Research on the Role of Internet Use and Embedding on Entrepreneurial Resilience in Major Crisis

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DOI: https://doi.org/10.30210/JMSO.202604.013

Submitted: Jun 12, 2026 Accepted: Aug 04, 2026

ABSTRACT

This study examines how Internet use and embedding influence entrepreneurial resilience during major crises. Drawing on a unique dataset of Chinese entrepreneurs during COVID-19, we distinguish between work-related and leisure-oriented Internet use and assess the effects of Internet embedding depth. The results show that Working Internet use strengthens entrepreneurial resilience, whereas Leisure Internet use weakens it. Internet embedding depth enhances resilience, but excessive embedding has a detrimental effect. Further analyses reveal heterogeneous effects across entrepreneur types: the effects of both Working and Leisure Internet use are stronger for female and necessity-driven entrepreneurs; the positive effect of Internet embedding is stronger for male and opportunity-driven entrepreneurs, while the negative effect of excessive embedding is more pronounced for male and necessity-driven entrepreneurs. The main contribution of this study is to move beyond the broad claim that digitalization supports resilience and to show that the resilience value of Internet use depends on entrepreneurs' online purposes and embedding conditions. The study also identifies gender- and motivation-based differences in these associations and offers practical implications for managing digital behavior during crises.

Keywords: Working Internet use, Leisure internet use, Internet embedding depth, Excessive internet embedding, Entrepreneurial resilience

1. Introduction

Entrepreneurial resilience involves adaptation, proactiveness, and the ability to seize opportunities in a challenging business environment [1]. Particularly in the context of major crises, entrepreneurs' ability to rapidly respond and enhance entrepreneurial resilience becomes particularly crucial. Major crises exert significant negative impacts on entrepreneurial activities. Beland et al. [2] using data from the Canadian Labor Force Survey, found that entrepreneurial activities in Canada declined by 10.1% to 14.8% during crisis. Similarly, Fairlie [3], drawing on data from the U.S. Census,

reported a 22% reduction in the number of active businesses in the United States during crisis periods. Especially during the COVID-19 pandemic, entrepreneurs have been negatively impacted to varying degrees [4-9]. In such situations, entrepreneurial resilience becomes particularly crucial during major crises [10-15].

In exploring the antecedents of entrepreneurial resilience, previous studies have primarily focused on individual traits, such as self-confidence [16], passion [17], flexibility, motivation, perseverance, and optimism [18]. In addition to individual characteristics, external contextual factors, such as entrepreneurs' social networks, also play an essential role in shaping entrepreneurial resilience [19]. Social networks represent a relatively stable system of relationships among interconnected individuals [20], and the Internet extends these relationships through online channels. With the rapid development and widespread utilization of the Internet, an increasing number of entrepreneurs are engaging in entrepreneurial activities through the Internet. Scholars utilizing datasets from different countries and regions, such as Canada [21], Germany [22] and China [23, 24], have validated the positive effects of Internet use on entrepreneurial performance in daily scenarios. However, the role of Internet use and embedding in entrepreneurial resilience during major crises remains an underexplored area in the existing literature [25]. Two research gaps motivate this study. First, prior studies often treat digitalization as a broad firm-level capability [14, 15], infrastructure condition, or transformation strategy. Less is known about how entrepreneurs' everyday Internet-use behaviors are associated with resilience during a crisis. Second, many studies emphasize the positive role of digital technologies [12], while paying less attention to the possibility that some forms of Internet use may consume attention, increase exposure to negative information, or create dependence on narrow information channels.

Based on the above considerations, we examine whether Internet use and embedding during a major crisis are associated with entrepreneurial resilience. Drawing on the 'Uses and Gratifications' theory [26, 27], we classify the motivations of Internet use into two major categories: working Internet use, with the purpose of acquiring information resources for work and study, and leisure Internet use, with the purpose of entertainment during leisure time. We further consider the depth of Internet embedding, categorizing it into Internet embedding depth and excessive Internet embedding.

To test our hypotheses, we use a unique dataset from China, which was implemented by the China Survey and Data Centre of Renmin University of China. The survey includes questions about respondents' income change and Internet use during the COVID-19 pandemic, and their personal and family situations. Building on this unique dataset, we further predict the influence of working Internet use on entrepreneurial resilience and find that working Internet use enhances entrepreneurial resilience. Then, based on a cognitive-behavioral model [28], we predict the impact of leisure Internet use on entrepreneurial resilience and find that leisure Internet use diminishes entrepreneurial resilience. Particularly, we explore the impact of Internet embedding depth on entrepreneurial resilience and find that Internet embedding depth is positively related to entrepreneurial resilience. We also extend the negative effects of network organization to the Internet domain, explore the impact of excessive Internet embedding on entrepreneurial resilience and find that excessive Internet

embedding is negatively related to entrepreneurial resilience.

This article makes the following main contributions. First, it contributes to the growing literature on digitalization and entrepreneurial resilience by shifting attention from broad digital transformation to concrete Internet-use behaviors during crisis conditions [29, 30]. Rather than claiming that Internet use is simply helpful or harmful, we show that work-related and leisure-oriented Internet use have different associations with income-based entrepreneurial resilience. Second, the study refines the digital resilience literature by showing that resilience depends not only on whether entrepreneurs go online, but also on what they do online and how they are embedded in digital information environments. This contribution responds to recent calls for more nuanced research on digital transformation, SME resilience, and entrepreneurial resilience in the digital era [11-15]. Third, the study offers an integrated theoretical framework. Uses and gratifications theory explains why entrepreneurs use the Internet for different purposes; the cognitive-behavioral model explains why leisure-oriented use may become harmful under crisis pressure; and embeddedness theory explains why digital embedding can be beneficial when it expands information and learning, but harmful when it creates dependence and information narrowing.

The rest of this article is organized as follows. In the following sections, we will review the literature and propose the four main research hypotheses based on relevant theories. Then, we detail the research design and report empirical results. Finally, we summarize the research findings, discuss its limitations, and suggest future research directions.

2. Literature Review

To better explain how Internet use shapes entrepreneurial resilience during major crises, we draw on uses and gratifications theory, the cognitive-behavioral model, and embeddedness theory to explain three related aspects of the research question: why entrepreneurs use the Internet, why some forms of Internet use may have unfavorable effects during crises, and why Internet-based connection may be both enabling and constraining.

Uses and gratifications theory suggests that media users actively select media to satisfy specific needs, such as information seeking, communication, learning, entertainment, relaxation, and social interaction [21, 31-33]. This perspective provides the basis for distinguishing work-related Internet use from leisure-oriented Internet use. Work-related Internet use is more closely associated with information acquisition, learning, and business communication, whereas leisure-oriented Internet use is more closely associated with entertainment, relaxation, and temporary escape. This distinction is important because Internet use should not be treated as a single homogeneous behavior.

The cognitive-behavioral model further helps explain the possible downside of leisure-oriented Internet use during crises. Prior research on problematic Internet use argues that online behavior may generate maladaptive cognition when psychological vulnerability, external stressors, and reinforcing online experiences interact [23]. During major crises, entrepreneurs may face anxiety, uncertainty, income pressure, and negative online information. Leisure activities can provide relaxation and temporary recovery [34], so leisure-oriented Internet use is not necessarily harmful. However, when

it becomes a response to crisis-related anxiety and diverts attention from business recovery, it may be associated with weaker entrepreneurial resilience.

Embeddedness theory is used to explain the role of Internet-based connection and information access. This theory suggests that actors' access to information, resources, and opportunities is shaped by their embeddedness in social and economic networks [35]. In this study, Internet embedding depth reflects entrepreneurs' reliance on Internet-based channels for information, communication, and learning. Such embedding may help entrepreneurs obtain timely information and maintain business connections during crises. Recent studies also show that digital technologies can support entrepreneurial and SME resilience under crisis conditions [6, 7]. At the same time, embeddedness theory cautions that excessive embeddedness may narrow information sources, increase dependence on existing networks, and reduce exposure to diverse views [35].

Overall, these theories help develop a more balanced view of Internet use during major crises. Internet use may support entrepreneurial resilience when it helps entrepreneurs obtain useful information, learn from others, communicate with stakeholders, and maintain psychological support. However, it may weaken resilience when it leads to distraction, avoidance, maladaptive cognition, dependence, or information narrowing. This balanced theoretical logic provides the basis for the four hypotheses developed below.

2.1 Working Internet Use and Entrepreneurial Resilience

Previous studies show that the Internet can significantly promote entrepreneurial performance through information channels in everyday situations [23]. We seek to examine whether this positive effect remains consistent during major crises. In the following, we discuss the impact of working Internet use on entrepreneurial resilience during major crises.

First, working Internet use during major crises helps entrepreneurs lower information barriers, assisting entrepreneurs in gaining a comprehensive understanding of the latest industry trends. Faced with a sudden crisis, entrepreneurs usually have limited understanding of the development and consequences of the major crisis [36]. Due to the objective needs of the real situation, entrepreneurs tend to mitigate uncertainty by acquiring sufficient information. However, the outbreak of sudden crisis makes the social structure less conducive to the free flow of information [37]. In such situations, the open nature of the Internet becomes a crucial channel for information dissemination during major crises [29, 30, 38, 39]. Entrepreneurs obtain business-related information through the Internet media platforms to understand and respond to customer needs [40]. Information acquisition has a significant impact on the performance of entrepreneurial enterprises, primarily reflected in mastering internal and external resources for enterprise development, which supports the continued operation of entrepreneurial ventures [41].

Second, working Internet use during major crises provides entrepreneurs with entrepreneurial experiences to cope with major crisis, promoting the process of entrepreneurial learning. Entrepreneurial learning is the process through which entrepreneurs acquire entrepreneurial knowledge based on existing experiences, observation, imitation, and entrepreneurial practice [42], including experiential learning [43, 44], cognitive learning [45, 46], and action learning [47]. The

complete entrepreneurial learning process consists of four stages: concrete experience, observation and reflection, formation of abstract concepts and generalizations, and testing implications of concepts in new situations [43, 44]. In the context of major crisis, entrepreneurial learning is further advanced through the real experiences gained by entrepreneurs, with a focus on crisis response. Due to the limitations of offline entrepreneurial learning, entrepreneurs need to engage in entrepreneurial learning through the Internet. On one hand, entrepreneurs can interact with other entrepreneurs online to seek new perspectives for problem-solving. On the other hand, entrepreneurs can find valuable references through working Internet use regarding the successful experiences of other entrepreneurs in handling crises. Through working Internet use, entrepreneurs can observe and learn how other entrepreneurs respond to crises to acquire skills, capabilities, and knowledge, finding new perspectives for addressing crises [46, 48]. Further, entrepreneurs closely integrate the information obtained from other entrepreneurs with the actual major crisis situation to form specific strategies for crisis response. Finally, inspired by others' experiences and behaviors in major crisis management, entrepreneurs can improve their own practices. The outcomes of these practices reflect the effectiveness of entrepreneurial learning, forming a feedback mechanism where entrepreneurial experience spirals upward, leading to enhanced entrepreneurial resilience [45, 49].

Third, working Internet use during major crises contributes to the development of psychological capital, thereby enhancing entrepreneurial resilience. On one hand, entrepreneurs can engage in deep interactions with other entrepreneurs through working Internet use, thereby enhancing their psychological capital during major crises. The outbreak of sudden crisis makes the social structure less conducive to the free flow of information [37], the Internet becomes an important channel for entrepreneurs to communicate, interact, and learn [38, 39]. Entrepreneurs can seek objective and crucial encouragement and feedback by exchanging entrepreneurial experiences on crisis management with other entrepreneurs online [16]. The continuous accumulation of entrepreneurial experiences cultivates entrepreneurs' self-confidence, enhances their psychological capital, and thereby strengthens entrepreneurial resilience [17, 50]. On the other hand, entrepreneurs can engage in authentic self-expression through working Internet use, thereby enhancing their psychological capital during major crises. Self-presentation is another essential function of the Internet in the crisis context [51]. Studies show that individuals expressing their authentic selves to others are more likely to experience positive emotions, including higher self-esteem and greater psychological well-being [52], and lower negative emotional impacts [53]. Entrepreneurs' face-to-face interactions and expressions are restricted to a certain extent during major crises [37], making online communication and expression even more important [38, 39]. Authentic self-presentation on the Internet can bring a series of positive emotions to entrepreneurs, such as optimism and greater life satisfaction, which is beneficial for mitigating negative emotions such as depression, anxiety, and stress [54]. It further contributes to the development of psychological capital for entrepreneurs [55]. Therefore, under the negative impact of a major crisis, working Internet use helps entrepreneurs in information acquisition, entrepreneurial learning, and the development of psychological capital, contributing to the enhancement of entrepreneurial resilience during major crises. This leads to Hypothesis 1:

H1: Working Internet use is positively related to entrepreneurial resilience during major crises.

2.2 Leisure Internet Use and Entrepreneurial Resilience

In addition to obtaining information resources for work, Internet users can engage in leisure and entertainment activities through the Internet [27]. The role of leisure Internet use is theoretically ambiguous. On the one hand, leisure activities may provide relaxation, psychological recovery, social connection, and temporary relief from stress, which may be valuable for entrepreneurs under pressure [56]. On the other hand, leisure-oriented Internet use during a crisis may increase exposure to negative information, absorb limited attention, encourage avoidance, and reduce the time and cognitive resources available for crisis response [28, 57]. Scholars hold conflicting perspectives on the role of leisure Internet use in general contexts. However, it remains unclear how leisure Internet use affects entrepreneurial resilience in the context of major crises.

According to the Cognitive-Behavioral Model, the experience of using the Internet can lead to abnormal cognition [28]. In the context of major crisis, the entrepreneur's anxiety is the psychopathology, negative messages on the Internet serve as stressors, and positive user experiences from entertainment Internet products are situational factors. The combined relationship of these three factors leads individuals to develop abnormal cognition regarding Internet use, known as maladaptive cognition.

Based on the Cognitive-Behavioral Model, individual psychopathology refers to the anxiety state of entrepreneurs under conditions of major crisis. The levels of negative emotions, such as worry, fear, and anxiety, triggered by major crisis are extremely high [4]. Under the negative impact of the major crisis, entrepreneurs not only face health risks but also encounter threats such as decreased business income and industry downturns, which further exacerbate anxiety and depression among entrepreneurs [58, 59]. Negative messages on the Internet during major crises act as a stressor. The Internet allows netizens to express opinions, participate in interactions, and vent emotions in a direct, open, and bold manner [60]. Major crises are characterized by their public, social, sensitive, urgent, and complex nature, attracting widespread attention and intense involvement from the public. This easily places audiences in states of panic and blind compliance. Such emotional states further encourage negative expressions, venting, continuous fermentation, and resonance on the Internet [61]. Situational factors refer to the positive user experiences from entertainment Internet products. Generally, users' engagement with entertainment-oriented Internet products tends to increase their fondness for the product and continuously bring about positive experiences [62]; the same applies to entrepreneurs. In other words, in the context of major crises, the anxiety experienced by entrepreneurs creates a fragile psychological foundation, making them more susceptible to the impact of negative online information. Additionally, positive user experiences from entertainment internet products can exacerbate this vulnerability, leading entrepreneurs to develop maladaptive cognitions, including distorted self-perceptions. This is primarily manifested as self-doubt, low self-efficacy, and negative self-evaluation. Low self-efficacy is detrimental to entrepreneurs' learning from failure [35, 63], reducing their willingness to continue entrepreneurship, and thus hindering entrepreneurial recovery [64]. This leads to Hypothesis 2:

H2: Leisure Internet use is negatively related to entrepreneurial resilience during major crises.

2.3 Internet Embedding Depth and Entrepreneurial Resilience

The preceding discussion suggests that different motives for Internet use have completely opposite effects on entrepreneurial resilience during major crises. However, it remains unclear whether different levels of Internet embedding depth have varying effects on entrepreneurial resilience under major crisis.

In the following, we discuss the impact of Internet embedding depth on entrepreneurial resilience during major crises. On one hand, as the level of Internet embedding deepens, entrepreneurs can access information more quickly, broadly, and flexibly. By promptly obtaining information during major crises, entrepreneurs can take flexible and adaptive actions to respond to crises, which helps enhance their entrepreneurial resilience [59]. Moreover, timely access to customer information can assist entrepreneurs in identifying the latest information and engaging more effectively in entrepreneurial activities [65]. Entrepreneurs are better able to strengthen feedback on user experiences through real-time communication with customers during major crises. It is more conducive for entrepreneurs to acquire information to upgrade products and services to meet market demands during major crises.

On the other hand, as the level of Internet embedding deepens, entrepreneurs can engage in entrepreneurial learning more quickly and effectively during major crises. According to the structural embeddedness perspective, individuals can access different resources based on their positions within the network [66]. As the depth of Internet embedding increases, entrepreneurs' positions in online networks become more crucial, and their connections with other entrepreneurs become closer. At the same time, the number of role models for entrepreneurs to imitate and learn from increases, which is beneficial for entrepreneurial learning under crisis conditions [42, 67]. Moreover, entrepreneurs can access more sources of entrepreneurial learning, including the latest market and industry dynamics, technical knowledge, and business management methods related to crisis response. This is beneficial for entrepreneurs to engage in practical learning and accumulate experience more effectively.

Therefore, under the negative impact of major crisis, as the level of Internet embedding deepens, entrepreneurs' speed, breadth, and depth of embedding in various social networks are further enhanced. Entrepreneurs are able to obtain more and higher-quality information and resources, which further contributes to enhancing entrepreneurial resilience during major crises. This leads to Hypothesis 3:

H3: Internet embedding depth is positively related to entrepreneurial resilience during major crises.

2.4 Excessive Internet Embedding and Entrepreneurial Resilience

Although Internet embedding depth may enhance entrepreneurial resilience during major crises, this does not mean that deeper or more frequent Internet-based engagement is always beneficial. Embeddedness can help actors access information, resources, and learning opportunities through network ties [68, 69]. In the context of major crises, Internet embedding provides entrepreneurs with

information, communication opportunities, and learning resources, which may help them maintain business connections and respond to environmental uncertainty [6, 7, 49, 63]. However, these benefits may depend on whether entrepreneurs remain exposed to diverse and useful information. Prior research on embeddedness and network structure suggests that overly cohesive or redundant networks may generate lock-in, reduce exposure to novel information, and constrain adaptation [70]. When Internet use becomes highly dependent on customized mobile messages and personalized information channels, entrepreneurs may enter a narrower digital environment. Research on algorithmic recommendation and information environments also suggests that personalized information flows may reduce exposure to alternative views and increase information narrowing [71, 72]. In this case, Internet-based connection may shift from a source of resource access to a source of dependence, repetition, and information narrowing.

Therefore, it is necessary to further examine excessive Internet embedding. In this study, excessive Internet embedding refers to entrepreneurs' frequent reliance on customized mobile messages and personalized information channels. This form of Internet embedding is different from ordinary Internet embedding depth. Internet embedding depth emphasizes the extent to which entrepreneurs are connected to Internet-based information and interaction channels, whereas excessive Internet embedding emphasizes the possible constraints created by overreliance on narrow and customized digital channels. This distinction allows us to consider not only the enabling side of Internet embedding, but also its potential downside during major crises.

Building on the embeddedness theory, network ties can provide access to information and resources, but overly closed or redundant networks may also create lock-in, dependence, and adaptation problems [73]. This phenomenon is known as the "embeddedness paradox" [74]. Scholars from different perspectives further confirmed the viewpoint of negative effects of network organizations [70, 75, 76], indicating that excessive network embeddedness can limit a company's ability to access external resources, weaken its learning ability, and hinder the improvement of entrepreneurial performance. In the digital context, a similar problem may arise when entrepreneurs rely too heavily on customized information flows and repeated online interactions. Such reliance may narrow their information environment and reduce their exposure to novel or diverse information.

Drawing from the perspectives of the aforementioned scholars, we propose that excessive Internet embedding hinders entrepreneurs' ability to acquire information and engage in effective communication with one another, thereby negatively impacting their entrepreneurial resilience during major crises. On one hand, excessive Internet embedding by entrepreneurs can lead to narrow social circles, which are detrimental to communication among entrepreneurs during major crises, just as excessive embeddedness can be detrimental in organizational networks. Excessive Internet embedding, characterized by high network density and clustering, can lead to entrepreneurial inertia and narrow viewpoints [75]. It may also lock entrepreneurs into narrow social circles [70], which can hinder effective communication and collaboration during times of major crisis. Such limited social interactions may restrict access to diverse perspectives and critical resources [77], thereby undermining the entrepreneur's ability to respond adaptively to rapidly changing environments,

especially during major crises. Furthermore, this can reduce entrepreneurial resilience in the face of crisis. During a major crisis, entrepreneurs need broad information, flexible judgment, and timely adaptation. If they repeatedly interact within familiar online circles, they may become less able to identify new risks, alternative solutions, or changing market signals.

On the other hand, excessive Internet embedding may lock entrepreneurs into customized information channels, preventing them from accessing diverse information during a major crisis. Excessive Internet embedding indicates that entrepreneurs rely heavily on a highly embedded Internet channel as an information source, which causes entrepreneurs to receive a large amount of homogeneous information. The encasement and confinement of homogeneous information result in information narrowing, which in turn raises concerns about information cocoons [72, 78]. In information cocoons, entrepreneurs' subjectivity diminishes as they become accustomed to receiving feedback and passive indoctrination. Moreover, information narrowing often evolves into group polarization, meaning that choices made after discussion among group members tend to become more extreme compared to individual choices [79]. In this process, the information cocoon is continuously reinforced, evolving from the narrowing of the entrepreneurs' information reception to a situation where only one type of information exists, while other information is suppressed or attacked. However, during a sudden crisis, entrepreneurs should actively seek diverse information to cope with the major crisis. Information narrowing and group polarization prevent entrepreneurs from accessing diverse information. Reliance on a single source of information may prevent entrepreneurs from protecting themselves against crisis threats [80, 81], thereby hindering crisis management and entrepreneurial recovery [82, 83]. Put differently, customized information channels may improve convenience, but they may also reduce exposure to alternative views and unfamiliar opportunities. During a major crisis, this narrowed information environment may weaken entrepreneurs' ability to identify changes in customer demand, evaluate external risks, and learn from diverse crisis responses.

In summary, excessive Internet embedding is detrimental to entrepreneurs' access to diverse information, which further hinders entrepreneurial resilience during a major crisis. Therefore, while Internet embedding depth captures the enabling side of digital connection, excessive Internet embedding captures its possible constraining side. This explains why, after discussing the positive role of Internet embedding depth, it is necessary to further examine excessive Internet embedding as a distinct source of potential risk. This leads to Hypothesis 4:

H4: Excessive Internet embedding is negatively related to entrepreneurial resilience during major crises.

3. Research Design

3.1 Sample Selection and Data Collection

We primarily utilize the Chinese General Social Survey (CGSS) for our research and analysis. Initiated in 2003, the CGSS is China’s first national, comprehensive, and continuous academic survey project, conducted by the China Survey and Data Centre at Renmin University of China. The CGSS collects data across multiple levels—society, communities, households, and individuals—exploring

topics of significant scientific and practical relevance. It serves as a multidisciplinary platform for economic and social data collection. Recognized for its credibility and rigor, the CGSS database is widely acknowledged by international scholars in entrepreneurship research [84-87]. The CGSS 2021 dataset, compared to previous years, includes a new section on the COVID-19 pandemic, addressing issues such as income, employment, government regulations, and other relevant topics during major crises. This provides crucial data for studying entrepreneurial resilience during major crises. We selected the CGSS 2021 data for empirical analysis, using STATA 17 software to filter the data. Given that this paper focuses on entrepreneurial recovery during the pandemic, we extracted a sample of entrepreneurs. Samples marked as "don't know" "not applicable" or "refused to answer" were removed, resulting in a valid sample size of 525. These 525 entrepreneur samples come from 19 regions across China, with ages ranging from 22 to 79, ensuring the representativeness of the sample.

3.2 Variable Measurement

3.2.1 Dependent variable

The dependent variable in this paper is entrepreneurial resilience under the major crisis. A significant amount of research has indicated that entrepreneurial resilience can be measured by entrepreneurial performance [88]. Accordingly, we use the CGSS questionnaire item "How has your household's current income changed compared to before the COVID-19 pandemic?" to measure this variable. The responses are categorized into five options: "decreased a lot," "decreased a little," "same as before the epidemic," "increased a little," and "increased a lot." For data analysis, these options are recoded from 1 (decreased a lot) to 5 (increased a lot). Thus, entrepreneurial resilience during the epidemic is represented as a five-point Likert scale.

3.2.2 Explanatory variable

Internet use and embedding. The core explanatory variable is Internet use and embedding. Based on the above discussion, we consider Internet use and embedding from the following four dimensions: working Internet use, leisure Internet use, Internet embedding depth, and excessive Internet embedding. Leisure Internet use evaluates Internet use during individuals' free time. The CGSS questionnaire includes the question, "In the past year, did you often engage in Internet activities during your free time?" Responses are categorized into five options: daily, several times a week, several times a month, several times a year or less, and never. These responses are recoded from 1 (never) to 5 (daily) for data analysis. Working Internet use assesses individuals' Internet use during work hours. To capture overall Internet use, we utilize the question: "In the past year, how often did you use the Internet (including mobile phone access)?" Responses are measured on a scale from 1 (never) to 5 (very often). The working Internet use variable is derived by subtracting leisure Internet use scores from overall Internet use scores. The questionnaire item "Which of the above media is your main source of information?" is utilized to measure Internet embedding depth. The responses were coded as follows: 1 = newspapers, 2 = magazines, 3 = radio, 4 = television, 5 = Internet (including mobile phone access), and 6 = mobile phone customized messages. Higher values correspond to a greater degree of Internet embedding. Existing research has found that personalized

customization and intelligent recommendation technologies can narrow the boundaries of information received by users, surrounding them with homogeneous content [89], thereby leading to excessive Internet embedding. Thus, excessive Internet embedding is measured using the question, "In the past year, how often did you use customized messages on your mobile phone?" Responses were coded on a scale from 1 (never) to 5 (very often).

3.2.3 Control variables

Following prior research [24, 87], we categorize the control variables into two levels: individual level and family level. The individual level contains gender, ethnicity, religion, political affiliation, age, age squared, marital status, educational status, social network and personal income. The family level contains household risk investment. The specific definitions of all variables used in this study are shown in Table 1.

Table 1. Variables and measurement

Variables	Measurement
Dependent variable	
Entrepreneurial resilience	5 point scale, decreased a lot = 1, increased a lot = 5
Independent variables	
Working Internet use	subtracting the results of leisure Internet use from the results of overall Internet use
Leisure Internet use	5 point scale, never = 1, daily = 5
Internet embedding depth	Newspapers = 1; magazines = 2; radio = 3; television = 4; the Internet = 5; mobile phone customised messages = 6
Excessive Internet embedding	5 point scale, never = 1, daily = 5
Control variables: individual level	
Gender	Male = 1; Female = 0
Ethnicity	Han = 1; otherwise = 0
Religion	Religious = 1; irreligious = 0
Political affiliation	Communist = 1; otherwise = 0
Age	Age of respondents
Age squared	Age squared of respondents
Marital status	Married = 1 (Cohabitation, first marriage with a spouse, remarriage with a spouse, separated but not divorced); otherwise = 0 (Unmarried, divorced, widowed)
Educational status	“Your current highest level of education is?”: currently studying = 1; dropped out of school = 2; incomplete = 3; graduation = 4
Social network	“In the past year, have you frequently gathered with

	relatives who do not live with you during your free time?": never = 1; several times a year = 2; several times a month = 3; several times a week = 4; every day = 5
Personal income	Log of total income (in RMB) last year
Control variable: family level	
Household risk investment	Engage in any investment activity = 1; No investment activity = 0

Source: By authors.

3.3 Analysis Strategies

In order to verify whether Internet use and embedding are associated with entrepreneurial resilience during major crises, the empirical model is constructed as follows:

$$Recovery_i = \beta_{1,1} + \beta_{2,1} Internet_i + \sum_{j=1}^{k} \gamma_{ij} \chi_{ij} + \varepsilon_i \quad (1)$$

$Recovery_i$ denotes entrepreneurial resilience during major crises for individual i and $Internet_i$ is Internet use and embedding for individual i. X_{ij} are the control variables in this paper, including individual level and family level. $\beta_{1,1}$ is the intercept term and $\beta_{2,1}$ is the regression coefficient of the explanatory variables. γ_{ij} is the regression coefficient of the control variables, and j is the number of control variables. ε_i is the random disturbance term. Since the variable for entrepreneurial resilience during major crises is a discrete ordered variable, we primarily utilize the Oprobit model for the analysis.

4. Results

4.1 Main Analysis

Table 2 reports the descriptive statistics for the model variables. The mean value of entrepreneurial resilience is 2.257, of which 57.3% of the entrepreneurs experienced a decline in income compared to the period before the major crisis, indicating that the majority of entrepreneurs were affected by the negative impact of the major crisis. The average age of the sample is 44.6 years, of which 60.2% are male, which is higher than the percentage of female respondents. The majority of the respondents are married, accounting for 82.1% of the sample. The mean value of total annual personal income (logarithmic) is 10.902 and the mean value of social network is 2.259. Only 14.3% of respondents are engaged in household risk investment.

Table 2. Descriptive statistics of variables

Variables	Obs	Mean	SD	Min	Max
Entrepreneurial resilience	525	2.257	0.943	1.000	5.000
Working Internet use	525	-0.253	0.807	-3.000	4.000
Leisure Internet use	525	4.545	1.112	1.000	5.000
Internet embedding depth	525	4.891	0.425	1.000	6.000

Excessive Internet embedding	525	2.360	1.428	1.000	5.000
Ethnicity	525	0.947	0.225	0.000	1.000
Gender	525	0.602	0.490	0.000	1.000
Religion	525	0.080	0.272	0.000	1.000
Political affiliation	525	0.063	0.243	0.000	1.000
Marriage	525	0.821	0.384	0.000	1.000
Risk investment	525	0.143	0.350	0.000	1.000
Age	525	0.446	0.114	0.220	0.790
Age squared	525	0.212	0.107	0.048	0.624
Education	525	3.754	0.664	1.000	4.000
Personal income	525	10.902	1.027	6.908	16.109
Social network	525	2.259	0.686	1.000	5.000

Source: By authors.

Table 3 reports the correlation coefficients between the variables. The correlation coefficients between the variables are all less than 0.5, indicating a low degree of correlation, which means that there is no serious multicollinearity issue.

Table 3. Correlation matrix

	1	2	3	4	5	6
1. Entrepreneurial resilience	1.000					
2. Working Internet use	0.088	1.000				
3. Leisure Internet use	-0.079	-0.433*	1.000			
4. Internet embedding depth	0.084	0.025	0.416*	1.000		
5. Excessive Internet embedding	-0.113*	-0.040	0.099	0.140*	1.000	
6. Ethnicity	0.101	0.020	-0.059	-0.041	-0.047	1.000
7. Gender	0.069	0.020	-0.022	0.030	-0.062	-0.020
8. Religion	-0.066	0.006	-0.031	0.042	0.024	-0.117*
9. Political affiliation	-0.012	0.004	0.078	0.066	0.100	-0.008
10. Marriage	-0.073	-0.017	-0.053	-0.002	0.045	-0.045
11. Risk investment	0.114*	-0.027	0.113*	0.053	0.019	0.048
12. Age	-0.031	0.059	-0.443*	-0.324*	-0.009	0.026
13. Age squared	-0.018	0.068	-0.473*	-0.348*	-0.025	0.029
14. Education	0.080	0.005	0.114*	0.094	0.023	0.065
15. Personal income	0.024	0.009	0.234*	0.193*	0.083	0.013
16. Social network	0.121*	-0.012	0.130*	0.129*	-0.002	-0.022
	7	8	9	10	11	12
7. Gender	1.000					

8. Religion	-0.061	1.000				
9. Political affiliation	0.146*	-0.019	1.000			
10. Marriage	-0.045	0.028	0.039	1.000		
11. Risk investment	0.121*	0.080	0.074	-0.037	1.000	
12. Age	-0.025	0.049	0.046	0.270*	-0.093	1.000
13. Age squared	-0.012	0.044	0.039	0.218*	-0.087	0.990*
14. Education	0.068	-0.081	0.049	-0.016	0.053	-0.062
15. Personal income	0.250*	-0.029	0.114*	-0.105	0.301*	-0.382*
16. Social network	-0.011	-0.019	0.028	-0.077	0.124*	-0.178*
	13	14	15	16		
13. Age squared	1.000					
14. Education	-0.061	1.000				
15. Personal income	-0.388*	0.146*	1.000			
16. Social network	-0.172*	0.065	0.204*	1.000		

Note: * shows the significance level at 1%.

Source: By authors.

Combining the above definitions of the relevant variables and econometric models, we conduct regression tests for each of the four research hypotheses. The regression results are presented in Table 4.

Table 4. Regression Results for the Sample of Entrepreneurs

Variable	1	2	3	4
Working Internet use	0.124*			
Leisure Internet use		-0.115**		
Internet embedding depth			0.282**	
Excessive Internet embedding				-0.074**
Ethnicity	0.441*	0.413	0.465*	0.427*
Gender	0.143	0.133	0.138	0.123
Religion	-0.215	-0.225	-0.236	-0.207
Political affiliation	-0.134	-0.089	-0.163	-0.093
Marriage	-0.103	-0.112	-0.110	-0.101
Risk investment	0.331**	0.349**	0.319**	0.321**
Age	-3.499	-2.425	-4.947	-3.333
Age squared	3.618	2.031	5.580*	3.528
Education	0.109	0.125	0.097	0.112
Personal income	-0.069	-0.062	-0.067	-0.053
Social network	0.181**	0.188**	0.168**	0.176**

Observations	525	525	525	525
Pseudo R^2	0.024	0.025	0.025	0.025

Note: *p < 0.1 **p < 0.05 ***p < 0.01.

Source: By authors.

Table 4 includes the effects of all control variables. In column (1) of Table 4, we incorporate the working Internet use. We find that working Internet use has a significant and positive effect on entrepreneurial resilience ($\beta = 0.124$, $p < 0.1$). This result supports Hypothesis 1, which describes the positive correlation between working Internet use and entrepreneurial resilience. Column (2) of Table 4 introduces the leisure Internet use. The impact of leisure Internet use on entrepreneurial resilience is significant and negative ($\beta = -0.115$, $p < 0.05$), which provides support for the idea that leisure Internet use during major crises is detrimental to entrepreneurial resilience (Hypothesis 2). Similarly, we incorporate the Internet embedding depth in column (3) of Table 4. Internet embedding depth is statistically significant ($\beta = 0.282$, $p < 0.05$), which indicates that an increasing Internet embedding depth during major crises contributes to entrepreneurial resilience (Hypothesis 3). Furthermore, we investigate the impact of excessive Internet embedding during major crises on entrepreneurial resilience in column (4) of Table 4. The result is that excessive Internet embedding has a significant and negative relationship with entrepreneurial resilience ($\beta = -0.074$, $p < 0.05$), which supports Hypothesis 4.

4.2 Further Analysis

The main analysis examines the overall association between Internet use, Internet embedding, and entrepreneurial resilience during a major crisis. However, the theoretical discussion also suggests that the role of Internet use may depend on entrepreneurs' crisis conditions and resource constraints. Work-related Internet use, leisure-oriented Internet use, and Internet embedding are not likely to affect all entrepreneurs in the same way, because entrepreneurs differ in their access to resources, exposure to pressure, risk perceptions, and ability to use digital channels for adaptation. Therefore, we further examine whether the main relationships vary across gender and entrepreneurship type.

There is ample evidence that the impact of major crises is not gender-neutral [90]. Men and women may differ in entrepreneurial motivation and career reasons [91], participation in entrepreneurial commercialization activities [92], and work-family pressures [93]. These differences may shape how entrepreneurs use digital resources and how they recover from crisis-related shocks. For example, if female entrepreneurs face greater family or resource constraints during crises, work-related Internet use may become a more important channel for information acquisition, learning, and business communication. At the same time, leisure-oriented Internet use may be more costly when time and attention are already constrained.

We also consider differences between necessity-driven and opportunity-driven entrepreneurs. These two types of entrepreneurs often differ in their reasons for entering entrepreneurship, available resources, growth aspirations, and exposure to survival pressure [91]. Necessity-driven entrepreneurs may rely more heavily on accessible digital resources when facing income pressure, whereas

opportunity-driven entrepreneurs may be better positioned to use digital connections to identify new opportunities and adjust business activities. Therefore, examining entrepreneurship type helps provide a more nuanced understanding of when Internet use and embedding are more strongly associated with resilience during a major crisis.

A grouping analysis is conducted to examine whether heterogeneity exists in the relationship between Internet use and embedding and entrepreneurial resilience across different genders and types of entrepreneurship. These are reported in Tables 5a, 5b, 5c and 5d in the Appendix. The ordered probit (Oprobit) results in Table 5a and Table 5b indicate that the impact of Internet use and embedding during major crises on entrepreneurial resilience differs by gender. Specifically, working Internet use has a significant positive relationship with the resilience of female entrepreneurs (β = 0.194, $p < 0.1$), while leisure Internet use exerts a significant negative relationship with their resilience (β = -0.231, $p < 0.05$). For male entrepreneurs, Internet embedding depth shows a significant positive relationship with entrepreneurial resilience (β = 0.377, $p < 0.1$), whereas excessive Internet embedding has a significant negative relationship (β = -0.087, $p < 0.1$).

Table 5a. The impact of entrepreneurial resilience on entrepreneurs of different genders

Variable	(1)		(2)	
	Male	Female	Male	Female
Working Internet use	0.065	0.194*		
Leisure Internet use			-0.010	-0.231**
Ethnicity	0.698**	0.005	0.704**	-0.056
Religion	0.007	-0.428*	0.003	-0.402*
Political affiliation	-0.156	0.061	-0.155	0.132
Marriage	-0.119	-0.145	-0.128	-0.130
Risk investment	0.108	0.844***	0.118	0.812**
Age	-5.939	2.423	-5.813	3.295
Age squared	6.535	-3.165	6.375	-4.626
Education	-0.051	0.291**	-0.056	0.335***
Personal income	-0.007	-0.171	-0.007	-0.107
Social network	0.205**	0.195	0.204**	0.178
Observations	316	209	316	209
Pseudo R^2	0.023	0.051	0.022	0.057

Note: *$p < 0.1$ **$p < 0.05$ ***$p < 0.01$.

Source: By authors.

Table 5b. The impact of entrepreneurial resilience on entrepreneurs of different genders

Variable	(3)		(4)	
	Male	Female	Male	Female
Internet embedding depth	0.377*	0.238		

Excessive Internet embedding			-0.087*	-0.046
Ethnicity	0.765**	-0.063	0.640*	-0.019
Religion	-0.050	-0.423*	-0.015	-0.388
Political affiliation	-0.197	0.108	-0.113	0.178
Marriage	-0.138	-0.086	-0.112	-0.091
Risk investment	0.105	0.724**	0.119	0.717**
Age	-7.990*	0.274	-5.254	0.997
Age squared	9.272**	-0.426	5.864	-1.483
Education	-0.059	0.297**	-0.054	0.314**
Personal income	-0.002	-0.148	0.001	-0.125
Social network	0.204**	0.162	0.198**	0.176
Observations	316	209	316	209
Pseudo R^2	0.027	0.045	0.027	0.043

Note: *$p < 0.1$ **$p < 0.05$ ***$p < 0.01$.

Source: By authors.

Entrepreneurship can be classified into necessity-driven and opportunity-driven entrepreneurship [94]. Necessity-driven entrepreneurs generally focus on objectives such as alleviating poverty, reducing conflict, and improving quality of life [95], whereas opportunity-driven entrepreneurs tend to seize market opportunities during the entrepreneurial process to realize their ideals and goals rather than solely pursuing financial returns [96]. Based on existing literature [33, 97], we use the survey question "Which of the following scenarios best fits your current job situation?" to categorize different types of entrepreneurship. Respondents who identified as "being an owner (or a partner)" are classified as opportunity-driven entrepreneurs, while those who selected "self-employment" or "freelancer" are classified as necessity-driven entrepreneurs. A heterogeneity analysis was then conducted, focusing on differing entrepreneurial motivations, with the empirical results presented in Table 5c and Table 5d. The data demonstrate that, compared to opportunity-driven entrepreneurs, working Internet use during major crises significantly enhances entrepreneurial resilience among necessity-driven entrepreneurs (β = 0.258, $p < 0.01$), while leisure Internet use during major crises significantly diminishes their resilience (β = -0.220, $p < 0.01$). Additionally, excessive Internet embedding during major crises has a significant negative relationship with the entrepreneurial resilience of necessity-driven entrepreneurs (β = -0.103, $p < 0.05$). In contrast, for opportunity-driven entrepreneurs, an increasing Internet embedding depth during major crises significantly enhances entrepreneurial resilience (β = 0.486, $p < 0.05$).

Table 5c. The impact of entrepreneurial resilience on different types of entrepreneurship

Variable	(1)		(2)	
	Necessity	Opportunity	Necessity	Opportunity
Working Internet use	0.258***	-0.129		

Leisure Internet use			-0.220***	0.108
Ethnicity	0.640*	0.323	0.595	0.342
Gender	0.130	0.106	0.103	0.110
Religion	-0.389*	-0.028	-0.429*	-0.036
Political affiliation	-0.098	-0.379	-0.006	-0.419
Marriage	-0.102	-0.197	-0.147	-0.214
Risk investment	0.258	0.337	0.276	0.310
Age	-3.159	-3.427	-0.883	-4.156
Age squared	3.033	4.002	-0.256	5.159
Education	0.109	0.119	0.133	0.099
Personal income	-0.137*	0.040	-0.129*	0.029
Social network	0.315***	-0.070	0.336***	-0.072
Observations	383	142	383	142
Pseudo R^2	0.043	0.025	0.045	0.025

Note: *$p < 0.1$ **$p < 0.05$ ***$p < 0.01$.

Source: By authors.

Table 5d. The impact of entrepreneurial resilience on different types of entrepreneurship

Variable	(3)		(4)	
	Necessity	Opportunity	Necessity	Opportunity
Internet embedding depth	0.192	0.486**		
Excessive Internet embedding			-0.103**	0.000
Ethnicity	0.619*	0.352	0.628*	0.299
Gender	0.125	0.103	0.098	0.106
Religion	-0.358	-0.114	-0.358	-0.006
Political affiliation	-0.108	-0.436	-0.053	-0.382
Marriage	-0.113	-0.222	-0.094	-0.214
Risk investment	0.233	0.341	0.238	0.348
Age	-4.642	-5.682	-2.914	-3.266
Age squared	5.000	7.050	3.014	3.792
Education	0.096	0.093	0.111	0.120
Personal income	-0.122	0.050	-0.099	0.038
Social network	0.296***	-0.060	0.300***	-0.067
Observations	383	142	383	142
Pseudo R^2	0.032	0.030	0.037	0.022

Note: *$p < 0.1$ **$p < 0.05$ ***$p < 0.01$.

Source: By authors.

4.3 Robustness Checks

Since the variable for entrepreneurial resilience during major crises is a discrete ordered variable, the empirical analysis employs either the ordered probit (Oprobit) model or the ordered logit (OLogit) model. To ensure the robustness of the empirical findings, we conduct robustness tests utilizing alternative empirical methods, such as Ologit model. As shown in Table 6, while the regression coefficients for the explanatory variables differ in magnitude across the models, the direction and significance of the results remain consistent. Thus, the empirical findings of this study demonstrate strong robustness, making the conclusions drawn from them reasonably reliable.

Table 6. Robustness tests

Variable	(1)	(2)	(3)	(4)
Working Internet use	0.217*			
Leisure Internet use		-0.177*		
Internet embedding depth			0.447**	
Excessive Internet embedding				-0.143**
Ethnicity	0.920**	0.869**	0.927**	0.868**
Gender	0.277	0.253	0.259	0.240
Religion	-0.391	-0.387	-0.432	-0.361
Political affiliation	-0.142	-0.067	-0.188	-0.049
Marriage	-0.250	-0.250	-0.252	-0.235
Risk investment	0.493*	0.525*	0.485*	0.499*
Age	-6.316	-5.021	-8.896	-6.111
Age squared	6.484	4.454	9.894*	6.407
Education	0.181	0.215	0.171	0.197
Personal income	-0.115	-0.101	-0.111	-0.084
Social network	0.384***	0.392***	0.369**	0.371**
Observations	525	525	525	525
Pseudo R^2	0.027	0.027	0.027	0.029

Note: *$p < 0.1$ **$p < 0.05$ ***$p < 0.01$.

Source: By authors.

5. Discussion and Conclusion

5.1 Conclusion

The research focus of this paper is to examine how different Internet-use purposes and digital embedding conditions are associated with income-based entrepreneurial resilience during a major crisis. In the current entrepreneurial market characterized by rapid changes and high uncertainty, entrepreneurial resilience has attracted continuous attention and research. Numerous studies have focused on the negative impacts of crises on entrepreneurial activities [2-5], but relatively little

research has examined how specific Internet-use behaviors are associated with entrepreneurial resilience during major crises. Given that the positive impact of Internet use on entrepreneurial resilience has been suggested in daily scenarios [23, 24, 40], we further investigate whether this positive relationship remains consistent in major crisis situations. We focus on the impact of Internet use and embedding during major crises on the entrepreneurial resilience, aiming to contribute to this line of research in this area. Using the 2021 CGSS data, we select a sample of entrepreneurs and conduct regression analysis to examine the influence of Internet use and embedding during major crises on entrepreneurial resilience. Our results suggest the following findings.

First, we find that working Internet use during major crises enhances entrepreneurial resilience. This finding is consistent with Hong's (2007) study, confirming that the Internet can effectively help entrepreneurs overcome information barriers [34]. When entrepreneurs engage in working Internet use during major crises, they can access more business-related information. This conclusion further supports the viewpoint that successful entrepreneurial experiences on the Internet during major crises can facilitate learning and imitation, aiding crisis response [46]. Additionally, it validates the viewpoint that working Internet use helps entrepreneurs build psychological capital and enhance entrepreneurial resilience [54]. Furthermore, heterogeneity analysis indicates that the positive impact of working Internet use during major crises on entrepreneurial resilience is more significant for female entrepreneurs and necessity-driven entrepreneurs.

Second, we find that leisure Internet use during major crises is detrimental to entrepreneurial resilience. The conclusion represents a further application of the cognitive-behavioral model in the field of entrepreneurship [28]. When entrepreneurs engage in leisure Internet use during major crises, the anxiety brought by the crisis, the negative messages on the Internet, and the continuous exposure to entertainment Internet products providing positive experiences collectively contribute to lower entrepreneurial self-efficacy. It ultimately hinders entrepreneurial resilience during major crises. Additionally, heterogeneity analysis indicates that the negative impact of leisure Internet use on entrepreneurial resilience is more significant for female entrepreneurs and necessity-driven entrepreneurs.

Third, we find that the increasing Internet embedding depth during major crises enhances entrepreneurial resilience. This conclusion aligns with Stephan's (2022) study, which suggests that timely access to information allows entrepreneurs to implement flexible and adaptive strategies in response to crises, thereby enhancing their entrepreneurial resilience [59]. It further validates that widespread online social interactions during major crises facilitate the continuity of entrepreneurial activities, thereby enhancing entrepreneurial resilience in the face of adversity [98]. Additionally, heterogeneity analysis indicates that the positive impact of the increasing Internet embedding depth during major crises on entrepreneurial resilience is more significant for male entrepreneurs and opportunity-driven entrepreneurs.

Fourth, we find that excessive Internet embedding during major crises is detrimental to entrepreneurial resilience. This conclusion supports the negative effects of network organization proposed by Uzzi (1996). It further suggests that excessive Internet embedding locks entrepreneurs

into specific networks and prevents them from accessing information and knowledge outside the network, ultimately reducing entrepreneurial performance [73]. Moreover, this conclusion confirms that excessive Internet embedding leads to information narrowing, raising concerns about information cocoons [72, 78], and is detrimental to entrepreneurs' crisis response. Additionally, heterogeneity analysis indicates that the negative impact of excessive Internet embedding is more significant for male entrepreneurs and necessity-driven entrepreneurs.

5.2 Theoretical Implications

Our findings offer three main theoretical implications. First, this study contributes to the literature on digitalization and entrepreneurial resilience by shifting attention from broad digital transformation to concrete Internet-use behaviors during crisis conditions. Recent studies have shown that digitalization, digital transformation, and digital infrastructure can support entrepreneurial firms and SMEs in responding to crisis conditions [6, 7, 9, 10, 50]. Prior research has also examined the positive role of Internet use in entrepreneurship and entrepreneurial performance in non-crisis or general settings [21, 23, 24]. However, this literature often treats digitalization or Internet use as a general resource, infrastructure condition, or firm-level capability. Our study provides a more fine-grained view by showing that different Internet-use purposes are associated with different resilience outcomes. Specifically, work-related Internet use is positively associated with income-based entrepreneurial resilience, whereas leisure-oriented Internet use is negatively associated with it. This finding suggests that the resilience value of the Internet depends not only on whether entrepreneurs use the Internet, but also on what they use it for during a major crisis.

Second, this study enriches the embeddedness perspective by extending the discussion of embeddedness to Internet-based information environments. Embeddedness can help actors access information, resources, and learning opportunities through network ties [68, 69]. In crisis conditions, Internet embedding depth may help entrepreneurs obtain timely information, maintain business connections, and respond to environmental uncertainty. This is consistent with research emphasizing the importance of digitalization, ICT infrastructure, digital capability, and adaptive responses in crisis or failure contexts [6, 7, 49, 63]. However, embeddedness theory also cautions that overly cohesive or redundant networks may generate lock-in and reduce access to diverse information [69, 70]. In the digital context, excessive Internet embedding may create dependence on narrow or customized information channels, reduce exposure to alternative views, and increase the risk of information narrowing or information cocoons [71, 72]. Therefore, digital embeddedness should not be understood only as a source of resource access. It can also become a source of constraint when entrepreneurs rely too heavily on repeated online interactions or personalized information flows. This finding highlights the dual role of digital embeddedness in entrepreneurial resilience and clarifies why both Internet embedding depth and excessive Internet embedding need to be considered.

Third, this study develops a more integrated theoretical explanation of Internet use and entrepreneurial resilience. Uses and gratifications theory suggests that individuals actively use media to satisfy different needs, such as information seeking, communication, learning, entertainment, and social interaction [26, 51]. This perspective helps explain why entrepreneurs use the Internet for

different purposes. The cognitive-behavioral model further suggests that Internet-related behavior may become problematic when psychological vulnerability, external stressors, and reinforcing online experiences interact [28]. This helps explain why leisure-oriented Internet use may become unfavorable under crisis-related anxiety and negative online information. Embeddedness theory suggests that actors' access to information, resources, and opportunities is shaped by their embeddedness in social and economic networks [69, 70, 98]. This helps explain why Internet-based connection may provide both resources and constraints. Taken together, these perspectives suggest that Internet use is associated with entrepreneurial resilience through a combination of online purpose, crisis-induced cognition, and digital information environment. This integrated view moves beyond a simple positive view of digitalization and offers a more balanced explanation of when Internet use may support or weaken entrepreneurial resilience during major crises.

5.3 Managerial Implications

We offer several practical implications in this study. First, entrepreneurs should pay more attention to how they use the Internet during major crises, as different forms of Internet use and embedding may have different implications. Our findings suggest that work-related Internet use is positively associated with entrepreneurial resilience, whereas leisure-oriented Internet use is negatively associated with entrepreneurial resilience. Therefore, during a major crisis, entrepreneurs should give priority to work-related Internet use, such as collecting business information, communicating with customers, learning from other entrepreneurs, and monitoring changes in policies and markets. These activities may help entrepreneurs reduce information barriers and respond more quickly when offline communication is disrupted.

At the same time, entrepreneurs should be cautious about excessive leisure-oriented Internet use during major crises. This does not mean that leisure activities should be completely avoided, because leisure may help entrepreneurs relax and recover from stress. However, when online leisure takes too much time or attention, it may reduce entrepreneurs' focus on business recovery. Entrepreneurs may therefore benefit from setting clearer boundaries between work-related Internet use and leisure-oriented Internet use, and from combining online leisure with offline recovery activities such as exercise, family interaction, or social activities.

Second, entrepreneurs should make better use of Internet embedding while avoiding excessive Internet embedding. The results show that Internet embedding depth is positively associated with entrepreneurial resilience, suggesting that entrepreneurs may benefit from using Internet-based channels to obtain timely information, engage in entrepreneurial learning, and maintain online business connections during a major crisis. However, excessive Internet embedding is negatively associated with entrepreneurial resilience. Therefore, entrepreneurs should not rely too heavily on customized mobile messages, familiar online circles, or single digital information sources. Instead, they should seek information from multiple channels and compare different sources before making important decisions.

Third, entrepreneurs may need to adjust their Internet use according to their own conditions. The heterogeneity results suggest that female entrepreneurs may benefit more from work-related Internet

use and may be more vulnerable to the negative effect of leisure-oriented Internet use. Therefore, female entrepreneurs should pay particular attention to using the Internet for business learning, customer communication, and information search during major crises. For male entrepreneurs, Internet embedding depth and excessive Internet embedding appear more relevant. Therefore, male entrepreneurs should pay attention not only to expanding online connections, but also to avoiding excessive dependence on narrow online networks.

Finally, the results also suggest that entrepreneurship type matters. Necessity-driven entrepreneurs may benefit from prioritizing practical work-related Internet use, such as searching for policy information, maintaining customer relationships, and identifying short-term business opportunities. They should also be cautious about excessive Internet embedding, which may limit their access to diverse information. Opportunity-driven entrepreneurs may benefit from using Internet embedding to identify market changes, learn from external examples, and adjust business activities. Overall, entrepreneurs should treat Internet use as a purposeful crisis-response tool rather than as a general or unlimited resource.

5.4 Limitations and Future Research

This study has several limitations that also point to future research directions. First, this study relies on cross-sectional CGSS data from China. This data structure is suitable for examining associations between Internet use, Internet embedding, and income-based entrepreneurial resilience, but future research could further examine the direction of these relationships by using longitudinal data, panel surveys, field experiments, natural experiments, or instrumental-variable designs.

Second, this study measures entrepreneurial resilience through household income change. Income maintenance is an important economic manifestation of resilience during a major crisis, but entrepreneurial resilience may also include psychological recovery, strategic adaptation, persistence, business model reconfiguration, opportunity development, and subjective well-being. Future studies could incorporate richer measures of resilience, such as self-efficacy, coping behavior, business model adaptation, reopening decisions, survival, growth, and mental health.

Third, the measurement of Internet behavior is constrained by the available CGSS survey items. Work-related Internet use is derived from overall Internet use and leisure-oriented Internet use, while excessive Internet embedding is proxied by the frequency of customized mobile messages. These measures provide useful information, but future research could use more direct and fine-grained measures, such as time spent on business platforms, online learning behavior, digital collaboration, platform diversity, exposure to algorithmic recommendations, information-source diversity, and digital recovery practices. Combining survey data with digital trace data may also provide a more accurate picture of how entrepreneurs use the Internet during crises.

Fourth, entrepreneurial resilience during a major crisis may also be shaped by individual, business, household, and regional conditions. Although this study includes a set of control variables, future research could incorporate richer business-level and regional-level variables, such as firm age, firm size, industry, cash flow, digital capability, local crisis severity, regional digital infrastructure, and government support.

Finally, this study focuses on COVID-19 and uses data from China. The findings should therefore be interpreted within this specific crisis and institutional context. Future research could examine whether similar patterns appear in other major crises, such as economic recessions, energy crises, supply-chain disruptions, climate disasters, or geopolitical conflicts. Comparative studies across countries would also help identify the boundary conditions of the relationship between Internet use, Internet embedding, and entrepreneurial resilience. Such research would further clarify when digital connection supports resilience and when it may become a source of distraction, dependence, or information narrowing.

Acknowledgements

This article received no financial or funding support.

Conflicts of Interest

The authors confirm that there are no conflicts of interest.

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