and technology, which will help to understand market knowledge, market segmentation, and current forms of competition, and improve the ability of enterprises to obtain and utilize opportunities promptly. Enterprises can also change the competitive environment, create opportunities or avoid the risks of technological changes in the industry. Based on the above analysis, we propose the following research hypotheses:

Hypothesis 4. Exploratory learning mediates the relationship between relational embeddedness and dynamic capabilities.

Hypothesis 5. Exploitative learning mediates the relationship between relational embeddedness and dynamic capabilities.

The Moderating Role of Prior Experience

As mentioned above, relational embeddedness facilitates enterprises building cooperative networks, where enterprises can actively acquire diversified information, and gain opportunities for new knowledge acquisition and application. We further discussed how the interaction between relational embeddedness and human capital affects ambidextrous learning. Knowledge can give it the potential to discover opportunities and new knowledge (Davidsson and Honig, 2003). As is well-known, knowledge can be got from formal education and experience. Prior experience refers to the knowledge, skills, and concepts accumulated in firms' business practices such as industry experience and target market experience. It can inform corporate decision-making in a volatile and changing environment, and effectively identify market opportunities (Cassar, 2014). The existing study confirms that the accumulation of prior experience is the basis for enterprise growth, and new enterprises with prior experience will have better performance expectations (Hopp and Sonderegger, 2015). We believe that prior experience is closely related to ambidextrous learning in the BOP context.

Some scholars have found that practitioners with more experience have more business awareness. This is a kind of tacit knowledge, which guides the sharing and exploration of new knowledge, accurately obtaining high-quality information. In addition, differences in prior experience largely affect the interpretation and understanding of the acquired information and knowledge (Shane and Venkataraman, 2000). According to the research of Garaud and Kumaraswam (2010), differences in prior experience will lead to different knowledge structures in enterprises, forming differences in organizational learning effects. Prior experience can also provide a basis for enterprises' decision to embed in the BOP market, and affects their understanding of the market and product development (Shane, 2000). Gregoire and Shepherd (2012) pointed out that prior experience enables deeper processing of information, identifying structural similarities between technical information and market needs, and then discovering more innovative and feasible opportunities. In short, prior experience promotes the acquisition and application of knowledge by enhancing the awareness and ability in the BOP market. Therefore, we propose the following hypotheses:

Hypothesis 6. The inverted *U*-shaped of relational embeddedness on exploratory learning increase with the increase of prior experience.

Hypothesis 7. The inverted *U*-shaped of relational embeddedness on exploitative learning increase with the increase of prior experience.

Figure 1 summarizes all the hypotheses and depicts our theoretical framework.

RESEARCH DESIGN

Data Sources and Sample

To examine the impact of relational embeddedness on ambidextrous learning and BOP-oriented dynamic capabilities, it is necessary to collect data from enterprises embedded in the BOP market. This research finally selects enterprises in those industries located in concentrated contiguous areas in the Qinba Mountains as the main survey objects. Qinba Mountains is one of the concentrated contiguous destitute areas in China, with abundant and diverse resources, covering a large number of poor groups. The government has increased investment and support

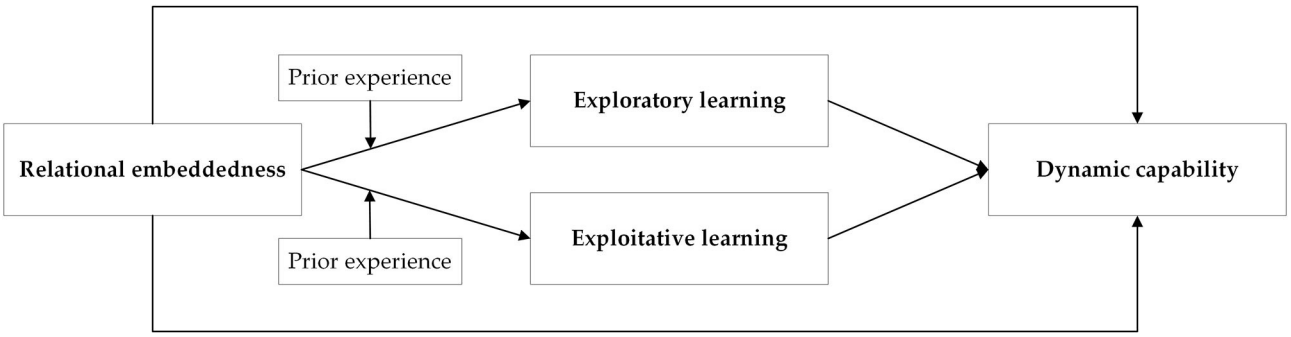

FIGURE 1 | Theoretical research framework.

for this area, and a large number of advantageous industries have emerged, as well as many enterprises developed relying on local advantageous resources. This area is typical and representative.

This research employs a questionnaire survey method to collect data, which is divided into two stages: pre-research and formal research. The survey started on March 21, 2021, and ended on July 21, 2021, lasting for 4 months. The specific process is as follows: (1) Pre-research. To better fit the purpose of this research, we selected the mature scales from abroad according to the research goals and related theories. The researcher translated them into Chinese, and combined them with the existing domestic scale for semantic adjustment, forming the most primitive survey questionnaire. The questionnaire uses a Likert five-level scale for measurement, where 1 means strongly disagree and 5 means strongly agree. The initial phase of the pre-research took place in an academic setting, where the adjustments were made based on the feedback of 1 professor and 4 associate professors. There was a rewording of some questions to improve clarity, specificity, and brevity. Subsequently, the pre-research was conducted on 6 employees of BOP-oriented enterprises in Qinba Mountains from the same background as the target respondents. Then, some further refinements of the wording were performed to ensure the interviewees accurately understood them, fitting the BOP context. (2) Formal research. We distributed the survey and collected responses using a popular online platform (https://www.credamo.com/) with a total of over 2.8 million registered samples, comprehensive coverage of all provincial administrative regions in China, and support for hundreds of user tags. Based on offline interviews with local enterprises and the investigation through online channels such as government websites, we selected industries that absorb a large number of BOP groups, such as manufacturing, wholesale and retail, agriculture, biology and medicine, and transportation and logistics, etc. Before distributing the questionnaires, the sample characteristic values were set in the online system, such as industry, enterprise type, etc. Then, we used the electronic fence function of the website to set the area where the questionnaires will be delivered. We distributed 600 questionnaires online targeting enterprises located in concentrated contiguous areas in the Qinba Mountains Shaanxi province. To encourage responses, the survey offered some monetary rewards to respondents who completed it. The survey ran for more than 1 month and 315 respondents filled the questionnaire, with a return rate of 52.5%. We deleted those responses that were incomplete, finished too fast (e.g., in <3 min), or with wrong answers to test questions (with the given answer), or these incomplete or obvious problems (including opposite intentions, consistent answers, and obvious regularity). Furthermore, by calculating Cook's distance, we drew a scatterplot, identified the outliers and deleted them. A total of 51 were excluded. This process leaves us 264 useable responses, and the response rate of valid questionnaires is 44%.

Among the samples, females accounted for 58.33% and males accounted for 41.67%. Employees under the age of 20 accounted for 10.23%, 21–30 years old accounted for 32.58%, 31–40 years old accounted for 30.3%, and 40 years old above accounted for 26.89%. 34.85% of employees with a junior college degree and below, 54.55% of undergraduates, and 10.61% of masters and above. These respondents included grassroots staff (61.7%), managers (38.3%) in firms. These data suggest that the respondents were experienced and knowledgeable about the issues under study, which increased our confidence in the quality of the data. The sample covered a range of industries, including manufacturing (21.59%), wholesale and retail (18.18%), agriculture (37.88%), biology and medicine (16.29%), and transportation and logistics (6.06%).

Measures

Independent Variables

The items of relational embeddedness are mainly designed from three aspects: mutual trust, information sharing, and joint problem-solving. This study is mainly based on the scale used by Mcevily and Marcus (2005) and Capaldo (2014) to measure the cooperative relationship mechanism. To this end, four items are used to measure mutual trust, four items are used to measure information sharing, and three items are measured to joint problem-solving.

Dependent Variables

According to the viewpoint of Teece (2007), dynamic capability is divided into three dimensions: sensing capability, adaptation capability, and shaping capability. Drawing lessons from research by Gibson and Birkinshaw (2004) and Wilden et al. (2013), four

items are used to measure sensing capability, three items are used to measure adaptation capability, and three items are used to measure shaping capability.

Mediator

Ambidextrous learning is based on the research of Chung et al. (2015), adopting five items to measure exploratory learning and exploitative learning respectively.

Moderator

Based on previous research, prior experience measures whether a company has the knowledge, skills, and experience needed for a new market. Respondents provided whether their firms had experience in the industry or target market in which their new business competes. 1 means experience, 2 means no experience.

Control Variables

Firms of varying ages and sizes and in multiple industries present distinct ambidextrous learning (Jansen et al., 2009). Since firm age expresses a firm's development stage and is associated with its exploration and exploitation. As larger organizations may have more resources yet may lack the flexibility to achieve ambidextrous learning. Furthermore, industry effects may influence the extent to which organizations pursue exploratory and exploitative learning. Following Jansen et al. (2009), we select firm age, size, and industry as control variables in this study. Among them, the firm age is measured by the natural logarithm of the company's establishment years. The firm size is measured by the natural logarithm of the number of employees to avoid excessive values. The industry to which the company belongs the agriculture, forestry, animal husbandry, and fishery industries are set to 1, and the other industries are set to 2.

RESULTS

Reliability and Validity Test

SPSS25.0 software was used to analyze the reliability of relational embeddedness, exploratory learning, and dynamic capability scales. Among them, the Cronbach's α coefficients of relational embeddedness, exploratory learning, exploitative learning, and dynamic capabilities are 0.941, 0.877, 0.927, and 0.952, respectively, which are all >0.800, indicating good reliability. It shows that the scales of relational embeddedness, ambidextrous learning, and dynamic capabilities have good reliability, consistency, and stability. At the same time, the CITC values of the overall correlation coefficients of the scale items were all greater than the acceptable standard of 0.40, and the value of α did not increase when any item was deleted. Therefore, the overall reliability of the scale is relatively high.

The validity test was carried out from two aspects of construct validity and convergence validity. First of all, all scale items in this study were sourced from mature research scales at home and abroad and discussed with experts in related fields before the formal survey. After small pre-research, some inappropriate items were modified. Therefore, the scale of this study has high content validity. Moreover, after exploratory factor analysis, it is found that the KMO value is 0.959, and the Chi-square value of Bartlett's test is 6635.818. We employed AMOS 24.0 software to perform confirmatory factor analysis on the variables selected in this study to test the aggregate validity of relational embeddedness, exploratory learning, exploitative learning, and dynamic capabilities. The confirmatory factor analysis results showed that $\chi^2/df = 1.764$, <3, RMSEA = 0.054, <0.08, CFI = 0.953, >0.9, AVE value >0.5, combined reliability CR >0.7, indicating variables' reliability of the scales is ideal.

Secondly, as shown in **Table 1**, the factor loadings of all items were larger than 0.7; thus, the convergent validity of each item was good. **Table 2** shows that the square roots of the AVE for each variable were greater than the Pearson correlation coefficients, so the questionnaire in this study has a good degree of discriminate validity, indicating that the validity of the measurement was good. No measurement error correction for independent or dependent variables and range restriction correction were performed in the paper.

Descriptive Statistics and Correlation Analysis

It can be seen from **Table 1** that the average values and standard deviations of the variables are within the normal range. The independent variable (relational embeddedness), the dependent variable (dynamic capability), and the mediating variables (exploratory learning, exploitative learning) all show a strong correlation. They have a significant positive correlation with the dependent variable. The main effect of this study has been initially verified, but further analysis is needed with multiple regression.

Regression Analysis and Hypothesis Testing

Based on the preliminary verification of research hypotheses by correlation analysis, this paper uses hierarchical regression analysis to explore the impact of relational embeddedness and ambidextrous learning on dynamic capabilities. The first layer puts the firm age, firm size, and industry to which it belongs as control variables. The second layer inputs independent variables and their square terms based on the research hypothesis model. The third layer inputs mediating variables (exploratory learning, exploitative learning). The fourth layer inputs the moderating variables (prior experience), and the interaction terms with independent variables and their square terms. Before calculating the square or interaction terms, the relevant variables are mean-centered to reduce the impact of multi-collinearity. After centralized processing, the VIF value is between 1 and 3, indicating that the collinearity problem will not affect the analysis results.

The Main Effect of Relational Embeddedness on Dynamic Capabilities

Regression analysis was performed by SPSS 25.0 software, and the test results are shown in **Table 3**. Model 1 examined the influence of control variables on the dynamic capabilities of the firms. Based on Model 1, the relational embeddedness variable and its square term were added to build Model 2, and the

TABLE 1 | The test results for variable reliability.

Constructs/measurement items	Standardized factor loadings	CR	AVE	Cronbach's α
Relational embeddedness (RE)		0.943	0.620	0.941
1 Partners can seek truth from facts when negotiating	0.708			
2 Partners can keep their promises in cooperation	0.734			
3 Partners do not mislead the company.	0.63			
4 Partners will not use the companies' weaknesses to obtain improper benefits	0.667			
5 Partners exchange information with the companies frequently, not limited to established agreements	0.799			
6 Partners and the companies remind each other of possible problems and changes	0.79			
7 Partners and companies provide each other with the required information as much as possible	0.855			
8 Partners share future development plans with the companies	0.775			
9 Partners and companies can be jointly responsible for completing tasks	0.849			
10 Partners and companies can help each other to solve the problems encountered in cooperation	0.851			
11 Partners and companies work together to overcome difficulties	0.851			
Exploratory learning (ER)		0.876	0.585	0.876
1 Attaches importance to acquiring product/service strategic knowledge that involves trials and high market risks in the BOP market	0.757			
2 Extensively searches for information in the BOP market to ensure trials in the development of new products/services	0.739			
3 For the purpose of acquiring new knowledge and developing products/services in the BOP market (e.g., new markets and technical experience)	0.771			
4 Collects new information beyond the existing technical experience in the BOP market	0.745			
5 Collects new information on the BOP market and learn new knowledge in the development of new products/services	0.811			
Exploitative learning (EI)		0.927	0.718	0.927
1 Searches for information and improve methods and ideas for solving problems in the development of new products/services	0.848			
2 Search the BOP market for ideas and information that can guarantee production capacity	0.846			
3 Finds common and widely accepted methods and paths in the BOP market to solve problems in product development/service development	0.895			
4 Uses methods of collecting information (for example, survey current customers and competitors) to understand and update the company's current product/service market experience	0.820			
5 Emphasizes the use of knowledge related to existing product/service experience	0.824			
Dynamic capability (DC)		0.951	0.662	0.951
1 Focuses on best practices within the company	0.844			
2 Collects economic information related to operations and operating environment	0.815			
3 Uses existing processes to identify BOP market segmentation and changes in consumer demand	0.820			
4 Encourages employees to participate in the activities of industry associations	0.822			
5 Encourages employees to challenge outdated traditions and practices	0.791			
6 Quickly responds to changes in the BOP market	0.823			
7 Updates the management process according to the priority of BOP market business development	0.818			
8 Frequently adopts new management methods	0.811			
9 Frequently adopts new or substantively changed marketing methods or strategies	0.825			
10 Frequently adopts new or substantive changes in business processes	0.766			

result shows that they have a significant impact on the dynamic capabilities ($\beta_1 = -0.365^{***}$, $P < 0.001$; $\beta_2 = 0.615^{***}$, $P < 0.001$), H1 was supported. Considering the control variables, the explanation rate of the relational embeddedness to the variance of dynamic capabilities reached 45.1%, indicating that the data fit the model well. Relational embeddedness and dynamic capabilities are in an inverted *U*-shaped relationship.

TABLE 2 | Descriptive statistics for the main variables.

	Age	Size	Industry	RE	ER	EI	DC	Experience
Firm age								
Firm size	0.504**							
Industry	−0.192**	−0.099						
RE	0.219**	0.052	−0.209**	0.787				
ER	0.191**	0.094	−0.028	0.711**	0.765			
EI	0.205**	0.048	−0.092	0.718**	0.646**	0.847		
DC	0.050	0.051	−0.011	0.552**	0.496**	0.487**	0.814	
Experience	0.223**	0.013	−0.149*	0.522**	0.363**	0.475**	0.273**	

*The diagonal values (in bold) are the square roots of AVE, others are Pearson correlations. *p < 0.05, **p < 0.01; two-tailed test.*

The Mediating Effect of Ambidextrous Learning

Hierarchical regression was used to analyze the mediating effect of ambidextrous learning between relational embeddedness and dynamic capabilities. The regression results are shown in **Table 4**. It can be seen from Model 5 that relational embeddedness has a significant positive impact on exploratory learning, and its square term negatively affects exploratory learning significantly ($\beta_1 = -0.095^*$, $P < 0.05$; $\beta^2 = 0.725^{***}$, $P < 0.001$), indicating that there is an inverted *U*-shaped relationship. H2 was supported. Model 3 shows that exploratory learning positively affects dynamic capabilities. Model 6 incorporates exploratory learning into the regression equation, and the results show that exploratory learning significantly promotes enterprises' dynamic capabilities ($\beta_3 = 0.131^*$, $P < 0.05$). The influence of the primary term of the relational embeddedness on the dynamic capabilities is significant, and the influence of its square term on the dynamic capabilities is weakened ($\beta_1 = -0.352^{***}$, $P < 0.001$), indicating that exploratory learning mediates the relationship between relational embeddedness and dynamic capabilities. H4 was supported. Following models 7 and 8 successively verify the mediating effect of exploitative learning in relational embeddedness that affects the dynamic capabilities. Specifically, model 7 shows that relational embeddedness has a significant positive impact on exploitative learning, and the square term regression coefficient is significantly negative ($\beta_1 = -0.104^*$, $P < 0.05$; $\beta_2 = 0.725^{***}$, $P < 0.001$), indicating that there is an inverted *U*-shaped relationship. Therefore, H3 was supported. Model 4 shows that exploitative learning positively affects dynamic capabilities. Model 8 indicates that after controlling for exploitative learning variables, the regression coefficient of the square term is significantly negative. Compared with the effect on dynamic capabilities alone, the absolute value of the coefficient was reduced, and the regression coefficient of exploitative learning is significantly positive, indicating that exploratory learning plays a significant mediating role in the inverted *U*-shaped relationship. Therefore, H5 was supported.

TABLE 3 | Regression results of direct effect.

Variables	Dynamic capabilities			
	Model 1	Model 2	Model 3	Model 4
Firm age	−0.038	−0.054	−0.063	−0.084
Firm size	0.021	0.080	0.042	0.072
Industry	−0.002	0.059	−0.014	0.027
RE		0.615***		
RE square		−0.365***		
ER			0.503***	
EI				0.503***
R^2	0.003	0.451	0.248	0.244
Adj R^2	−0.008	0.441	0.237	0.233
F	0.297	42.423	21.388	20.922

***p<0.001.

The Moderating Effect of Prior Experience

Introducing the interaction terms of the independent variable and its square term and moderating variables, the study tested the moderating effects of prior experience (models 9 and 10). The results are shown in **Table 4**.

Models 9 and 10 show the moderating effect of prior experience. The results show that the coefficient of the relational embeddedness and its square term and the interaction terms of the prior experience are significant ($\beta = 0.298^*$, $P < 0.05$) between relational embeddedness and exploitative learning, that is, the moderating effect of prior experience does exist, and H7 was supported. As for exploratory learning, the interaction coefficients between relational embeddedness and its square term and prior experience are not significant. It can be seen that there is no moderating effect between relational embeddedness and exploratory learning. H6 was not supported.

To intuitively reflect the moderating effect of prior experience between relational embeddedness and ambidextrous learning, we draw a schematic diagram of moderating effect according to the method recommended by Cohen (2003). When drawing the graph, the mean plus or minus one standard deviation is used to indicate the level of relational embeddedness and prior experience, as shown in **Figure 2**.

TABLE 4 | Results of mediation regression analysis and moderated regression analysis.

Variables	ER	DC	EI	DC	ER	EI
	Model 5	Model 6	Model 7	Model 8	Model 9	Model 10
Firm age	0.041	−0.059	0.083	−0.063	0.037	0.071
Firm size	0.041	0.075	−0.018	0.082	0.038	−0.022
Industry	0.139**	0.040	0.057	0.052	0.124**	0.027**
RE	0.725***	0.521***	0.725***	0.534***	0.919***	0.204***
RE square	−0.095*	−0.352***	−0.104*	−0.353***	−0.231	−0.375**
ER		0.131*				
EI				0.112†		
EXP					−0.008	−0.011
RE*EXP					−0.207	−0.510***
RE square *EXP					0.148	0.298*
R^2	0.516	0.459	0.533	0.457	0.522	0.566
Adj R^2	0.506	0.447	0.524	0.444	0.507	0.552
F	54.984	34.409	58.974	36.063	34.800	41.514

†*p* < 0.1; *p < 0.05; **p < 0.01; ***p < 0.001.

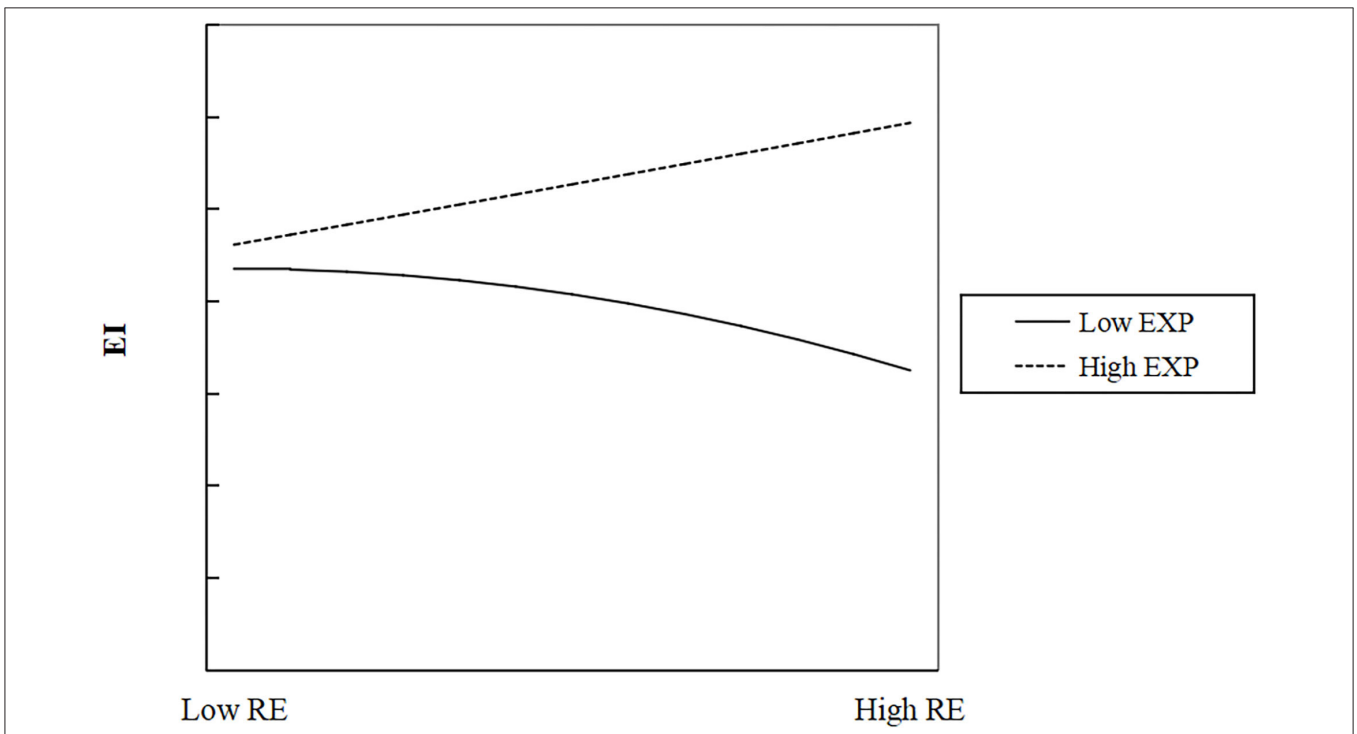

FIGURE 2 | The moderating effect of prior experience between relational embeddedness and exploitative learning.

Figure 2 shows that the non-linear relationship between relational embeddedness and exploitative learning moves with changes in prior experience. Prior experience strengthens the positive influence of relational embeddedness on exploitative learning and moves to the upper right while no-prior experience strengthens the negative influence of relational embeddedness on exploitative learning and moves to the lower left. It shows that prior experience plays a positive moderating role, so H7 was supported.

DISCUSSION

In this paper, using survey data from 264 valid samples, we examined how relational embeddedness affects dynamic capabilities *via* ambidextrous learning. The study found that relational embeddedness has a curvilinear effect on dynamic capabilities, as well as ambidextrous learning. On this basis, we found that the relationship between relational embeddedness and dynamic capabilities is positively mediated

by ambidextrous learning. Furthermore, the study also found that prior experience positively moderates the relationship between relational embeddedness and exploitative learning.

Theoretical Implications

The current study has made several theoretical implications. First, this study provides a new understanding to reveal the effect of relational embeddedness and extends its application to dynamic capabilities in the BOP context. Whereas a plethora of studies has claimed conceptually that relational embeddedness practices influence firms' dynamic capabilities (e.g., Frasquet et al., 2018; Alinaghian et al., 2020), our study contributes to the dynamic capabilities literature by empirically supporting the notion that relational embeddedness is an enabler of dynamic capabilities. However, we found that the impact of relational embeddedness on dynamic capabilities is not just a simple linear relationship. After a certain boundary point, relational embeddedness has a decreasing effect on dynamic capabilities. That is, higher relational embeddedness is not necessarily better (Burt, 1992; Uzzi, 1997; Obukhova and Zhang, 2017). This is inconsistent with Rodrigo-Alarcón et al. (2018), Ai and Peng (2021), Zheng (2021), and Zhou et al. (2021), who found that relational capital may positively predict dynamic capabilities. As mentioned earlier, most of the previous literature shows the positive effects of relational embeddedness. The negative effects (so-called actors' social overembeddedness) are rarely the subject of in-depth considerations (Mitrega and Zolkiewski, 2012; Obukhova and Zhang, 2017). However, Czernek-Marszaek (2020b) confirmed that social embeddedness has not only positive but also negative effects on economic activity, such as high maintenance cost, redundant information, opportunistic behaviors, and lower adaptation abilities caused by adjusting to known partners. These negative effects will inhibit the dynamic capabilities of enterprises. Our findings empirically reveal that growing partnerships are a double-edged sword. That is, moderate partnerships of enterprises can bring advantages while too close partnerships lead to disadvantages. This confirms the view that an enterprise that is too deeply socially embedded is less adaptable (Nahapiet and Ghoshal, 1998; Mizruchi and Stearns, 2006). The study discloses an in-depth understanding of the process of the "embeddedness paradox" and facilitates understanding the antecedents of dynamic capabilities in the BOP context.

Second, the current study advances the literature of dynamic capabilities by showing that as a mediation device, ambidextrous learning may transform useable resources (source from relational embeddedness) into capability or advantages. In establishing this, it draws on the "resource-capability-high-order capability" framework (Winter, 2003; Cepeda and Vera, 2007; Wang and Ahmed, 2007), and builds on the basis of significant direct effects of relational embeddedness on ambidextrous learning as well as ambidextrous learning on dynamic capabilities. The research has found that moderate relational embeddedness enables enterprises to obtain key resources from bridged individuals or organizations, effectively absorb and transform the acquired more information and technologies, and enhance the dynamic capabilities of enterprises. The study indicates that exploratory learning and exploitative learning may enable firms to benefit from relational embeddedness. As stated by Wang et al. (2020), relational embeddedness improves the quality and quantity of knowledge acquisition and exchange, thereby helping enterprises explore and exploit knowledge from their environments. Some scholars claimed that ambidextrous learning is a necessary condition for the realization of dynamic capabilities (O'Reilly and Tushman, 2008; Yuan et al., 2021). Ambidextrous learning connects relational embeddedness with dynamic capabilities, through which available and new resources or knowledge can be used to improve functions of sensing, adaptation, and shaping the environment. Nevertheless, we found that excessive relational embeddedness will cause negative effects such as information redundancy, cognitive bias, and opportunistic behaviors, which restrains exploratory learning and exploitative learning, thereby inhibiting the dynamic capabilities. Therefore, enterprises need to continuously improve embeddedness strategies to provide sufficient relevant information and resources for ambidextrous learning, thereby improving dynamic capabilities. In a word, this is a supplement to the previous view and consolidated support for the dynamic capabilities of social capital through the perspective of organizational learning (Aranda et al., 2017).

Third, from the perspective of human capital, we explore the boundary problem of the role of relational embeddedness on the inverted *U*-shaped effect of exploratory learning and exploitative learning. It provides a new perspective for exploring the relationship between social capital, human capital, and ambidextrous learning. That is to say, relational embeddedness provides enterprises with more ways to acquire information and resources, but they are complementary to human capital. The resources needed for exploratory learning and exploitative learning come from social capital as well as human capital such as prior experience. Although some studies believe that prior experience will also bring disadvantages, such as cognitive inertia (overconfidence, minority principle), risk aversion, and lock-in effects (Simon et al., 2000), our research finds that prior experience positively moderates the relationship between relational embeddedness and exploitative learning in the BOP market, this is consistent with Hatch and Dyer (2004) and Politis (2005). They hold that the accumulation of prior experience is more likely to lead organizations to carry out exploitative learning behavior. The reason is that, due to the particularity of the BOP market, the prior experience can better identify the value of local resources, acquire tacit knowledge of the existing market, and promote experiential learning and transformation of existing knowledge. However, its moderating effect on exploratory learning was not significant. It may be because exploratory learning specifically refers to searching for experience and knowledge unrelated to the current experience to actively conduct experimental attempts. For example, in the BOP market, firms establish relationships with universities and research institutes to carry out project cooperation (breeding pig research and development, Drug Discovery, etc.), and these experiments are less affected by prior experience. This research inspires those enterprises should focus on summarizing successes and failures or bring in experienced teams to deal with the negative effects of overembeddedness, which will improve future exploitative

learning outcomes. At the same time, it also enlightens us that exploratory learning and exploitative learning are related to social capital and human capital. The enterprises with different human capital may differ in the performance of relational embeddedness on ambidextrous learning. The study promotes understanding of the contextual factors that affect the inverted *U*-shaped relationship between relational embeddedness and ambidextrous learning and its contingency mechanism.

Practical Implications

The research conclusions of this paper have important management enlightenment for BOP market-oriented enterprises.

(1) The research has practical enlightenment for improving the dynamic capabilities of enterprises. Actively maintaining appropriate contact with partners and cultivating external relationship networks increase opportunities for enterprises to obtain and use external resources that can enhance their dynamic capabilities. Studies have shown that excessive embeddedness can damage the dynamic capabilities of enterprises. Managers can't just rely on relational embeddedness as an informal network governance mechanism. In business practice, they should actively explore the combination of formal network governance mechanisms and informal network governance mechanisms to establish moderate relational embeddedness.
(2) Take note of the construction and cultivation of exploratory learning and exploitative learning. Ambidextrous learning is conducive to the improvement of organizational dynamic capabilities. The influence of relational embeddedness on dynamic capabilities is also partly realized through exploratory learning and exploitative learning, which emphasizes the importance of ambidextrous learning to improve dynamic capabilities. For enterprises in real situations, learning behavior is very important. In practice, enterprises should continue to expand the existing resource base and improve the diversity of capabilities through experiments, innovations, and other behaviors, to continue to gain competitive advantages in the ever-changing environment.
(3) Entering a new market is a process of learning by experiment. Establishing a higher level of local relational embeddedness do benefit from different resources and information. More important is how to use these resources and information. Enterprises should appropriately emphasize the effects of prior experience. Let them participate in the activities of enterprises embedding in the BOP market so that enterprises have the consciousness, ability, and opportunity to make full use of social capital, adjust or strengthen their networks to adapt to the environment, and improve future beneficial results.

Limitations and Future Research

The research has the following limitations. First, in the process of data collection, although the universality and completeness of the data have been ensured as much as possible, the sample inevitably has limitations. In the future, the sample size and diversity should be expanded to further enhance the universality of the theory. Second, neither overembeddedness nor so-called underembeddedness is beneficial for a company. The question of what the optimal combination of strong and weak ties is, however, is still open. Third, the enterprises' practice generally includes exploratory learning and exploitative learning. In future research, more attention should be paid to practical significance, and the relative balance and interactive effects of exploratory learning and exploitative learning should be studied, rather than taking exploratory learning and exploitative learning as independent elements that have no mutual influence and relevance. Finally, the relationship between relational embeddedness and dynamic capabilities is very complex, and the perspectives and research entry points are also diverse. In the future, we can research more perspectives to finally improve our understanding of relational embeddedness, dynamic capabilities, and their relationship.

CONCLUSION

Based on the literature review and hypotheses development, the study explores the influence of relational embeddedness on the dynamic capabilities *via* ambidextrous learning in the BOP context, as well as the moderating effect of prior experience. The results indicated that the impact of relational embeddedness on dynamic capabilities is a curvilinear relationship. Moderate relational embeddedness is an enabler of dynamic capabilities, but after a certain boundary point, overembeddedness has a decreasing effect on dynamic capabilities. Meanwhile, the positive or negative effects of relational embeddedness on dynamic capabilities are partially mediated by exploratory learning and exploitative learning. Finally, this study examined the contextual effect of prior experience on ambidextrous learning. Prior experience amplified the positive effect of relational embeddedness on exploitative learning and mitigated its negative effect. However, its moderating effect on exploratory learning was not significant. In conclusion, this research enriches our understanding of the dynamic capabilities' antecedents and the black box of the "embeddedness paradox" in the BOP context. We hope that our theoretical model and empirical evidence will inspire more attention to the potential mechanism between relational embeddedness and dynamic capabilities.

DATA AVAILABILITY STATEMENT

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

ETHICS STATEMENT

Ethical review and approval were not required for the study on human participants in accordance with the local legislation and institutional requirements. Written informed consent for participation was not required for this study in accordance with the national legislation and the institutional requirements.

AUTHOR CONTRIBUTIONS

YZ designed and executed the study, analyzed the data, and prepared the first draft. JL planned and designed the study. WZ designed the study and reviewed and revised the draft. All authors read and approved the submitted version.

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The Influence of System Dynamics Resource Sharing on Collaborative Manufacturing Efficiency—Based on the Multiagent System and System Dynamics Method

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To improve the problems of inconvenient communication in the manufacturing industry, the ineffective use of resources, and the inability to efficiently complete manufacturing tasks, resource sharing has become an important model to promote the transformation and upgrading of the manufacturing industry. We used multiagent modeling to construct a resource-sharing model and take Baosteel as the micro background and the manufacturing industry as the macro background. Under this model, we discovered the effect of resource sharing on the efficiency of intelligent manufacturing under network collaboration through system dynamics research. We built and simulated a dynamic model of system dynamics that couples the two backgrounds and have given policy suggestions according to the simulation result.

Keywords: Internet, collaborative manufacturing, resource sharing, system dynamics, multiagent

INTRODUCTION

Manufacturing Operation Mode

As the Internet has rapidly developed,all types of traditional enterprises have combined,which brings infinite convenience to people's lives. However, because of the characteristics of the manufacturing industry, the combination of the Internet and the manufacturing industry remains limited. The traditional manufacturing operation mode is to use enterprise resources and a few partners to outsource production activities. These basic activities cannot transcend geography and new enterprise thresholds. Accordingly, research on manufacturing resource management platforms came into being. Beginners used the Internet technology to build, but its disadvantages gradually appeared. Guo et al. (2000) introduced agents into manufacturing systems and used multiagent systems to construct a manufacturing resource collaborative management platform. Enterprises in different regions cannot cooperate well and find it difficult to accurately understand unfamiliar enterprises. Therefore, an important research issue has become how to transcend the boundaries of the manufacturing industry to share technologies, equipment, and services.

Transcending these boundaries will allow "shared manufacturing" to optimally allocate and efficiently utilize manufacturing resources.

Research Progress of System Dynamics

This article uses system dynamics to study the influencing factors of innovation in resource sharing. System dynamics was founded in 1956 by Professor Forrester of the Massachusetts Institute of Technology. Forrester (1958) proposed a system simulation method to analyze enterprise problems, such as production and inventory management. Since then, it has become a horizontal discipline that integrates the natural and social sciences and has been widely used in many fields. Naill (1992) and Naill et al. (1992) used system dynamics to analyze national energy policy planning and the cost of reducing energy policy. Domestic system dynamics research has been ongoing since the start of the 21st century. Wang (1984) led the development of system dynamics. He used books to introduce it to Chinese academic circles. In subsequent decades, Chinese scholarly achievements blossomed; these scholars applied system dynamics at both the macro and micro levels and to various industries. Regarding management, Ning and Liu (2004) studied industrial cluster evolution using system dynamics. Hu et al. (2006) used system dynamics to examine the problems of the enterprise life cycle. Cai et al. (2008) researched early warnings of enterprise financial crises based on system dynamics. Sun et al. (2008) employed system dynamics to explore the performance management of dynamically balanced scorecards in manufacturing enterprises. Lai et al. (2009) utilized system dynamics to solve logistical outsourcing problems and found that it was also very effective in measuring the innovation effect. Dong et al. (2009) studied the original innovation ability of enterprises based on system dynamics. Xu and Zhao (2011) examined the uncertainty of enterprise original innovation. Hu et al. (2011) investigated the influencing factors of industry–university–research cooperation under open innovation. Xu et al. (2012) explored the influencing factors of government research and development (R&D) subsidies and enterprise R&D behavior based on system dynamics. Lin and Guo (2017) carried out system dynamics-based simulation research on enterprise network public opinion propagation based on the characteristics of the communication subject. Zhao and Guo (2016) used system dynamics to control the logistics costs of enterprises. Because of its extraordinary adaptability, system dynamics have solved some innovation problems well. For example, Li and Qi (2017) considered the system dynamics of enterprise open innovation community management from the perspective of the innovation value chain. Gong and Li (2020) discussed the role of emotional communication and information exchange in the evolution of creative performance. Chen and Wang (2020) analyzed the impact of three systems on the innovation performance of high-tech enterprises from the perspective of knowledge spillover.

The existing research has not given enough attention to the manufacturing value network, innovation input factors, and macro-level government behavior factors at the macro- and micro-comprehensive levels. Based on the current research methods of scholars on innovation issues, this article expands the existing research on manufacturing synergy efficiency from two dimensions. First, we used systematic thinking to further study the innovation of manufacturing resource sharing at the macro and micro levels. Second, combining the internal coupling and external synergy effects of the manufacturing industry, we quantitatively analyzed the synergistic efficiency of manufacturing resource sharing.

To extend the above two dimensions, the first part of this article expounds on the research progress of the manufacturing production mode and system dynamics. The second part introduces multiagent and system dynamics methods and describes the construction process of the cloud service platform and system dynamics model. The third part outputs the manufacturing flow diagram under the micro and macro scenarios and quantitatively studies the influencing factors of collaborative manufacturing efficiency. The fourth part discusses the research methods, challenges, and limitations and proposes suggestions for improving the efficiency of collaborative manufacturing in the manufacturing industry. The fifth part contains a summary of the full-text research.

MATERIALS AND METHODS

Methods

Multiagent Systems

An agent is a software or hardware entity capable of independent activities. It has some characteristics—such as autonomy, sociality, reactivity, initiative, mobility, honesty, rationality, and adaptability—and is widely used in various fields. Multiagent systems use multiple agents to complete a certain work, and each agent communicates with other agents and coordinates and shares all of the system tasks.

Complete internal enterprise processes, such as information registration and resource integration, are combined, as are complete macro manufacturing enterprise processes, such as communication and purchase transactions. Likewise, the multiagent system advantages are used. In these ways, the resources distributed in different regions, organizations, or systems can be organized to complete a specific task through networked manufacturing resource collaboration. The collaborative problem of the manufacturing business lies in spatiotemporal coordination. Different agents can solve this problem well.

System Dynamics

System dynamics is a discipline that analyzes and studies the information feedback system. It is also an interdisciplinary subject for understanding and solving system problems. Its purpose is to determine the influencing factors of the problem by analyzing the causal feedback relationship between the system elements to provide the basis for resolving the issue.

Using system dynamics to study problems is a process of decomposition and synthesis, repeated cycles, and the gradual realization of the research purpose. At the same time, system dynamics is based on a study of the whole and the relationship among the parts of the whole. As such, it replaces the traditional element view with the overall view and is

suitable for multiple complex interactions that occur in the collaborative process between manufacturing enterprises. System dynamics are introduced into the research on collaborative manufacturing efficiency.

Platform Construction

Research Framework

Scenario setting is performed through a cloud service platform to clearly understand the resource-sharing behaviors among manufacturing enterprises. After clarifying the resource-sharing process, we combined the principles of system dynamics to study the effect of resource sharing on the efficiency of collaborative manufacturing. Taking Baosteel enterprises as the research object and the collaborative transaction process of resource sharing as the basis, this study draws a coupling relationship between resource sharing and network collaborative manufacturing, analyzes the factors in the subsystem, and calculates the influencing effect between each factor. Then, we explored the internal coupling and external equilibrium effects of manufacturing resource sharing. The research framework is presented in **Figure 1**.

Enterprise Resource Sharing Based on the Multiagent System

The cloud service platform established by the multiagent system is shown in **Figure 2**.

The resource-sharing and cooperation relationship of manufacturing enterprises can be divided into internal and macro-manufacturing activities. In resource-sharing activities, each agent is assigned behavioral rules according to its essential attributes, and the agents act according to their own rules. Over time, the manufacturing system forms different scenarios.

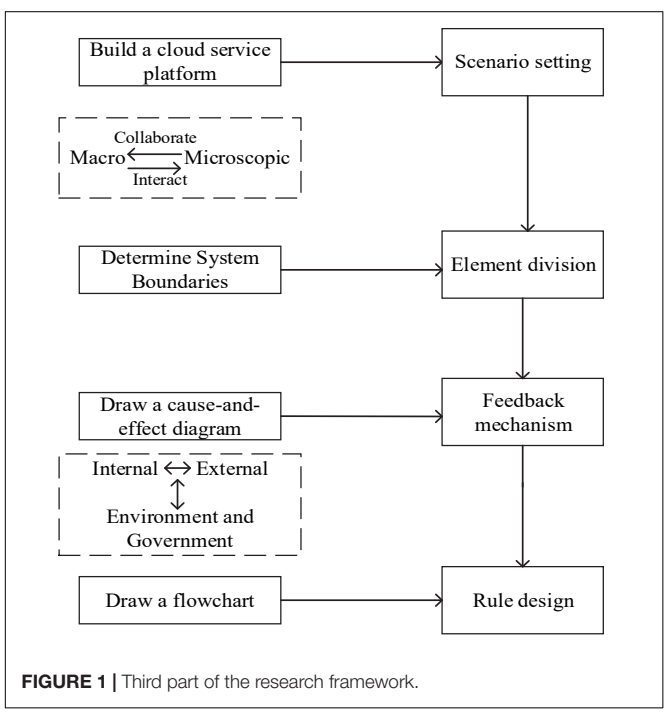

FIGURE 1 | Third part of the research framework.

(I) First, the micro-enterprise individual is the main body of resource sharing. The individual joins the multiagent system and develops resource-sharing behaviors with tens of thousands of enterprises. In this system, individuals carry out information registration, resource sharing, supply, and demand, and so on. These behaviors mainly need to be carried out by agents, such as information registration, resource integration, retrieval, release task, resource release, and bidding task agents. Among them, the information registration agent is the basis, and the resource integration and retrieval agents play intermediary roles by providing the information aggregated within the enterprise to the publishing resource and bidding task agents and cooperating with other manufacturing systems through communications between the publishing resource and the bidding task agents.

(1) Information registration agent: Enterprises that use this agent need to first register, and the information collection agent collects the enterprise's information (enterprise name, address, resources, and business items).

(2) Resource integration agent: Enterprise-owned resources are entered into the resource database app. This agent is in charge of the classification and integration of resources in the resource library. The integration agent understands the nature and types of resources.

(3) Retrieval agent: The retrieval agent has two tasks. Enterprises can search for the required resources according to their own different needs, and enterprises can search or browse the tasks.

(4) Release task agent: Task enterprises can release some out-of-task packages.

(5) Release resource agent: Enterprises release their resources for other enterprises to seek cooperation.

(6) Bidding task agent: Enterprises look for tasks. When they find suitable and competent tasks, they express their desire to bid and do so along with their competitors. Then, they wait for the task enterprise to reply.

(II) The entire platform provides a public resource-sharing channel for the manufacturing industry. A single enterprise becomes a user in the platform, and each enterprise meets other enterprises' resource or labor needs, which greatly increases resource-sharing efficiency within the manufacturing industry. From the perspective of the macro-manufacturing industry, transaction behavior occurs between individual users (enterprises), and the platform is managed through agents, such as communication, purchase transaction, and customer service maintenance agents. Among them, the communication agent purchases from the transaction agent, and the client service maintenance agent promotes the relationship between the two.

(1) Communication agent: When an enterprise selects a resource or task enterprise, the communication agent provides both enterprises with communication channels and opportunities for in-depth understanding.

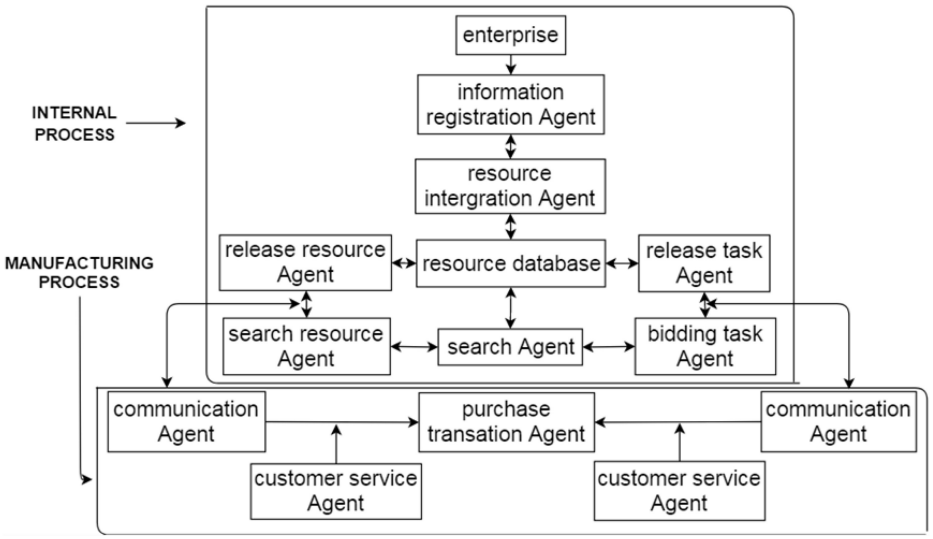

FIGURE 2 | Cloud service platform.

(2) Purchase transaction agent: The cooperation between the two enterprises is enacted through the purchase transaction agent.
(3) Customer service maintenance agent: In the process of independent communication and transactions, some questions and even friction may arise. Customer service maintenance can help to solve the problems that arise on both sides.

Through the cloud service platform, we can clearly understand the resource-sharing behaviors among manufacturing enterprises. After clarifying the process, we used system dynamics to study the impact of resource sharing and other factors on the efficiency of collaborative manufacturing.

System Dynamics Model

Method of Analysis

The analysis process is illustrated in **Figure 3**.

After we chose the research methods of multiagent system and system dynamics, we further selected a suitable manufacturing enterprise to support the micro-level research. Baosteel Group has spent considerable resources promoting the construction of smart manufacturing. It has also established a resource-sharing management and control model that combines a professional focus and regional coordination. This model has become a new growth pole for the mutual support and coordinated development of manufacturing industries. To this end, we first studied the specific resource-sharing process, combined with the principle of system dynamics, by taking Baosteel enterprises as the research object based on the collaborative transaction process of resource sharing. Then, we drew a coupling relationship between resource sharing and network collaborative manufacturing. Then, we analyzed in detail the factors in the subsystem, calculated the influence effect among the factors, and explored the internal coupling effect of the manufacturing resource-sharing external equilibrium effect.

Problem Identification

(1) System boundary: The manufacturing system is divided into micro- and macro-manufacturing enterprises.
(2) A single enterprise internal organization structure subsystem: This includes the influence of resource sharing on the internal production and operation of an enterprise, the structure of production departments, and the organizational structure of the entire enterprise. The manufacturing enterprise relations subsystem includes the collaborative effect of resource sharing. The manufacturing eco-environmental subsystem includes the changes that resource sharing will bring to the whole manufacturing environment and operation, the impact on networked manufacturing resource sharing, and the impact of government macro-control on the manufacturing ecosystem.

Causal Diagram

System 1 includes internal enterprise behavior, such as the organizational behavior of learning ability training, material resource allocation, operation mode selection, and production mode selection. System 2 involves the manufacturing enterprise. System 3 comprises the manufacturing environment mode (Guo et al., 2019) and government behavior. The main causal relationships are illustrated as follows.

(1) Resource sharing → production flexibility → enterprise structure flattening → operating revenue → investment in scientific and technological innovation → network collaborative manufacturing efficiency.

Resource sharing is based on intelligent manufacturing, which has a definite impact on enterprise production processes.

FIGURE 3 | System dynamics flow.

Virtual intelligence relates to the flexibility of production, and enterprises can adjust their organizational structures according to continuous market changes. Collaborative production reduces the management level and helps adjust the organizational structure of the enterprise by flattening the organizational structure. That is, it simplifies the organizational structure, reduces the management level, and establishes a compact and capable organizational structure. Collaborative production can enhance management efficiency, which increases operating income and promotes the efficiency of network collaborative manufacturing.

(2) Resource sharing → value network → number of enterprise cooperation units→ operating income → investment in scientific and technological innovation → network collaborative manufacturing efficiency.

Resource-sharing behavior encourages more transactional relationships so that the enterprise value network and enterprise cooperation increase while enterprise operating income improves. As income increases, more investments will be made in scientific and technological innovation, and efficiency will be promoted by network collaborative manufacturing.

(3) Resource sharing → network collaborative manufacturing efficiency → trust → resource sharing.

Resource sharing directly improves the efficiency of network collaborative manufacturing. This phenomenon promotes a virtuous circle that improves the trust of the entire manufacturing industry and results in a continual expansion of resource sharing.

(4) Resource sharing → production flexibility → enterprise structure flattening → operating revenue → manufacturing gross product → manufacturing operating environment → investment in scientific and technological innovation → network collaborative manufacturing efficiency.

Resource sharing promotes an increase in operating revenue; thus, it increases the gross product of the manufacturing industry, enhances the recognition of resource sharing in the whole manufacturing industry, increases investment in scientific and technological innovation, and improves the efficiency of network collaborative manufacturing.

(5) Resource sharing → organizational learning ability → enterprise structure flattening → operating income → investment in scientific and technological innovation → network collaborative manufacturing efficiency.

Resource sharing is equivalent to cooperation with more enterprises, and improving the learning ability of enterprises is conducive to improving network collaborative manufacturing efficiency.

(6) Resource sharing → production flexibility → production efficiency → operating revenue → investment in scientific and technological innovation → network collaborative manufacturing efficiency.

Resource sharing promotes production flexibility and improves production efficiency. Production efficiency increases operating income and improves efficiency.

The system causal diagram is obtained, as shown in **Figure 4**.

Overall, enterprises share resources not to cooperate with familiar or long-term partners but to choose the enterprises with the most appropriate resources according to their specific business needs. Business diversification results in a broader circle of business contacts, promotes a production value network, and improves enterprise popularity in the manufacturing industry. It increases economic benefits, investment in collaborative manufacturing, and network collaborative manufacturing efficiency.

System Flow Diagram

The system causal diagram contains subsystems, including the single enterprise under the entire microscopic and macroscopic manufacturing subsystems and the subsystem under different manufacturing enterprises. Therefore, in the study of quantitative system flow diagrams according to the micro and macro levels, which are divided into internal flow diagrams and macro manufacturing, the influence of resource sharing on collaborative manufacturing efficiency is studied from two aspects.

Internal Flow Diagram of the Enterprise in the Microscopic Situation

Resource sharing within the enterprise mainly influences the efficiency of the production department, which affects the production department structure and makes the whole enterprise organizational structure flexible to improve collaborative manufacturing efficiency. The simulation undertaken in this article selects the Baosteel Group as an example. The Baosteel Group mainly engages in steel production, manufacturing, and sale, and it is among the world's 500 compulsory molding enterprises with the typical operating characteristics of manufacturing enterprises.

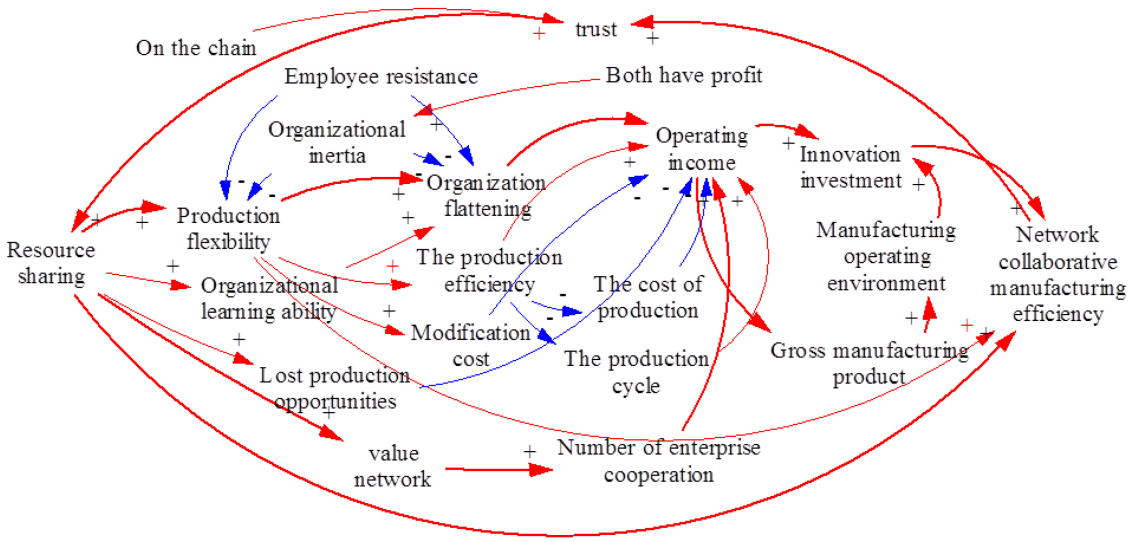

FIGURE 4 | System causal diagram.

DESCRIPTIVE STATISTICS

Influencing Relationships

Based on the data in **Table 1**, the internal flow chart of the enterprise is obtained, as shown in **Figure 5**. The relationships between the variables and the main equation in the internal micro flow diagram of the enterprise are as follows.

(1) INITIAL TIME = 2008, FINAL TIME = 2019, STEP = 1 year.

(2) Value network = 2.5. The value network at the level of a single enterprise is expressed as the number of enterprise partners, which is set to 5 from the 2018 standard from the years 2008–2019, and the value network of the other years is obtained according to the standard.

(3) Flattening of the enterprise organizational structure = (total number of employees/number of administrative administrators) * 0.4 + staff skills * 0.3 + production flexibility * 0.3. The parameters are set according to the principle of importance sorting. (a) The reduction of management levels is the key factor that leads to enterprise flattening and the reduction in administrative personnel. Therefore, the weight of this part is greater than that of the other two parts. Based on experience, the weight is set to 0.4. (b) Enterprise flattening is also affected by the increase in employees' skills. The workers' skills are set to 1, and the annual growth rate is 5%. Based on experience, the effective weight is set to 0.3. (c) Production flexibility affects flattening, and it has the same probability of affecting flattening as employee skills have. Let the weight of production flexibility be 0.3. When the degree of enterprise flattening is higher, this is more conducive to the network collaborative manufacturing efficiency of the enterprise.

(4) Production flexibility = (labor productivity/100) * 0.6 + inventory proportion * 0.4. To increase production efficiency and reduce costs and inventory, flexible production in this article is defined as more production that is lean and intelligent (Guo et al., 2001). Set the parameters according to the principle of importance sorting. The quantitative measurement of flexible production is primarily measured by the input of enterprise technicians and automation equipment. According to management knowledge, the labor productivity ratio is the most important measure of production flexibility, and its impact is higher than the impact of the inventory ratio. For calculation convenience, this article sets the weight of labor production efficiency as 60% and the weight of the inventory ratio as 40%.

(5) Output = INTEG (changes in output, 22,813,000). The number 22,813,000 is the output in 2008 and is set as the initial value of the whole model: changes in output = −2,216,480 + 1,161.912 * change of production staff + 3,16,244 * resource sharing. The output of more mature enterprises is generally determined by the quantity demanded; therefore, the quantity demanded is used in this article to substitute for the output.

(6) Labor productivity = output/number of production staff.

(7) Number of production staff = INTEG (change of production staff, 26,327), change of production staff = 13,262.7 + 1,326.69 * resource sharing − 25.165 * production efficiency.

(8) Number of enterprises cooperating = INTEG (the change in the number of enterprises cooperating, 21). The initial value is the number of enterprises cooperating (21) in 2008. The change in the number of enterprise cooperation = −1.854482 + 0.369372 * resource sharing.

(9) Operating income = INTEG (change in operating income, 2003.32). The operating income in 2008 (2003.32) is the

TABLE 1 | Partial data for the Baosteel Group from 2008 to 2019.

Year	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Value network	2.5	2.6	2.5	3.1	3.2	3.1	3.0	3.0	3.8	4.2	5.0	5.2
Resource sharing	6.91	5.89	7.44	9.17	9.04	9.46	9.25	9.08	11.19	15.26	17.72	17.52
Production flexibility	7.45	7.22	7.70	8.59	9.62	8.95	8.81	9.01	9.95	11.03	11.26	12.20
Flatness degree	7.42	7.37	7.52	7.81	8.13	7.95	7.93	8.01	8.31	8.66	8.75	9.05
Production [ton]	22813000	20629080	23308511	25800000	23566000	21993100	21817000	22148300	24090000	46170000	47100000	47185000
Production personnel	26327	25468	25804	25839	20536	21694	22558	22745	21807	36734	37191	33652
Production efficiency [ton/person]	867	810	903	998	1148	1014	967	974	1105	1257	1266	1393
Number of cooperation between enterprises	21	22	21	26	27	26	25	25	32	35	42	44
R&D investment [100 million]	23.03	25.96	42.45	51.18	38.23	34.14	39.36	34.56	37.09	53.48	70.10	88.64
Proportion of R&D investment [%]	1.15	1.75	2.10	2.30	2.00	1.80	2.10	2.11	2.00	1.85	2.30	3.04
Operating revenue [100 million]	2003.32	1483.26	2021.49	2225.05	1911.36	1896.88	1874.14	1637.90	1854.59	2890.93	3047.79	2920.90
Network collaborative manufacturing efficiency [%]	6.99	6.27	12.95	7.02	9.52	5.29	5.16	0.90	7.68	12.24	12.70	7.05

Source: Original data are from the 2009 to 2019 annual report of the Baosteel Group.

initial value of the entire model, and the change in operating income = 25.21294–1.820862 * number of enterprise cooperation + 5.43E – 05 * change in output.

(10) Enterprises' investment in resource sharing = operating income * R&D investment ratio. R&D investment ratio = 2%. Given the average R&D expenses in the years 2008–2019, the R&D investment ratio was 2.04%. In addition, due to the different annual operating incomes and an upward trend, the annual investment ratio changed little, but from the overall 12-year trend, the R&D investment ratio increased to a certain extent; thus, the R&D investment ratio was 2%.

(11) Resource sharing = (1.209575 + 0.213763 * inventory ratio + 2.999953 * network collaborative efficiency) * value network. Resource sharing indicates the effective flow of resources between enterprises. In addition, network collaboration efficiency influences resource sharing; an increase in the value network greatly promotes resource sharing.

(12) Network collaborative efficiency = 0.329512-0.046255 * enterprise organizational flattening + 0.000509 * enterprise investment in resource sharing + 0.003445 * enterprise cooperation. Collaborative manufacturing efficiency is mainly manifested in enterprise profitability, and enterprises can obtain greater output levels with the same assets. In this article, the weighted average return on equity represents the collaborative manufacturing efficiency of networks.

Flow Chart of the Manufacturing Industry Under the Macro Situation

From the perspective of the system flow diagram for a single enterprise, the internal changes of the enterprise can be well observed. From the perspective of an outstanding single enterprise, it is equally important for the manufacturing industry and the government to understand the operational environment and affect the entire manufacturing ecosystem. In the macro-environment, the entire manufacturing industry and the government's macro-control are essential because they mainly study the manufacturing industry and the government's adjustment and change of some influencing factors.

Based on the data in **Table 2**, the macro flow chart of the manufacturing industry was obtained, as shown in **Figure 6**. The main factor relations and the main equation in the macro manufacturing flow diagram are as follows.

(1) INITIAL TIME = 2008, FINAL TIME = 2019, STEP = 1 year.

(2) Value network = 3.6. On the macro level, the value network is given in the number of enterprises above the manufacturing scale. The number of enterprises in 2010 compared with the highest number of enterprises in each year from 2008 to 2019 is regarded as the standard value of 5. The value network of this system takes the lowest value from 2008 to 2019.

(3) Manufacturing gross product = INTEG (manufacturing added value, 1,02,539.5), which indicates that the initial

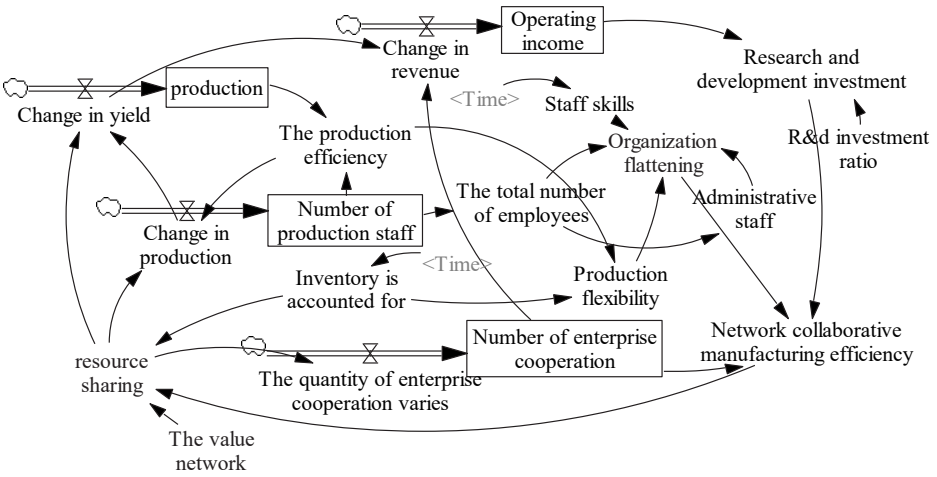

FIGURE 5 | Internal enterprise flow diagram.

value of manufacturing gross product is 10,253.95 billion, and the manufacturing gross product = Σannual added value of sigma, manufacturing annual added value = 11163.9 + 453.0325 * resource sharing.

(4) GDP = INTEG (annual added value of GDP, 319245), which indicates that the initial value of GDP is 3,1924.5 billion, and GDP = Σannual added value of sigma GDP, annual added value of GDP = 1,34,142.7 + 1.133849 * added value of manufacturing industry – 10,426.41 * resource sharing.

(5) Main operating income = INTEG (added value of main operating income, 4,32,759.95), which means that the initial value of main operating income is 4,32,755.995 billion, and main operating income = added value of sigma main operating income, added value of main operating income = -421,152.3 + 0.770451 * total innovation investment + 52,836.33 * resource sharing.

(6) Investment in manufacturing innovation = gross product of manufacturing industry * manufacturing innovation input ratio. The innovation input ratio of the manufacturing industry was 4.56% on average each year from 2008 to 2019.

(7) Government investment in innovation = GDP * government investment in innovation ratio, and the government investment in innovation ratio was 0.41% on average from 2008 to 2019.

(8) Total profit = −738.7928 + 0.061555 * main operating income.

(9) Network collaborative manufacturing efficiency = total profit/(core operating income - total profit).

(10) Average balance of current assets = −9424.888–917037.3 * network collaborative manufacturing efficiency + 0.503167 * main operating income.

(11) Resource sharing = (current assets average balance) * value network. Resource sharing means that each enterprise can share. This article used the current asset turnover to quantify resource sharing. Liquid assets reflect the enterprise's current asset turnover speed, which means that the enterprise has better liquidity intuitive performance.

The above two structure flow diagrams were based on the system causal diagram, in which the set equation can determine the relationship between various variables. The data were obtained from the annual report of the Baosteel Group, the *China Statistical Yearbook*, and the calculations. Some constants were calculated based on known data, and some equation relations were calculated with the help of econometrics.

Model Output and Response

The problem studied generates two flow diagrams due to dimensional differences, namely, one for macro manufacturing and the other for micro-enterprises. The contact points of the two flow diagrams are all enterprises, and the center is on the impact of resource sharing on network collaborative efficiency.

Flow Chart 1

The internal flow chart mainly studies the impact of resource sharing on various aspects of a single enterprise. Starting from resource sharing, it affects the number of cooperation enterprises, the number of production personnel, production flexibility, enterprise organizational flattening, output, operating revenue, R&D investment, and ultimately network collaboration efficiency. The two indicators of the final output and response of this flow chart are business income and network synergy efficiency, which directly or indirectly consider the benefits of resource sharing.

Flow Chart 2

The macro flow chart of the manufacturing industry studies the overall situation of many manufacturing enterprises, such as that depicted in Flowchart 1. It still affects the whole system from the perspective of resource sharing, affects the gross product and core operating income of the manufacturing industry, and thus affects network collaborative efficiency. The final output of this flow diagram demonstrates the corresponding network collaboration efficiency and operating revenue.

TABLE 2 | Important data for the above-scale manufacturing industry from 2008 to 2019.

Year	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Manufacturing GDP [100 million]	102539.5	110118.5	130325.0	150597.2	161326.1	181867.8	195620.3	202420.1	214289.3	240505.4	264820.0	269000.0
Manufacturing R&D investment [100 million]	4165.2	5090.4	6260.1	5695.4	161326.1	181867.8	195620.3	202420.1	214289.3	240505.4	264820.0	13569.7
Manufacturing R&D investment ratio [%]	4.06	4.58	4.80	3.78	4.26	4.39	4.55	4.78	4.95	4.84	4.74	5.04
GDP [100 million]	319244.6	348517.7	412119.3	487940.2	538580.0	592963.2	641280.6	685992.9	740060.8	820754.3	900309.5	990865.1
Government R&D investment [100 million]	1088.9	1358.3	1696.3	1883.0	2221.4	2500.6	2636.1	3031.2	3140.8	3487.4	3978.6	4537.3
Average balance of current assets of enterprises above the scale [100 million]	165058.53	183687.26	220500.52	265861.02	304222.98	340777.26	376424.15	403471.30	429330.14	460106.71	483577.08	507578.3
Main operating income [100 million]	432759.95	471869.71	606330.07	729278.44	805662.29	901941.49	978229.96	992673.82	1047710.96	1019597.52	931189.9	943582.0
Value network	4.7	4.8	5.0	3.6	3.8	3.9	4.2	4.2	4.2	4.1	4.2	4.2
Resource sharing	9.3	9.1	9.8	9.9	9.5	9.5	9.3	8.6	8.7	7.8	6.9	6.6
Network collaborative efficiency	0.053	0.063	0.075	0.070	0.064	0.060	0.062	0.062	0.066	0.070	0.065	0.062

Source: China Statistical Yearbook, number unit: 100 million.

Model Validation and Simulation

Effectiveness Test

(I) The original data used in the simulation were all from the 2008 to 2019 annual report of the Baosteel Group. The simulation parameters were configured according to relevant research and the actual situation. The authenticity of the data and the practicality of the parameters demonstrate the practical significance of the simulation results.

(II) In the adaptability test of the model, we know the adaptability of all aspects of the system model, which is in line with the policy and environment of all system aspects, and the policy analysis is of practical significance; therefore, the model has adaptability.

(III) The authenticity of the model is verified by comparing the actual data with the data generated by the system simulation. We thus observed the fitting degree of the enterprise's operating revenue and network collaborative manufacturing efficiency. **Table 3** shows that the output value of the simulation deviates to some extent from the real value, but the results reflect the yearly change in operating income and the influence of different factors on the network collaborative manufacturing efficiency, which has a reference value for policy analysis.

Table 3 shows a certain deviation between the fitted values and real values, but the results generally conform to the changing trend. Therefore, the flow diagrams of the two systems are feasible and can be simulated.

Simulation

In the two flowcharts, the effect and size of the output results are obtained by changing the value network and technological innovation input.

(I) Changing the value network (resource sharing) and the technological innovation input of enterprises changes the business income and efficiency of collaborative manufacturing in the enterprise network.

(1) Value network

In the microenvironment, the value network is divided into cooperation between enterprises. Businesses that work with more companies have greater trading opportunities and sharing conditions. The currency value network takes the lowest value of 2.5 of the value network from 2008 to 2019. Current11 takes 3 and Current22 takes 3.5 (**Figures 7**, **8**).

Four cooperative enterprises are aggregated for each 0.5 value network added. The simulation results shown in **Figures 7**, **8** indicate that the yearly operating revenue increases by 134, 217, 268, . . .,100 million, and the yearly network collaborative efficiency increases by 0.0002791, 0.001007, and 0.0019599. Thus, the value network has an obvious impact on operating income.

The increase in partners provides more business opportunities, which greatly improves the business income of enterprises. In the conventional manufacturing environment, the limited cooperative operation objects of enterprises limit the maximum utilization of resources, which causes waste or

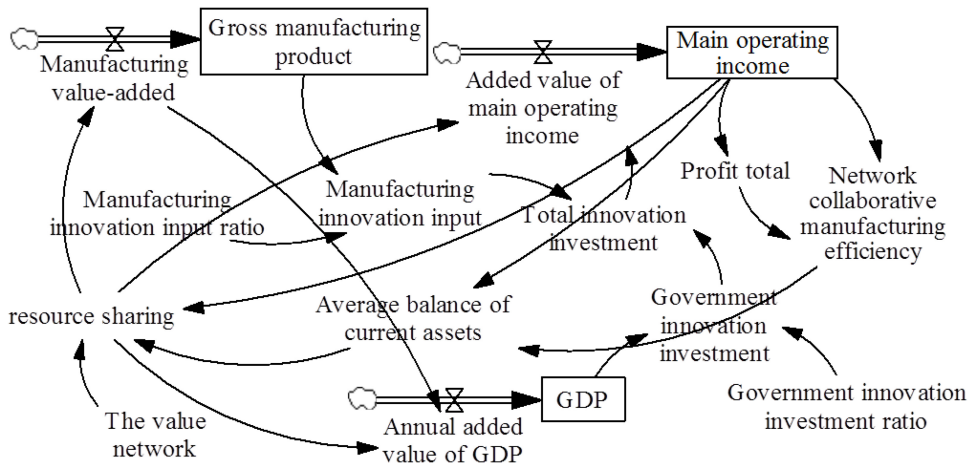

FIGURE 6 | Macro flow diagram of the manufacturing industry.

TABLE 3 | Comparison of the real value and fitting values.

	Enterprise internal flow diagram				Macro manufacturing			
	Operating income		Collaborative efficiency		Operating income		Collaborative efficiency	
Year	Real value	Fitting values	Real value	Fitting values	Real value	Fitting values	Real value	Fitting values
2008	2003.32	2003.32	6.99%	7.94%	432759.95	432760	0.0530	0.0636
2009	1483.26	1999.00	6.27%	7.93%	471869.71	565175	0.0630	0.0641
2010	2021.49	2011.68	12.95%	7.91%	606330.07	646655	0.0750	0.0643
2011	2225.05	2034.78	7.02%	7.88%	729278.44	710145	0.0700	0.0644
2012	1911.36	2063.88	9.52%	7.84%	805662.29	763401	0.0640	0.0645
2013	1896.88	2096.07	5.29%	7.81%	901941.49	809876	0.0600	0.0646
2014	1874.14	2129.39	5.16%	7.77%	978229.96	851482	0.0620	0.0646
2015	1637.90	2162.46	0.90%	7.73%	992673.82	889415	0.0620	0.0647
2016	1854.59	2194.23	7.68%	7.69%	1047710.96	924483	0.0660	0.0647
2017	2890.93	2223.79	12.24%	7.65%	1019597.52	957262	0.0700	0.0647
2018	3047.79	2250.33	12.70%	7.61%	931189.90	988179	0.0650	0.0647
2019	2920.90	2272.99	7.05%	7.56%	943582.0	1017560	0.0620	0.0648

As an iron and steel manufacturing enterprise, Baosteel Group is more vulnerable to the influence of uncontrollable factors, such as the overall economic development and industrial policies; thus, the actual situation and simulated situations will deviate to some extent.

shortage of resources. After resources are effectively shared, the business circle of a manufacturing enterprise greatly expands, which improves the efficiency of resource flow and reduces the excess or shortage of resources.

(2) Investment in technological innovation

Because of the enterprise nature of Baosteel Group, the current technology innovation investment ratio averages 2% from 2008 to 2019, Current1 increases by 3%, and Current2 increases by 4% (**Figures 9**, **10**).

The simulation results shown in **Figures 9**, **10** indicate that for every 1% increase in the technological innovation of enterprises, the operating revenue increases by 7.72, 12.16, 14.44, . . ., 100 million. Thus, the network increases in collaborative efficiency by approximately 0.01 per year. Increasing the investment in science and technology innovation greatly influences network collaboration efficiency. Therefore, investment in scientific and technological R&D is extremely important for enterprise development, which includes not only technology improvement but also production equipment improvement.

(II) The investment in the value network (resource sharing) and scientific research and innovation in the macro-environment are changed, and the changes in the operating income of enterprises and the efficiency of enterprise network collaborative manufacturing are observed.

(1) Value network

The value network in the macro-environment represents the number of manufacturing enterprises. The value network increases from Current (3.6) to Current11 (3.9) and Current22 (4.2) (**Figure 11**).

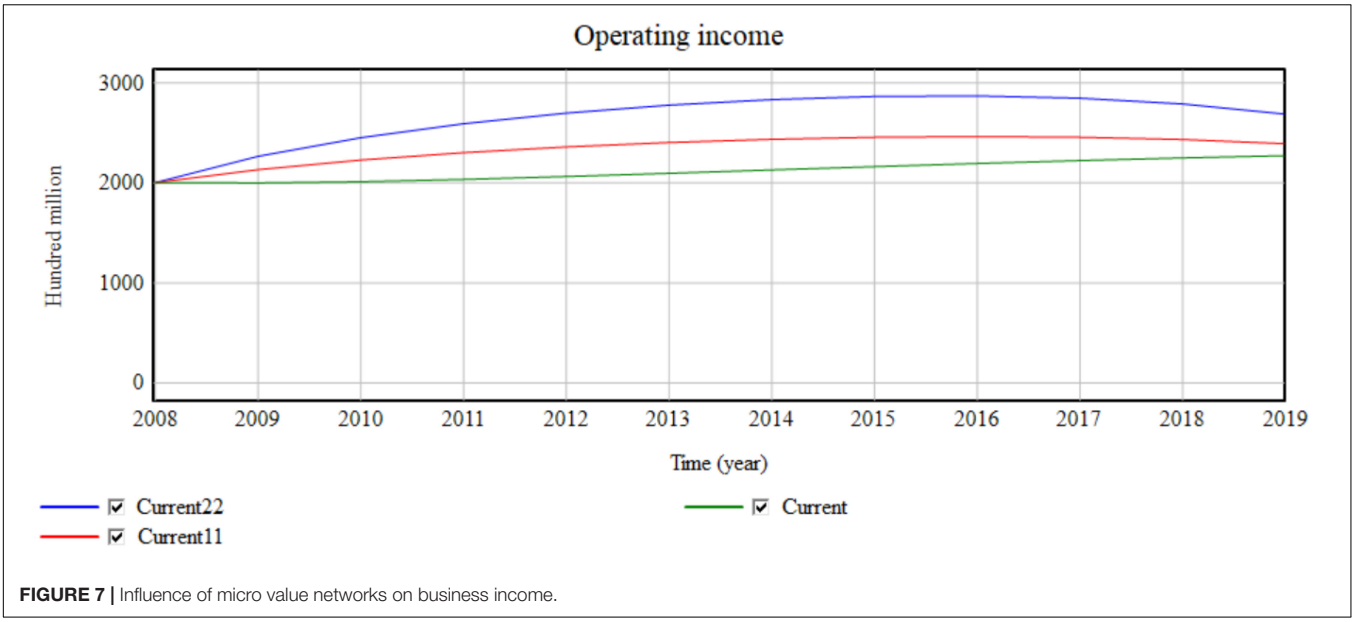

FIGURE 7 | Influence of micro value networks on business income.

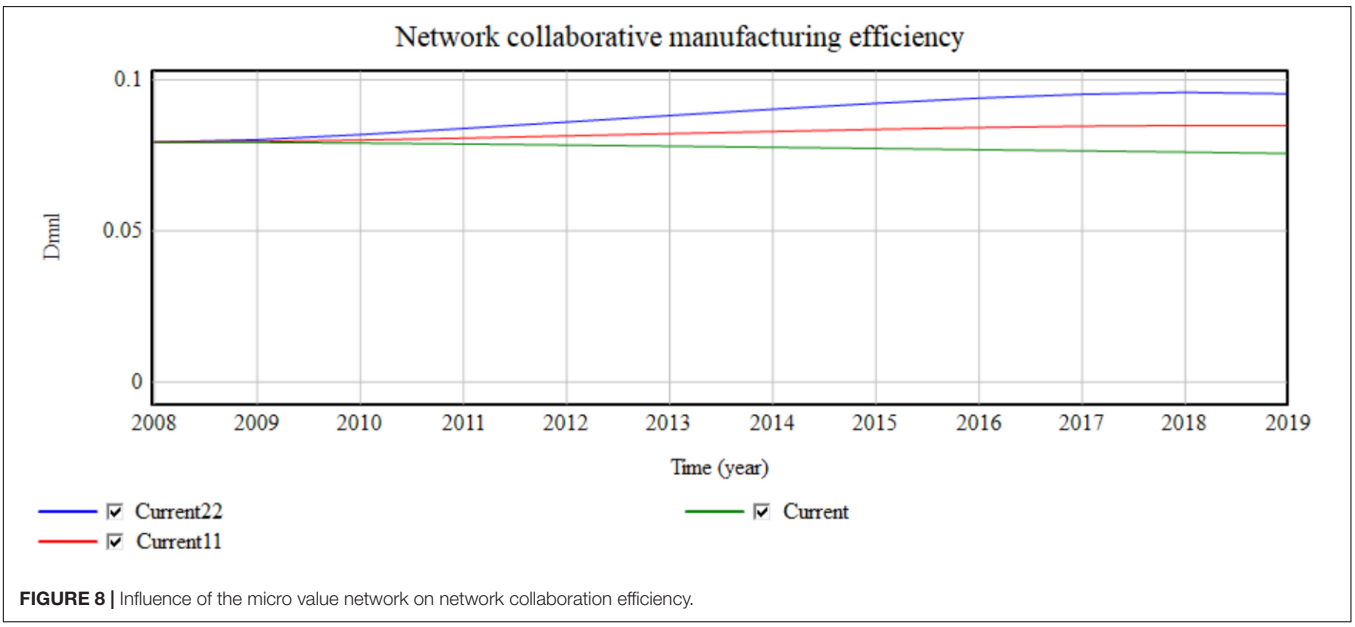

FIGURE 8 | Influence of the micro value network on network collaboration efficiency.

Each 0.3-unit increase in the value network is equivalent to an increase of 26,000 enterprises. The simulation results shown in **Table 4** and **Figure 11** indicate that with the change in the value network, the collaborative manufacturing efficiency of the network increases by almost 0.0001. The increase in the main operating income increases with the yearly increase of 45,746, 749,63,. . ., 100 million. The increase in the number of enterprises improves the competitiveness of the entire manufacturing industry, which also improves the production efficiency and operating income of the industry. The increase in the efficiency of resource-sharing opportunities is also key to improving the efficiency of network collaborative manufacturing. The value network has a significant influence on revenue and synergetic efficiency in the macro-environment.

(3) Technological innovation investment in the manufacturing industry

The technology innovation input ratio is set at an average of 4.56% of the actual technology innovation input ratio from 2008 to 2019. The technology innovation input ratio of System Current1 increases by 5.56% and that of Current2 increases by 6.56% (**Figure 12**).

The simulation results shown in **Table 5** and **Figure 12** indicate that for every 1% increase in the investment in scientific and technological innovation, the main operating income increases successively with the increase in annual income of 790, 1,488, . . ., 100 million. As the input value of scientific and technological innovation increases, the main operating income

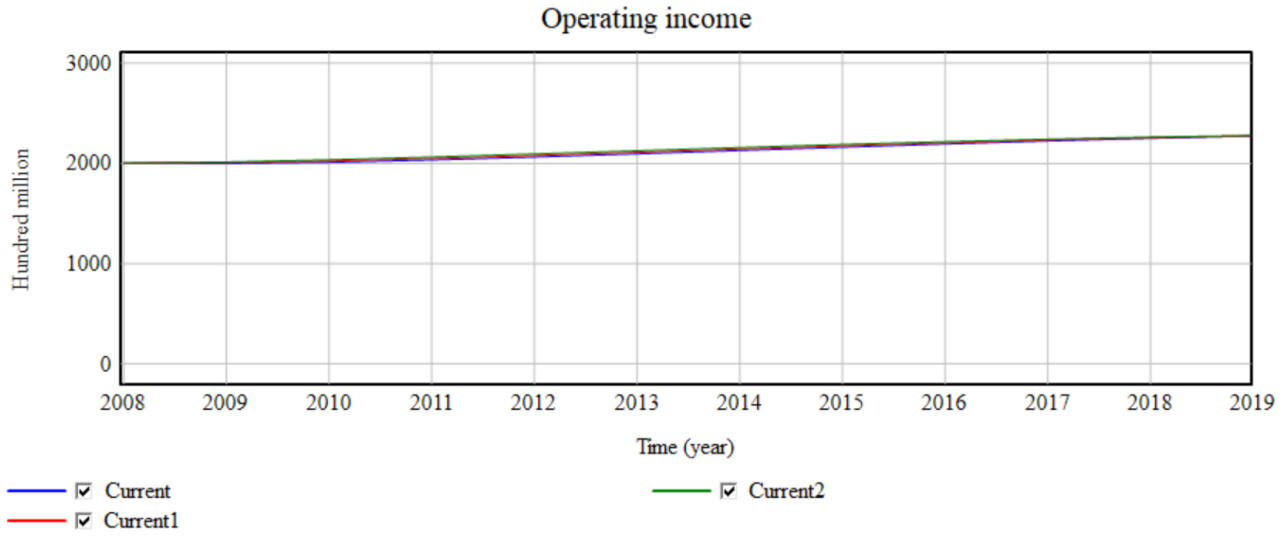

FIGURE 9 | Influence of micro science and technology innovation investment on business income.

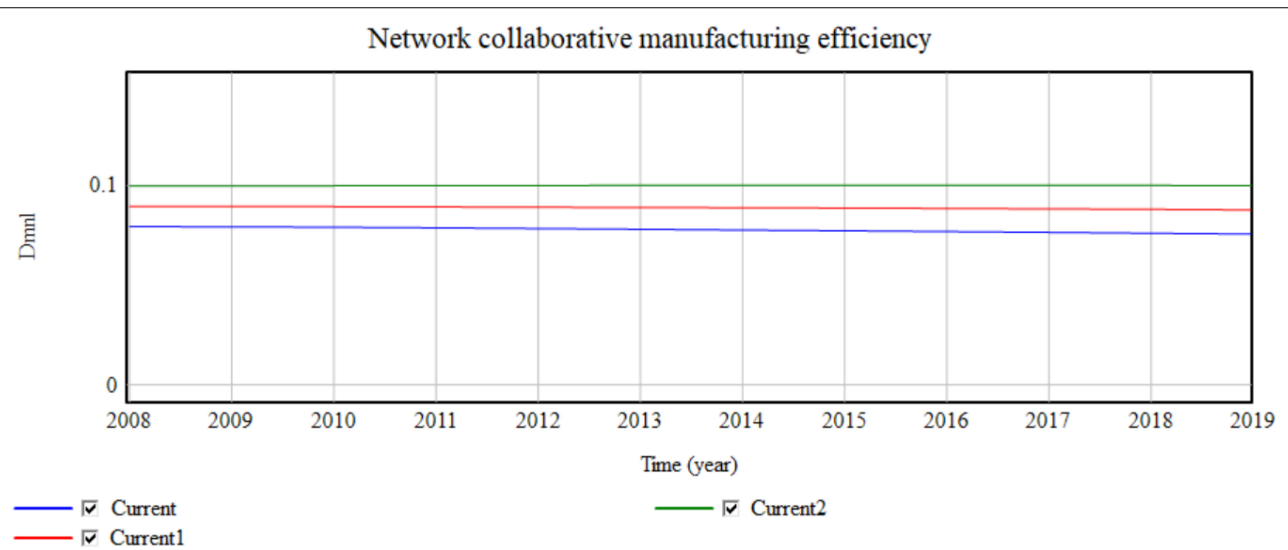

FIGURE 10 | Impact of micro science and technology innovation investment on network collaboration efficiency.

increases more obviously. Improving the science and technology investment also has a certain, non-obvious influence on the network collaborative manufacturing efficiency. For every 0.5% increase in the investment in science and technology innovation, the network collaborative efficiency increases by 0.00001. Thus, a large part of higher efficiency and better product quality depends on the improvement of technology, which ultimately increases the output value and improves efficiency.

(4) Government investment in scientific research and innovation

The government's behavior is an important factor that affects the operation of the manufacturing industry. The government's greatest support for enterprise resource sharing is to offer financial assistance for scientific and technological innovation. The initial government science and technology innovation investment ratio is 0.41%. Therefore, the current is 0.41%. Increasing the science and technology innovation investment results in a Current111 of 0.8% and a Current222 of 1.2% (**Figure 13**).

Table 6 and **Figure 13** indicate that for every 0.4% change in the investment in science and technology, the network collaborative efficiency increases by 0.00001. For every 0.4% change in technology income, the main operating income increases with the increase of revenue in each year 959, 1,790, . . ., 100 million. Changing the government's investment ratio for scientific and technological innovation amends the government's support for manufacturing resource-sharing innovation.

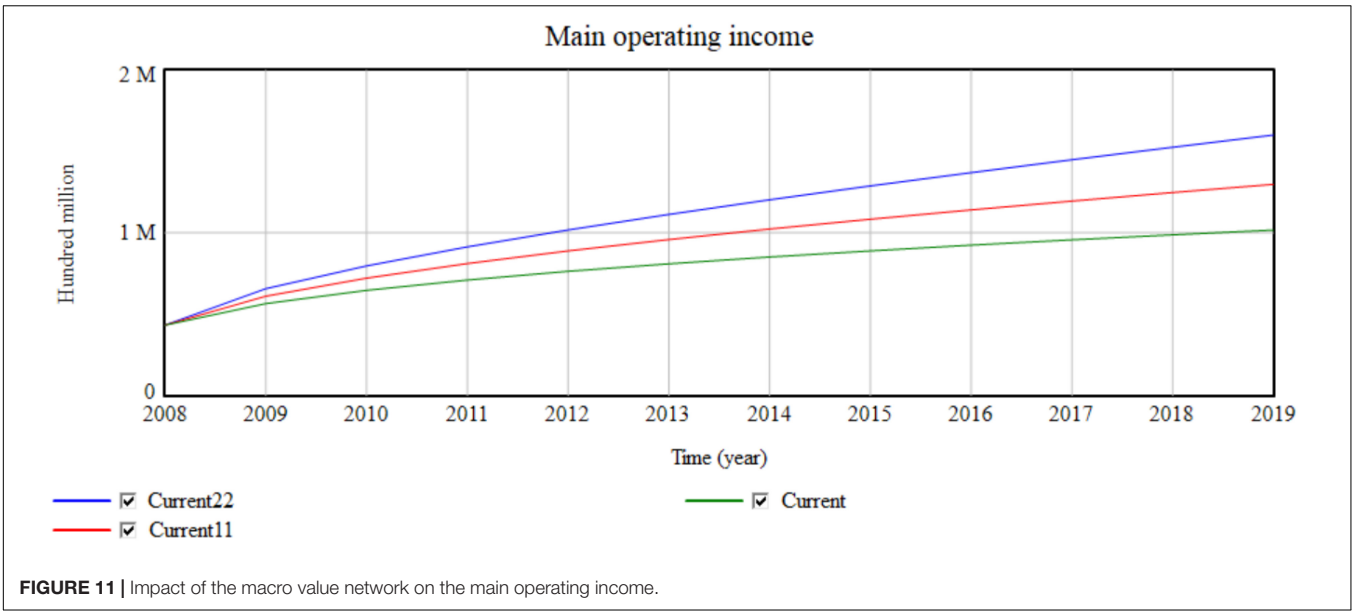

FIGURE 11 | Impact of the macro value network on the main operating income.

TABLE 4 | Influence of the macro value network on collaborative efficiency.

	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Current	0.0637	0.0641	0.0643	0.0644	0.0645	0.0646	0.0646	0.0647	0.0647	0.0647	0.06547	0.0648
Current11	0.0637	0.0642	0.0644	0.0646	0.0646	0.0647	0.0648	0.0648	0.0649	0.0649	0.0649	0.0649
Current22	0.0637	0.0643	0.0645	0.0647	0.0648	0.0648	0.0649	0.0649	0.0650	0.0650	0.0650	0.0651

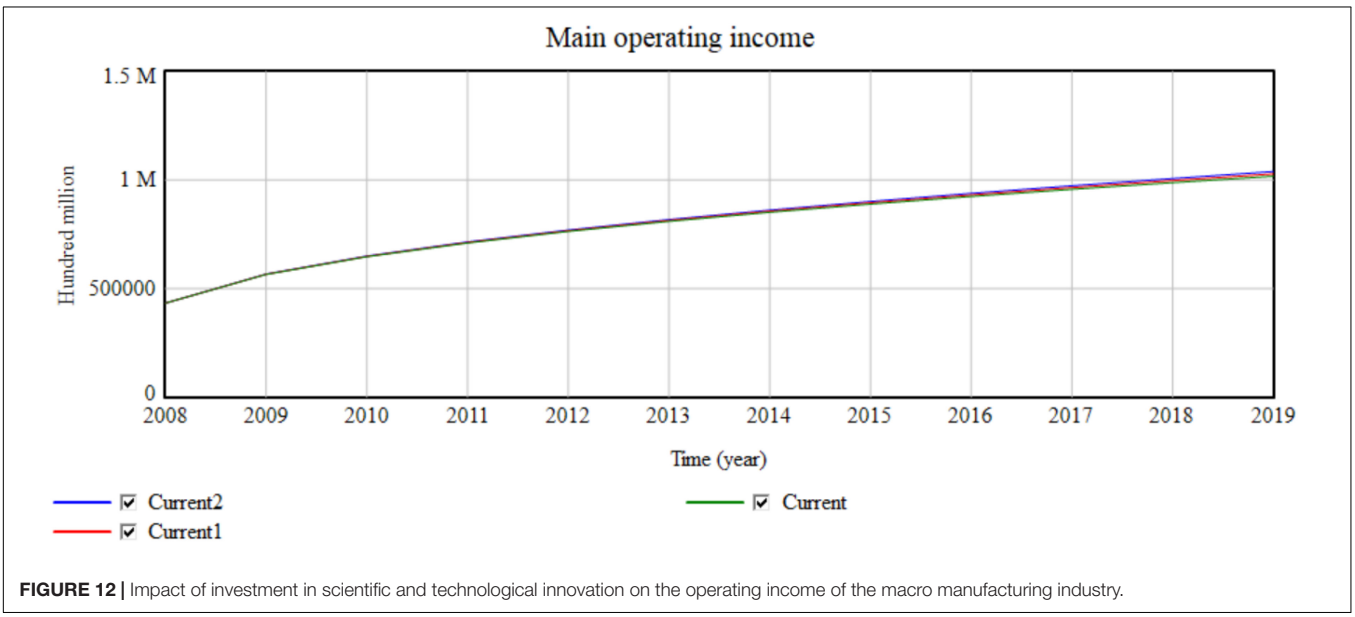

FIGURE 12 | Impact of investment in scientific and technological innovation on the operating income of the macro manufacturing industry.

TABLE 5 | Influence of innovation input on the network collaborative efficiency of the macro manufacturing industry.

	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Current	0.0637	0.06411	0.06430	0.06441	0.06449	0.06456	0.06461	0.06465	0.06469	0.06472	0.06474	0.06477
Current1	0.0637	0.06411	0.06430	0.06442	0.06450	0.06456	0.06461	0.06466	0.06469	0.06472	0.06475	0.06478
Current2	0.0637	0.06411	0.06430	0.06442	0.06450	0.06457	0.06462	0.06466	0.06470	0.06473	0.06476	0.06479

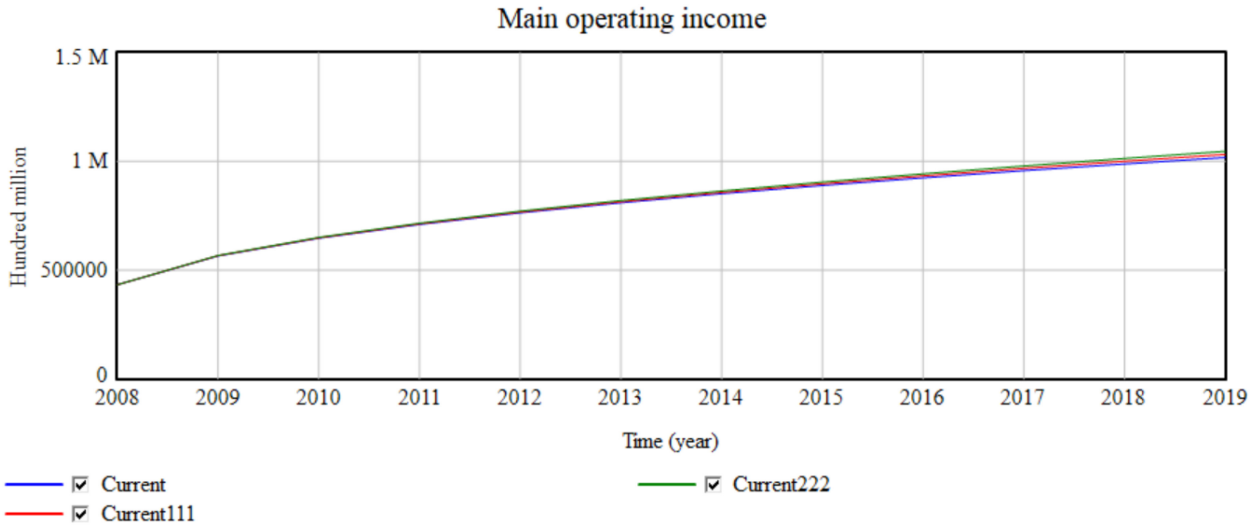

FIGURE 13 | Impact of the macro government investment in science and technology innovation on operating revenue.

TABLE 6 | Influence of the macro government investment in science and technology innovation on network collaborative manufacturing efficiency.

	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Current	0.06366	0.06411	0.06430	0.06441	0.06449	0.06456	0.06461	0.06465	0.06469	0.06472	0.06474	0.06477
Current 111	0.06366	0.06411	0.06430	0.06442	0.06450	0.06456	0.06462	0.06466	0.06469	0.06473	0.06475	0.06478
Current 222	0.06366	0.06412	0.06430	0.06442	0.06451	0.06457	0.06462	0.06467	0.06470	0.06474	0.06477	0.06479

The above simulation results yield the following conclusions.

(1) From the micro perspective, due to the objective finiteness, the change in variables caused by the change will be more obvious. The impact of the value network on operating income is greater than the impact of changing the investment in scientific and technological innovation. In addition, a single enterprise must increase its operating income so that it can increase revenue more quickly by cooperating with more enterprises to improve operating conditions. In addition, the impact of science and technology innovation investment on network collaborative efficiency is greater than the impact of the value network. The collaborative manufacturing efficiency can be improved. The priority is to upgrade the technology and equipment within the enterprise.

(2) From the macro perspective, due to the objectivity of larger sample formation, the change of the variable produces little change. According to the simulation results, changing the number of enterprises in the manufacturing industry has a significant impact on operating income and network collaborative manufacturing efficiency. In contrast, the influence of technological innovation of both enterprises and the government on business income and network collaborative manufacturing efficiency is relatively small. Therefore, the manufacturing industry must regulate and control the number of enterprises. Eliminating inferior enterprises can steadily expand the manufacturing market by ensuring quality to improve the possibility of resource sharing. However, increasing investment in scientific and technological innovation is also very significant for the upgrading of manufacturing industry efficiency. Although such an investment cannot greatly increase income, it will greatly promote the high-quality development of the manufacturing industry.

DISCUSSION

Method Comparison

The comparison and analysis of the related references and the research in this article are depicted in **Table 7**.

Based on the systematic research perspective of the manufacturing industry in the context of "Internet+", systematic collaborative manufacturing thinking is used for research. First, this article deeply discusses the collaborative relationship in resource sharing. Based on the shared organizational system of a multiagent architecture, this article details the internal and manufacturing enterprise levels. Second, regarding the shared process, the current research focuses on the improvement of macro synergy efficiency. This article comprehensively explores the synergy of various enterprises and resources with the help of micro-enterprise individuals and macro-manufacturing scenarios to efficiently use resources and operate enterprise production activities. Third, so that enterprises can share resources on the platform, a certain quantitative

TABLE 7 | Comparative analysis of the research methods.

Analysis object	Perspective	Thinking	Relationship	Scenario	Mode
Related research	Manufacturing system optimization in the context of the "internet+" (Zhang and Li, 2017)	Systems thinking in manufacturing (Eijnatten et al., 2007) Collaborative systems thinking (Lamb and Rhodes, 2010)	Coordinated scheduling of human resources, product collaborative design and information resources (Antti et al., 2020)	Exploration of synergy strategies, influencing factors, off-site processes, improved organizational synergy capabilities and development paths (Mincuzzi et al., 2019)	Ways of building shared platforms, cloud manufacturing, intelligent manufacturing and collaborative interaction models (Guo et al., 2000)
Our research	Manufacturing system optimization in the context of "internet+"	Systematic collaborative manufacturing thinking	Complete internal and macro manufacturing enterprise processes	Quantitative analysis of the interaction between intrafirm activities and macro manufacturing firms	Combination of the causal relationship and flow diagrams of system dynamics to quantitatively and jointly analyze the influencing relationship along the entire system

analysis is needed to measure the impact of resource sharing on the enterprise and the entire manufacturing industry (a quantitative analysis refers to the impact of various factors in the manufacturing enterprise system). A specific quantitative analysis first uses system dynamics to establish the influencing relationship of the entire system. Furthermore, it uses a system causal diagram and flow graph quantification to study the influence of resource sharing on the efficiency of network collaborative manufacturing. This systematic quantitative analysis studies the interrelationships in detail and describes the influences between various factors numerically, which reduces the uncertainty of the heterogeneous resources and information asymmetry of each participant, accurately evaluates the influencing factors of collaborative manufacturing efficiency and is conducive to the rapid allocation of resources. Effective measures promote the efficiency of network collaborative manufacturing, improve the operating effectiveness of the entire manufacturing market, and make policy suggestions from the government's macro-control level for the industry. Thus, such measures provide a basis for government departments to formulate control strategies.

Combining **Table 7** and the above comparison and analysis yields the following conclusions.

System dynamics has certain advantages in measuring the efficiency of collaborative manufacturing. First, the modeling and simulation of system dynamics can more accurately reflect the causal relationship in the process of collaborative manufacturing efficiency. Most of the current research on collaborative manufacturing efficiency adopts cross-sectional research, which makes it difficult to reflect the causal relationship in the continuous change process of individuals (Vancouver et al., 2010). Second, placing the interacting micro-enterprise individuals and macro manufacturing under the same framework can more comprehensively reflect the generation mechanism of collaborative manufacturing efficiency. System dynamics can include the two in the same frame system and examine their role in the impact mechanism in the dynamic impact. Third, other research methods have difficulty simulating long-term evolution, and system dynamics can make up for this defect. Using system dynamics to solve problems is beneficial to accurately quantify and reflect the complex connections in the entire system and further explore how to maximize the overall degree of synergy.

Limitations and Challenges

Shared platforms have been widely used to solve the problem of resource sharing, but an important emerging challenge is measuring the degree of collaboration between enterprises in the process of resource sharing. The research on collaborative manufacturing mainly focuses on the manufacturing enterprise relationships among resource sharing, production, and operation. In addition, it also focuses on measuring and comparing their impact among them. However, there is a lack of quantitative analyses and exploration of the degree of synergy in the research results.

Systems thinking is an important scientific mode. In recent years, system dynamics research has focused on sustainable development, policy simulation, urban rail transit, the supply chain, and network public opinion. Few related studies have examined manufacturing progress. At present, the related research on collaborative manufacturing lacks the research-systems thinking perspective.

Recommendations

The results suggest the following recommendations.

First, compared with other industries, the manufacturing industry, especially the large-scale manufacturing industry, works in a relatively backward combination. The reasons are various. In this article, the cloud platform constructed by the multiagent system provides the direction for manufacturing + Internet. More importantly, manufacturing enterprises should increase their trust and openness and provide practical experience for directional exploration.

Second, manufacturing enterprises must expand their communication circle, share resources, and increase trading opportunities. Second, enterprises need to constantly devote themselves to innovation and development to further improve production efficiency through technological reform. In the increasingly competitive enterprise environment, more profits can be guaranteed.

Third, from a macro perspective, the impact is not intuitive but is very important for the government and industry macro-control of economic efficiency and collaborative manufacturing efficiency. The quantity and quality of enterprises in the market must be adjusted, and investments must be made in scientific and technological innovation.

CONCLUSION

This article focuses on systems thinking, breaks the boundaries between micro-enterprise individuals and macro manufacturing, and puts them under the same framework. Because of the difficulty in simulating long-term evolution with other research methods, we introduced a system dynamics simulation of the long-term efficiency of collaborative manufacturing. The specific changes can more comprehensively and systematically reflect the mechanism of collaborative manufacturing efficiency. Based on systematic collaborative manufacturing, by combining the macro-manufacturing industry with the micro-individual enterprises, this article sets the resource-sharing interaction scenario by building a cloud service platform to analyze the resource-sharing behavior among manufacturing enterprises. It also quantitatively studies the influencing factors of collaborative manufacturing efficiency with dynamic modeling and simulation analysis to propose improvement strategies, which will help make policy to improve creative performance and optimize the allocation of manufacturing resources.

Based on a multiagent shared platform, this article presents and quantifies the impact of resource sharing on the efficiency of network collaborative manufacturing through system dynamics and yields accurate influencing effects. However, this research focuses on only three systems in the macro-manufacturing industry. In actuality, the manufacturing industry and the relationships among its enterprises are more complex than these three systems alone indicate. Therefore, future research should continue to measure qualitative factors and explore relational systems and more accurate quantitative methods.

DATA AVAILABILITY STATEMENT

The original contributions presented in the study are included in the article/supplementary material, further inquiries can be directed to the corresponding author/s.

AUTHOR CONTRIBUTIONS

XXZ and XG wrote the section of the manuscript. SL and XHZ contributed to data curation and visualization. XXZ and HL contributed to manuscript revision. All authors approved the submitted version.

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Brokering or Sitting Between Two Chairs? A Group Perspective on Workplace Gossip

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Brokerage is a central concept in the organization literature. It has been argued that individuals in broker positions—i.e., connecting otherwise disconnected parts within a firm's social network—can control the flow of information. It would imply their increased relevance in workplace gossip. This allegation, however, has not been addressed empirically yet. To fill this gap, we apply social network analysis techniques to relational data from six organizations in Hungary. First, we identify informal groups and individuals in broker positions. Then, we use this information to predict the likelihood with which positive or negative gossip is reported. We find more gossip when the sender and receiver are part of the same group and more positive gossip about in-group rather than out-group targets. Individuals in broker positions are more likely the senders and targets of negative gossip. Finally, even if both the brokers and the boss(es) are the targets of their colleagues' negative gossip, the combination of the two categories (bosses in broker positions) does not predict more negative gossip anymore. Results are discussed in relation to the theoretical accounts on brokerage that emphasize its power for information control but fail to recognize the pitfalls of being in such positions.

Keywords: workplace gossip, organizational networks, informal groups, brokerage, multilevel analysis

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INTRODUCTION

During the last few years, organization researchers have shown an increasing interest in *workplace gossip* (Kniffin and Wilson, 2005; Michelson et al., 2010; Mills, 2010; Kong, 2018; Kuo et al., 2018; Wu et al., 2018; Beersma et al., 2019; Dores Cruz et al., 2019b; Fan and Grey, 2020; Lee and Barnes, 2021; Spoelma and Hetrick, 2021; Tan et al., 2021; Zong et al., 2021). One reason for this attention lies in the acknowledgment that gossip is a behavior that can have both "bright" and "dark" effects on a firm's dynamics (Brady et al., 2017; Dores Cruz et al., 2019b). On the one hand, gossip can wreck the image of some individuals, affecting their performance, commitment, or self-esteem (Wu et al., 2018; Xie et al., 2019; Martinescu et al., 2021). On the other hand, gossip can sustain mechanisms fostering cooperation, mutual control, and self-organization (Ellickson, 1991; Dunbar, 1998; Hardy and Van Vugt, 2006; Nowak, 2006; Barclay and Willer, 2007; Piazza and Bering, 2008; Beersma and Kleef, 2011; Feinberg et al., 2014;

Wu et al., 2016; Boehm, 2019; Giardini and Wittek, 2019a; Számadó et al., 2021; Giardini et al., 2022).

We define "workplace gossip" as any form of communication in which one member of the organization (the sender) provides another (the receiver) with evaluative information about an absent third (the target). Note that this definition characterizes gossip as a three-person phenomenon. Also, it can contain both positive and negative content. Although multiple conceptualizations of gossip exist (for a review, see Dores Cruz et al., 2021a), our definition is in line with typical usage in the literature: a communication about someone in their absence (hence, unaware of the communicated content). The three parties would allow us to distinguish between *emission* (or sending), *reception*, and *being the target* of somebody else's gossip. The inclusion of *positive and negative content* enables comparing two related yet dissimilar forms of third-party communication. Examples of positive gossip may be praising, defending, or vouching for an absent colleague, whereas negative gossip could be blaming, criticizing, or complaining about them.

Since gossip can be consequential for the functioning of an organization, multiple studies try to identify which factors favor (or hinder) this behavior. Two research strands stand out in the literature. The first one looks primarily into the multiple functions gossip serves for those engaging in it. To this day, the list of motivations includes information gathering and validation, social influence, interpersonal aggression, emotion venting, social enjoyment, group protection, social bonding, clarifying norms, social comparison, and status enhancement (Dunbar, 2004; Wert and Salovey, 2004; McAndrew et al., 2007; Beersma and Kleef, 2012; Hartung et al., 2019; Shank et al., 2019; Dores Cruz et al., 2019a). The second strand underscores structural aspects instead as the drivers of gossip, for instance, interdependencies (e.g., competition and collusion) and informal social networks (Wittek and Wielers, 1998; Grosser et al., 2010; Ellwardt et al., 2012a; Giardini and Wittek, 2019b; Yucel et al., 2021). These two strands should not be seen as opposed, however. For example, a motivation to harm someone's reputation may be the presence of an underlying negative relationship tie (e.g., envy, dislike, distrust). So-called coalition triads (Wittek and Wielers, 1998) can result from social bonding where two individuals grow closer by expressing shared animosity for a specific target (Bosson et al., 2006; Peters et al., 2017).

This article aims to contribute to the literature on workplace gossip by focusing on two structural aspects that have received scant attention: *informal groups* and *broker positions*. By informal groups, we refer to relatively cohesive communities that stand apart from each other (Stadtfeld et al., 2020) and exist more or less independently from the formal organizational structure (i.e., work teams). Brokerage is a central concept in the organization literature (Gould and Fernandez, 1989; Burt, 1992, 2007). It has been argued that individuals in broker positions—namely connecting otherwise disconnected parts of an organization—may have control over the information flow in a company (Stovel and Shaw, 2012; Kwon et al., 2020), which would imply their increased relevance in organizational gossip. This claim, however, has not been addressed empirically yet (Foster and Rosnow, 2006).

In the next section, we develop expectations regarding how membership in the same group and having a broker status can affect the dynamics of workplace gossip (i.e., who gossips with whom about whom). Hypotheses are tested using data collected in six different working units ($N = 128$), all located in Budapest (Hungary). Network data were collected and then transformed using composite networks (Vörös and Snijders, 2017) and graph partitioning (Blondel et al., 2008) to identify informal groups within each unit. Individuals with a broker status were singled out based on their betweenness centrality (Freeman, 1977, 1978). Multilevel models (Snijders and Bosker, 2011) connected same-group membership and having a broker status with the gossip reported: who gossiped with whom, about whom, and how (positively vs. negatively).

THEORETICAL FRAMEWORK

Structural Antecedents of Gossip

According to previous studies, workplace gossip is a behavior whose occurrence and valence (positive vs. negative) are shaped by structural dimensions, in particular by underlying relationship ties (e.g., friendship, liking, enmity, trust; Turner et al., 2003; Grosser et al., 2010; Dores Cruz et al., 2021b). Since gossip requires at least three people in different roles (sender, receiver, and target), "structural antecedents" comprise the three ties within the gossip triad (Wittek and Wielers, 1998; Giardini and Wittek, 2019b): the *sender–receiver*, the *sender–target*, and the *receiver–target* relations. We address each of these ties in detail below:

First, a good relationship (e.g., personal closeness, affection, alliance, or trust) is usually invoked as a critical condition facilitating the sharing of gossip (Bergmann, 1993; Gambetta, 1994; Burt, 2001). Gossip always entails talking behind someone else's back, which is a *socially condemned behavior* in almost all cultures (Foster, 2004; Giardini and Wittek, 2019b). One way of maneuvering around this social norm is sharing gossip selectively—the more sensitive the content, the more exclusively (e.g., with friends and acquaintances vs. with close friends only). Grosser et al. (2010) obtained support for this idea using social network data collected in an American firm. They observed that an expressive tie (e.g., friendship) between the sender and the receiver predicts negative gossip, whereas instrumental ties suffice for the exchange of positive gossip.

Second, while a positive tie between the sender and receiver facilitates gossip sharing, a negative relation between the sender and target can be the driver behind negative gossip. Spreading negative gossip about someone can be a form of *relational aggression* (Ingram, 2014; McAndrew, 2014; Davis et al., 2019). Not surprisingly, individuals would preferably spread negative gossip about enemies and rivals (McAndrew et al., 2007; Davis et al., 2019; Hess and Hagen, 2019; Wyckoff et al., 2019). Positive gossip, in contrast, can be *status enhancing* for the target. For this reason, most people refrain from passing along positive information about enemies and rivals and do it instead about those with whom they have a good relationship (e.g., friends or allies; McAndrew et al., 2007).

Lastly, the tie between the gossip receiver and the target is probably the most subtle of the three. The moment a person decides to pass along information about somebody else; it is to be expected that they will first assess the connection between their potential recipient(s) and the target (Burt and Knez, 1995; Burt, 2001). If these two have a good relationship, negative information is likely withheld. In organizations, *selective disclosures* are observed in the way employees complain about colleagues (Behfar et al., 2019). Hostility between the receiver and target can give cause for negative gossip, even when the sender might not feel animosity toward the latter. This effect is detected among adolescents in classrooms (Estévez et al., 2022). One explanation for this pattern is that (mutual) negative ties offer a perfect chance to share the gossip that *strengthens social bonds* (Dunbar, 1998, 2004; Bosson et al., 2006; Peters et al., 2017).

In sum, the underlying relationship ties among the three gossip parties have proven to play a crucial part in gossip dynamics (i.e., who gossips with whom, about whom, and how). Hereafter, we will focus on two additional structural aspects: *informal groups* (the cohesive communities that stand apart from each other and exist more or less independently from the formal organizational structure) and *brokers* (individuals whose social connections cut across groups bringing together distant parts of an organization). "Gossip and Informal Groups" explains why informal groups are relevant for workplace gossip, whereas "Gossip and Brokerage" addresses how individuals in brokerage positions may affect the dynamics of workplace gossip.

Gossip and Informal Groups

A close association between gossip and informal groups is not new in the gossip literature (Gluckman, 1963; Merry, 1984; Elias and Scotson, 1994; Michelson et al., 2010). Gluckmann already expressed this core intuition in what is considered one of the first scientific studies on gossip:

> '[Gossip] is a privilege which is only extended to a person when he or she is accepted as a member of a group […] it is a hallmark of membership.' (Gluckman, 1963, p. 277).

According to Gluckmann, what makes a person a genuine group member is the decision of other group fellows to extend the gossip with them. Curiously, Gluckmann's argument lays bare an aspect often downplayed in the literature: whereas one can always distinguish between a sender, a receiver, and a target analytically; in practice, gossip is often *expressed in small groups* (Hannerz, 1967; Elias and Scotson, 1994; Kurland and Pelled, 2000; Kniffin and Wilson, 2010).

In the workplace, informal groups are characterized by *intense interaction* among their members (e.g., cooperating on tasks, sharing lunch or dinner after work), which favors engagement in gossip. On top of more chances for gossip to happen, informal groups also create the *expectation* (if not the *obligation*) to do it. For instance, it raises suspicion if individuals are part of a group but avoid sharing gossip with their group fellows. These may feel that critical information is withheld for some shadowy reasons (Nijstad and De Dreu, 2012; Levine and Smith, 2013) or that this member's loyalty does not lie in the group but elsewhere. As a general pattern thus, one can expect that most gossip in an organization would be shared within informal groups: with other members of one's informal group rather than with non-members.

> People are expected to share gossip *with* other members of their informal group rather than with non-members. This holds for positive gossip (H1a) and negative gossip (H1b).

Other members of the informal group can be not only the natural recipients of gossip but also their targets. Previous research observed that both positive workplace gossip and negative workplace gossip focus on members of the sender's work team (Kniffin and Wilson, 2005; Ellwardt et al., 2012a). One reason why positive gossip concentrates on group members is that this gossip helps develop and sustain in-group solidarity norms (Dunbar, 2004):

> 'By gossiping positively about other members of our group who are not present, group members stay informed about each other, and demonstrate support and solidarity towards the gossip object and the group' (Ellwardt et al., 2012a, p. 195).

In addition, sending positive gossip about co-members can also improve the sender's reputation by signaling a commitment to in-group norms (Ellwardt et al., 2012a). All in all, since positive gossip about group members can yield potential benefits both for the sender (*status-enhancement*) and the group (*solidarity norms*), the expectation is that it will occur among in-group members and refer to another member of the same group. The above implies that people would also be less inclined to send/receive positive gossip about individuals who are not members of their informal group.

According to previous studies (Kniffin and Wilson, 2005; Ellwardt et al., 2012a), negative gossip concentrates on same-team members because individuals in teams are *interdependent* (e.g., bonuses and other benefits can depend on collective performance). Consequently, violations committed by other team members are more important and judged more sternly. This argument, however, downplays the high *costs of negative gossip* in informal groups, where individuals are affective rather than functionally interdependent (Giardini and Wittek, 2019b).

One of the main reasons people share negative gossip at work is not because they want to manipulate someone else's reputation but because of its strong bonding effect with other individuals (Dunbar, 2004; Bosson et al., 2006; Peters et al., 2017). In other words, sharing negative gossip can be just a form of social glue (Turner et al., 2003). For this purpose, however, the sender must select a target without hurting the receiver. It is well established that exposure to gossip that confronts our positive opinion of a specific person tends to elicit a *negative response* (Hallett et al., 2009; Caivano et al., 2020): the sender might lose face in the eyes of the

receiver, be perceived as unable to solve their problems, be vindictive, or just evil. Gossip can even *trigger a conflict* between the sender and the receiver (Giardini and Wittek, 2019b).

As a result of the above, we expect that most people would temper their inclination to share negative impressions of someone too close to their receivers (e.g., another group member). Instead, one way of exploiting the bonding effects of negative gossip is talking about relatively distant others. Previous studies have noticed that stereotypical persons and stigmatized minorities are exceptionally functional for this (Crothers et al., 2009; Carrim, 2016). Also, preferentially shared negative gossip have been used to explain why individuals' reputations can be sticky, especially in dense networks (Burt, 2001, 2008).

To sum up, we argue that because of its potential benefits for the sender (status-enhancement) and the group (solidarity norms), most positive gossip focuses on targets who are members of the same group as the sender and receiver. In contrast, negative gossip will focus on out-group targets instead to prevent hazards like face loss or conflict escalation.

> People are expected to *send* positive gossip *about* other members of their informal group rather than about non-members (H2a), whereas they are expected to send negative gossip about out-group members rather than in-group members (H2b).
> People are expected to *receive* positive gossip *about* other members of their informal group rather than about non-members (H3a), whereas they are expected to receive negative gossip about out-members rather than in-group members (H3b).

Notice that, unlike in previous work, we distinguish here between emission and reception as two closely related yet different dimensions of gossip.

Gossip and Brokerage

Thus far, we talked about informal groups as if their members were perfectly outlined (either someone is a member or is not). Often, however, we observe that some individuals, because of their patterns of interactions with other colleagues, could be part of several groups (Krackhardt, 1999; Vedres and Stark, 2010; Tasselli and Kilduff, 2017). This fact gives cause for another differentiation: individuals whose connections are primarily within the same group vs. individuals whose ties cut across different groups. Organizational and social scholars sometimes refer to these individuals who bring separate parts of a network together as (network) "brokers" (Gould and Fernandez, 1989; Burt, 1992). For conciseness, we will also use this term here. Curiously, although an extensive literature has connected having a broker position with multiple benefits derived from information advantages (Burt, 1992, 2004, 2010; Stovel and Shaw, 2012; Kwon et al., 2020), the link between workplace gossip and having a broker status remains almost entirely unaddressed.

Foster and Rosnow (2006) argued that individuals in broker positions might feel more compelled to employ negative gossip insofar as, compared to those in more embedded positions, the opportunity structure they face allows for *exploiting personal benefits*. Specifically, it gives the broker a competitive advantage that their potential receivers often belong to separate groups. As long as the individuals in those different groups seldom interact, brokers can manipulate the information they share to their benefit with low risk of others will cross-check its veracity.

Of course, having the opportunity to exploit their position and actually doing it are two different things (Halevy et al., 2019). Notwithstanding this, previous studies have observed how, in organizations at least, individuals in bridging positions also tend to present certain traits, like *self-monitoring personalities* (Sasovova et al., 2010; Landis, 2016). Considering that brokers may extract more considerable gains from negative gossip and that they tend to present personalities that make them more in need of others' attention and approval, a foreseeable pattern is that, in the workplace, brokers send negative gossip on a more regular basis:

> Brokers are expected to send more negative gossip than individuals whose ties are primarily intra-group (H4).

Whereas the argument of Foster and Rosnow (2006) pertains to the emission of gossip, they did not address how brokers may receive or be targets of others' gossip. Indeed, it is well known that having a broker status might provide an advantage for information access and control (Burt, 2004; Stovel and Shaw, 2012; Kwon et al., 2020). Nonetheless, bridging positions between informal groups can also come with high costs. In a seminal work, Simmel (1950) already underlined how go-betweens could be left with a sense of anomie since they are *not full-fledged members of any group*. When informal groups are the basis of a strong 'us-them' mentality (e.g., due to assortative mixing, past conflicts, or intense group-level competition), group spanning can entail even larger disadvantages (Krackhardt, 1999; Tasselli and Kilduff, 2017). For example, members of the two (or more) groups that they bridge can perceive the broker with *suspicion* and *distrust*. In such cases, one may expect that brokers would be systematically avoided as confidants and, consequently, gossip partners. In addition to refraining from sharing gossip with them, suspicion and distrust can also cause brokers' actions to be more thoroughly examined and frowned upon. The natural outcome thus is that many colleagues can share negative gossip about those in broker positions. In summary:

> Brokers are expected to receive less gossip than individuals whose ties are primarily intra-group. This holds for both positive (H5a) and negative gossip (H5b).
> Compared to those whose relationships are mainly within a group, brokers are expected to be more often the targets of others' negative gossip (H6).

DATA, MEASURES, AND METHODS

Research Setting

We collected data from six working units located in Budapest (Hungary) to test our hypotheses. The six units are independent. Three units are small-size companies, whereas the other three are subunits (departments) of a larger firm:

- Unit A ($N = 24$) is a subunit of a firm operating in the public sector. The personnel comprise a chief manager plus five other managers, each in charge of a team of three to seven. Employees are primarily social workers and administrative professionals, mostly young or middle-aged women.
- Unit B ($N = 19$) is a small web development company composed of six project managers (three women), one administrative professional, and twelve employees.
- Unit C ($N = 29$) is a subunit of a software development firm. All but one member of this unit are men. Of these, four hold management positions.
- Unit D ($N = 18$) is a firm working on the development of access control systems. The personnel in this unit is mostly engineers and IT specialists. Six (one woman) hold a management position.
- Unit E ($N = 16$) is a subunit of a different software development company. This unit comprises six men (all managers) and ten women (two in management positions).
- Lastly, Unit F ($N = 22$) is a firm operating in the financial sector. The personnel of this unit is mostly composed of middle-aged men, of whom four have managerial positions.

All units together, our sample comprises 87 men (68.0%) and 41 women (32.0%). The gender composition is very disparate across units, ranging from 75% women in Unit A to 3.4% in Unit C.[1]

Data were collected using self-administered computer-based questionnaires.[2] First, we initiated personal contact with the CEOs. After obtaining their agreement, both managers and employees in the units were asked to participate in the survey. All information was collected between 2016 and 2018. Only 4 out of the 128 respondents did not complete the questionnaire (3.1% missing data).

Measures

Response Variable: Gossip

Workplace gossip was collected by asking respondents three nested questions. First, each respondent was requested to indicate who of all their colleagues (*sender*) provided them with personal information about another colleague while the latter was absent from the conversation. After this, for each sender declared, respondents were asked to report who the object of the gossip was (*target*). Finally, for each pair sender–target, respondents had to characterize the tone of the information received as either positive, negative, or neutral (*valence*).

This tool is inspired by previous studies using the exact three-step procedure (Ellwardt et al., 2012b,c). Notice that the word 'gossip' was not used in the questionnaire. Since the term carries negative connotations, we avoided its usage to prevent non-response. This data collection procedure provides us with a number of "rated gossip triplets" (g_{srtv}) per unit, where s stands for the gossip sender, r for the respondent in the role of receiver, t for the target, and v for the valence of the contents. For analysis, these gossip triads are transformed into two dummy variables—*positive gossip* and *negative gossip*—as we explain in "Method."

Explanatory Variables: Same-Group Membership and Brokerage

Same-group membership and whether an individual has a broker status were computed using standard social network analysis tools.

The *Louvain algorithm* for graph partitioning (Blondel et al., 2008) was used to divide each of the six working units into smaller non-overlapping communities (here, informal groups). Graph partitioning comprises a family of algorithms, all of which use a set of relationship ties among a finite number of actors to uncover latent community structures, like cliques or groups of friends (Newman and Girvan, 2004; Blondel et al., 2008; Lancichinetti and Fortunato, 2009; Bruggeman et al., 2012). The solution given by the Louvain algorithm was used to create a dyadic-level variable (X_{ij}) capturing where two individuals (i, j) are members or not of the same group: $x_{ij} = 1$ indicates that i and j are group fellows, otherwise $x_{ij} = 0$.

To classify individuals as brokers or not, we used *betweenness centrality*—a measure of the extent to which an actor serves as a potential go-between for other pairs of actors (Freeman, 1977, 1978). As with graph partitioning, this procedure requires a set of relationship ties defined over a finite number of individuals. However, the outcome here is not a subset of actors but a value for each individual summarizing their "brokerage potential." These values were dichotomized as either "1" (broker) or "0" (non-broker) in a second step by running a hierarchical clustering (Borgatti et al., 2013) on the matrix of absolute distances for every pair of individuals. Notice that *broker* is an individual-level variable (X_i), unlike *same group* which is a dyadic-level variable (X_{ij}).

While the input of these two procedures has not been explained yet (the network of positive ties; see "Control Variables"), **Figure 1** visually displays the output in every unit. Isolates aside (individuals with no positive ties with anybody else), each unit contains three-to-four informal groups. The number of brokers is heterogenous across working units, ranging from only two in Unit D to seven in Units A and C. In total, 28 of our 128 individuals were classified as 'brokers' (21.9% of the sample).

Control Variables

Gender

Controlling for gender responds to the commonly held belief that women are more gossipy than men (Michelson and Mouly, 2000). Women are identified with "1" and men with "0" in our data.

[1]Further information about the sample is available in **Supplementary Table S1**.
[2]**Supplementary Table S2** contains all the variables used in the current study.

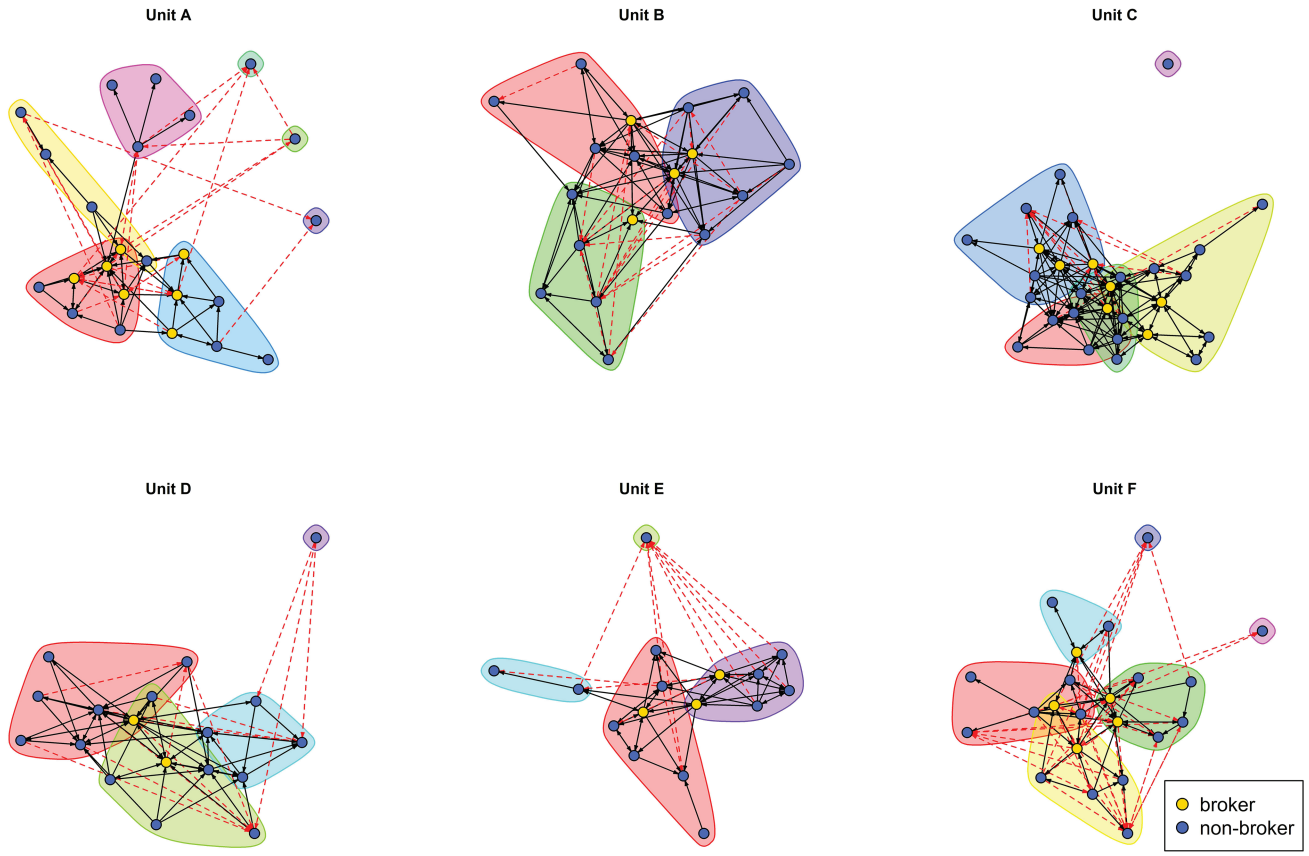

FIGURE 1 | Visual representation of the informal groups and brokers in every unit. Solid black arrows represent positive ties. Dashed red arrows represent negative ties. Colored areas in the background capture different informal groups. Individuals with a broker status are colored in yellow, non-brokers in blue.

Hierarchical Position

Individuals holding positions of responsibility in a company may have a more significant degree of involvement in the office grapevine. One can expect that many employees actively seek information about those they depend upon and whose decisions can affect them most (Ellwardt et al., 2012c). Further, managers and team leaders can activate "tall poppy syndrome" (Feather, 1998), making others find pleasure in pulling them down (Graffin et al., 2013). As a result of all this, gossip about bosses is likely to be more widespread than gossip about mere employees. We created a dummy variable where "1" stands for being a boss to control this potential bias. Otherwise, the value is "0." As a boss, we include any person whose title in the firm contains the words "manager," "director," "leader," or "chief."

Positive and Negative Relationship Ties

As mentioned before ("Structural Antecedents of Gossip"), underlying relationship ties like who has a good (or bad) relationship with whom (Wittek and Wielers, 1998; Ellwardt et al., 2012a; Yucel et al., 2021; Estévez et al., 2022) is one of the main predictors of gossip. These relationships, however, are not directly observable and need to be inferred somehow. Given the small size of all units, we collected sociometric data on 25 dimensions (e.g., friendship, trust, appreciation), including impressions and assessments (e.g., whether the other person is popular, does their job well, or deserves a salary raise or cut). Then, we used all these items to construct two binary networks (one of "positive ties" and the other of "negative ties") in a data-driven fashion.

The procedure followed the guidelines proposed by Vörös and Snijders (2017). First, we calculated the matrix overlap (Jaccard index) between each pair of items per unit and checked the consistency of these values across units. Iteratively, items with a Kendall W below 0.5 were excluded, meaning that the resemblance of these items across units was poor.[3] With the remaining items, we search for latent dimensions based on the similarity of the items in all six units (mean Jaccard indices). As **Figure 2** shows, two latent dimensions emerged. On the bottom left corner of the figure, we can see 15 items with a resemblance ranging from 19.3% up to 67.6%. All these items capture some positive relationship, impression, or assessment. On the top right corner, we see the remaining eight items. Here, overlaps are smaller (0.3–26.3%). Still, all these items

[3]Two items were excluded: "Are the executive pet" and "I want to make better than them."

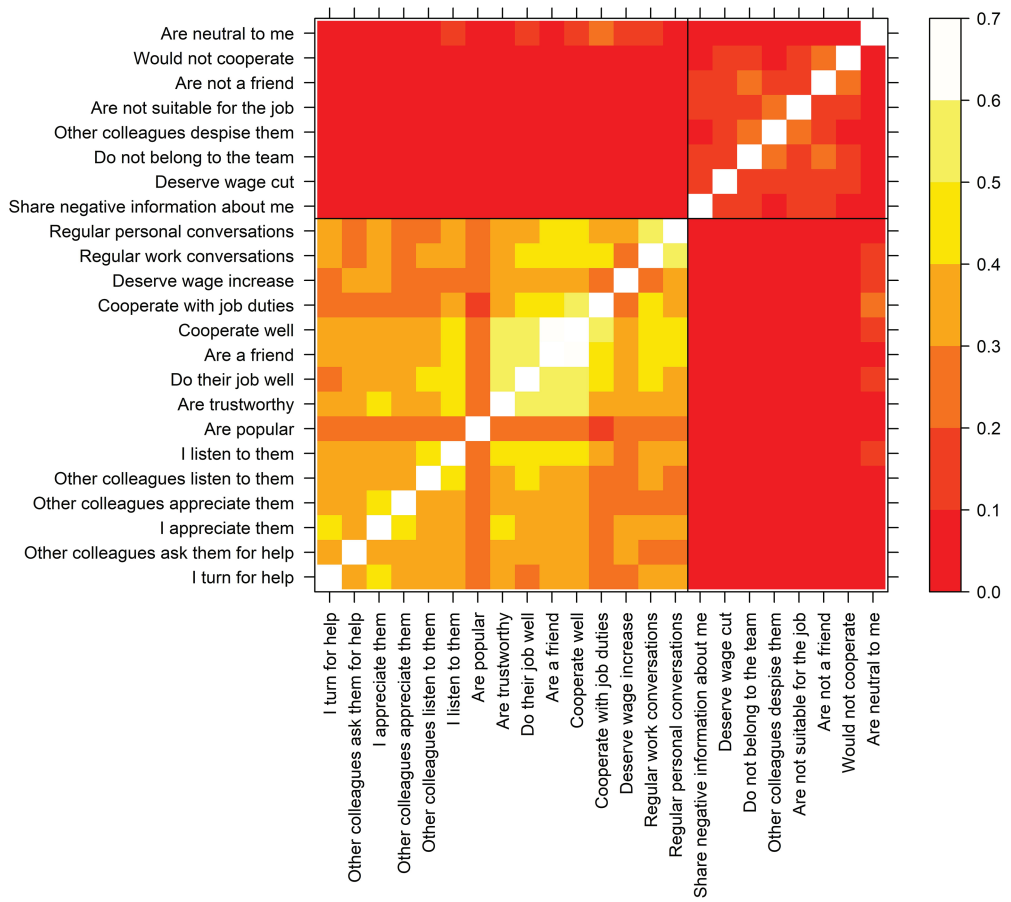

FIGURE 2 | Overlap between network items (mean Jaccard indices for all six units).

share that they manifest negativity (or indifference at best). We chose a two-dimension solution because the interpretation of a two-cluster solution was straightforward (positive vs. negative).[4]

Lastly, we turned the two clusters of items detected into binary network variables (X_{ij}): "positive ties" and "negative ties." The transformation was done by adding up all matrices in the same cluster into a "weighted" matrix (W_{ij}) first. Then, we set a minimum number of nominations as a threshold. If $w_{ij} \geq threshold$, then $x_{ij} = 1$. Otherwise $x_{ij} = 0$. Concretely, we used 10 out of 15 for the positive cluster and 3 out of 8 for the negative one. These threshold values were chosen to yield relatively low out-degrees.[5] Also, they do not create overlaps between the resulting positive and negative ties (i.e., no person in our sample nominates someone else positively and negatively).[6]

The resulting positive and negative ties are shown in **Figure 1**. Besides considering them as a control variable, the positive ties were used to identify informal groups and brokers in the work units (as explained in "Explanatory Variables: Same-Group Membership and Brokerage").

Method

Multilevel models (Snijders and Bosker, 2011) connected our response and explanatory variables. First, we retrieved all possible permutations of three individuals per working unit to create the sample space: $N(N-1)(N-2)$. Then, we created two dichotomous triadic-level variables (X_{ijk}) where we allocated the rated gossip triplets (g_{srtv}). Specifically, in the variable *positive gossip*, $x_{ijk} = 1$ indicates that person i sent positive gossip to j about target k. If not, $x_{ijk} = 0$. The same goes for the second variable, *negative gossip*, where $x_{ijk} = 1$ indicates that person i sent negative gossip to j about k, otherwise $x_{ijk} = 0$. The treatment of positive and

[4]Though some positive items emphasize affective aspects whereas others capture more instrumental ones (Lincoln and Miller, 1979; Umphress et al., 2003), these two aspects are closely intertwined in our data. Therefore, we did not distinguish between sub-types of positive ties in this article (e.g., a three- or four-dimension solution).

[5]Still, four respondents in Unit C had their out-going positive ties corrected. This is because of their seemingly indiscriminate nomination of others (22–28 ties sent or (almost) all colleagues). For these four respondents, we only kept ties when there are mutual (i.e., if i nominates j and j chooses i). A total of 78 ties were deleted.

[6]A further description of the positive and negative networks is available in **Supplementary Tables S3**, **S4**.

negative gossip as two different variables responds to the fact that we hypothesized opposite effects in the patterns of targeting depending on the gossip valance (see H2a and H2b, for instance). If combined together, some factors could cancel each other out. Notice that we did not analyze gossip characterized as neutral. The reason is that, unlike other scholars (Robbins and Karan, 2020; Dores Cruz et al., 2021a,b), we excluded exchanges with non-evaluative contents from our definition of gossip.

Because our models measure the contribution of individual-level and dyadic-level variables to the occurrence of specific triadic configurations ($x_{ijk}=1$), we always input one predictor in several different ways. For individual-level variables (X_i), we include three variants of the same variable capturing the contribution of the factor in question to the three gossip roles. For example, we have a predictor for the gender of the gossip sender [*woman* (*sender*)], receiver [*woman* (*receiver*)], and target [*woman* (*target*)]. For dyadic-level variables (X_{ij}), we use dyadic combinations, for instance, whether the sender and receiver share a positive tie [*positive tie* (*sender–receiver*)], the sender and target [*positive tie* (*sender–target*)], or the receiver and target [*positive tie* (*receiver–target*)].

To account for the cross-nested structure of our data, we built our models using examples handing triadic network data as inspiration (Bond et al., 1997; Card et al., 2010; Van Duijn, 2011; Swartz et al., 2015). Concretely, we let θ_{ijku} be our response variable, namely the probability of observing a specific positive (or negative) gossip triad in unit u, or $\Pr\left(gossip_{ijku}=1|i\neq j, i\neq k, j\neq k\right)$, assuming independent binary responses: $gossip_{ijku}\sim Bernoulli\left(\theta_{ijku}\right)$. Then, we modeled θ_{ijku} as:

$$logit\left(\theta_{ijku}\right)=\mu+A_u+B_{iu}+C_{ju}+D_{ku}+\varepsilon_{ijku}$$

where μ is the intercept or grand mean of the model. A_u refers to the random variation in the intercept across working units. B_{iu}, C_{ju}, and D_{ku} represent the random variation for the intercept across individuals in the roles of the sender, receiver, and targets, respectively. Finally, ε_{ijku} is the error term. Note that results are calculated for the six units altogether in order to guarantee statistical power for all the estimated parameters (some could not be estimated for each unit independently).

Models were fitted in four steps. First, we ran a null model that includes only random (non-fixed) factors to observe different sources of variability (namely, across units, senders, receivers, or targets). Second, we added the control variables: gender (*woman*), formal hierarchy (*boss*), *positive ties*, and *negative ties*. Third, we included all predictors related to membership in the *same group*. Lastly, we extended the previous model specification with the effects for *brokers*. Notice that we also included two extra dimensions. *Isolates* were included because they can distort the comparison between brokers and non-brokers (individuals whose connections are primarily within the same group). *Same group* (*sender–receiver–target*) is an interaction term seizing the effect when all three gossip parties are in the same group rather than in combinations of two (*sender–receiver*, *sender–target*, *receiver–target*).

Analyses were performed in the statistical system R (R Core Team, 2021), using the package *lme4* version 1.1–27-1 (Bates et al., 2015). Coefficients were standardized with the package *effectsize* version 0.6.0.1 (Ben-Shachar et al., 2020), and marginal and conditional R^2 values were computed using the package *insight* version 0.17.1 (Lüdecke et al., 2019). In the article, we only report standardized estimates for the fixed effects. For further results, the reader can see **Supplementary Tables S5** and **S6.**

RESULTS

Descriptive Results

Table 1 displays the summary statistics of our gossip data. Remember that gossip here is in the form of valued triplets (g_{srtv}). All six units together, 557 positive and 446 negative unique gossip triads were reported. These figures represent roughly 1.0 and 0.8% of all possible triplets (in the hypothetical scenario where every respondent had received gossip from everyone in the office about everyone else). More positive than negative triads are observed in units B, C, D, and E. In contrast, there are more negative than positive gossip triads in Units A and F. This is probably related to the presence of more negative relationship ties (and fewer positive ties) in these two units.[7]

Taken together, 74 of the 128 respondents (57.8%) reported at least one gossip triplet. Eighty-eight individuals (68.8%) were reported as senders in at least one positive gossip triad and 80 (62.5%) as senders of negative gossip. One hundred sixteen (90.6%) were reported as the target in at least one positive gossip triad and 94 (73.4%) as targets of negative gossip. If we disregard the valence of the gossip, 112 individuals (87.5%) were reported as either gossip senders or receivers, and 127 (99.2%) as gossip targets. Thus, all but a single subject was involved in the gossip triads collected in one of the three gossip roles (sender, receiver, target).

When we look at the interplay between gossip and same-group membership, in 45.6% of all positive gossip triads (254/557) and 32.0% of the negative gossip triads (178/446) are the sender and receiver members of the same group. In 230 of all positive gossip triads (41.3%) and 77 of all negative gossip triads (13.8%) are the sender and target in the same group. Similarly, in 195 of all positive gossip triads (35.0%) and 96 of all negative gossip triads (17.2%) are the receiver and the target group fellows. If we consider those cases where all three gossip parties are in the same group, they represent 20.5% of all the positive gossip triads (114/557) and 5.6% of all the negative gossip ones (5.6%). Overall, these numbers suggest that, compared to negative gossip, positive gossip is more likely shared among group members and focuses on other group members.[8]

[7]**Supplementary Tables S3**, **S4** shows that, while in units B, C, D and E, individuals send on overage 3.2–4.9 positive and 0.4–0.9 negative ties, in units A and F these same numbers are 2.0–2.2 and 1.0–1.9, respectively.

[8]**Supplementary Figure S1** displays a classification of all the gossip triads in our data by group membership and unit.

TABLE 1 | Summary statistics of gossip.

	Unit A	Unit B	Unit C	Unit D	Unit E	Unit F	Total
Gossip triads							
Positive gossip triads	79 (0.65%)	94 (1.62%)	157 (0.80%)	66 (1.35%)	123 (3.66%)	38 (0.43%)	557 (1.02%)
Negative gossip triads	144 (1.19%)	37 (0.64%)	38 (0.19%)	32 (0.65%)	85 (2.53%)	110 (1.25%)	446 (0.82%)
Potential triads (NA excluded)	12,144	5,814	19,656	4,896	3,360	8,820	54,690
Individuals							
Unit members	24	19	29	18	16	22	128
Gossip reporters	15	9	17	11	10	12	74
Positive gossip							
Senders	17	12	18	13	15	13	88
Receivers	14	9	14	8	8	7	60
Targets	21	19	29	16	15	16	116
Negative gossip							
Senders	17	10	14	9	15	15	80
Receivers	12	8	7	9	8	8	52
Targets	22	8	18	10	14	22	94

Before addressing the involvement of brokers in gossip, we inspect whether individuals qualified as brokers possess specific characteristics compared to the rest of the sample. No differences in gender are observed: 8 women and 20 men were categorized as brokers for 33 non-broker women and 67 non-broker men [$\chi^2(1) = 0.05, p = .830$]. Brokers, however, seem to be overrepresented in management positions: 47.1% of all bosses (16/34) were categorized as brokers compared to only 12.8% (12/94) of all employees [$\chi^2(1) = 15.23, p < .001$]. As **Figure 3** shows, there are no differences between brokers and non-brokers in age, tenure, or the number of negative ties received. And yet, brokers receive more positive ties and send more positive and negative ones.

Finally, **Table 2** describes the involvement of brokers in the three gossip roles. Overall, 41.8% of all positive triads (233/557) and 42.4% of all negative triads (189/446) have a broker as the sender; 48.3% of all positive triads and 36.1% of all negative triads have a broker as the receiver; and 23.0% of all positive gossip triads and 29.4% of all the negative gossip triads have a broker as the target. Since brokers only represent 21.9% of the total sample (28/128), at first sight at least, the involvement of brokers in all three gossip roles seems to be noteworthy.

Hypothesis Testing

The main results of the study are displayed in **Table 3**. Models 1 and 2 show the same model specification. The only difference between the two models is that the first has *positive gossip* as the response variable, whereas the second has *negative gossip*.

Focusing on the hypothesized effects, Model 1 shows that it has a positive contribution to gossip when the sender and receiver are in the same group: *same group* [*sender–receiver;* $\hat{\beta}$ = 0.28, 95% CI (0.16, 0.39)]. This finding provides support for H1a, which posits that being group fellows favors the exchange of positive gossip. A similar pattern is observed in Model 2: $\hat{\beta}$ = 0.27, 95% CI (0.15, 0.39). This finding supports H1b, according to which negative gossip is more likely to be exchanged between group fellows than between individuals in different groups. Together, these two findings corroborate our general expectation that gossip is more likely expressed among group members.

To address the hypotheses regarding the importance of group membership for who the target of the gossip is (H2a, b and H3a, b), we look at the contributions of *same group* (*sender–target*), *same group* (*receiver–target*), and *same group* (*sender–receiver–target*). Save the effect of *same group* (*sender–target*) on positive gossip [$\hat{\beta}$ = 0.25, 95% CI (0.15, 0.35)]; none of these predictors contribute to gossip. It entails that though respondents were more likely to send positive gossip about a target in the same group (which supports H2a), no differences between group members and non-members are observed for who the target of negative gossip is (going against H2b and H3b). Also, the fact that *same group* (*sender–target*), but neither *same group* (*receiver–target*) nor *same group* (*sender–receiver–target*) has an association with positive gossip suggests that group membership may affect gossip emission but not reception (contradicting H3a). Put differently, people could be more inclined to gossip positively about those in the same group but not necessarily with other group fellows.

Hypotheses 4–6 concern the association between having a broker position and workplace gossip. Model 2 evaluates H4 regarding the more active part of brokers in the spread of negative workplace gossip. Consistent with this hypothesis, we find that *broker* (*sender*) makes a positive contribution to negative gossip [$\hat{\beta}$ = 0.76, 95% CI (0.06, 1.47)]. In terms of gossip reception, no differences are observed between brokers and non-brokers. As **Table 3** shows, *broker* (*receiver*) has no association with either positive or negative gossip. These findings contradict H5a and H5b, respectively. Finally, H6 posited that brokers would likely be the objects of their colleagues' negative gossip. The positive contribution of *broker* (*target*) in Model 2 [$\hat{\beta}$ = 0.66, 95% CI (0.14, 1.18)] confirms

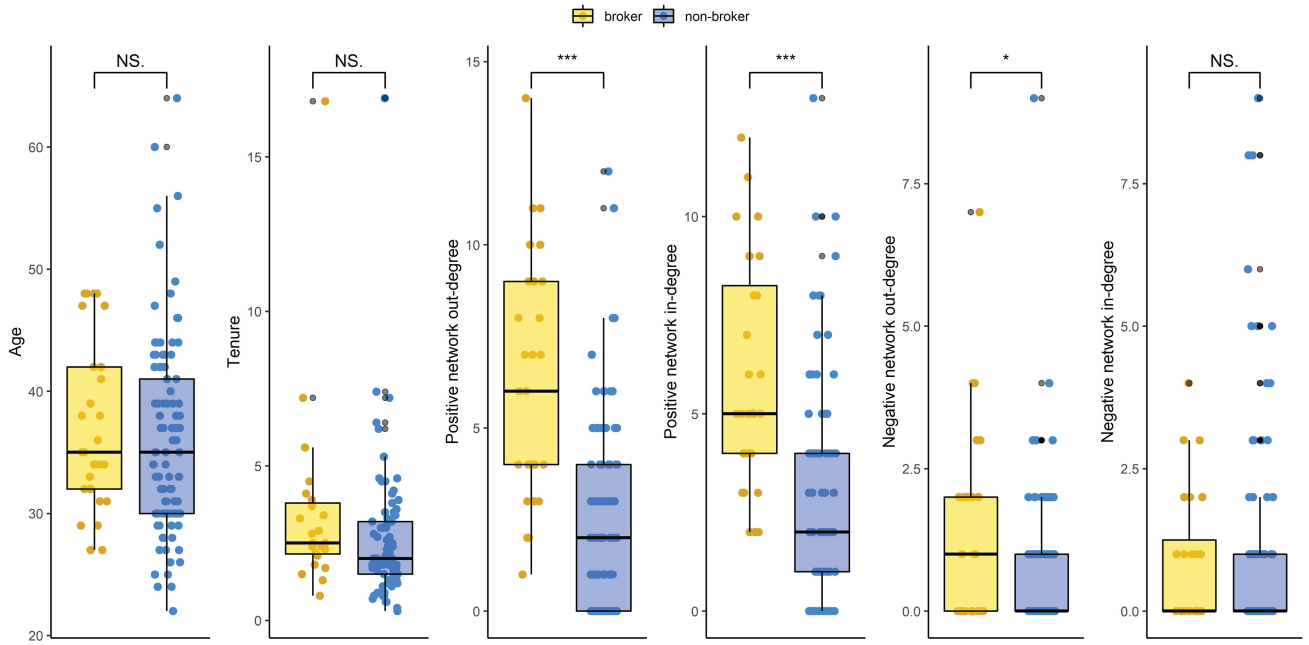

FIGURE 3 | Comparison between brokers and non-brokers. NS. non-significant, *$p < 0.05$, **$p < 0.01$, and ***$p < 0.001$.

TABLE 2 | Involvement of brokers in the gossip triads.

	Positive gossip				Negative gossip			
	As sender	As receiver	As target	Gossip triads	As sender	As receiver	As target	Gossip triads
Unit A	52	30	29	79	95	68	71	144
Unit B	38	55	23	94	16	14	3	37
Unit C	78	52	42	157	12	11	11	38
Unit D	18	35	6	66	14	4	1	32
Unit E	33	77	23	123	31	55	19	85
Unit F	14	20	5	38	21	9	26	110
Total	233	269	128	557	189	161	131	446

this expectation. Together, the findings in this paragraph support that brokers may send more negative gossip than those who are more embedded in a group. At the same time, however, brokers are also more likely to be targets of others' negative gossip.

Regarding the variables that worked as a control in the present study, no association was detected between *gender* and gossip (for either sending, receiving, or being its object). This lack of effect echoes some previous studies (Levin and Arluke, 1985; Leaperand and Holliday, 1995) denying that women are more gossipy than men.

In terms of *hierarchy*, our results reveal that bosses played a key part in the dynamics of gossip. In Model 1, both *boss* (*sender*) and *boss* (*receiver*) have a positive contribution, whereas all three factors [*boss* (*sender*), *boss* (*receiver*), *boss* (*target*)] have a positive contribution in Model 2. The above entails that those in managerial positions might be sending and receiving gossip more often when compared to employees (Kuo et al., 2018). As expected, bosses also seem to be those whom others gossip negatively about (Ellwardt et al., 2012c). Since the overlap between being a boss and having a broker status was substantive in our sample (16 of our 28 brokers were also bosses), to discard the possibility that brokers were negative targets simply because of their formal position, we reran Model 2 including the interaction *broker* (*target*) × *boss* (*target*). Results confirmed that the contribution of these two variables is independent while, strikingly perhaps, their interaction is non-significant. Arguably, both the brokers and the bosses are more likely negative gossip targets, at least so long as these two categories do not go together.

Isolates did not play any different role in gossip. As for the dyadic-level variables (the *positive* and *negative ties*), they chiefly confirmed what is expected based on the literature (see "Structural Antecedents of Gossip"). In Model 1, for example, *positive tie* (*sender–receiver*), *positive tie* (*sender–target*), and *positive tie* (*receiver–target*) have a positive association

TABLE 3 | Multilevel logistic estimates of the association between same-group membership/brokerage and gossip.

	Model 1 (positive gossip)			Model 2 (negative gossip)		
	Est.	95% CI		Est.	95% CI	
Constant	−8.64	−9.46	−7.81	−9.26	−10.17	−8.34
Individual-level control variables						
Woman (sender)	0.14	−0.17	0.45	0.04	−0.30	0.37
Woman (receiver)	0.00	−0.53	0.53	0.21	−0.32	0.75
Woman (target)	0.01	−0.18	0.19	−0.16	−0.41	0.09
Boss (sender)	0.43	0.16	0.70	0.44	0.15	0.73
Boss (receiver)	0.55	0.03	1.06	0.82	0.29	1.35
Boss (target)	−0.01	−0.18	0.16	0.24	0.03	0.46
Isolate (sender)	0.01	−0.30	0.33	0.03	−0.28	0.34
Isolate (receiver)	0.36	−0.16	0.89	−0.32	−0.92	0.29
Isolate (target)	−0.24	−0.47	0.00	0.16	−0.03	0.35
Dyadic-level control variables						
Positive tie (sender–receiver)	0.45	0.34	0.57	0.32	0.18	0.45
Positive tie (sender–target)	0.26	0.16	0.37	−0.20	−0.36	−0.05
Positive tie (receiver–target)	0.24	0.14	0.35	−0.26	−0.41	−0.11
Negative tie (sender–receiver)	−0.03	−0.16	0.10	0.23	0.14	0.32
Negative tie (sender–target)	−0.15	−0.31	0.00	0.26	0.20	0.33
Negative tie (receiver–target)	−0.14	−0.27	−0.01	0.25	0.18	0.32
Variables based on group membership						
Same group (sender–receiver)	0.28	0.16	0.39	0.27	0.15	0.39
Same group (sender–target)	0.25	0.15	0.35	−0.08	−0.23	0.06
Same group (receiver–target)	0.10	−0.05	0.26	0.13	−0.03	0.29
Same group (sender–receiver–target)	0.00	−0.11	0.11	0.05	−0.07	0.18
Variables based on broker status						
Broker (sender)	0.56	−0.12	1.23	0.76	0.06	1.47
Broker (receiver)	0.87	−0.42	2.15	0.22	−1.09	1.54
Broker (target)	−0.11	−0.53	0.31	0.66	0.14	1.18
Observations	57,378			57,378		
Marginal R^2	0.151			0.155		
Conditional R^2	0.749			0.782		

Marginal R^2 indicates the proportion of the model variance explained by the fixed effects only. Conditional R^2 indicates the proportion of the model variance explained by the fixed and random parts.

with gossip. In contrast, *negative tie* (*receiver–target*) has a negative association. These findings support that people are likely to share positive gossip with and about those they have a good relationship (McAndrew et al., 2007; Grosser et al., 2010), while they might avoid positive gossip if their receiver and target have a negative relationship with one another (Burt, 2001).

Model 2 reveals a positive association between *positive tie* (*sender–receiver*), *negative tie* (*sender–target*), *negative tie* (*receiver–target*), and negative gossip. Meanwhile, *positive tie* (*sender–target*) and *positive tie* (*receiver–target*) have a negative effect. Not surprisingly, people were more likely to share negative gossip with those they have a good relationship (Grosser et al., 2010) and about those with whom either themselves or their receiver have a troubled relationship (Wittek and Wielers, 1998; McAndrew et al., 2007; Estévez et al., 2022). In the meantime, negative gossip about friends (or friends of the receiver) was either unlikely or probably evaded (Burt, 2001).

Bewildering is the positive association between *negative tie* (*sender–receiver*) on negative gossip. It suggests that colleagues holding a negative opinion of one another were more likely to share negative gossip. One plausible explanation for this pattern is that the negative tie developed after the gossip because either specific comments about someone caused annoyance or gossip played havoc with the image of the sender (Turner et al., 2003; Gawronski and Walther, 2008; Farley et al., 2010; Caivano et al., 2020). However, the cross-sectional nature of the data does allow us to either confirm or refute this conjecture.

DISCUSSION AND CONCLUSION

Every organization has its informal structure that operates more or less independently from formal relations. This structure is often fragmented into small groups characterized by relative internal cohesion and differentiation from other groups (Stadtfeld et al., 2020). These groups and the individuals who can broker between informal groups have been considered in the literature to be essential for informational flow in a firm and the transmission of gossip in particular (Gluckman, 1963; Merry, 1984; Elias and Scotson, 1994; Beersma et al., 2019). Despite all this, few studies have empirically addressed the spread of social information within/across informal groups (Tassiello et al., 2018). In the present study, we formulated hypotheses

regarding the effect of informal groups and broker positions for gossip dynamics (who gossip with whom about whom). We tested our expectations using data from six firms in Hungary. Social network analysis techniques were used to identify informal groups and individuals in broker positions. Then, we used this information to predict how likely it is to observe positive or negative gossip while controlling for individual- and dyadic-level factors: gender, hierarchical position (boss vs. employee), and both positive and negative relationship ties.

Starting with the effects based on group membership, results revealed that it favors (positive and negative) gossip when the sender and receiver are members of the same informal group. This finding is consistent with a long literature suggesting that gossip is shared within groups primarily (Gluckman, 1963; Hannerz, 1967; Merry, 1984; Elias and Scotson, 1994; Kurland and Pelled, 2000; Kniffin and Wilson, 2010; Michelson et al., 2010). We also observed that individuals are more likely to send positive gossip about those in the same group. This agrees with our stated expectation (see H2a). That said, we did not observe that positive gossip about group members is shared with other group members (as captured by the null effect of *same group* (*sender–receiver–target*)). This detail raises the question of whether mechanisms other than group solidarity and signaling a commitment to in-group norms (which assume that all three gossip parties are members of the group; Ellwardt et al., 2012a) are behind the inclination to send positive gossip about group fellows. One explanation could be that, when praising group members, the sender flags their value as someone protective of their own. It is even possible that, in some cases, positive gossip attempts to enhance one's status among out-group members rather than signal a commitment to in-group fellows (McAndrew et al., 2007).

No evidence supports the hypothesis that negative gossip concentrates on targets outside the sender's and receiver's group. Based on our results, whether the target is part or not of one's informal group makes no difference at all for negative gossip. It contradicts our expectation that negative gossip avoids other group members to prevent conflicts or uncomfortable situations (Hallett et al., 2009; Giardini and Wittek, 2019b; Caivano et al., 2020). Furthermore, this finding also comes into conflict somehow with previous results in the literature. Both Kniffin and Wilson (2005) and Ellwardt et al. (2012a) noticed that negative gossip focuses on other team members. However, let us not forget that these other scholars examined row teams and formal units, where rewards demand high levels of cooperation. Unlike them, we focused on informal groups instead, where interdependencies are more affective than functional. Based on the discrepancy, one may speculate whether or not negative gossip can be an effective means of sustaining cooperation in groups that lack functional interdependencies (Feinberg et al., 2014; Giardini and Wittek, 2019a; Dores Cruz et al., 2019b). Future research may address this by comparing the impact of negative gossip on cooperation in formal vs. informal groups.

Moving to the effects based on brokerage, results support the expectations that individuals in broker positions spread more negative gossip (H4) and are more often the objects of their colleagues' negative gossip (H6). However, no association was detected between brokerage and (positive or negative) gossip reception. Since the data here are receiver-reported (i.e., respondents reported who sent gossip to them instead whom they sent gossip to), one explanation for this null result is that many brokers could leave much gossip unreported. Perhaps for fear of disclosing information involving colleagues at distant parts of the networks or because reporting it could make them look nosy. In this regard, future studies may benefit from alternative data-collection tools. All in all, our findings concur with previous studies advocating for a more nuanced picture of brokerage, in which not everything is advantageous about this position (Krackhardt, 1999; Xiao and Tsui, 2007; Barnes et al., 2016; Tasselli and Kilduff, 2017). Here, we observed that individuals in broker positions might have to pay a high reputational price in the form of loads of negative gossip about them.

Indeed, a follow-up question could be whether this more considerable amount of negative gossip detected may be caused by brokers sending more negative gossip in the first place (or the other way around). There is evidence that individuals who are targets of negative gossip respond to it by engaging in negative gossip (Zong et al., 2021). Consequently, we cannot discard the possibility of self-reinforcing dynamics: one part starts spreading negative gossip about the other, the latter learns about it and follows suit, etc.

Since brokers have an increased relevance as senders but not receivers of negative gossip, one can speculate about the reason behind this unbalance. One possibility is that brokers have some amplifying effect: once some piece of juicy information reaches them, they send it to many others. However, it could also be that brokers are not mere transmitters but the source. Since brokers may have more leeway to exploit gossip for personal benefits (Foster and Rosnow, 2006), the increased amount of negative gossip detected in this study comes maybe from lying or making up information (Peters and Fonseca, 2020).

Our last point before addressing the limitations of this study concerns the reasons why the effect of brokers on being the target of negative gossip disappears when they are bosses. This finding was somewhat unexpected since both brokers and bosses draw lots of negative gossip upon themselves as separate categories. One plausible explanation is that when the boss holds a broker position, this tempers the inclination others have to speak negatively about them. If so, brokering can act as a buffer to the natural tendency for a boss to become the gossip target at work (Ellwardt et al., 2012c).

Like any study, ours has many limitations. Methodologically, conclusions rest on a series of techniques that are novel in the gossip literature. Many of these, however, leave space for alternative operationalization. For instance, other graph partitioning algorithms exist, which can produce different classifications (Newman and Girvan, 2004; Lancichinetti and Fortunato, 2009; Bruggeman et al., 2012). Likewise, alternative metrics could be used to capture a subject's brokerage potential, including betweenness in a weighted rather than binary network (Opsahl et al., 2010). We always tried to use widely accepted measures as a rule of thumb, but agreement on which measure is best could change. On a similar note, different types of ties can be distinguished beyond simply positive vs. negative (for instance, expressive vs. instrumental; see Umphress et al., 2003) and used as the basis for group detection algorithms.

Finally, note that this study does not control for personality traits or psychological factors, although we partly attributed why brokers send negative gossip to a self-monitoring personality (Sasovova et al., 2010; Landis, 2016).

Taken together, our results demonstrate that structural aspects beyond the relationship ties in the gossip triad (Wittek and Wielers, 1998; Giardini and Wittek, 2019b) matter for workplace gossip dynamics. In studying some of these aspects (*viz.* informal groups and network brokerage), we gained further insights into the specific contexts where negative gossip is more likely a viable solution for the hassle of sustaining cooperation. Importantly, our findings suggest that brokers can use their structural position to control the social information in the organization. Yet, perhaps because of this, they are also subject to the negative evaluations of their colleagues.

DATA AVAILABILITY STATEMENT

The datasets supporting the present findings of this document including as a replication package and all code used in the article is readily available via https://github.com/joseluisesna/Gossip_in_Hungarian_firms.

ETHICS STATEMENT

The studies involving human participants were reviewed and approved by Research Ethics Committee of the Centre for Social Sciences, Budapest. The participants provided their written informed consent to participate in this study.

AUTHOR CONTRIBUTIONS

KT designed and supervised data collection and commented and worked on sections resulting in the current manuscript. JE developed the theoretical framework, performed statistical analyses, and wrote the first draft of the manuscript. All authors contributed to the article and approved the submitted version.

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SUPPLEMENTARY MATERIAL

The Supplementary Material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fpsyg.2022.815383/full#supplementary-material

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