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What catalyzes the proactive recovery of peasants from the COVID-19 pandemic? A livelihood perspective in Ningqiang County, China

Huizeng Zhao, Xuesong Guo *, Ni Peng

School of Public Policy and Administration, Xi’an Jiaotong University, Xi’an, China

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ABSTRACT

The livelihood recovery strategy is utilized for peasants during the COVID-19 pandemic. This strategy serves a salient role to help them recover from the relevant hazardous impacts. Disaster risk has been a major concern among hazards for the increasing likelihood of exposure and vulnerability, especially in the process of poverty alleviation in China. However, few studies have discussed the factors and mechanisms that influence peasants to adopt livelihood recovery strategies in the context of the COVID-19 pandemic in China. Based on a case study of Ningqiang County, China, this study explores the mechanisms that catalyze the proactive recovery of peasants from the COVID-19 pandemic from a livelihood perspective. Methodologically, the study proposes a framework that integrates the modified pressure-state-response (PSR) framework and the sustainable livelihoods approach (SLA), and it employs structure equation modeling (SEM) approach to examine how specific factors affect peasants to proactively adopt livelihood strategies to recover from the COVID-19 pandemic. The results indicate that the COVID-19 pressure significantly increases the risk perception of peasants and decreases their livelihood capital. Further, the decreased livelihood capital, the improvement of risk perception and supportive policy will promote peasants to adopt livelihood strategies. Moreover, the results specify that risk perception and supportive policy mediate the relation between livelihood capital and recovery strategy. The findings will be beneficial for policymakers and researchers to understand the mechanisms that peasants adopt livelihood strategies to recover from disasters, and can serve as references for formulating disaster risk reduction and resilience policies.

1. Introduction

The COVID-19 pandemic has spread to over 200 countries, claiming more than 4.7 million lives and 231 million confirmed cases globally as of September 26, 2021 [1]. Pandemics are more than health crises as they also impact the economic, social, and even political systems, seriously hindering the sustainable development of society [2,3]. Many countries have used a combination of containment and mitigation to deal with COVID-19, and China has implemented extremely strict restrictions to curb the spread of the virus [4]. Although these measures have prevented the overload of healthcare systems and reduced mortality, many businesses, industries, and households’ livelihoods have been affected negatively by the unprecedented lockdown [5]. Companies and retails were closed and traffic lines were blocked in China during the peak of the pandemic, which in turn could have potential negative impacts on
household livelihoods due to massive unemployment and overstocking [6,7]. As Luo et al. pointed out in 2020, 23% of the households in China who have escaped poverty since 2013 perceived they would fall back into poverty due to the pandemic in the middle February of 2020 [8].

Poverty eradication is one of the primary goals on the global development agenda [9]. Different from urban areas, rural household livelihoods and assets are more vulnerable to the pandemic as they are facing the risk of losing prime income sources [10]. A large number of migrant workers in China had stopped working due to their workplaces being closed, and peasants had difficulties selling their agricultural products and storing their produce because of the restrictions on transportation during lockdown [11]. The socioeconomic disruption of COVID-19 is expanding daily on the rural households due to diminished livelihoods, putting peasants under the threat of falling into or backing into poverty [12]. These problems are even more salient for China as the country has ended all extreme poverty by the year 2020 through the targeted poverty alleviation (TPA) program, but there is still a great concern to reduce relative poverty and lift the poor into sustainable livelihoods. There is a growing body of literature focusing on household livelihoods in rural China. Using clustering analysis, He et al., in 2014 analyzed the spatial distribution of farmers’ livelihood capital in China’s Liangshan Yi Autonomous Prefecture [13]; Quan and Chen in 2018 analyzed the factors influencing the livelihood assets mobility of rural households in Hubei Province based on the sustainable livelihoods approach [14]; Guo and Kapucu in 2018 examined the effects of disaster resettlement on peasants’ livelihoods in Qinling Mountains [15]; Liu et al., in 2018 investigated the influence of poverty alleviation resettlement on rural household livelihood vulnerability in Ankang, Shaanxi [16]; Yang et al., in 2018 evaluated the relationship between post-disaster changes of Wenchuan Earthquake and rural household livelihoods in China’s Wolong Nature Reserve [17].

Livelihood strategy is the allocation of assets and selection of business activities by people to achieve their goals [18]. Some studies have been conducted to analyze the factors that influence the adoption and adjustment of livelihood strategies in rural China. For example, Ding et al., in 2018 developed an evaluation index to analyze how livelihood capitals affect the adoption of livelihood strategies of herdsmen in Inner Mongolia using the multinomial logit model [19]; Zeng et al., in 2021 explored the correlation between livelihood risk and livelihood strategies of farmers in Sichuan [20]; Hua et al., in 2017 examined the relationship between livelihood assets and strategies based on the topic of anti-poverty policies in Tibetan Plateau [21].

While many studies have investigated the different aspects of livelihoods, it was after the Wenchuan earthquake in 2008 that livelihood in a disaster context began receiving attention from academia in China [22]. Proactively adopting livelihood strategies is a key approach for peasants to recover from disasters. Although disasters threaten family livelihoods, in rural China, COVID-19 recovery strategies and the mechanisms are relatively insufficient from a livelihood perspective. This is an important issue in disaster recovery and poses a challenge to poverty alleviation. Paul et al., in 2021 investigated the psychological and livelihood impacts of COVID-19 on Bangladeshi lower-income people, and they found that daily workers’ livelihoods have been seriously affected and those working in industries, farmers, and day laborers have been stressed out due to fear of infection and lack of livelihood means [10]. Using an online survey during the COVID-19 outbreak in China, Guo et al., in 2020 found that the perceived negative impact of the pandemic on livelihoods could predict mental health problems [23].

Facing the impact of COVID-19 on livelihoods and assets, timely adoption and adjustment of livelihood recovery strategies can provide effective protection for both individuals and families [24–27]. This not only determines peasants’ current livelihood outcomes but also affects them to achieve sustainable livelihoods and enhance resilience. Implementing livelihood recovery strategies has become an effective way for peasants to deal with pandemic risk and help them to survive, mitigate, and recover from COVID-19 [28]. In practical terms, peasants’ livelihood strategies are constantly adjusted depending on the changes in livelihood capitals, policies, and external shocks. Different strategies have been taken among the peasants to tackle the impacts of the pandemic. The proactive strategies at the individual level usually include income diversification, like searching for part-time jobs or starting online businesses; While some peasants do not adopt recovery strategies, like taking a wait-and-see attitude or doing nothing are also observed. Proactively adopting livelihood strategies to recover from the pandemic is crucial to maintain the achievements of eradicating extreme poverty in China, and it’s an approach to prevent peasants from falling into or backing into poverty. However, few studies have examined the adoption of peasants’ livelihood recovery strategies and the influencing factors in rural China in the context of COVID-19, and this knowledge gap is addressed in this research. This study builds on and contributes to the previous work on disaster recovery and livelihood strategy. Based on a case study of Ningqiang County, Shaanxi Province, China, this research investigates the mechanisms that catalyze the proactive recovery of peasants from the COVID-19 pandemic from a livelihood perspective. More precisely, it proposes a framework that combines the modified pressure-state-response (PSR) framework and the sustainable livelihoods approach (SLA), and it employs structural equation modeling (SEM) to examine how specific factors affect peasants to adopt livelihood strategies to recover from the COVID-19 pandemic in rural China.

2. Framework and hypothesis

2.1. Framework

Early research normally regards income as the dominant component in household livelihoods. People engage in livelihood activities to survive and perhaps pursue wealth and prosperity. However, a lack of income cannot fully reflect the level that individuals or households are deprived due to contingency [29]. Scoones in 1998 outlined a framework that addresses the livelihood strategies of natural resource users and questions of sustainability, which is now commonly referred to as the SLA [30]. According to the SLA, a livelihood is sustainable when it can cope with and recover from shocks, maintain functions and capabilities, while not destroying the natural resource base. The SLA has been adopted by many organizations and can be reviewed in different views, for instance, the UK’s Department for International Development (DFID) regards the SLA as a framework for analysis and the United Nations Development Programme (UNDP) emphasizes its value in planning for projects [31]. The main part of SLA is livelihood capitals, which consist of...
human capital, social capital, natural capital, physical capital, and financial capital. The SLA begins with an evaluation of livelihoods and regards livelihood strategy is sensitive to livelihood capital, particularly when the living environment is vulnerable [32]. In addition, it incorporates the vulnerability context that may have impacts on livelihoods, such as shocks, seasonality, and critical trends, into the research scope [33].

This study modified the PSR framework and integrates factors specified by the SLA to develop a conceptual model for investigating what makes peasants proactively adopt livelihood recovery strategies in the context of the COVID-19 pandemic in China. The PSR framework as a causal model, initially proposed by Rapport and Friend, was largely promoted by the Organisation for Economic Co-operation and Development (OECD) to provide support for environmental policy-making and employed in livelihoods and disaster research [34,35]. Hazbavi et al., in 2020 assessed a watershed health condition in central Iran by integrating climatic, anthropogenic, and hydrologic indicators with the PSR framework [36]; Guo and Kapucu in 2018 investigated the impacts of disaster resettlement on peasant livelihoods in China’s Qinling Mountains using a model that combined the PSR framework and the sustainable livelihoods approach [15]; Wollflehner and Vacik in 2008 utilized the Analytic Network Process (ANP) to evaluate the sustainable forest management strategies with regard to the PSR framework [37]; Chen et al., in 2021 used the method of participatory appraisal and the PSR framework to analyze the impacts of farmer livelihood behavior on soil erosion in southern China [38].

Essentially, three categories of indicators are included in the PSR framework, namely pressure indicators, state indicators, and response indicators. Pressure indicators describe the impacts on the environment and ecosystem originating in human activities, such as discharging waste, putting fertilizers, and changing natural habitats; State indicators describe the status quo and changes of the environment and ecosystem, for instance, the forest and wetland habitats; Response indicators describe the response degree of society to the changes of environment and ecosystem through policies, regulations, and actions, ranging from public sectors, private sectors, and individuals [39]. Hence, it’s clear that the content of the SLA can be applied to the PSR framework to identify related indicators. Martins et al., in 2012 suggested that the PSR framework should be integrated with sustainable dimensions to appraise livelihoods [40]; Rudd in 2004 developed a framework that encompass the PSR framework and sustainable livelihoods indicators based on the SLA, establishing a policy experiment platform [41]. Therefore, the PSR framework and the SLA are amalgamated here to construct a model for this study.

Meanwhile, both the consequences caused by the disaster and external assistance will influence individuals to adopt livelihood recovery strategies [42]. Although according to the PSR framework, the correlation between internal states such as livelihood capital and the adoption of livelihood recovery strategy may reflect the basis of peasants’ choice in the context of COVID-19, the supportive policy promulgated by the government may guide the logic that peasants adopt livelihood recovery strategy [43]. The supportive policy is therefore integrated into the PSR framework as an external factor for this study. Hence, a theoretical model is proposed based on both the modified PSR framework addressed here and the SLA, as shown in Fig. 1. In this study, pressure is due to peasants facing the challenging contexts of the COVID-19 pandemic and its control measures; State is due to COVID-19 shocking livelihood capital of peasants and affecting their risk perception; Response is due to the adoption of livelihood strategies as peasants recover from COVID-19 and rebuild their livelihoods. Additionally, the supportive policy is the external assistance provided by the government to support the recovery of peasants’ livelihoods during the COVID-19 pandemic.

2.2. Hypotheses

The COVID-19 pandemic is widely affecting public health, socioeconomic activity, working life, and many other sectors due to the virus itself and the measures taken to control the spread, and the threats have brought major risks and pressures to the peasant livelihoods. Almost half of the world’s workforce is at risk of losing their livelihoods, and an additional 130 million people are facing acute food insecurity by the end of 2020 [44]. Livelihood capital is the resource base of a household that comprises human, social, natural, physical, and financial capital [45]. These capitals have significant effects on the peasants because they can help them to cope with and resist the impacts of the pandemic and prevent the risk of backing into poverty. Facing the shock of COVID-19, the financial capital of peasants may be consumed to maintain their livelihoods and their natural capital may be reduced due to lockdown measures. Due to the social distancing policy, other aspects of livelihood capitals will also be affected. Gatiso et al., in 2018 pointed out that the spread of the virus negatively affected the production of crops, and thus the shocks caused by pandemics weakened peasants’ livelihood capitals [46]. In addition, the pressure generated by COVID-19 will change the living conditions of peasants and increase their vulnerability, which will make them aware of the risks on livelihoods brought by the pandemic. Dryhurst et al., in 2020 found that despite the substantial variability across cultures, public risk perception of COVID-19 in ten countries across Europe, America, and Asia is relatively high [47]. This leads to the following hypotheses:

H1-1. The COVID-19 pressure leads to the decrease of peasants’ livelihood capital.

![Fig. 1. The theoretical model.](image-url)
H1-2. The COVID-19 pressure improves the risk perception of peasants.

The status of peasants’ livelihood capital is a key factor that determines their livelihood strategy and asset allocation mode [28]. Under the impact of the COVID-19 pandemic, the peasants’ livelihood capital has been decreased, prompting them to adopt recovery strategies to achieve sustainable livelihood development. Smith et al., in 2020 found that fishers in the Northeast United States engaged in a number of adaptation strategies due to the changing circumstances and affected livelihoods brought by the pandemic [48]. Risk perception, another indicator of State in the framework, is the peasants’ intuitive evaluations of the pandemic that they exposed and will be influenced by experience, attitudes, as well as social and cultural processes [49]. The decrease of peasants’ livelihood capital is a manifestation of the COVID-19 impact on their livelihoods, which will intensify peasants’ perception of pandemic risk. In addition, many industries were also threatened by the pandemic and over 83% of different industry sectors indicated that they needed government assistance, and the supportive policies requested were tax preferences, financial support, employment subsidies, and operating subsidies [50]. Ashley et al., in 2003 highlighted that governments are able to limit damage and recompense by implementing supportive policies [51]. Livelihood capital is a key determinant of livelihood outcomes, and it can be used by the government to assess the impact on peasants’ livelihoods by COVID-19 and formulate supportive policies for livelihood recovery. In accordance with the reality of the pandemic and Hypothesis 1-1 (H1-1), the livelihood capital of peasants is generally weakened by the COVID-19 pandemic, and thus it can be described as the decreased livelihood capital in this context. This leads to the following hypotheses:

H2-1. The decreased livelihood capital of peasants forces them to adopt recovery strategies.

H2-2. The decreased livelihood capital of peasants improves their risk perception of COVID-19.

H2-3. The decreased livelihood capital of peasants drives the formulation of supportive policy.

According to Protection Motivation Theory, the protective behavior is driven by the magnitude of a hazardous event, the probability that the event will occur, and the efficacy of a protective response [52]. A higher perception of risk will be related to a greater likelihood for people to take protective and adaptive actions to cope with the negative effect caused by hazardous events. Risk perception emphasizes an individual’s understanding of various objective risks existing in the outside world and could trigger precautionary actions [53]. Xu et al., in 2018 pointed out rural households’ risk perception is an important factor affecting their willingness to purchase earthquake disaster insurance in Southwestern China [27]; Savadori and Lauriola in 2021 addressed the importance of risk perception in promoting the adoption of protective behaviors during the COVID-19 crisis in Italy [54]. Therefore, in the circumstance of the COVID-19 pandemic, the higher peasants’ awareness of the risks of the pandemic, the more they will adopt recovery strategies to deal with the impact on their livelihoods. In addition, combined with Hypothesis 2-2 (H2-2), risk perception is a mediating variable in the process of peasants’ livelihood capital affecting the adoption of the recovery strategy. This leads to the

Fig. 2. Location and elevation of Ningqiang County.
following hypotheses:

**H3-1.** Peasants’ risk perception of COVID-19 drives them to adopt recovery strategies.

**H3-2.** Risk perception mediates the relationship between livelihood capital and recovery strategy.

Policy support from government agencies and other types of external assistance are regarded highly in supporting livelihood recovery and can determine livelihood outcomes [55]. The Chinese government scrambled with emergency actions to respond to COVID-19, including lockdown, massive testing and tracing, quarantine, and economic packages. The purpose of these actions is to limit the spread of the virus and reduce the impact on the economy and livelihood. Razumovskala et al., in 2020 evaluated the effectiveness of government policy to support SMEs (small and medium-sized enterprises) in Russia during the COVID-19 pandemic [56]. Government supportive policies have a guiding role in the adoption of peasants’ livelihood recovery strategies and can reduce the shock on livelihood capital caused by COVID-19. In the context of the pandemic, supportive policies usually have preferential features, which can reduce the cost of adopting livelihood recovery strategies. In addition, combined with Hypothesis 2-3 (H2-3), the supportive policy is a mediating variable in the process of peasants’ livelihood capital affecting the adoption of the recovery strategy. This leads to the following hypotheses:

**H4-1.** Supportive policies encourage peasants to adopt recovery strategies.

**H4-2.** Supportive policy mediates the relationship between livelihood capital and recovery strategy.

Based on the above hypotheses, we developed the theoretical model, as shown in Fig. 1.

### 3. Methodology

#### 3.1. Study area

COVID-19 cases were consecutively reported in 34 provinces and regions in China, including Hong Kong, Macau, and Taiwan [57]. Although Wuhan was the epicenter of COVID-19 in China and entered full lockdown on January 23, 2020, similar strict control measures were adopted in other parts of China to contain the spread of the virus. Taking Ningqiang County as an example, this study investigates the livelihood recovery strategies of peasants affected by the COVID-19 pandemic.

The county of Ningqiang, located at the junction of Qinling and Bashan Mountains in the south of Shaanxi Province, China, has experienced a series of earthquakes and flood-related disasters. The county was hit by the Wenchuan earthquake in 2008 and is a poverty alleviation area in China. Fig. 2 shows the map of the location and elevation of Ningqiang County. The complex topography and harsh weather conditions make the livelihoods of peasants in Ningqiang County highly vulnerable, and the COVID-19 pandemic has exacerbated this situation. There were in total 26 confirmed cases of COVID-19 in Hanzhong City, where Ningqiang County is located. These cases were reported between 26 January and 19 February 2020, and no new cases were identified thereafter until this study was conducted. Although Ningqiang County has no confirmed cases of COVID-19, which is consistent with the pandemic situation in many other counties in China, strict lockdown measures were imposed from 25 January to February 28, 2020 in Ningqiang as the domestic outbreak spreads. On January 25, 2020, the Ningqiang County government issued a statement on joint prevention and control of the COVID-19 pandemic, beginning to implement strict restriction measures such as traffic control, business closures, home isolation, and social distancing throughout the county. The lockdown measures in Ningqiang County were only lifted, following a cautious step-by-step protocol, upon being classified as a low-risk area of COVID-19 on February 28, 2020. The government believes these measures can contain the virus and protect public health, but in fact they also incur huge socioeconomic costs, threatening peasants’ livelihood capital and changing their risk perceptions. For instance, the strict traffic control in Ningqiang county not only brought significant suspension to agricultural products distribution but also blocked the way of returning workers after the Lunar New Year break, which may result in job loss. The business closures due to the lockdown resulted in significant backlogs of agricultural products and their consequent price falling even made some of them rot in the field. Moreover, measures like social distancing retarded the economic activities in which intensive labor work is required, such as spring ploughing and poverty alleviation industries in the county.

The local economy and peasants’ livelihood capital suffered a blow in Ningqiang County, and problems persist even after the lockdown was lifted, threatening peasants’ existing livelihood strategies. Due to the subsequent and irreversible effects of the COVID-19 pandemic on peasants and the tightened socioeconomic environment, such as cancellation of orders, product backlogs, delayed spring farming, and declining demand for migrant workers, it is difficult for peasants in Ningqiang County to utilize their existing strategies without any adaptations to maintain livelihoods and adapt to the huge challenges after the lifting of the lockdown. The existing strategies and capital stocks may be tried to use by peasants to cope with their reduced livelihood capital during the early stages of COVID-19, but in the long-term peasants need to find ways to adapt to the continuing uncertainty and the changing circumstances brought by the pandemic. Peasants in Ningqiang County reported gradually engaging in a number of livelihood adaptation strategies to respond to and recover from this unprecedented situation after the end of the lockdown, especially since mid-March 2020, such as participating in e-commerce promotions and doing part-time jobs locally. It should be noted that with the endeavor followed by the guidance of TPA, Ningqiang County has just ended extreme poverty at the end of February 2020, and the poverty incidence rate dropped to 1.01%. However, how to reduce their livelihoods vulnerability and achieve sustainable livelihoods are still topics of wide concern. The COVID-19 pandemic challenges Ningqiang County to face the dual pressure of stabilizing poverty alleviation and preventing the backing into poverty.
A survey on the impact of the COVID-19 pandemic and the recovery of peasants’ livelihoods was carried out in Ningqiang County in August 2020. We consulted with county officials and village cadres, who usually have a better understanding of the local conditions and peasants’ livelihood status, to determine the approximate sampling groups of peasants in Ningqiang County concerning geographic dispersal, gender, age, income, etc. In addition, a convenience sampling method with the assistance of the local government was used to select samples and ensure the quality of the responses. Initially, a pre-survey was implemented with 60 peasants to ensure validity. The formal survey, which was through face-to-face interviews and questionnaires, involved 400 peasants living in Ningqiang County. Of these, 378 questionnaires were returned and the response rate was 94.5%. Finally, the valid number of questionnaires was 358. Table 1 lists the descriptions of the demographic characteristics of the respondents.

As shown in Table 1, the gender ratio of the respondents is approximately balanced, and it conforms to the situation that there are slightly more males than females in Ningqiang County. Most of the respondents are of the working-age and educated. The relatively low annual income of the respondents reflects the fact that the local economy is underdeveloped, and it is in general consistent with the 2020 National Economic and Social Development Statistical Bulletin of Ningqiang County.

3.3. Measurement

This research was carried out in two steps. The first step was to describe the measurement of variables and examine the reliability and validity of the questionnaire. The SEM was used in the second step to analyze the relationships between variables and test the hypotheses.

Based on previous research and interviews among peasants living in Ningqiang County, a five-point Likert scale from 1 to 5 representing complete disagreement, disagreement, unclearness, agreement, and complete agreement was adopted to measure the variables of COVID-19 pressure, livelihood capital, risk perception, supportive policy and recovery strategy in this study. These variables are operationalized as follows:

COVID-19 pressure refers to the pressure on peasants caused by the virus itself and its containment measures. The socioeconomic and living environment is changing due to the pandemic, causing external hits on peasants. Baldwin and Tomiura in 2020 pointed out that the pandemic is both a supply shock and a demand shock, both aspects will impact trade in goods and services [58]. Combined with the survey and interviews in Ningqiang County, we found that the limitation on income, sale, employment, and repayment are the main pressures caused by the COVID-19 pandemic.

Livelihood capital and risk perception are the two dimensions of the state layer. According to the SLA, livelihood capital can be divided into five categories: natural capital, physical capital, social capital, financial capital, and human capital. Morse and McNamara in 2013 pointed out natural capital refers to the natural resource stocks, physical capital refers to the infrastructure and tools for production, social capital represents social relationships and connections, financial capital mainly points to economic assets, human capital could be the capacity to work [59]. One should note that because peasants’ livelihoods are generally shocked by the pandemic, the variable of livelihood capital is measured as a negative indicator and described the state of reduction. Therefore, the higher the score of this variable, the more the livelihood capital is decreased. Risk perception is the subjective assessment of the possibility and consequences of risk events. Wise et al., in 2020 measured the perception of risk from COVID-19 in the United States through livelihood and severity, and they questioned people how badly they felt about the pandemic [60]. Thus, items of possibility, severity, and panic of the risk from COVID-19 were adopted to measure risk perception in this study.

The government has introduced a package of measures dealing with the socio-economic impact of COVID-19 and supporting the recovery of livelihoods. According to the document “Nine Measures to Deal with the Impact of COVID-19 and Fight Against Poverty” issued by the Ningqiang County government and interviews with government officials, the supportive policies introduced by the government can be attributed to employment support, loan and repayment support, sale support, and subsidy mechanism. This

| Table 1 Descriptions of the respondents. |
|-----------------------------------------|
| Variable                      | Category            | Frequency | Percentage |
| Gender                        | Male                 | 213       | 59.5%      |
|                              | Female               | 145       | 40.5%      |
| Annual income                 | Less than CNY 3000   | 42        | 11.7%      |
|                              | CNY 3001-5000        | 67        | 18.7%      |
|                              | CNY 5001-7000        | 137       | 38.3%      |
|                              | CNY 7001-9000        | 83        | 23.2%      |
|                              | More than CNY 9000   | 29        | 8.1%       |
| Age                          | Less than 25 years old| 9         | 2.5%       |
|                              | 26-40 years old      | 52        | 14.5%      |
|                              | 41-55 years old      | 192       | 53.6%      |
|                              | 56-70 years old      | 92        | 25.7%      |
|                              | More than 70 years old| 13       | 3.6%       |
| Education level              | Illiteracy           | 43        | 12.0%      |
|                              | Elementary school    | 161       | 45.0%      |
|                              | Junior middle school | 119       | 33.2%      |
|                              | Senior middle school | 28        | 7.8%       |
|                              | Undergraduates and postgraduates| 7    | 2.0%       |
variable measures the peasants’ perception of supportive policies. Specifically, the following items were used to measure peasants’ perception of supportive policies through the five-point Likert scale ranging from complete disagreement to complete agreement: (1) The government has provided us with a lot of employment information and job opportunities to deal with the pandemic; (2) The government has introduced sufficient preferential policies for loans and repayments to support our response to the pandemic; (3) The government has formulated measures to provide sales channels and assistance for us to cope with the pandemic; (4) The government has introduced various subsidy mechanisms such as transportation subsidies and subsistence allowances to help us deal with the pandemic.

Recovery strategy refers to the measures that peasants take to restore their livelihoods under the impact of COVID-19, which manifests as a way for peasants to make a living. Livelihood strategies indicate the activities and choices adopted by peasants to reach their livelihood targets [61]. Raut in 2021 pointed out remittance, borrowing, and sale of assets are major livelihood strategies for households in Nepal to recover from the earthquakes in 2015 [62]. Synthesize the background of this study and interviews, use agricultural insurance, seek government subsidies, employ in community, engage in e-commerce, and participate in cooperatives were distinguished in this study as different types of recovery strategies.

Table 2 lists the measurement of variables used in the model.

One has to consider the indices to assess the questionnaire’s reliability and validity. Table 3 shows the Cronbach’s alpha coefficients of each subscale of the questionnaire, all of which are higher than 0.8, suggesting that the items have high internal consistency. Moreover, a confirmatory factor analysis (CFA) employing AMOS 23.0 was used to examine the validity by measuring the path significance and coefficient of the observed variables in the proposed model, and all of the coefficients were higher than 0.6 with the significant level of 0.1%. Composite reliability (CR) and average variance extracted (AVE) were introduced to evaluate the reliability and convergent validity. Hair et al., in 2010 pointed out that the CR value should be greater than 0.6 and the AVE should be greater than 0.5 [63]. According to the results, the CR value of all constructs was within the range of 0.855–0.955, and the AVE of all variables was ranging from 0.544 to 0.833. Hence, all factors have adequate reliability and validity.

4. Results and discussion

4.1. Results

Prior to the analysis, some indices were performed to assess the SEM’s goodness of fit, including \( \chi^2/df \), the root mean square error of approximation (RMSEA), the goodness of fit index (GFI), the incremental fit index (IFI), the Tucker-Lewis index (TLI), and the normed fit index (NFI). Table 4 shows the values of indices in the measurement model and the levels of recommended values, and all the fit indices meet the adaption requirements. The SEM is diagrammatically illustrated in Fig. 3.

Table 5 shows the estimation of path coefficient and significance, and all the direct hypotheses proposed in this study are supported. The results reveal that livelihood capital, risk perception, and supportive policy have a significant positive influence on recovery strategy, with a direct effect of 0.313, 0.213, and 0.412, respectively; thus, they support H2-1, H3-1, and H4-1. One should bear in mind that, as illustrated in the measurement section, livelihood capital is measured as a negative variable describing the state of reduction. Further, the results indicate that COVID-19 pressure is positively and significantly related to livelihood capital and risk

| Table 2 Variables and measurements.
| Latent variable | Observed variable | Mean  | SD   |
|-----------------|------------------|-------|------|
| COVID-19 pressure (CP) | Income pressure (CP1) | 4.13  | 1.239|
|                  | Sale pressure (CP2) | 3.25  | 1.365|
|                  | Employment pressure (CP3) | 4.09  | 1.232|
|                  | Repayment pressure (CP4) | 3.39  | 1.369|
| Livelihood capital (LC) | Profit of crop planting (LC1) | 3.57  | 1.335|
|                  | Progress of spring ploughing (LC2) | 3.63  | 1.342|
|                  | Backlog of agricultural products (LC3) | 3.47  | 1.357|
|                  | Availability of agricultural tools (LC4) | 3.34  | 1.343|
|                  | Relationships with relatives (LC5) | 3.77  | 1.312|
|                  | Help from relatives (LC6) | 4.12  | 1.139|
|                  | Amount of net income (LC7) | 3.87  | 1.349|
|                  | Availability of loan (LC8) | 3.30  | 1.279|
|                  | Employment opportunities (LC9) | 3.61  | 1.330|
| Risk perception (RP) | Possibility of the risk (RP1) | 3.69  | 1.184|
|                  | Severity of the risk (RP2) | 3.92  | 1.233|
| Supportive policy (SP) | Panic of the risk (RP3) | 3.77  | 1.252|
|                  | Employment support (SP1) | 3.53  | 1.189|
|                  | Loan and repayment support (SP2) | 3.48  | 1.227|
|                  | Sale support (SP3) | 3.43  | 1.311|
|                  | Subsidy mechanism (SP4) | 3.39  | 1.471|
| Recovery strategy (RS) | Use agricultural insurance (RS1) | 4.04  | 1.173|
|                  | Seek government subsidies (RS2) | 3.70  | 1.176|
|                  | Employ in community (RS3) | 4.23  | 1.116|
|                  | Engage in e-commerce (RS4) | 3.67  | 1.288|
|                  | Participate in cooperatives (RS5) | 3.41  | 1.383|
perception, with a direct effect of 0.857 and 0.559, respectively; thus, they allow us to accept H1-1 and H1-2. Finally, livelihood capital is positively and significantly linked to risk perception and supportive policy, with a direct effect of 0.300 and 0.768, respectively; thus, we accept H2-2 and H2-3.

To test the mediating role of risk perception and supportive policy between the relationship of livelihood capital and recovery strategy, we used the bootstrap procedure. Table 6 presents the results of mediating effects (see H3-2, H4-2). It shows that risk perception and supportive policy are two factors mediating the relationship between livelihood capital and recovery strategy, and the mediating effect of the supportive policy is stronger than risk perception. More specifically, peasants’ risk perception of COVID-19

| Table 3 | Questionnaire subscale reliability coefficients. |
|---------|-----------------------------------------------|
| Subscale | COVID-19 pressure | Livelihood capital | Risk perception | Supportive policy | Recovery strategy |
| Cronbach’s alpha | 0.869 | 0.952 | 0.920 | 0.902 | 0.861 |

| Table 4 | Values of acceptance fit. |
|---------|-------------------------|
| Fit index | Measurement model | Recommended value |
| $\chi^2$/df | 2.860 | <3.00 |
| RMSEA | 0.072 | <0.08 |
| GFI | 0.938 | >0.90 |
| IFI | 0.939 | >0.90 |
| TLI | 0.929 | >0.90 |
| NFI | 0.909 | >0.90 |

Fig. 3. Structural equation model.

| Table 5 | Summary of direct hypothesised results. |
|---------|----------------------------------------|
| Hypothesis | Proposed relationship | Effect | Path coefficient | S.E. | Results |
| H1-1 | CP $\rightarrow$ LC | Direct | 0.857*** | 0.073 | Supported |
| H1-2 | CP $\rightarrow$ RP | Direct | 0.559*** | 0.110 | Supported |
| H2-1 | LC $\rightarrow$ RS | Direct | 0.313*** | 0.072 | Supported |
| H2-2 | LC $\rightarrow$ RP | Direct | 0.300** | 0.093 | Supported |
| H2-3 | LC $\rightarrow$ SP | Direct | 0.768*** | 0.055 | Supported |
| H3-1 | RP $\rightarrow$ RS | Direct | 0.213** | 0.062 | Supported |
| H4-1 | SP $\rightarrow$ RS | Direct | 0.412*** | 0.064 | Supported |

Notes: ***p < 0.001, **p < 0.01, *p < 0.05.

| Table 6 | Summary of the bootstrap mediating effect results. |
|---------|-----------------------------------------------|
| Hypothesis | Proposed relationship | Path coefficient | S.E. | Bias-corrected 95% CI | Percentile 95% CI |
| | Lower | Upper | P | Lower | Upper | P |
| H3-2 | LC $\rightarrow$ RP $\rightarrow$ RS | 0.064 | 0.027 | 0.021 | 0.124 | 0.011 | 0.011 | 0.113 | 0.031 |
| H4-2 | LC $\rightarrow$ SP $\rightarrow$ RS | 0.316 | 0.077 | 0.182 | 0.491 | 0.001 | 0.173 | 0.479 | 0.001 |
significantly and positively mediates the influence of livelihood capital on recovery strategy with an effect of 0.064, supporting H3-2. The results further reveal that supportive policy implemented by the government has a significant and positive mediating effect on the nexus between livelihood capital and recovery strategy with an effect of 0.316, supporting H4-2. Hence, livelihood capital also has indirect influence on recovery strategy through risk perception and supportive policy, with an indirect effect of 0.380. Therefore, considering the direct and mediating effects as shown in Tables 5 and 6, livelihood capital, risk perception, and supportive policy influence recovery strategy, with a total effect of 0.693, 0.213, and 0.412, respectively.

4.2. Discussion

The present study proposes a conceptual model that draws upon the modified PSR framework and integrates the SLA to conduct an empirical analysis of the factors contributing to peasants in China proactively adopting livelihood strategies to recover from the COVID-19 pandemic. The results verified the relationships among the following factors: COVID-19 pressure, livelihood capital, risk perception, supportive policy, and recovery strategy.

The study found that the COVID-19 pressure is positively linked with the risk perception and the decreased livelihood capital of peasants. In line with the study of Gatiso et al., in 2018 [46], this finding demonstrates that the livelihood capital of peasants will be weakened by the increased pressure and shock caused by the COVID-19 pandemic and its control measures. According to the data from the questionnaire, 82.2% and 81.6% of the peasants believed they were suffering from the income pressure and employment pressure due to COVID-19. As Peng et al. claimed in 2019, rural household livelihood capital is a key means of resisting external shocks [64]. In Ningqiang County, a disaster-prone and poverty area, the financial capital may be utilized by peasants to buffer the shock of COVID-19, and other aspects of livelihood capital, like social capital, may be hindered by the containment measures. For instance, factory closures during the peak of the pandemic made migrant workers unemployed, resulting in a decrease in human capital; and 84.9% of the peasants believed that the help they received from relatives has been reduced due to social distancing measures. This highlights that the goal to achieve sustainable livelihoods should be based on the SLA. We suggest that in the process of development, especially poverty alleviation, one should not only focus on increasing the income of individuals and improving physical assets. The cultivation of social networks, individual knowledge, and skills cannot be neglected. Meanwhile, consistent with the research by Abdelrahman in 2020 [65], the study also revealed that the pressure caused by COVID-19 on peasants will increase their risk perception. During the pandemic, peasants in Ningqiang County experienced a stressful and controlled living environment that may increase their risk awareness, more specifically, the perception of the possibility, consequences, and panic of the risk caused by COVID-19.

In addition, the results suggest that the decreased livelihood capital of peasants, the improvement of risk perception and supportive policy will directly promote peasants to proactively adopt livelihood strategies to recover from the pandemic. Among these, the supportive policy was found to have the highest direct effect. The findings are aligned with the research of Zhou et al., in 2021 [28], as they emphasized that peasants’ livelihood strategies are constantly adjusted according to the changes in their livelihood capital and resilience. Livelihood capital is the guarantee for peasants to resist external shocks and reduce vulnerability. In Ningqiang County, the decreased livelihood capital reflects the extent that peasants are affected by COVID-19, and it will encourage them to adopt recovery strategies to sustain their livelihoods. Additionally, consistent with the Protection Motivation Theory, which posits that threat appraisal is one of the factors that explain why people engage in protective actions [52]. We discovered that peasants in Ningqiang County may become more inclined to adopt livelihood recovery strategies as their risk perception of COVID-19 increases. In this case, for those peasants who perceive that COVID-19 may pose a greater risk to their livelihood, they may take the initiative to adopt diversified recovery strategies. However, the public’s perception of risk varies, and it also can have consequences for how people respond to threats. Thus, we argued that effective risk communication considering individual differences and misinformation should be put on the agenda during the pandemic. Further, the study found that supportive policy plays a crucial role to catalyze these processes. This demonstrates the importance of external assistant policy, such as recruitment and subsidies, for people to recover from disasters. It also coincides with the research of Pu et al., in 2021 [55]. However, according to the data from the questionnaire, only less than half of the peasants in Ningqiang County were aware of and comprehended that the government has formulated sufficient supportive policies for their recovery from the impact of the COVID-19 pandemic, reflecting that certain gaps remain in the formulation and publicity processes of support policies. At this point, it is a priority that the public fully understands the content of policies. This study suggests that the government should further facilitate supportive policies dissemination and communication via various channels. For example, the local government can carry out face-to-face introduction programs to help the public better understand the supportive policy and encourage them to further publicize the policy to their relatives. Still, the use of media and the role of poverty alleviation cadres should not be neglected.

Moreover, the study found that risk perception and supportive policy significantly mediate the relation between livelihood capital and recovery strategy. This result provides evidence that the decrease of peasants’ livelihood capital could not only directly promote them to adopt recovery strategies, but also affect the implementation of livelihood recovery strategies by changing their risk perception and the government’s supportive policy. It also confirms and extends the findings of various studies, such as Lu et al., in 2021 [50], Savadori and Lauriola in 2021 [54]. Our finding demonstrates that when peasants’ livelihood capital is weakened by the shock of the COVID-19 pandemic, it will increase the risks perceived by peasants and prompt the government to formulate policies to support peasants in restoring their livelihoods, thereby encouraging peasants to adopt livelihood recovery strategies.

5. Conclusion

This study develops an integrated framework to reveal the driving factors of the proactively adopting livelihood strategies of peasants in China, which aims to help them recover from the COVID-19 pandemic. A survey was conducted in Ningqiang County,
Shaanxi Province to collect data and the structural equation modeling approach was utilized for the empirical test. Hypotheses related to COVID-19 pressure, livelihood capital, risk perception, supportive policy, and recovery strategy have been analyzed. The empirical results indicate that COVID-19 pressure has a significant and positive impact on peasants’ risk perception and the decrease of peasants’ livelihood capital. The current study also finds that the decreased livelihood capital, the improvement of risk perception, and supportive policy are key drivers for peasants to proactively adopt livelihood recovery strategies. Further, the present study highlights the important mediating role of risk perception and supportive policy between livelihood capital and livelihood recovery strategy, indicating that the decreased livelihood capital can encourage peasants to adopt livelihood recovery strategies directly and indirectly.

The study enriches the literature on disaster recovery strategy from a livelihood perspective, particularly in the context of the COVID-19 pandemic in rural China. The findings can contribute to the understanding of the mechanism that peasants proactively adopt livelihood strategy to recover from the COVID-19 pandemic and can serve as references for governments to formulate policies for disaster risk reduction and enhance resilience. This is also a key means of maintaining peasants’ sustainable livelihoods and consolidating the achievements of poverty alleviation. However, one should note that the present study also has certain limitations. Firstly, the data is mainly collected from the survey in Ningqiang County, peasants living in other areas especially those in the epicenter of the COVID-19 pandemic in China may provide different views and give further insights. The non-probability sampling method used in this study may result in sampling bias, and caution is required when generalizing the findings. Moreover, the study focuses on the COVID-19 pandemic which is caused by viruses. Other types of disasters, for instance, natural hazard-related disasters, may pose different perspectives and findings. Therefore, further studies could consider expanding research areas and investigating other types of disasters.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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