ADDRESSING THE EFFECTS OF COVID-19 ON RURAL AREAS IN LOW AND MIDDLE INCOME COUNTRIES

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Table of Contents

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Editorial: Addressing the effects of COVID-19 on rural areas in low and middle income countries

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Editorial on the Research Topic
Addressing the effects of COVID-19 on rural areas in low and middle income countries

Rural households are facing severe challenges while adapting to existing and emerging risks of various kinds, including the effects of unprecedented shocks that affect individuals and families in terms of lack of income, reduced consumption and the sale of assets. Health shocks, i.e., unpredictable diseases that undermine people's health status, are the most common unprecedented shocks and the most pressing causes of families falling into poverty. When an illness or injury impairs the health of a family member or causes the income of the family to be reduced or even lost, the family is faces high levels of vulnerability due to the costs of medical treatment as well as the lack of income caused by incapacity for work. Health shocks, together with economic ditto, thus place a heavy financial burden on families and are, de facto, one of the most important factors related to poverty in these regions.

Risk adaptation and coping has become necessary activities for families living in rural areas of low and middle income countries, but this is also taking a significant share of their income. Consequently, understanding these risks and related coping strategies is crucial for policymakers. This is also reflected in the Global Development Report entitled Risks and Opportunities, which examines how families can cope with the wide range of risks they face.

The focus of this special issue addresses the effects of COVID-19 on rural areas in the Low- and Middle - Income Countries. Several researchers submitted a significant number of high-quality papers for consideration in this special issue, which went through

a rigorous peer-review process, with an acceptance rate of 50%. Finally, 16 quality contributions were published, and among them were the following papers:

- *COVID-19's Impact on China's Strategic Emerging Industries: An Observation of Policy Difficulties* studies the influence of the COVID-19 on R&D investment and foreign exchange development of China's most important emerging industrial firms.
- *Analysis of Preventive Behaviours of Rural Tourism Hosts in the Face of COVID-19 Pandemic: Application of the Health Belief Model* discusses preventive behaviors of rural tourism hosts and the COVID-19 utilizing the HBM model.
- *Investigating the Adoption of Precautionary Behaviours Among Young Rural Adults in South Iran During COVID-19* investigates the factors affecting youth intention and preventive behavior with respect to COVID-19, also using the HBM.

Besides of those the issue also discussed the following topics:

- Social, Environmental and Economic Impact Assessment of COVID-19 on Rural tourism.
- Dynamic conservation in risk society: A case study of COVID-19 pandemic risk in Kashan Qanat Irrigated Agriculture.
- Tourism development during the pandemic of coronavirus (COVID-19): Evidence from Iran.
- The impact of COVID-19 pandemic on food security, and food diversity of Iranian rural households.
- How do collective efficiency and norms influence the social resilience of Iranian villagers against COVID-19? The mediating role of Social leadership.
- Impacts of COVID-19 pandemic on micro and small enterprises (MSEs): Evidence from Rural Areas of Iran.
- Developing a paradigm model for resilience of rural entrepreneurial businesses in dealing with the COVID-19 crisis; application of grounded theory in western of Iran.

We hope that the papers presented in this special issue will be useful and stimulating for further understanding of risks, vulnerabilities, and counter mechanisms available to deal with a wide range of health and economic shocks faced by rural households and to properly design and develop social safety nets.

Due to the good response from the researchers to this Research Topic, the journal has decided to initiative, the Volume 2 with the same editorial team. Further information can be found at: https://www.frontiersin.org/research-topics/41035/addressing-the-effects-of-covid-19-on-rural-areas-in-low-and-middle-income-countries-volume-2.

Author contributions

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

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Conflict of interest

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

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Analysis of Preventive Behaviors of Rural Tourism Hosts in the Face of COVID-19 Pandemic: Application of Health Belief Model

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The novel coronavirus (COVID-19) is one of the most severe public health crises in recent history. Therefore, in order to prevent the spread of COVID-19 and its negative effects on the health of rural tourist hosts and the rural community, it is necessary to pay attention to the conservation and health behaviors of rural tourist hosts. This study was conducted with the purpose of analyzing preventive behaviors of rural tourism hosts in the face of COVID-19 pandemic with the application of the health belief model (HBM) that is one of the most widely used models to study behavior to prevent and control diseases. In this study, all 80 tourism hosts of tourism target villages in Kermanshah province (the west of Iran), were studied as study population. A questionnaire was used to collect data which its validity and reliability were confirmed. Structural equation modeling (SEM) using Smart PLS software was used to analyze the data. The results of SEM indicated that perceived severity, perceived susceptibility, self- efficacy, perceived benefits, and cues to action accounted for 56% of the variance of "COVID-19 preventive health behavior" among the hosts of rural tourists in Kermanshah province. Moreover, the perceived susceptibility was the strongest predictor of preventive health behavior, while perceived barriers were not significant on behavior. Therefore, planning based on the HBM with emphasis on increasing awareness to improve and modify the health behavior of rural tourist hosts is recommended.

Keywords: health perception, rural tourism hosts, health belief model, risk preventative behavior, safety behavior, COVID-19

INTRODUCTION

The COVID-19 pandemic crisis is a threat to public health for both developing and developed countries (1). The COVID-19 first appeared on December 31, 2019 in Wuhan, China, and then spread rapidly around the world, with the World Health Organization (WHO) declaring it a pandemic crisis on March 11, 2020 (2, 3). Globally, the COVID-19 crisis is seen as a major public health challenge that although not as deadly as the H1N1 flu pandemic, it is unprecedented in terms of the rapid transmission of viral agents from one human to another (4). The COVID-19 pandemic crisis has had devastating effects on various systems such as health, political, social, and especially

economic in rural areas (5, 6). In this regard different countries have taken several protective and preventive measures to prevent its spread, which have had the most negative impact on businesses, especially tourism businesses (7, 8).

The tourism industry has long been recognized as one of the most vulnerable sectors to crises (9). Over the past 15 years, many health-related crises, particularly epidemics and pandemics, have severely damaged the tourism industry at the regional, national, and international levels (10). In this regard, the sudden outbreak of the COVID-19 has been an unprecedented shock to the tourism industry (11).

International tourism has declined by more than 80% since the outbreak of the COVID-19 in 2019 (12). The World Tourism Organization (WTO) estimates in 2021 that the outbreak of the COVID-19 will cause $1.3 trillion damage to the tourism industry (13). The emergence of the COVID-19 crisis has also suspended interactions between the origin and destination of tourism in the tourism industry (14) and the unfortunate consequences of the COVID-19 crisis have led to a change in the attitude of the host community, as a result, to their interactions with tourists (15). The tourism host community is aware of health ethics and treatment standards, and seeks to minimize public uncertainty and risk through new behavioral changes (16).

In this regard, Iran was one of the first countries in which the COVID-19 spread rapidly. With the aim of controlling the spread of the COVID-19, the Iranian government has put on the measures such as travel restrictions, social distancing, closure of markets and crowded areas and etc. As a result, the tourism sector was rapidly disrupted, so that these control measures have had a great impact on the country's economy, especially the tourism industry. The prolongation of the COVID-19 crisis and the uncertainty of the end of this crisis and the increase of economic pressure on the government and people of Iran led to the government being forced to reduce restrictions after a few months, and as a result, in mid-March 2020, the outbreak of the COVID-19 was intensified again in Iran (17). In this regard, unfortunately, we have witnessed an intensification of the outbreak of the COVID-19 in Iran during different waves (18). Tourists in Iran were also tired of the continued restrictions and quarantines. Therefore, according to health recommendations, most tourists tended to go to sparsely populated, pristine and natural areas instead of visiting densely populated areas. One of the most important and talented areas is rural areas and the exploitation of rural tourism. The presence of tourists in rural areas during the COVID-19 outbreak, although associated with many opportunities, it has led to the formation of feelings of anxiety, pressure and stress in the life of the rural host community due to the rapid increase in the number of new cases of COVID-19 (19, 20). Currently, government officials, the private sector, and most social researchers are working to develop strategies for planning and redeveloping tourism and building the confidence of tourists to return to their destinations and ensure their health; but an important issue that has been overlooked is the behavior of rural communities hosting tourists during pandemic. Numerous models such as protection motivation theory (21, 22), theory of planned behavior (23, 24), social cognitive theory (25, 26), Johnson's comprehensive model of information seeking (27) have been developed to study behavior (28), which is one of the most popular and widely used models is HBM. Gochman in 1997 defines health behaviors as overt patterns of behavior, practices and habits related to health maintenance, restructuring and improving health (28). The HBM is one of the most important models in the field of health issues that provides strategies to deal with various factors that threaten the health of individuals, such as the COVID-19. This theory was developed by social psychologists, Godfrey Hochbaum and Irwin Rosenstock in the early 1950s (29), to better understand why some people have failed to adopt health prevention programs (30). This theory has provided a useful framework to examine health behaviors and identify key beliefs of health, and has shown acceptable success in predicting a wide range of health behaviors (28). Therefore, in this study, due to the health of tourists and tourism hosts and the validity of the HBM model due to multiple applications in various studies, this model has been used to investigate the health behavior of hosts; this is while other models are less involved in health issues.

Various studies (9, 28, 31–33) show that HBM has had many applications in various topics related to human health behaviors. However, few studies have been conducted using this model during the outbreak of the COVID-19, especially in the field of tourism. For example, although studies such as Mahindarathne (28), and Sreelakshmi and Sangeetha (33) have addressed this model in terms of the conditions created by the COVID-19 outbreak, in both studies the general public has been examined as a statistical population. Also, various studies such as Thams et al. (14), Williams (3), Liew (8), and Abu Bakar and Rosbi (34) emphasized the importance of the tourism industry and the economic effects of the COVID-19 crisis on it. Although Huang et al. (9) used HBM in the field of tourism, this study also focused on tourists and ignores the study of the host community as well as how they react and behave. Therefore, due to the lack of studies as well as the importance of host community behaviors in tourism development, this study uses HBM to investigate the preventive behavior of the tourism host community, which somehow refers to the resilience of tourism hosts in times of crisis to retain their customers.

HBM is one of the most well-known and practical theories of behavioral change and preventative behaviors based on risk perception (35). The outbreak of the COVID-19 has caused fear, anxiety and risk perception in the rural tourism host community. Since the outbreak of the COVID-19 has led to the perception of risk in the rural tourism host community, they believe that the presence of tourists has increased the risk of the COVID-19 in rural communities. Therefore, improve of preventive behaviors in the community is essential. This study seeks to investigate the preventive behaviors of the rural tourism host community against the COVID-19 through HBM in the tourism target villages (more details in the study area section Research Methodology) of Kermanshah province in western Iran. The results of the present study are very important to understand preventive and health behaviors, reduce casualties and increase the safety of the tourist host community, promote health, reduce rural treatment costs, and measure the knowledge and attitude of the host community toward the risks of the COVID-19. Given that rural tourist hosts and also rural population are faced with the threat of the COVID-19 outbreak caused by rural tourists,

so what is important is to analyze the preventive behaviors of rural tourist hosts in this situation. In this regard, to provide operational strategies to strengthen preventive behaviors and increase their safety, study of their behavior in this specific condition was the main purpose of this study. In this way, the continuation of the activity of rural businesses and the provision of livelihood for the villagers in the conditions of the COVID-19 crisis will be provided. Specifically, the objectives of this study are: (1) To apply the HBM to explore the preventive behaviors of rural tourist hosts in the face of COVID-19, (2) To identify variables affecting the preventive behavior of the tourism host community, (3) To discuss the appropriateness of the HBM framework and draw conclusions about its predictive power, and (4) To provide operational strategies to promote and improve the host community's preventive behaviors. In general, despite the importance of understanding the behavior of tourism hosts, based on the studies, no HBM study was found to understand the preventive behavior of the tourism host community, especially in rural areas. Therefore, the main purpose of this study is to analyze the preventive behaviors of rural tourism hosts in the face of COVID-19 pandemic with the application of HBM.

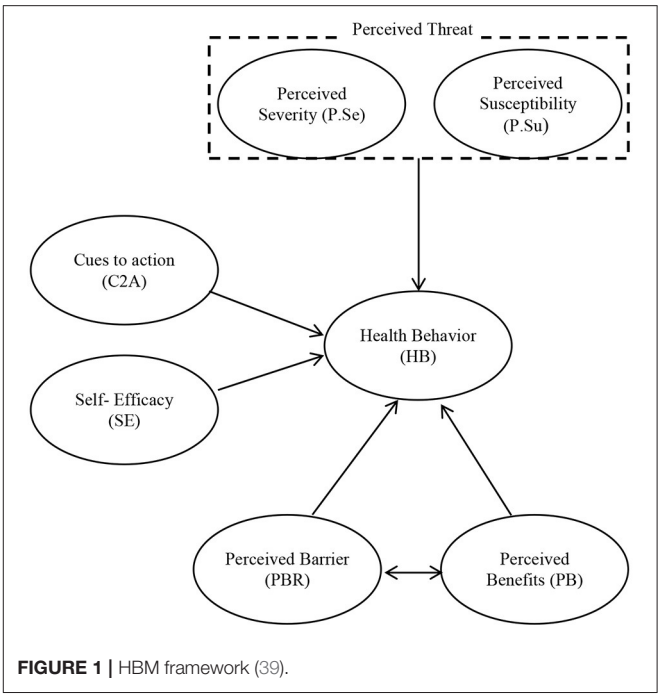

FIGURE 1 | HBM framework (39).

THE HEALTH BELIEF MODEL

This model focuses on a person's mental perceptions such as perceived susceptibility (Person's opinion about the chance of getting the disease), perceived severity (Person's opinion about the condition, the consequences and complications of the disease), perceived benefits (Person's belief about the usefulness of recommended actions to eliminate the risk or usefulness of accepting a behavior), perceived barriers (Person's perception of the tangible and psychological costs of recommended actions), self-efficacy (Perceived ability of a person to perform an activity) (36, 37) and cues to action (Strategies to activate readiness to take or not to take any actions) (37). Some studies [see (37)] also state that this model is influenced by several factors (moderating factors) such as demographic, socio-cultural, economic, knowledge, and psychological factors.

In general, HBM assesses the relationship between health-related beliefs and health preventive behaviors (38). Based on this, it can be said that people's preventive measures depend on their beliefs, because if people feel that they are exposed to susceptibility (perceived susceptibility), they take preventive measures to avoid risks. In other words, if a person believes that a situation is potentially dangerous and can have a significant impact on it (perceived severity) and thinks that he can reduce the risks and complications of the situation by taking a series of measures also, realizing that the benefits of these actions (perceived benefits) outweigh the barriers, the person will be more involved in the required behavior (35). **Figure 1** shows the theoretical framework of the HBM.

RESEARCH METHODOLOGY

The Area of Study

Kermanshah province is one of the western provinces of Iran and its center is Kermanshah city (**Figure 2**). The area of Kermanshah province is equal to 24,640 square kilometers (1.5% of the total area of Iran). This province is ranked 17th out of 31 provinces of Iran in terms of area. Kermanshah province is limited to Iraq from the west, Hamedan province from the east, Kurdistan province from the north and Ilam and Lorestan provinces from the south (40). At the time of this research (2020), this province has 14 townships, 31 central parts of the township, 84 districts and 2,793 villages (41). Kermanshah province has a high potential in the field of tourism because this province has pristine nature, suitable climate, four seasons climate, abundant water, numerous border markets, cultural diversity and fertile plains, infrastructure and proper communication routes and international airport. Kermanshah province is one of the oldest provinces of Iran with more than 4,000 known historical and natural monuments, of which more than 2,200 have been nationally registered and works such as Biston and Uramanat region have been registered worldwide (42).

In 2008, 14 villages in Kermanshah province, which are in a much better situation in terms of tourism capacity, were introduced as "tourism target villages"; These villages are: Piran (in Sarpol-e-Zahab township), Harir (in Dalahoo township), Kandoleh (in Sahneh township), Hajij (in Paveh township), Harasam (in Islamabad Gharb township), Shalan (in Dalahoo township), Fash (in Kangavar township), Noji Varan (in Bistoon township), Varmaghan (in Sonqor township), Charmah Olya (in Sonqor township), Khanghah (in Paveh township), Golain (in Gilangharb township), Sorkheh Dizeh (in Dalahoo township), and Shamshir (in Paveh township) (42); The location of the mentioned villages can be seen in **Figure 2**.

In this province, on February 20, 2020, the first sample of the COVID-19 was identified and officially registered by the Ministry of Health. After that, the COVID-19 spread rapidly throughout

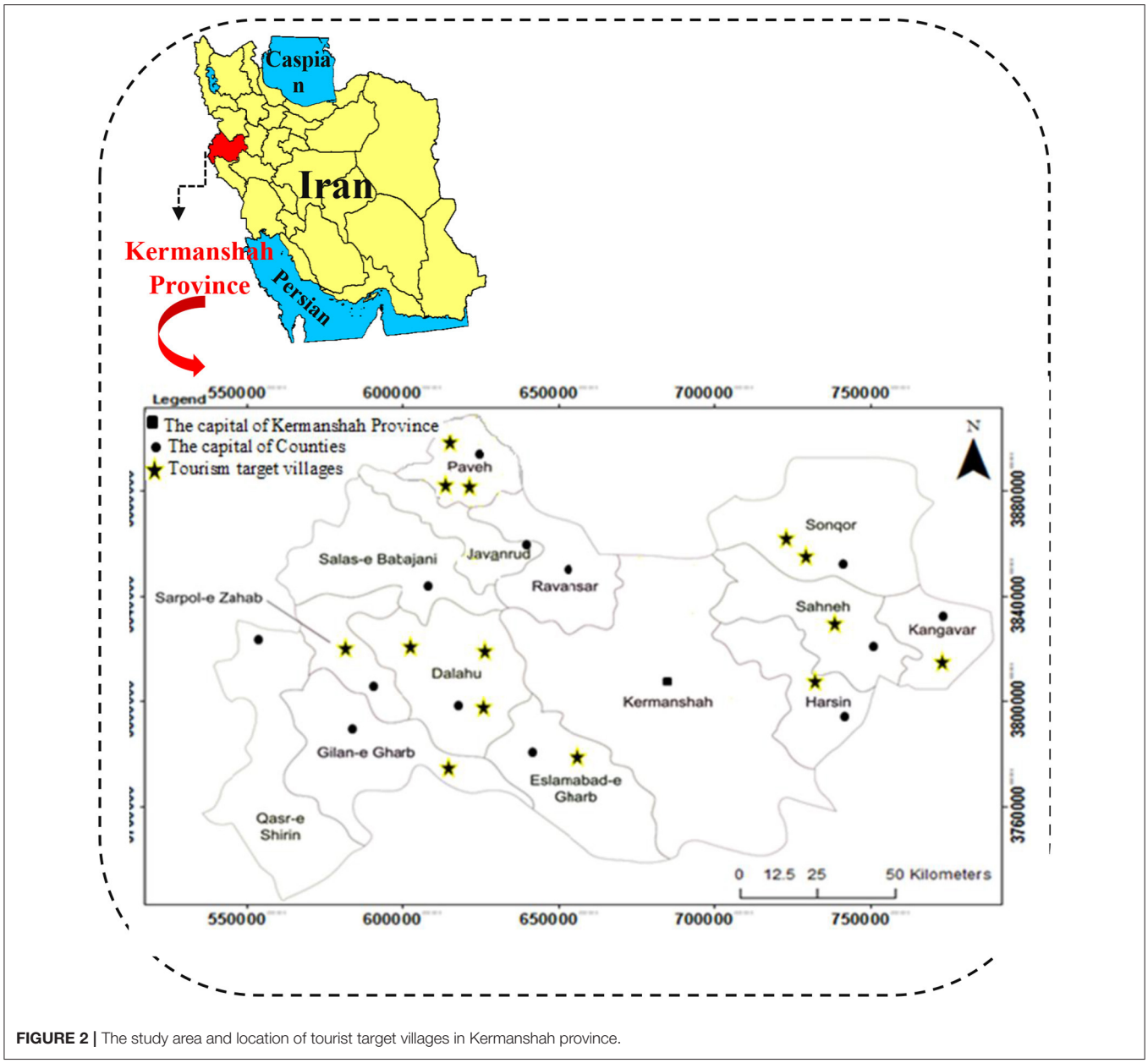

FIGURE 2 | The study area and location of tourist target villages in Kermanshah province.

the cities of Kermanshah province. Then, the cities of this province have been in the colors of mainly red (very dangerous) and orange (high-risk) colors, and in very few cases in some sparsely populated and low-traffic cities, such as Salas-e Babajani, have yellow (danger) colors. These conditions continued until the writing of the report of this study (i.e., the first of October 2021).

Study Design and Sample Size

The present study was a descriptive-survey research with a quantitative approach. The present study is a cross-sectional study conducted from September to December 2020 in Kermanshah province in the west of Iran (**Figure 2**). The statistical population included all rural tourist hosts in 14 tourism target villages in Kermanshah province. Rural tourism hosts meant those villagers who provided accommodation services to rural tourists in rural areas such as rural ecotourism centers. Since the Tourism office of Kermanshah Province provided only the official (formal) number of tourism hosts, so the researchers decided to ask the villagers (Rural officials) of 14 tourism target villages for the number of formally and informally hosts. According to statistics provided by the officials of tourism target villages, 80 tourism hosts are formally and informally providing services to tourists at the time of the survey (2020). Since the number of study populations was small, the census method was used for sampling, so the whole statistical population was selected as a statistical sample ($N = n = 80$). Due to the critical situation of the COVID-19 and also the existence of traffic restrictions between cities, a telephone interview was used to complete major

TABLE 1 | The items, constructs, and descriptive results of HBM.

Construct			Item	Mean	SD
P.Su		P.Su1	In my opinion, the hosts of rural tourists have a higher risk of the COVID-19 than other occupational groups.	3.54	0.70
		P.Su2	In my opinion, if you do not follow the health protocols, the risk of the COVID-19 increases.		
		P.Su3	I think the more rural tourists we receive, the more likely we are to get the COVID-19.		
		P.Su4	In my opinion, more than 80% of carriers not only do not have obvious symptoms of the COVID-19, but they themselves do not know that they are carriers, and the only way to diagnose it is to do the relevant medical tests.		
		P.Su5	In my opinion, the COVID-19 can be transmitted through various means such as respiration, etc.		
P.Se		P.Se1	I think getting the COVID-19 can affect all aspects of my life.	3.11	0.87
		P.Se2	In my opinion, if I get the COVID-19, I will have high treatment costs.		
		P.Se3	I think getting the COVID-19 can cause irreversible side effects in my body.		
		P.Se4	I think getting the COVID-19 can reduce the vitality in my life.		
		P.Se5	I think getting COVID-19 can be fatal in some cases.		
PB		PB1	In my opinion, the prevention of the COVID-19 reduces the economic costs of disease in the workplace.	3.63	0.72
		PB2	In my opinion, preventive measures against the COVID-19 cause mental health in a person.		
		PB3	In my opinion, the prevention of the COVID-19 reduces its economic costs.		
		PB4	In my opinion, the prevention of the COVID-19 causes the health of my family.		
		PB5	In my opinion, the prevention of the COVID-19, in addition to attracting and retaining tourists provide an opportunity to rebuild infrastructure and address the shortcomings of the service unit.		
PBR		PBR1	In my opinion, the hosts of rural tourists do not have enough time to disinfect the environment due to their busy schedule and excessive fatigue.	4.05	0.61
		PBR2	In my opinion, lack of knowledge about health protocols in the field of the COVID-19 has led to non-compliance with the principles of prevention.		
		PBR3	In my opinion, the unavailability of disinfectants and sanitary facilities such as masks, etc. in rural areas will cause a greater prevalence of the COVID-19.		
		PBR4	In my opinion, psychological problems are one of the effective factors in increasing the incidence of the COVID-19.		
		PBR5	In my opinion, the current economic situation has made it difficult to deal properly with the COVID-19.		
C2A	C2Ae	C2Ae1	In my opinion, the recommendations of your rural health network staff are an incentive to take preventive behaviors.	3.79	0.64
		C2Ae2	In my opinion, the warnings of official authorities such as the WHO, the Ministry of Health of Iran, medical staff and rural health networks are effective in reducing the prevalence of the COVID-19.		
	C2Ai	C2Ai1	In my opinion, observing the condition of patients and their recommendations in the field of the COVID-19 (from acquaintances, relatives or even people who are on TV or virtual networks) can motivate them to take preventive measures.		
		C2Ai2	In my opinion, searching in media such as the Internet and social networks to find ways to prevent the COVID-19 is effective in reducing the prevention.		
		C2Ai3	In my opinion, knowing the daily death rate due to the COVID-19 is effective in performing preventive behaviors.		
		C2Ai4	In my opinion, increasing the awareness of the irreversible side effects of the COVID-19 can be effective in preventive behaviors.		
SE		SE1	In my opinion, despite all the restrictions in the workplace, by learning the principles of prevention and following health protocols, I can prevent coronary heart disease.	3.73	0.70
		SE2	I think I can strengthen my immune system to fight Corona.		
		SE3	In my opinion, despite my busy schedule, I can exercise for at least 30 min daily to strengthen my immune system.		
		SE4	I think I need to improve my diet to strengthen my immune system.		
		SE5	I think I have to respect social distance in the workplace.		
		SE6	I need to use the right mask and gloves at work to prevent the COVID-19.		
		SE7	I think I need to reduce work-related stress in the face of the COVID-19 outbreaks by establishing appropriate communication with rural tourists and other colleagues (virtually or in person with social distance).		
		SE8	I am sure I can prioritize washing and disinfecting my hands and face.		
		SE9	I am sure I can reduce my communication with tourists and others during the day (without harming my business) as much as possible by planning to increase work efficiency.		
HB		HB1	Since the outbreak of the virus, how many people have you suspected of having the COVID-19?	3.60	0.72
		HB2	How much disinfectant and mask have you used since the outbreak of the COVID-19?		
		HB3	Since the outbreak of the COVID-19, to what extent have you minimized social interactions and maintained social distance?		

(Continued)

TABLE 1 | Continued

Construct	Item		Mean	SD
	HB4	Since the outbreak of the COVID-19, to what extent have you continuously disinfected tourist accommodation?		
	HB5	How much have you exercised to boost your immune system since the outbreak of COVID-19?		
	HB6	Since the outbreak of the COVID-19, to what extent have you controlled your diet to boost your immune system?		
	HB7	Since the outbreak of the COVID-19, to what extent have you followed the correct way to wash your hands and face (hot water and soap for 20–30 s)?		
	HB8	To what extent didn't you leave your home when the quarantine was announced by the government due to the outbreak of the COVID-19 and did you follow the principles of quarantine in hosting tourists?		
	HB9	Since the outbreak of the COVID-19, to what extent have you been constantly following and following up-to-date ways and principles of prevention and health advice from reliable sources?		
	HB10	To what extent have you installed equipment and structural changes (air conditioning, etc.) in your business environment?		
	HB11	To what extent have you been able to raise awareness and share information and experiences about the COVID-19 with other colleagues and locals?		

questionnaires from September to November 2020. In general, it took about 30–45 min to complete each questionnaire. All tourist hosts were informed that participation in this study was entirely voluntary.

Study Instrument and Data Collection Process

The data collection tool in this study was a questionnaire whose items and constructs were based on a comprehensive review of previous relevant studies and the theory of health belief (9, 28, 31–33, 35). The questionnaire included closed questions in two general parts: (1) Demographic section and (2) HBM section. In the demographic section, the demographic characteristics of the respondents and characteristics of their business such as age, gender, marital status, level of education, underlying diseases, etc. were examined.

The second part of the questionnaire included items and constructs of HBM that were adjusted according to the COVID-19 crisis based on the experts' opinions. This section included the following constructs: Perceived Susceptibility (P.Su); Perceived Severity (P.Se); Perceived Benefits (PB); Perceived Barriers (PBR); Cues to Action (C2A) [External (C2Ae) and Internal (C2Ai)]; Self-Efficacy (SE); and Health Behavior (HB). All constructs and all items are shown in **Table 1**.

In the HBM section, all items were measured through a 5-point Likert scale (1 = Strongly Disagree to 5 = Strongly Agree). In order to evaluate the validity of the research tool, content validity and structural validity were used. The content validity of the questionnaire was confirmed by experts in the field of rural tourism and health. Average of variance extracted (AVE) and discriminant validity indexes were used for structural validity. The reliability of the questionnaire constructs was measured through Cronbach's alpha value and composite reliability (CR). **Table 1** shows all the items and constructs of the research questionnaire.

Data Analysis

Data analysis was performed in two sections of descriptive statistics and inferential statistics using SPSS V. 20.0 and Smart PLS software. Structural equation modeling (SEM) was done using Smart PLS software.

RESULTS

Descriptive Statistics

Demographic Characteristics of Respondents

The results showed that the average age of the respondents was 40 years. Most of the respondents (77.5%) were male. In terms of marital status, 67.5% of the respondents were married. Result showed that in terms of education, 50% of the respondents had diploma and the half of them (50%) had educated in university. The highest percentage of education was related to bachelor's degree with 26.2%. Regarding the underlying diseases (diabetes, kidney disease, cardiovascular disease), 87.5% of the respondents stated that they did not have any diseases. In terms of health education, 66.2% stated that they were educated (including formal or informal education) and 42.5% of the respondents stated that they had received formal health education in order to obtain a health license for their business. Respondents stated that in Kermanshah province, the most prosperous seasons for tourism businesses are spring, summer and winter. Eighty percentage of the respondents stated that the number of tourists has decreased after the outbreak of the COVID-19.

Descriptive Analysis of Constructs and Items

The items, constructs, and descriptive results of HBM constructs are shown in **Table 1**. As **Table 1** shows, the average score of all constructs in HBM is higher than 3 (out of 5). Based on the results, perceived barrier had the highest mean score among hosts (Mean = 4.05 out of 5, SD = 0.61). After that, cues to action had a mean of 3.79 out of 5 (SD = 0.64). Perceived severity had the lowest mean score (Mean = 3.11 out of 5, SD = 0.87). In addition, the results of a descriptive analysis of the health behavior of rural tourism hosts against the COVID-19 showed that they have a high preventive behavior (Mean = 3.60 out of 5, SD = 0.72) (**Table 1**).

Results of SEM Analysis

First, the fit and validity of the measurement model were verified through confirmatory factor analysis (CFA). Six items with standardized factor loadings of 0.5 or less were removed. In order to evaluate the model fit, 5 indices including the following were used: SRMR < 0.10, D_G > 0.05, D_LS > 0.05, NFI > 0.90, RMS_ Theta ≤ 0.12 (43). In this study, after model saturation all model fit indices were higher than the recommended value. Therefore, the research model had an appropriate fit (**Table 2**). **Table 3** shows the values of AVE and CR. The recommended values are 0.5 and 0.6, respectively (43). **Table 3** also shows the diagnostic validity. The AVE for the research constructs ($0.726 < \text{AVE} < 0.921$) was greater than their correlation ($0.005 < r < 0.657$), which indicated that the diagnostic validity of the structures in the proposed research model was confirmed. So, the validity and reliability of all latent variables in the proposed model are at an acceptable level.

SEM analysis showed that perceived severity, perceived susceptibility, self- efficacy, perceived benefits, and cues to action could predict 56% of the variance of "COVID-19 preventive health behavior" among the hosts of rural tourists in Kermanshah province. Also, according to the results, perceived barrier did not have a significant effect on preventive behavior. The results showed that the most important predictor of COVID-19 prevention behavior is perceived susceptibility ($\beta = 0.34$, $P < 0.00$). In this regard, cues to action has the least power in predicting the health behavior of rural tourism hosts against COVID-19 ($\beta = 0.09$, $P < 0.00$) (**Figure 3**). **Table 4** shows Cronbach's alpha, standardized factor loadings, *t*-value value and standardized beta coefficients in saturated model.

TABLE 2 | Fit indices for the measurement model.

Fit index	SRMR	D_G	D_LS	NFI	RMS-Theta
Recommended value	<0.10	>0.05	>0.05	>0.90	≤0.12
Estimated value	0.09	3.05	5.87	0.91	0.11

DISCUSSION

The main purpose of this study was to investigate the predictors of preventive behaviors of rural tourism hosts in the face of COVID-19 crisis, which in this regard, the HBM model was used as a theoretical model. The results of SEM indicated that perceived severity, perceived susceptibility, self- efficacy, perceived benefits, and cues to action accounted for 56% of the variance of "COVID-19 preventive health behavior" among the hosts of rural tourists in Kermanshah province. Moreover, the perceived susceptibility was the strongest predictor of preventive health behavior, while perceived barriers did not have a significant impact on behavior. Therefore, the HBM is a good model to explain and predict preventive rural tourist hosts' behaviors in face of COVID-19 pandemic. This finding is important because the study was conducted in the context of the COVID-19 crisis. Because despite the frequent changes in policies and programs, as well as the lack of public confidence in health advice, the changing behavior of the COVID-19 pandemic, the spread of rumors in the political space and uncertainty about the future, this model has been able to provide relatively valuable guidance to researchers and executives in dealing with such crises. While this model has been used in previous studies [see (35)] under normal conditions and in various subjects, that are not comparable to COVID-19, and in comparison with the recent studies that have used this model in the context of the COVID-19 crisis [see (28)], the findings are significant.

Perceived susceptibility of COVID-19 prevention was the most powerful predictor of preventive health behavior, which is consistent with the studies conducted by Alhazmi et al. (32), Sreelakshmi and Sangeetha (33), Tajeri moghadam et al. (35), and Huang et al. (9). In this regard, it can be said that the nature of tourism in dealing with contagious diseases such as COVID-19 due to the possibility of getting infected and the transmission of the virus by tourists coming from different places, makes tourism hosts more sensitive to this issue. Another reason for this is that the families of tourism hosts are at risk. In this regard, the HBM model has shown its ability to highlight the effect of this variable on behavior. In addition, this finding indicates that rural tourism hosts have realized the susceptibility of the

TABLE 3 | Diagnostic validity, AVE, and CR.

Constructs	Diagnostic validity							AVE	CR
	C2A	HB	P.Se	PB	P.Su	PBR	SE		
C2A	0.921[a]							0.848	0.918
HB	0.385[b]	0.741[a]						0.550	0.930
P.Se	0.122[b]	0.444[b]	0.755[a]					0.570	0.868
PB	0.177[b]	0.623[b]	0.413[b]	0.726[a]				0.527	0.848
P.Su	0.500[b]	0.657[b]	0.318[b]	0.501[b]	0.739[a]			0.547	0.856
PBR	0.054[b]	−0.097[b]	−0.056[b]	−0.005[b]	0.027[b]	0.785[a]		0.617	0.824
SE	0.602[b]	0.523[b]	0.206[b]	0.441[b]	0.648[b]	0.167[b]	0.816[a]	0.666	0.909

[a] *The square roots of AVE estimate.*

[b] *Correlation is significant at the <0.01 level.*

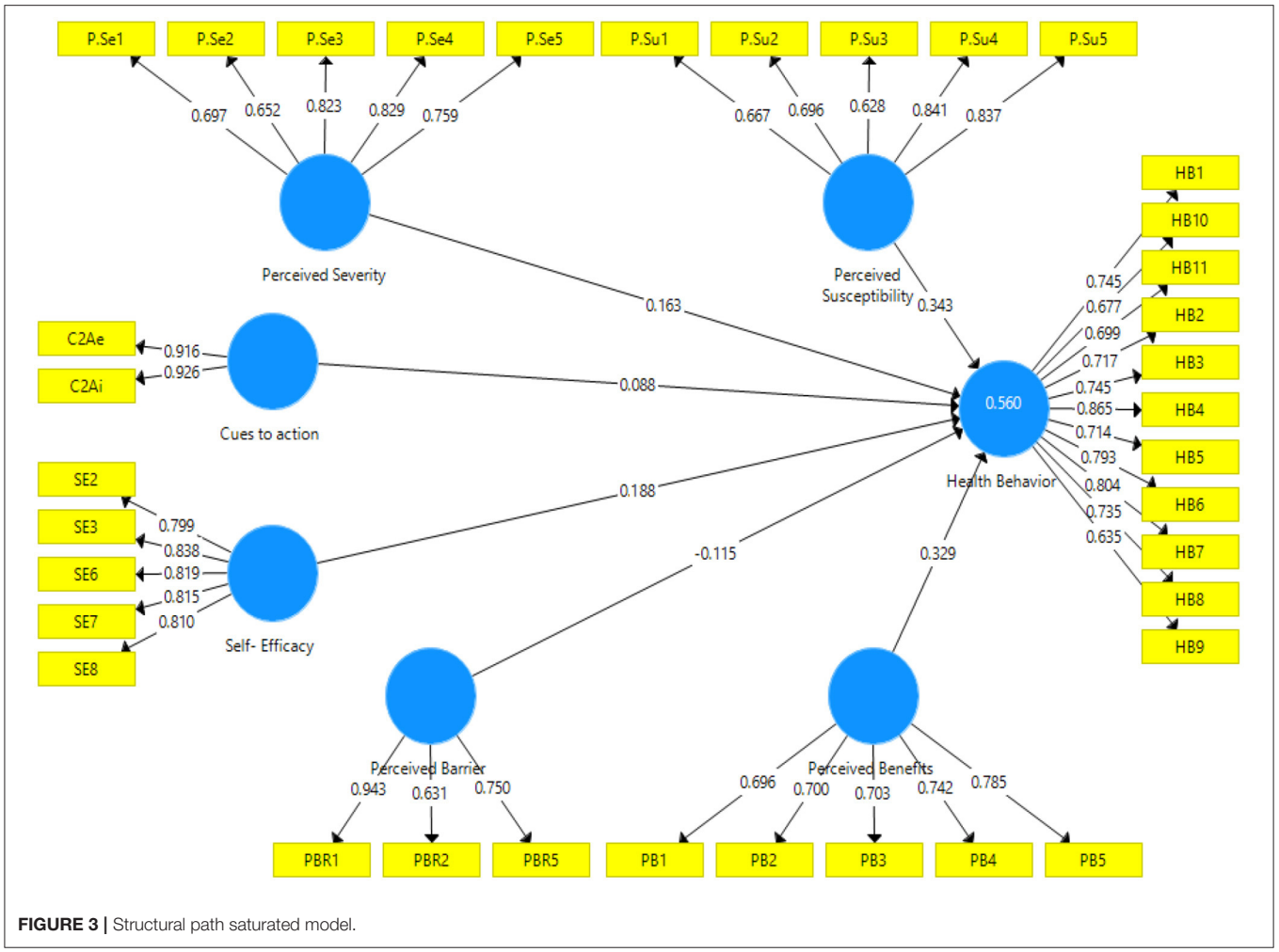

FIGURE 3 | Structural path saturated model.

situation and this makes them ready and resilient in the face of such crises. According to this, if tourism hosts accept that they are susceptible to the disease and there is a possibility of infection and consequent harm to them, then they are more likely to follow preventive behaviors, and through this perceived susceptibility, they will predict appropriate health behavior. Therefore, updating the knowledge of tourism hosts through valid and timely awareness can be considered as a key factor in the management of COVID-19 crisis in the rural tourism industry.

Given the expansion of virtual networks and the elimination of time and distance, networking is a possible measure in crisis management in rural communities in the study area. Also, since the pandemic conditions are the same for all the villages of the province and the country, the possibility of applying the results of this research in other parts of the country depends on environmental conditions, especially the timely action of managers and officials in decision making and informing stakeholders. The results showed that perceived severity also has a positive and significant effect on the incidence of health behavior. This finding is in accordance with the studies of Alhazmi et al. (32), and Sreelakshmi and Sangeetha (33), but it is not similar to results of study Tajeri moghadam et al. (35). This finding shows that the tourists' hosts have assessed COVID-19 as a serious and dangerous disease for their health as well as their business, which can have serious consequences in rural health, and therefore on various dimensions such as economic, social, cultural and political situation of rural areas. Therefore, perceived severity can lead to preventive behaviors. Since the COVID-19 disease has never been similar in the study area and also, during the outbreak of the disease, the hosts of rural tourism were in quarantine, the effect of perceived severity is lower than other factors and it only has more predictive power than cues to action. Based on this finding, institutions and trustees of rural tourism businesses and community health can reveal the facts of the crisis by sharing the experiences, pathology of behaviors and actions of rural tourism activists and reduce the probability of misunderstanding of the severity of the crisis and lack of proper and timely behavior by tourism hosts. Since time is of the essence in such cases, perceived intensity can have a significant effect on reducing the effects of the crisis, and the results of this study also show the positive effect of perceived intensity on the behavior of actors.

The results showed that the effect of perceived benefits of protecting behaviors by hosts had a significant effect on the type

TABLE 4 | Cronbach's alpha, beta coefficients, *t*-value and factor loadings in saturated model.

Constructs and items	Factor loading	*t*-value
PB ($\alpha = 0.79$) ($\beta = 0.33$)**		
PB1	0.69	7.48
PB2	0.70	7.58
PB3	0.70	6.25
PB4	0.74	8.57
PB5	0.78	11.44
P.Se ($\alpha = 0.82$) ($\beta = 0.16$*)		
P.Se1	0.69	8.96
P.Se2	0.65	7.99
P.Se3	0.82	10.63
P.Se4	0.83	12.20
P.Se5	0.75	7.24
P.Su ($\alpha = 0.77$) ($\beta = 0.34$)**		
P.Su1	0.67	8.09
P.Su2	0.70	9.16
P.Su3	0.63	5.60
P.Su4	0.84	21.36
P.Su5	0.84	23.28
PBR ($\alpha = 0.71$) ($\beta = -0.11^{ns}$)		
PBR1	0.94	2.90
PBR2	0.63	1.99
PBR5	0.75	2.26
C2A ($\alpha = 0.82$) ($\beta = 0.09$)**		
C2Ae (It consisted of two items that were computed for the model)	0.91	14.89
C2Ai (It consisted of four items that were computed for the model)	0.92	9.33
SE ($\alpha = 0.88$) ($\beta = 0.18$)**		
SE2	0.80	15.16
SE3	0.83	25.17
SE6	0.82	16.92
SE7	0.81	17.29
SE8	0.81	20.91
Health behavior (HB) ($\alpha = 0.91$) ($R^2_{Behavior} = 0.56$)		
HB1	0.74	12.22
HB2	0.72	11.01
HB3	0.74	11.95
HB4	0.86	30.62
HB5	0.71	10.36
HB6	0.79	20.22
HB7	0.80	20.97
HB8	0.73	14.27
HB9	0.63	7.24
HB10	0.68	9.82
HB11	0.70	8.93

*$P < 0.05$.
**$P < 0.01$.
^{ns}Non-significant.

of action they took in the face of COVID-19. This result is parallel with studies of Mahindarathne (28), Tajeri moghadam et al. (35), and Huang et al. (9). One of the reasons that can justify this positive effect is the susceptibility of the tourism business to COVID-19. Accordingly, the hosts have made every effort to maintain the job and attract customers by carrying out protective behaviors and have understood its benefits. This has had a positive effect on the continuation of preventive behaviors. Therefore, since the experience of COVID-19 has had a positive effect on improving the health behavior of hosts, it is suggested that by gathering the lived experience of the hosts and compiling it in the form of local tourism health protocols, these protocols be transferred to other similar occupations through the training program. In this way, the readiness and resilience of tourism hosts and rural services can be increased in cases similar to COVID-19.

Also the results showed that perceived barriers did not have a significant effect on health behavior. The insignificance of perceived barriers to host protection behavior may be due to the fact that the motivation to control and manage the effects of COVID-19 on tourism businesses and deleting its negative effects was so great that the existing barriers to preventive behaviors were not understood or did not matter to the hosts. This result is parallel with the study of Tajeri moghadam et al. (35), but it is not similar to the results of Mahindarathne (28), which showed perceived barriers had ability to predict behavior. This may be due to the different nature of the subject of COVID-19 with the subjects pursued in the mentioned research. One reason for this result in comparison to other research results (28) may be the place and sample of the study. Also this may be due to the different nature of the subject of COVID-19 with the subjects that have been studied in previous research.

The results showed that cues to action have a positive and significant effect on health behavior, which is consistent with the study conducted by Tajeri moghadam et al. (35). In other words, recommendations and warnings at the macro and micro levels have led to preventive behaviors. In this study, warnings at the macro level of society such as the WHO, the Ministry of Health of Iran and social channels, as well as at the micro level, the recommendations of regional health experts and other local social networks in the region and villages as cues to action were emphasized. Overall, the results showed that cues to action have a positive and significant effect on health behaviors, but its predictive power is the lowest among the other studied constructs. This shows that if we consider the haste and multiple and sometimes contradictory decisions of officials at the macro level regarding the management of COVID-19, the study model has shown the effect of the variable of "cues to action" at the lowest level compared to other structures of the model. It seems that due to the fact that most of these businesses are located in pristine and less developed areas and these areas are not in a good position in terms of communication infrastructure, cues to action in practice does not have high power in predicting preventive behaviors. Therefore, in this regard, it is recommended that the information communication infrastructure of these areas be upgraded to increase the hosts' access to the most up-to-date information. In this way, the incidence of preventive behaviors in accordance with the most up-to-date health protocols will increase. It is also recommended that in times of crisis, a group of career counselors and health counselors provide expert advice

at the appropriate time in order to take timely action by hosts to mitigate the effects of the crisis.

The results showed that self-efficacy has a positive and significant effect on health behavior. This finding is in accordance with the studies of Mahindarathne (28), Huang et al. (9), and Sreelakshmi and Sangeetha (33). The coefficient of this variable indicates that tourism hosts have a good understanding of Susceptibility in the face of COVID-19 and have had considerable self-confidence and self-efficacy when confronted with it, but the predictive power of the "cues to action" variable (which can most likely be related to the haste of officials and the frequent changes in decisions and programs and sensitive conditions governing the society) is very low for various reasons. In other words, in the face of the COVID-19 crisis, what goes back to the individual and to the area of individual decisions and authority has a more positive effect on behavior, than variables related to environmental conditions (e.g., decisions of managers and officials and informing systems).

CONCLUSION

This research was conducted due to the COVID-19 crisis in the world and its negative effects on various communities, especially rural communities. In rural communities, non-agricultural occupation has an undeniable effect on the sustainability of rural livelihoods. One of these jobs is rural tourism, which has been severely affected by COVID-19. Hence, the sustainability of these jobs and the livelihood of this group of rural actors depend on the behavior of managers and hosts of rural tourists to manage the risks posed by COVID-19. Therefore, this study has used the HBM model to study the behavior of this community in the COVID-19 crisis to determine whether this model can be used in critical situations to manage behavior in rural communities with its own unique complexities. The results of the research are important both in practical and scientific dimensions. In the scientific dimension, the application of HBM model in analyzing the behavior of rural tourist hosts (rural community) in times of crisis is possible and justifiable. The importance of this finding in this dimension is that so far the behavior of the host community and tourism managers has not been addressed in previous studies and in most of them the behavior of tourists has been considered. In the executive dimension, the results of the research showed that despite the surprise of the COVID-19 pandemic, rural tourism hosts have increasingly relied on individual capabilities such as self-efficacy, understanding the susceptibility and severity of the event, as well as the benefits of their protective behaviors to manage the effects of the disease, and what has been related to the conditions of environment, especially the political and economic environment that has been less able to influence hosts to provide preventive behaviors. As in this regard, the effect of cues to action on protective behavior has been negligible. In other words, in the absence of educational and support services, this society has been able to manage its business with the behavior resulting from the understanding of the situation. Therefore, it is suggested that the trustees, by recording the lived experience of rural actors (at the national and international level) in the face of the COVID-19 crisis and similar cases, take action to realize (community-based) behavioral protocols in national and international level.

LIMITATIONS AND FUTURE RESEARCH DIRECTIONS

The most important limitations of this research include the following: This study was performed in the context of COVID-19, which resulted in non-cooperation of some samples due to the fear of COVID-19 infection; due to traffic restrictions in Kermanshah province and the prevalence of COVID-19, physical presence in tourist centers in the villages was difficult; having access to the hosts of rural tourists was very time consuming and costly due to the dispersion of villages in Kermanshah province; and due to the low literacy of some rural tourist hosts, completing some of the questionnaires took time. Also, in order to conduct future research, a comparison of the planned behavior model and the health behavior model in terms of the power of predicting health behaviors among the hosts of rural tourists is proposed.

DATA AVAILABILITY STATEMENT

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

AUTHOR CONTRIBUTIONS

AAM, FK, and EK contributed to conception and design of the study and performed the statistical analysis. FK and EK wrote the first draft of the manuscript. FP contributed in data collection. AAM, FK, and EK wrote sections of the manuscript. All authors contributed to manuscript revision, read, and approved the submitted version.

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COVID-19's Impact on China's Strategic Emerging Industries: An Observation of Policy Difficulties

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The study investigates the influence of the COVID-19 on the rate of R&D investment and foreign exchange development of China's most important emerging industry firms. From 2010 to 2020, data were collected from 26 locations across China, focusing on seven different types of critical creating companies. To analyze the data, we have applied Fourier Increased Unit Root Test, Granger causality assessments test, Pattern Assessment test, Poisson pseudo most excellent probability (PPML) approach, Wald test, and Regression analysis test. The results of the tests reveal a clear underlying association among COVID-19 relates Chinese exports and imports. COVID-19's instant effects on imports and exports lack working capital have been calculated, but the short-term, medium-to-long-term products are composite and unidentified. The article result main results are following: (i) The COVID-19 impacts the R&D investment is main industries like as high-end equipment industry, new materials industry, and new-era data innovation. (ii) The COVID-19 highly affects the imports and exports development network of Chinese strategic emerging industries which emphasizes cross-industry grouping features. The study provides the guidance to the future researchers to focus on COVID-19 affects on the strategic emerging industries of developed and underdeveloped countries to determine of foreign direct investment inflow and unemployment growth rates.

JEL: G20, O10, O40

Keywords: COVID-19 epidemic, R&D investment rate, financing constraints, baseline estimation test, PPML, Fourier Augmented Unit Root Test, Chinese strategic emerging industries

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INTRODUCTION

The COVID-19 pandemic is affecting families, networks, and organizations worldwide; the episode of the COVID-19 pandemic is referred to as a "dark swan event" (1). It not only harms people's health around the world, but it has also harmed countries' financial activities. Controlling the epidemic has necessitated monstrous lockdowns and travel restrictions, which have changed human behaviors and hampered contemporary exercises, posing challenges and vulnerabilities to the global economy and human social systems (2, 3). Therefore, this study aims to investigate the effects of the COVID-19 on the rate of R&D investment and foreign exchange development of China's emerging industry firms.

By the beginning of April 2020, the repression policy has kept 81% of the global labor force at home (4), resulting in a 20% reduction in global assembly yield (5). In the meanwhile, the movement request was meeting with little success, with 90% of the world's air armadas grounded

(6). COVID-19 has undoubtedly had a significant impact on the car industry, with production lines being shut down, supply networks being disrupted, and customer demand being reduced (7). We chose China for our evaluation since it was the first country to announce COVID-19 and are the best at mitigating the pandemic's effects. The blueprint for the 13th long-term plan for the People's Republic of China's public financial and social development advances the prerequisites and plans to improve the supporting role of emerging businesses, develop and foster key industries, build another example for the advancement of emerging ventures, and further develop the arising ventures' development climate (8).

This study aims to focus on how the intelligent Covid-19 resurgence in 2020 impacted China's central emerging industries. Wen et al. (9) study the impact of COVID-19 on China's economy to determine the yield of ventures, which results in a drop in capital consumption, experience, and a fall in utilization interest. Currently, China has one of the world's fastest-growing financial exchanges (10–12). Despite various studies demonstrating a substantial premium on its market, Chinese travel industry businesses have received insufficient attention (13). Accelerating the growth of critical emerging industries is strategic for changing China's financial development model, increasing the nation's global intensity, and creating a development-oriented country. Since the incident in China, China has been subjected to various restrictions imposed by other countries. As a result, China's economy has shut down, and the economy has been heavily impacted. In any event, this plague will significantly impact commerce, with China's imports and prices significantly reduced (14). Most areas rely on local electronic data science and education, ventures, and assets to increase logical and innovative examination on COVID-19 anticipation and control, supplement the inadequacies of pestilence. The board controls innovation and speeds up the creative work of new advancements, strategies, items, and hardware for pandemic avoidance and control to combat this scourge. Experts in logical and mechanical disciplines must conduct primary research on infection transmission properties and apply their findings in the battle against the new Covid-19 (15). The rapid spatial spread of the COVID-19 plague outbreak prompted the World Health Organization (WHO) to declare a pandemic resulting in line terminations and mass isolation. The review's primary goal is to look into the impact of COVID-19 on R&D venture rates, imports, and fares in seven key emerging industries: biotechnology, very high-quality hardware industry, new material industry, new energy industry, intelligent and new energy vehicle industry, energy preservation and ecological insurance industry, and computerized innovation. The advancement of China's sophisticated economy inflicts a turn of events and the growth of automated innovations such as artificial intelligence, big data, distributed computing, 5G, whipping, and item organization. There is also a dearth of sophisticated and astute applications in strategic areas such as competent medical care, intelligent training, astute transportation, driverless driving, astute urban communities, quick assembly, and astute houses (16). In the worst-case scenario, the financial growth rate will fall by 2–3 % in the first quarter and 5% in 2020. In comparison to SARS in 2003, COVID-19 proves to be a deadly virus (17, 18).

The main research question of this study is to explore the influence of the COVID-19 on the rate of R&D investment and foreign exchange development of China's most important emerging industry firms. To the novelty, this study mainly focuses on the COVID-19 impacts on the growth rate of R&D investment Chinese strategic emerging industries as since last 5 years Chinese government especially focused on the innovative technologies in these seven strategic emerging industries to compete with the production and quality standards of products. Secondly, we have also measured how much COVID-19 disturbed the imports and exports of these strategic emerging industries products in the world, especially USA and European countries. The results reveal that compared to other factors, COVID-19 plays a more significant role in reducing R&D investment and international trade rate of strategic emerging economies in China. The contributions of this study are following: (i) The COVID-19 impacts the R&D investment is main industries like as high-end equipment industry, new materials industry, and new-era data innovation. (ii) The COVID-19 highly affects the imports and exports development network of Chinese strategic emerging industries which emphasizes cross-industry grouping features. To the implication, this study sheds light on the effects of COVID-19 on China's related industries, which lay a solid foundation to analyse the COVID-19 is how to affect the R&D investment and foreign exchange development in emerging economies.

This paper is organized as follows. Section Literature Review presents a review of the research literature conducted on strategic emerging industries and COVID-19 epidemics. The research methodology and Research design is explained in section Methodology. Section Research Analysis and Results revealed the analysis the results of research methods such as Fourier Increased Unit Root Test, Granger causality assessments test, Poisson pseudo most excellent probability (PPML) method. Conclusion and implications with limitations and future research directions are discussed in section Conclusion.

LITERATURE REVIEW

COVID-19 began to spread in December 2019 and was first detected in early January 2020. In China, it first appeared in mid-to-late January (19). Despite the many types of chaos and data difficulties, we must remember that COVID-19 is, first and foremost, a humane exam (20). According to the study, continued proliferation inside existing structures and localized transmission in new buildings will result in a 0.3 to 0.7 % drop in global GDP growth in 2020. To begin with, disasters and anthropogenic natural concerns (21) and their capacity to alter objectors' perception impact travel and the travel business on many scales. According to the World Travel Industry Association (WTO), travel industry appearances in China decreased by 1.2 to 694 million in 2003 (compared to a similar time in 2002), and hotel occupancy rates plummeted by 10% (More out of control). Despite the COVID-19 attack

in key emerging businesses, China's exports increased by more than 20% in November 2020 compared to November 2019, driven by prices for PPE, customer hardware, other purchaser merchandise, and notably therapeutic goods. Along these lines, China's inconvenient new price-quality tests for personal protective equipment (PPE), particularly veils carried out by China's Public Clinical Items Organization (NMPA), significantly slowed commerce. China's Ministry of Commerce (MOFCOM) announced new capabilities for clinical inventory send-outs on March 30, 2020. As a result, buyers' earnings have decreased, prompting a further drop in interest rates. Automobile manufacturers, except a few, have all ceased produce in Europe and China (22). Strategicly, the families' wages have decreased due to the epidemic, but their expenditure on food has remained relatively constant compared to other goods. Force is strategic for pushing economic development, particularly in growing business sectors such as those affecting well-being, education, industry, and sustainable urban communities, and the possibilities are endless. COVID-19 impacts the region, notably by causing a drop in interest rates, the financial pressure, and disruptions in the force production network, which are particularly vulnerable to these developments. The Chinese Communist Party (CPC) and the government took swift steps to combat the epidemic, including massive scale isolation, travel restrictions, and the disengagement and observation of suspected patients. COVID-19 has been a major test of China's general health framework and administration restriction, highlighting the critical importance of working on significant pandemic avoidance and control frameworks alongside public general health framework crisis the board (23). First and foremost, governments must balance financial fluctuations and general well-being (24). In the long run, as a fundamental component of human resources, happiness is a key driver of financial outcomes. China's use of energy and natural resources is currently characterized by a low overall use level, a broad use mode, and a reverse use method. Financial progress is needlessly reliant on asset and energy investment, which results in massive waste and pollution (25). In 2020, global growth was expected to be−4.9 %, 1.9 % lower than the April 2020 World Financial Standpoint (WEO) forecast. Its recovery is expected to be more rapid than previously predicted (26). Despite its impact on economic mobility and energy consumption, the COVID-19 epidemic has made a significant contribution to environmental betterment, particularly in countries and domains that have implemented strict lockdown and constraint measures (27). The lockout implements a major travel day for those planning to return for the holidays one day before Chinese New Year's Eve. COVID-19 has a significant impact on China's transportation industry. Currently, the global energy usage of transportation sectors accounts for ∼33% of total global energy utilization, with China accounting for around 20% of that (28). The mash and paper business encompasses a wide range of disciplines, including ranger service, agriculture, synthetic substances, science, conveyance, and transportation, and so plays an important role in the global economy (29). The COVID-19 pandemic has had a major impact on people's life, contemporary creation, and the global economy, which has unavoidably had a big impact on the mash and paper business. The government's sponsorship plan demands the electronic data industry's full and precise expansion, and it is also critical to its outcome. Combating the COVID-19 virus is also a test of the emerging online taxpayer-driven organization's development and social sustainability (30). The COVID-19 pestilence, triggered by the US-China trade war, had a significant impact on the Chinese economy and put it to the test (31). Because of the preponderance of highly developed financial business sectors in the United States, we use it as a benchmark in developing these rankings (32). Simultaneously, a new era of financial innovation known as Fin-Tech has emerged. A new industry of businesses employing online platforms, block chain, artificial intelligence, and other advancements to challenge conventional financial plans of action (33). Labor in the financial sector has worsened in many parts of the globe, not least due to the introduction of innovations, other business administrations, such as bookkeeping, corporate law, and business counseling, have experienced substantial growth (34). Fuchs et al. (35) used trade data in China to examine the exchange impacts of COVID-19. They investigate if historical financial ties established through trade and ventures and political ties are connected to China's fine example of strategic clinical items. In the first quarter of 2020, Hayakawa (36) investigated trade across 186 countries and discovered the COVID-19 issue has a significant negative impact on exchange trading nations, but not on bringing in the country. COVID-19's mission is to wreak havoc on hardware part suppliers by focusing on the prices of finished apparatus products. According to certain reports, a few clinics with somewhat weak financial foundations are in a dire financial situation in the medical care business (37). Local medical clinics have a lower working edge than city clinics, especially in the southern United States. Despite wearing heavy protective gear, there is a chance that clinical personnel will be too concerned about the risk of COVID-19 contamination (38). According to the (4), the COVID-19 impact on the world economy and has identified three possible scenarios for the unemployment rate of 188 million last year to between 5.3 million in their low-end scenario and 24.7 million in their very excellent quality situation, up from a base level of 188 million this year (4). The COVID-19 event has also impacted global oil prices and, by extension, financial growth (Gross domestic product). As a result, oil costs and financial development are frequently intertwined, and if both fall, there will be less abundant and fewer opportunities available in the labor market. It is critical to remember that oil prices were impacted not just by the Covid-19 event but also by subsequent events such as the OPEC meeting on oil production and the countries of oil producers and political tensions throughout the world. Despite the company's vulnerability to various shocks, its capacity, and capability to manage an emergency remain low in many ways. The tourist industry considers a significant transmission route that assists in the spread of numerous illnesses throughout the world owing to the mobility of affected people. The aviation sector was one of the most badly hit financial areas by COVID-19, according to Sun et al. (39), and it also had a significant role in spreading the virus early in the pandemic. According to Chung (40), the quick expansion

of the aeronautics sector prepared for rapid multiplication. It spreads diseases throughout individual development, placing pressure on the world to take sufficient defensive measures to defend the global economy. COVID-19 was recognized as a global wellbeing problem of worldwide concern by the World Well-being Association on January 30, 2020 (41). As a result of this pattern, several countries reported a significant drop in power usage in commercial and contemporary areas (42), posing various challenges for electric utilities and system managers (43). The COVID-19 outbreak has impacted supply chains and drew the attention of analysts (44) and business experts all over the world. Furthermore, the pandemic's impact on the economy has been seen as a result of the worldwide lockdown of urban areas, work flexibility restrictions, travel boycotts, carrier suspensions seriously affecting the maintainability of supply chains in numerous organizations (45). The effective use of social capital is critical for combating environmental vulnerability, increasing intensity, advancing new product creation and mechanical development, and improving execution (46). These developments reveal China's position in the pandemic-related shock, as well as its role in global creation sharing. To be sure, pandemic-related disruptions to China's central role in global supply chains have sent shockwaves across industry hubs from one side of the globe (47). The issue of unshipped and inactive holders at Chinese ports resulted in compartment shortages at major ports worldwide. The scourge's impact on China's economy is vital (28) is a big concern, especially for countries shipping out novel foods cultivated on the ground. The travel industry is extremely vulnerable to pandemics, and the impact of regular risks on the retail industry with the conclusion that regular risks frequently result in a high retail shop conclusion proportion, as well as a decrease in the number of small retailers (48). The COVID-19 pandemic has substantially influenced corporate development and has had a considerable impact on popular life owing to widespread closures (49). To have a stable future beyond COVID-19, organizations should look for ways to improve the maintainable evolution of the store network (50). Research and development investment impedes financial skills development, which contradicts the previous conclusion that research and development investment constantly cultivates productive financing (51). Jiao (52) demonstrated that recognizing high mechanical levels need significant public funding for research and development ventures. Apart from the severe social and financial consequences of COVID-19 lockdown, the isolation guidelines resulted in a few ecological improvements in a few countries (53). According to figures provided by China's Public Agency of Measurements on April 1, 2020, China's GDP growth ratio fell by 6.8% in the first quarter of 2020 (54). During the climax of the country's COVID-19 lockdown in the spring of 2020, the Spring Celebration excursions caused a brief outflow dip akin to the odd effects of the COVID-19. Our month-to-month CO_2 emissions estimates, based on daily data, are consistent with previous studies (55), which depicted the magnitude of the global month-to-month CO_2 emissions decline in February 2019 due to decreased energy interest during China's Spring Festival. During the flare-up of the COVID-19 pandemic and the following local area lockdown to limit the spread, these benefits were mostly exploited by a few SMEs in high-level economies (56).

METHODOLOGY

Data Collection Process

The research will run from 2010 until 2020. **Table 1** displays a list of 26 categorized business sectors drawn from seven distinct categories of key developing industries.

We gathered data from 450 companies, including 26 sectors from the seven types of strategic emerging industries (including bio and medicine, high-end equipment industry, new material, new energy, intelligent and new energy vehicle industry, energy conservation, environmental protection industry, and digital creative industry). COVID-19 data is obtained from the World Health Organization website (https://covid19.who.int/region/wpro/country/cn) and is utilized from December 01, 2019 to April 10, 2020. The CSMAR database provided information such as R&D investment statistics and financial indicators.

Research Design

The fundamental idea behind creating the industry accounting index is as follows. To weight the equity and calculate the bookkeeping index $A_i(t)$ represents industry i and quarter t by analyzing each industry's periodical secretarial directory second $a_i(t)$. Finally, create an optimal industry accounting index, *Yi,* using the synthetic index compilation approach (t). The cost index shows the industry's operational expenditures every quarter. The cost index comprises operating costs, taxes and levies, sales expenditures, and management charges. The price, leverage, and inventory indices are all negative. As a result, a drop in these indexes is advantageous to the industry's expansion. The final industrial accounting index $A_i(t)$ is obtained after passing through the standardization and compilation of synthetic indexes. The steps involved in creating a composite index are as follows.

Step 1: We utilize the method to decrease the impact of seasonal fluctuations and irregular Variables on the index computation $A_i(t)$ to calculate the symmetric change rate, use the current and prior periods as the base–so that the change is equal/symmetric whether the index increases or decreases. The symmetric change rate is calculated as follows:

$$C_i(t) = \begin{cases} \frac{A_i(t)-A_i(t-1)}{A_i(t)+A_i(t-1)} \times 200, & A_i(t) > 0 \\ A_i(t) + A_i(t-1), & A_i(t) \leq 0 \end{cases},$$

The C_i(t) described the rate of change, A_i(t) represents the industry bookkeeping index, i represent industry, and t represents the quarter.

Step 2: To reduce the impact of excessive change in the index, we normalized the symmetric change rate. First, we determined the normalization factor U_i(t):

$$U_i(t) = \frac{\sum_{t=2}^{n} | C_i(t)}{n - 1}$$

The pace of change is enhanced to show the influence of COVID-19 on various industry indices more clearly while maintaining the

TABLE 1 | Shows the 26 industries classified in eight strategic emerging industries.

SR. NO.	Strategic Emerging Industries	Sector	SR. NO.	Strategic Emerging Industries	Sector
		Chemical raw materials and products indust			
		Chemical fiber industry			
Case A	New material industry	Rubber and plastic products	Case D	New energy automobile industry	Automobile industry
		Non-metallic mineral products industry			
		Ferrous metal smelting and rolling industry			
		Non - ferrous metal smelting and rolling processing industry			
		Metal products industry			
		The production and supply of water	Case E	New energy industry	Power and heat production and supply industries
Case B	High-end equipment industry industry	Industry of railway, shipping, aerospace, and other transport equipment	Case F	Biological industry	Agricultural and sideline food processing
		Electrical machinery and equipment industry			
		Instrument industry			Food industry
		Metal products, machinery, and equipment repair industry			
		Extracting oil and gas Mining of ferrous metal			
Case C	Energy conservation and environmental protection industry	Mining and cleaning of coal are two different industries.			Pharmaceutical industry
		The mining of nonferrous metals	Case G	The new generation of the information technology industry	Computers, communications, and other electronics
		Non-metallic mining industry			
		Petrochemical, coking, and nuclear fuel processing industries			
		General equipment industry			
		Special equipment industry			

Source: List of these strategic emerging industries get from http://www.xinhuanet.com/.

index's stability. The standardized rate of change is a measure of how quickly something changes R_i(t) is attained:

$$R_i(t) = \frac{R_i(t)}{H_i} \times 10000$$

Step 3: Calculate the composite index of each subsequent quarter, which is the final industry accounting index Y_i(t), when Y_i(t) = 100:

$$Y_i(t) = Y_i(t-1) \times \frac{200 + R_i(t)}{200 - R_i(t)}$$

Imports and Exports Empirical Framework

This section outlines our experimental design for investigating COVID-19's impact on global imports and fares. We examine these impacts by looking at data on respective imports and exports month by month from December 2019 to April 2020. The previous section posits that COVID-19 damages in sending countries influence imports and fares *via* the evolution of import and fares expenditures and supply constraints. COVID-19 injuries in bringing in nations also affect imports and exports through changes in the cost of imports and exports and the rate of interest. The recurrence research of imports and exports esteems on specific nations' COVID-19 damages was not established to investigate the absolute influence of COVID-19 in bringing in Chinese trade. The following is how we came up with our pattern model:

$$Imports \ \& Exports_{ijym} = exp\{a_1 COVID_{iym} + \beta_1 COVID_{jym} + \delta_{ijy} + \delta_{ijm} + \delta_{ym}\}.\epsilon_{ijym} \quad (1)$$

Imports and exports$_{ijym}$ is the export value from countries i to j in month m year y. As explained in more detail later, $COVID_{iym}$ and $COVID_{jym}$ are the extent of COVID-19 damages in exporting and importing countries, respectively. We controlled for three

TABLE 2 | The short-term impact of the COVID-19 on the strategic emerging industries.

Short-term impacts	Case A	Case B	Case C	Case D	Case E	Case F	Case G	Case H
Loss as a result of a product's expiration (S1)	*	*	*	*	*	*	*	*
Working capital shortage (S2)	*	*	*		*	*	*	*
Expenses of routine operations are difficult to meet (S3)	*	*	*	*	*	*	*	*
The lack of cash causes a delay in the opening of LCs (S4)	*		*	*	*	*	*	*
Distributors and trade partners stop or curtail their activities (S5)	*	*			*	*	*	*

*Source: Authors. *Indicates the result is significant.*

TABLE 3 | The medium-to-long-term impacts of the COVID-19 on Strategic emerging industries.

Medium-to-long-term impacts	Case A	Case B	Case C	Case D	Case E	Case F	Case G	Case H
Return on investment (ROI) reduction (L1)	*	*	*	*	*	*	*	*
In the industry, there are job cutbacks (L2)	*		*		*	*	*	*
Reduction of trade relationships (L3)	*	*			*	*	*	
The supply chain network is being rebuilt and restructured (L4)	*	*		*	*	*	*	*
The industry's contribution to GDP is being reduced (L5)	*		*	*	*		*	

*Source: Authors. *Indicates the result is significant.*

kinds of fixed effects (δ_{ijy}, δ_{ijm}, and δ_{ym}). $_{ijt}$ is a disturbance term. We estimated this equation using the Poisson pseudo maximum likelihood (PPML) method. Then, we investigated the time-series changes of the coefficients for the COVID-19 variables. To this end, we estimated the following equation:

$$Imports \ \& \ Exports_{ijym} = \exp\{COVID_{iym} \, D_m^{'}\alpha + COVID_{iym} \, D_m^{'}\beta + \delta_{ijy} + \delta_{ijm} + \delta_{ym}\}.\epsilon_{ijym} \quad (2)$$

All coefficients in both the imports and exports are strategic and D is a vector factor indicating monthly loss occurred due to COVID-19 impacts on Chinese strategic emerging industries products. It also denotes the other confirmed cases, more passing, more inactivity in retail or the workplace, and more days with lockdown orders. We lead the Wald test of the coefficient for importers' COVID-19 effects are equal to that for Exporters' COVID-19 impacts to think about the greatness of the edge impacts.

Fourier Augmented Unit Root Test

The Dickey-Fuller unit root test equation can be described as follows.

$$Y_t = \beta_t + \sigma \ Y_{t-1} + \delta_t + \epsilon_t \ (i)$$

Where β_t refers to a time-dependent function root is tested by examining, $\sigma = 1$ which shows a term that might lead to biased test results when the deterministic time is unknown.

TABLE 4 | Fourier ADF unit root test.

	Levels	1st variation	No. of Fourier
COVID-19 cases	−2.689		1
COVID-19 deaths	−1.597	−3.198	1
Imports	−1.713	−5.088	1
Exports	−2.697		1

*Note that the symbols ***, **, and * represent the significance levels of 1, 5, and 10%, respectively.*
These estimates are from the author.

Granger Causality Estimations

Granger causality is a method for determining the causal relationship between two elements in a time series. The process is a probabilistic record of causality that uses observational informational collections to find examples of relationships. Even though it isn't the same, causality is strongly associated with conditions and logical outcomes. The invalid theory for the test is that slacked x-values don't clarify the variety in y. As such, it accepts that x(t) doesn't Granger-cause y(t). You may theoretically use the Granger Test to check if two elements are linked at a single instant on schedule. In any event, that version of the test is only used on rare occasions because it isn't beneficial, so I've left it out of this discussion.

Steps for the F-Test

The approach might get complicated due to many options available, such as browsing a variety of circumstances for f-esteem estimates. By using programming, you can bypass the

TABLE 5 | COVID-19's influence on Chinese exports and imports: a causality test.

Prob.	F-Statistic Adj R^2		*P*	
China				
Exports of COVID-19 Cases	2.4546	0.382	0.08	11
Exports of COVID-19 fatalities	4.897	0.09	0.07	11
Imports of COVID-19 Cases	1.107	0.08	0.06	11
Imports of COVID-19 fatalities	4.007	0.06	0.05	11

The author discovers these estimations.

majority of the intermediate strides. Some well-known financial affairs programming packages, such as E-Perspectives and PC-Give, rely on the Granger causality test to double-check that your time series is correct. We should change the Data to avoid the possibility of autocorrelation. You should also check for any unit roots in your model, as they can skew the test results. The following are the fundamental procedures for doing the test: the following two equations can be used to find f-value, if $\beta_i = 0$ for all lags *i*:

$$x(t) = \sum_{i=1}^{\infty} \beta_i x(t\text{-}i) + g_i + u_i(t)$$

$$x(t) = \sum_{i=1}^{\infty} \beta_i x(t\text{-}i) + \sum_{i=1}^{\infty} \alpha_i x(t\text{-}i) + g_2 + u_2(t)$$

Two equations for Granger causality: Restricted (top) and unrestricted (bottom). Similarly, these equations test to see if *x(t)* Granger-causes *y(t)*:

$$y(t) = \sum_{i=1}^{\infty} \beta_i y(t\text{-}i) + g_i + \mu_i(t)$$

$$y(t) = \sum_{i=1}^{\infty} \beta_i y(t\text{-}i) + \sum_{i=1}^{\infty} \alpha_i y(t\text{-}i) + g_2 + \mu_2(t)$$

Alternatively to calculate the f-statistic we can use the following equation:

$$F = \frac{(ESS_R - ESS_{UR})/q}{ESS_{UR}/(n-k)}$$

RESEARCH ANALYSIS AND RESULTS

Data Analysis Methods

To analyze the data, we have used the E-views version-10, and R-studio package my-data <- read.csv ("/shared/hartlaub@kenyon.edu/dataset_name.csv") #use to read a csv file from my shared folder on R-Studio. For the data arrangement, Microsoft excel 2016 is used, and all the data is arranged in Panel data form.

Covid-19 Short-Term Impacts

One of the short-term effects of the COVID-19 pandemic is reduction in the product of Chinese strategic emerging industries as items have been placed in retail outlets in April 2020 to satisfy the peak shopping season's demand (April through July). The scarcity of operating working capital during the COVID-19 crisis is the short-term consequence. This particular short-term effect has several secondary results. Companies are struggling to fund routine operational expenses, such as paying employees' salaries, covering the rent of the factory and warehouses, and paying energy bills, interest charges from bank loans, and other operating expenses, owing to reduced cash inflow. Furthermore, businesses are having difficulty obtaining a letter of credit (LC) to purchase source materials that will allow them to satisfy future demand. Given the present issue of product expiration, businesses are preparing to retain supplies on hand for the future and resume industry once the public-health limitations are lifted. **Table 2** highlights the strategic emerging industries industry's short-term consequences of the COVID-19 pandemic, with an asterisk symbol indicating those firms recognized each impact.

Medium-to-Long-Term Effect

Effects our meetings revealed numerous medium-to-long-term impacts from the COVID-19 pandemic, in addition to the transient effects. One of the critical medium-to-long-term impacts mentioned by the respondents is a decrease in investment as a result. As a result, businesses may suffer the negative consequences of a lower return on original capital investment over the medium to long term (i.e., in the 3rd and 4th quarters of 2020). **Table 3** summarizes the COVID-19 medium-to-long-term impacts on the Chinese strategic emerging industries. The mark image does represent the case organizations that referred to the separate effect.

Other medium-to-long-term effects include those affecting inventory network connections and design. A last medium-to-long-term contribution of the country total annual GDP growth, and there is possibility of a drop in popularity over the medium-to-long term will undoubtedly influence the strategic emerging industries obligations to the economy as a GDP growth participants.

Fourier ADF Unit Root Test

Table 4 shows the Fourier ADF unit pulls tests in China separately, using a similar setup. Because of China, COVID-19 cases, deaths, imports and exports are all non-fixed at different levels. Even though the fares are level writing content, these characteristics have been the primary distinction.

There is no factor which sets at the following distinction the Fourier quantity is equal to 1. Such adversaries of exchange techniques hampered the smooth and successful flow of trade, such as COVID-19-related clinical equipment and other COVID-19-related healthcare equipments. Causality test results are presented in **Table 5** which described the impacts of COVID-19 on Chinese international trade.

Furthermore, enforced lockdowns severely impede the growth of unemployment, Covid-19 lockdown training and execution harmed the Chinese strategic emerging industries network since

TABLE 6 | Measurements of Imports for Chinese strategic emerging industries.

Products	Contribution to Gap 2020 (%)	Change in total imports, 2020%	Change in total imports from the world, 2020 (%)	Typical seasonality	DD (Gap2020–Gap2019)	Positive demand shock products
Case A	35.3	4.6	2.86	Yes	Negative	
	9.3	1.21	0.75			TW
Case B	3.1	0.4	0.25			DI
	2.3	0.3	0.19			SH
Case C	2.2	0.29	0.18	Yes		
	1.7	0.22	0.14			SH
Case D	1.1	0.14	0.09			TW
	1	0.12	0.08	Yes		
Case E	0.8	0.1	0.06		Negative	
	0.7	0.1	0.06			SH?
Case F	0.7	0.09	0.06		Negative	
	0.6	0.08	0.05	Yes		
Case G	0.6	0.08	0.05		Negative	
	0.6	0.07	0.05			SH?

The products listed here are those with contribution ratios of more than 0.5%. DD denotes differences between January 2020 and Gap2019, and TW, DI, and SH indicate teleworking disinfection and stay-home.
Source: Author's calculations.

TABLE 7 | Baseline estimation results.

	(I)	(II)	(III)	(IV)
Importers' COVID-19	−0.032	−0.023	−0.342	−0.083
Exporters' COVID-19	[0.003]	[0.004]	[0.052]	[0.026]
COVID-19 measure	Case	Death	Immobility	Lockdown
Wald statistics	0.049	0.478	4.087	0.02
Wald *P*-value	0.932	0.523	0.062	0.897
Log Pseudo likelihood	9.2+E 10	8.8+E 10	9.3+E 10	8.9+E 10
Pseudo *R*-squared	0.8789	0.9876	0.9356	0.9834
Number of observations	75,430	75,430	75,430	75,430

*This table reports the estimation results using the PPML method. ***, **, and * indicate the 1, 5, and 10% levels of statistical significance, respectively.*

additional safety and security procedures increased exchange prices. However, in the long early stretches of 2020, China reduced veil fares and, on second thought, changed into a merchant.

Parts and Component Trade Connections

Because China is the dominating start of imports in ultimate results, China is the key to solving this conundrum. **Table 6** shows all items with the most significant import deficits from January, 2019 to April, 2020 amounting to more than 0.5% of overall imports from China for outcomes. Surprisingly, all items on this list are expected to be connected with both preceding cases: teleworking, sterilization, and remain at home/do-it-yourself in 2020 compared to 2019 (Do-It-Yourself).

Teleworking-related products include PCs, tablets, information, and primary memory; imports of PC input/yield units have increased alarmingly since January 2020. Shower/power scattering devices, except agricultural and plant-based ones, should be used for sanitization. Since April, their imports have increased considerably. Coolers, hand-held force devices, and sanitizing contraptions may be goods that have increased interest from stay-at-home workouts.

Baseline Estimation Results

To assess the severity of the COVID-19 damage, we used four methods. The first and second terms are the numbers of COVID-19 cases and deaths obtained from WHO's Sickness Prevention and Control Division reports. We increased the value of these integers by one and then collected their logs. Individuals' flexibility in terms of shopping and amusement and working settings is the third metric. We begin by sketching down the trade progressions. In a coordinated framework, **Table 7** displays the month-to-month trades of Chinese strategic emerging businesses goods.

The errors in brackets are those that are grouped by country sets. We took into account country pair-year fixed impacts, country pair-month fixed impacts and year-month fixed impacts in all cases. All of the statistics in this table are based on data sent out. "Wald test" delves into the Wald test's application to the false hypothesis that the COVID-19 significance coefficient for importers and exporters is the same. "Wald p-value" is used to account for its p-value. The variable "COVID-19 evaluation" is used to assess the severity of the COVID-19 damage. The numbers of affirmed cases and passing are addressed separately under Case and Demise. The Lockdown variable also accounts for the number of days on which stay-at-home requests were feasible due to merchants' COVID-19 seriousness and the number of days on which work environment closing orders were successful

TABLE 8 | Monthly estimation results of Chinese strategic emerging industries trade values.

	(I)	(II)	(III)	(IV)
Importers' COVID-19				
1 for December	−0.023	−0.034		−0.632
1 for January	−0.042	−0.044		−0.227
1 for February	−0.027	−0.021	−0.398	−0.143
1 for March	−0.041	−0.025	−0.421	−0.315
1 for April	−0.032	−0.056	−0.378	−0.127
1 for May	−0.038	−0.026	−0.129	−0.053
1 for June	−0.022	−0.008	−0.054	−0.042
1 for July	−0.009	−0.003	−0.052	−0.49
1 for August	−0.007	−0.007	−0.111	−0.042
1 for September	−0.004	−0.014	−0.089	−0.093
1 for October	−0.005	−0.023	−0.075	−0.048
1 for November	−0.009	−0.009	−0.065	−0.031
1 for December	−0.003	−0.005	−0.121	−0.078
COVID-19 Measure	**Case**	**Death**	**Immobility**	**Lockdown**
Log pseudolikelihood	9.2+E 10	8.8+E 10	9.3+E 10	8.9+E 10
Pseudo R-squared	0.8789	0.9876	0.9356	0.9834
Number of observations	75,430	75,430	75,430	75,430

*This table reports the estimation results using the PPML method. ***, **, and * indicate the 1, 5, and 10% levels of statistical significance, respectively.*
*The findings of the evaluation using the PPML approach are presented in this table. *** represents the 1, 5, and 10% degrees of factual relevance, **, and *, respectively. The standard errors are not responses; nevertheless, they were grouped by country pair for the study. We considered country pair-year fixed impacts, country pair-month fixed impacts, and year-month fixed impacts in every detail. All of the statistics in this table are based on trade data. The variable "COVID-19 measure" denotes the variable used to assess the severity of the COVID-19 damage. The numbers of affirmed cases and passing are addressed separately under Case and Passing. For shippers' COVID-19 seriousness, stability is defined as a % change in visits to retail and sporting outlets increased by an adverse one, and a comparable measure for exporters' COVID-19 seriousness is defined as visits to work settings. Similarly, the Lockdown variable tracks the number of days when stay-at-home requests were granted due to merchants' COVID-19 seriousness and the number of days when work environment shutdown orders were granted due to exporters' COVID-19 seriousness.*

due to exporters COVID-19 seriousness. The month-to month estimated trade values of Chinese strategic emerging industries are shown in the **Table 8**, which described these values in four columns.

The results of the **Table 8** shows that the Chinese exports surprisingly get reduction in a low level in the whole world during the first quarter of COVID-19 attack as the whole country was facing a non-stop lock down in the whole country. As a result of these circumstances by August 2020, transactions had returned to a similar level as the previous year. The standard errors are not replied to; instead, they were grouped by country pair for the examination.

R and D Investment and Financing Constraints

The findings of the FIN and NAT relationship of words are shown in **Table 9** and both FIN1*NAT and FIN2*NAT have negative and negligible coefficients. It indicates that financial development has minimal influence on decreasing R&D investment funding

TABLE 9 | Shows the findings of the FIN-NAT relationship and R&D investment.

RD	FIN–NAT interaction	
Constant term	3.201*** (4.267)	4.081*** (4.998)
FIN1	0.201*** (3.741)	
FIN2		5.003*** (3.997)
FC	−0.092*** (−6.087)	−0.076*** (−6.023)
ROA	−1.306*** (−2.982)	−1.211*** (−4.031)
Growth	−0.201*** (−4.082)	−0.201*** (−4.007)
Cap	−0.312*** (−9.003)	−0.305*** (−9.051)
Q	0.108*** (7.005)	0.129*** (5.098)
Size	−0.194*** (−6.031)	−0.207*** (−6.003)
NAT	−0.003	−0.231* (−1.783)
	(−0.041)	
FIN1*NAT	−0.208	
	(−2.091)	
FIN2*NAT		−2.722
		(−2.035)
Age	−0.011* (−2.034)	−0.102* (−2.072)
Year	Controlled	Controlled
Adjusted R squared	0.256	0.276
Prob>F	0	0

*** *Denotes a significant level of 0.01; * denotes a significant level of 0.1.*

restrictions for state-owned and non-state-owned firms in strategic emerging industries.

Table 10 shows the consequences of the FIN and SIZE connection period. At the 5% level, the FIN1*SIZE coefficient is negative and high, and FIN2*SIZE does not complete the significance evaluation. Compared to short and long foundation time ventures, intermediary financial advancement plays a more significant function in short foundation venture R&D expenditure. Long-term initiatives have long-term cooperation ties with banks, and their development is relatively steady, less influenced by funding requirements. The significance of financial exchange development isn't immediately apparent. Data transparency is highly valued in economic trade, and data variation is reduced to some extent. For companies with varying foundation timelines, there is no substantial difference in decreasing financing requirements.

The results in **Table 10** did not affect the coefficients or meaning of other autonomous and control variables as explained in **Table 9**. Considering everything, the expansion of financial mediators and the securities market both play a more significant role in reducing financing limitations on strategic emerging industries R&D initiatives. Furthermore, based on financial events, there is no substantial difference between state-owned and non-state-claimed firms in terms of R&D funding requirements. Again, financial mediator advancement outperforms long-established ventures in terms of reducing financing demands for R&D investment. To be more precise, businesses of diverse sizes, types, and founding seasons should use various techniques to decrease data imbalance. The government should assist them in increasing R&D investment

TABLE 10 | Shows the consequences of the FIN and SIZE connection time period.

Research and development	FIN–SIZE relations	
Constant items	2.081** (4.087)	4.007*** (6.008)
FIN1	0.201*** (5.008)	
FIN2		5.038*** (3.098)
FC	−0.079*** (−6.002)	−0.092*** (−6.032)
ROA	−2.062*** (−5.002)	−2.005*** (−4.202)
Growth Rate	−0.214*** (−4.056)	−0.203*** (−4.081)
Cap	−0.224*** (−9.002)	−0.321*** (−9.034)
Q	0.098*** (7.078)	0.0792*** (6.009)
Size	−0.206*** (−6.003)	−0.206*** (−6.052)
NAT	−0.195*** (−4.087)	−0.197*** (−4.008)
Size	0.0076	−0.0087
	−0.943	(−1.543)
FIN1*SIZE	−0.202*** (−4.987)	
FIN2*SIZE		−0.846
		(−0.525)
Year	Controlled	Controlled
Adjusted R squared	0.308	0.266
Prob>F	0	0

*Note that *** indicates that a level of 0.01 is significant, ** means that a group of 0.05 is strategic, and * indicates that a level of 0.1 is necessary.*

by entirely using the financial intermediary and securities exchange function.

CONCLUSION

The master plan of this study is to learn the COVID-19's impact on Chinese strategic emerging industries using a significant information sway. This article examines COVID-19 impact on Chinese strategic emerging industries by making the link between financial events, financing constraints, and ventures' research and development supposition, to determine the growth rate of these industries international trade and R&D investment funds during the COVID-19 crisis period from December, 2019 to December, 2020. The study applied some research models to check the effects of COVID-19 on R&D investment and international trade. To analyze the data, we have applied Fourier Increased Unit Root Test, Granger causality assessments test, Pattern Assessment test, Poisson pseudo most excellent probability (PPML) approach, Wald test, and Regression analysis tests. The results reveal that compared to other factors, COVID-19 plays a more significant role in reducing R&D investment and international trade rate of strategic emerging economies in China. We used the original Fourier causality test to determine the causal linkages and the results revealed that COVID-19 has a negative relationship with R&D investment and international trade growth. The results also reveal that the COVID-19 pandemic's temporary impacts include more lapsed goods, a lack of working capital, difficulty in calculating functional expenses, a delay in opening LCs, and the termination of wholesalers' responsibilities such as financial constraints. It is also found that the short-term and medium-to-long effects of COVID-19 will most likely include a decrease in return on capital invested in strategic emerging industries. On the other hand, it has built negative relationships with importers, exporters, and a general reduction in the business' commitment to share their part in the annual GDP growth of China. Finally, a part of the short-term and medium-to-long-term consequences appear to be linked. Future research should explore these interrelationships since they may provide critical direction for developing good activity programs. Furthermore, the current review does not attempt to place the impacts and systems. Future analysis on the overall relevance of the approaches may help determine where businesses should focus their efforts first as they, along with the rest of the company; try to recover from the COVID-19 epidemic.

DATA AVAILABILITY STATEMENT

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

ETHICS STATEMENT

Ethical review and approval was not required for the study on human participants in accordance with the local legislation and institutional requirements. The Ethics Committee waived the requirement of written informed consent for participation.

AUTHOR CONTRIBUTIONS

DL: conceptualization, methodology, data curation, supervision, and writing-reviewing and editing. WG: methodology, formal analysis, software, and investigation. WD: conceptualization and writing-reviewing and editing. All authors contributed to the article and approved the submitted version.

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Investigating the Adoption of Precautionary Behaviors Among Young Rural Adults in South Iran During COVID-19

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COVID-19 is an unprecedented challenge for public health worldwide. Reducing the incidence of the disease requires protective measures to prevent virus transmission. Understanding those factors influencing preventive behavior is the first step in preventing the spread of the disease. This study investigates factors affecting youth intention and preventive behaviors in the face of COVID-19 through the health belief model by using a cross-sectional survey collected through an online questionnaire. The sample comprises 304 rural youth in South Iran who were selected through a random sampling technique. The results reveal that perceived severity, perceived benefits, public health beliefs, perceived self-efficacy, and the cue to act positively and significantly affect preventive behaviors. The model explains 59% of variance changes in rural youth preventive behaviors during COVID-19. Cue to action is the strongest and self-efficacy was the weakest determinant of youth's preventive behavior. This study confirms that the HBM framework has appropriate predictive power and is an effective tool for investigating preventive behaviors during COVID-19. These results provide important policy implications for the development of policies that aim to avoid the further spread of COVID-19 between young citizens.

Keywords: COVID-19, preventive behavior, rural youth, health belief model, adoption

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INTRODUCTION

On January 30, 2020, the World Health Organization (WHO) issued a statement declaring the outbreak of the new coronavirus to be a public health emergency and a threat to the entire world (1). Due to its contagious nature and rapid spread around the world, on March 11, 2020, the World Health Organization confirmed it as a pandemic (2). The disease severely disrupted the daily activities of more than half of the world's population. The movement of people and many goods from different regions stopped completely (3). The coronavirus not only severely affected people's health, it also affected the world economy (4). The increasing outbreak of COVID-19 cases and deaths has also increased the fears of household vulnerability to food insecurity worldwide (5).

To counteract the rapid spread of the disease, key action areas were promoted by many governments, seeking to minimize virus transmission by promoting preventive behaviors that would flatten the peak of the disease and reduce its impact on health care, allowing doctors to treat severe cases while also reducing overall mortality (6). Existing research shows that the rapid spread of COVID-19 is strongly associated with the displacement of people with no-to-mild symptoms; i.e., those who are unaware they are infected (7). Therefore, non-medical practices, such as promoting protective behaviors like staying at home (home quarantine and reducing human interactions), increasing social distance, avoiding travels, and following personal hygiene tips (washing hands regularly and using masks when going to public places and crowded places) (8, 9), are used to control the spread of the disease (10). Promoting these preventive behaviors is essential for slowing the spread of COVID-19 (11, 12).

Despite the availability of COVID-19 prevention recommendations, people's adoption of behaviors that prevent the spread of COVID-19 differs between groups, generally leaving room for improvement. Monitoring people's perceptions and behavioral responses to COVID-19 is necessary to improve health risk communications and achieve successful changes in people's behaviors. However, globally, there is little information about people's perceptions and preventive behaviors regarding COVID-19.

Protective measures to prevent the transmission of the disease largely depend on rapid changes in the behavior of communities, thus relying on the ability of individuals to understand the risks associated with the virus and adapt their behaviors accordingly (13). For example, Wise et al. (13) show that understanding higher personal risk predicts preventive behaviors like hand washing and social distance. Akter (6) show that people who perceive a threat from COVID-19 collect medical and cleaning equipment, while those who do not take the disease seriously are careless, for example, moving around freely, traveling, gathering together, and not engaging in any preventive behaviors.

Reports indicate that rural communities perform fewer preventive health behaviors than urban communities. Villagers are not just more likely to have a negative attitude toward the effectiveness of preventive behaviors but also have a lower level of information about COVID-19 and its prevention measures (14). Studies also show that rural communities face health inequalities due to numerous barriers, including a lack of health care infrastructure (comprising transportation, health insurance, providers, and facilities), geographical distance, and lower socioeconomic status (15–17). The lack of these resources, services, and support put these populations at a higher risk and vulnerability (17). Public health researchers are concerned that rural communities may experience a worse situation in relation to the COVID-19 pandemic, for example, higher mortality rates, than their urban and suburban counterparts due to rural/urban health inequalities (18, 19).

In addition, reports indicate that rural communities, especially rural youth, are not taking the risk of the disease seriously and are continuing their daily activities. Further, people are usually reluctant to employ preventive behaviors due to physical discomfort, cost, and inconvenience (20). The results of an Italian study by Ceccato et al. (21) show that younger people are less confident in the information received about COVID-19 and are less interested in restrictive measures. They think that most deaths are related to the elderly or people with underlying diseases.

According to FAO reports (20), rural youth suffer disproportionately from the ubiquity of COVID-19 and its consequences because they are among the most vulnerable groups during the twenty-first century. Facing high unemployment rates, not only do rural youth have very little financial strength and income, but they also lack health insurance coverage and other social supports (20). Young villagers are vital stakeholders because they are in direct contact with food resources in supply chains. Their travel to urban areas and remaining there is in opposition to health advice and can increase the spread of the disease. For this reason, the protection of this group and the encouragement of healthy behaviors within it are of major importance. The study of health protection measures in Iran is important because it was the first low- or middle-income country to suffer a major outbreak including rural areas and learning from Iran's experience will help all low- and middle-income countries (22). Certainly in developing countries, including Iran, the shock of COVID-19 will be much more severe because most farmers in rural areas in these countries are not just prone to poverty and extreme vulnerability but they also have limited access to formal mechanisms to deal with these shocks (23).

Following these findings, this study investigates why the adoption of preventive behavior by youth differs from other age groups? This research seeks to answer this question among rural youth in Bushehr province of southern Iran. Iran and its southern region are chosen because of its severe experience with COVID-19 (5, 17, 24, 25). According to statistics, as of August 10, 2021, COVID-19 has resulted in 94,603 deaths in Iran, with numbers continuing to increase (26). The existing literature shows that various factors affect the preventive behavior of people with respect to infectious diseases. Further, the behaviors of people in potentially high-risk groups can play an important role in preventing and controlling infectious diseases (27). Thus, it is important to examine why some people, especially rural youth, participate in the prevention, screening, and control of health behaviors regarding COVID-19, while others do not. However, little information exists on the reasons for the participation or non-participation of rural youth in Iran with respect to preventive behaviors for COVID-19 and the evaluation of the factors affecting this behavior.

Given the significance of psychological and behavioral factors in the management of severe global pandemics, like COVID-19, it is essential to assess behavioral and psychological responses to the situation and to determine the relationship between perceived risk and participation in engaging in protective behaviors to facilitate disease minimization strategies (13). Studies use various theories and models to investigate the factors influencing preventive behaviors for various diseases, including COVID-19. For example, the health belief model to predict the use of personal

protective equipment in SARS outbreaks (28), unified theory of acceptance and use of technology to predict the willingness to wear a mask (29), the theory of protection motivation against COVID-19 (22, 30), as well as knowledge, attitudes, and practices theory to investigate preventive behaviors against COVID-19 (27). In this regard, Mukhtar (31) recommends using the Health Beliefs Model (HBM) for recognizing preventive behaviors during the COVID-19. Since, HBM is one of the most functional theories related to behavioral change and preventive health behaviors (32), this theory is used in this study.

In addition, recent studies on the use of psychological structures and models in predicting COVID-19 prevention behaviors have focused on different groups of people. For example, study Irigoyen-Camacho et al. (33) in Mexocity on the behavior of staying at home among a group of adults, Roberts and David (34) on the general acceptance of preventive behaviors by undergraduate students in the United States, Šurina et al. (35) on compliance with health recommendations and social distance among the Latvian general population, and the study Lin et al. (36) on the acceptance of preventive behaviors by the people of Iran. However, in most of these studies, the rural youth group is neglected. Therefore, this study is innovative in two ways: first, an HBM theory has been used and second, it has considered rural youth. Therefore, in this study, the HBM framework, one of the most popular health research frameworks, is used to understand why rural youth take or do not take action for personal or community health in the face of COVID-19.

Health Beliefs Model

HBM was introduced in the early 1950s by social psychologists in the United States (37). HBM assumes that safe actions originate from two main mechanisms: One's attitude toward danger (threat perception) and individual assessment of preventive behavior (behavioral evaluation). Perception of threat includes two sub-components or social psychological beliefs: perceived susceptibility (PSU) and perceived severity (PSE). The behavioral assessment comprises two sub-components of perceived benefits (PBE) and perceived barriers (PBR) (38, 39). PSU means people's beliefs regarding the probability of getting an illness (32). PSE means the belief that a severe health problem can lead to death or other serious consequences (40–42). The PBE refers to a person's assessment of the worth or effectiveness of performing health-oriented behaviors to reduce the risk of disease (37). Perceived barriers refer to a person's estimation of challenges to behavior change (43). HBM assumes that people engage in preventative behaviors if they (i) believe that they are more likely to get a disease (perceived susceptibility); (ii) understand the depth of the risk and its severity (perceived severity); (iii) perceive the benefits by adopting preventive health behaviors; and (iv) recognize that there is an imperfect obstacle to the implementation of preventive behaviors (44, 45) (see **Figure 1**).

In addition to these variables, HBM includes other variables that predict behavior, including self-efficacy, cue to action, and general health beliefs (46). Self-efficacy originates from Bandura's known theory (Social Cognitive Theory), which refers to the confidence and belief that the person can perform a specific behavior (47). HBM also states that a trigger is necessary to stimulate the conduct of health behaviors. Cues to action remind someone to engage in a particular behavior (48). Cue to action may be internal (physical symptoms of pain, fever, cough) or external (friends, health care providers, media, and social media) (49). In HBM, general health beliefs refer to the person's disposition or routine regarding health seeking behavior in general. It is not related to the expected concerns of healthcare behavior; instead, it is a person's general response predisposition (50).

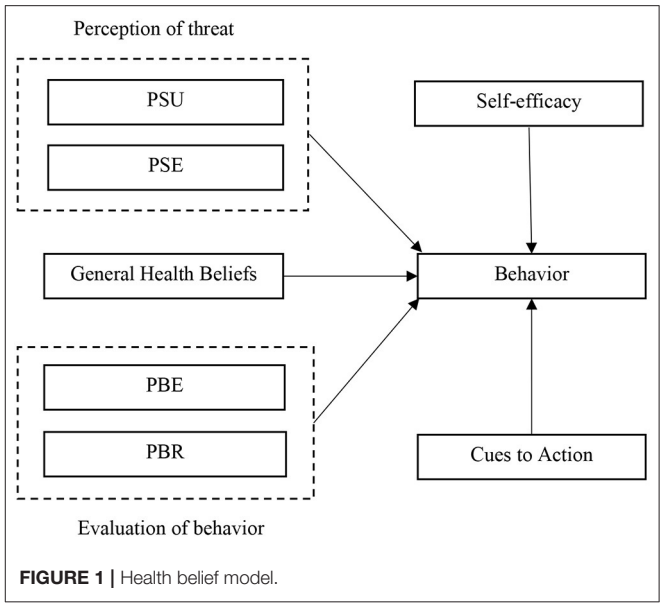

FIGURE 1 | Health belief model.

Therefore, the present study examines seven following hypotheses.

H1) Perceived Susceptibility positively affects people's preventive behavior.
H2) Perceived severity positively affects people's preventive behavior.
H3) Perceived benefits positively affect people's preventive behavior.
H4) Perceived barriers negatively affect people's preventive behavior.
H5) Perceived self-efficacy positively affects people's preventive behavior.
H6) Cue to action positively affects people's preventive behavior.
H7) General health beliefs directly affect people's preventive behavior.

METHODOLOGY

Participants

The present study is applied research in terms of purpose, non-experimental in terms of control variables, and a field survey in terms of data collection. This study is quantitative research carried out through a sectional online survey. Data

were collected in August 2020 through an online platform; all data were collected in the Persian language. The population of concentration (statistical population) of this study comprises rural youth (between 18 and 30 years) of Dashtestan county in Bushehr province in southern Iran ($N = 1{,}500$). Based on (51) table and using random sampling, 304 rural youths were selected as the study sample. The mean age of respondents was 24.79 years. In terms of gender, 125 people (41%) were male, and 180 were female (59%). The average household size was 4.68, with a standard deviation of 1.67.

Survey

The data collection tool in this study was an online questionnaire. It consisted of two sections, including socio-economic characteristics and the HBM variables. HBM variables measured in the form of a spectrum of a 5-point Likert scale: "very low (1)" to "very high (5)" that were extracted from previous studies. Faculty members confirmed the facial and content validity and psychometric properties of the questionnaire. The internal validity of each variable examined using Cronbach's alpha. As shown in **Table 1**, all scales had good to excellent validity, generally between 0.78 and 0.93 (**Table 1**). SPSSversion24 and AMOSversion20 software used to analyze the data.

RESULTS

Description and Relationship Between Variables

The Pearson correlation test is applied to examine the correlation among HBM constructs (**Table 2**). The results show that there is a positive and significant correlation between preventive behavior and perceived severity, PSU, PBE, self-efficacy, general health beliefs, and cue to action. The PBR is not meaningfully correlated to preventive behavior.

Main Analysis

Structural equation modeling is used to investigate the explanatory power of HBM in predicting preventive behaviors. The two stages of structural equation modeling include Confirmatory Factor Analysis (CFA) to evaluate the suitability of the measurement model and structural equation modeling (53).

Assessment of Measurement Model

To estimate the measurement models of the components affecting preventive behavior, the data collected using AMOS 20 was analyzed using CFA. The results show the measurement model has an acceptable fit. (RMSEA = 0.038; CMIN = 796.705, DF = 550, $p = 0.000$; CMIN/DF = 1.449; CFI = 0.957; GFI = 0.878; AGFI = 0.853; IFI = 0.957; and NFI = 0.874). The acceptable level of CFI, IFI, GFI, and AGFI is generally equal to, or greater than, 0.9. Values from 0.8 to 0.9 are considered marginal. RMSEA is acceptable between 0.03 and 0.08 and relative Chi-square (CMIN/DF) equal to, or less than, three is associated with a better fit (54). Thus, the results of our measurement model commonly show an adequate fit.

To confirm convergent validity, the average variance extracted (AVE) and composite reliability (CR) were calculated. AVE results show that the value of this index for all variables studied is more than 0.5. Except for perceived severity, perceived benefits, and behavior, the composite reliability calculated for the model variables was >0.7 (**Table 2**). The acceptable value for AVE and CR is 0.5 and 0.7, respectively (54). However, according to (55), if the composite reliability is >0.6, an AVE <0.5 is acceptable. Therefore, the instrument has an acceptable convergent validity.

Assessment and Results of Structural Equation Model

The process of validation and the structural equation model reveal sturdiness for the practical data, thus meeting the necessities of convinced indexes. The goodness-of-fit indices suggested that the HBM model has a suitable fit (RMSEA = 0.038; CMI*N* = 796.705, DF = 550, $p = 0.000$; CMIN/DF = 1.449; CFI = 0.957; GFI = 0.878; AGFI = 0.853; IFI = 0.957; and NFI = 0.874). In **Table 3**, it is shown that 5 out of 7 hypotheses are confirmed: Hypotheses H1 and H4 are not empirically confirmed. In the HBM model, the variables of self-efficacy ($\beta = 0.141$, $p < 0.05$), general health beliefs ($\beta = 0.248$, $p < 0.0001$), PSE ($\beta = 0.177$, $p < 0.05$), PBE ($\beta = 0.142$, $p < 0.05$), and cue to action ($\beta = 0.347$, $p < 0.0001$) have a significant impact on behavior and are able to predict 59% of behavioral changes (**Figure 2**).

DISCUSSION

Effective suppression of COVID-19 requires nontrivial efforts by a substantial portion of the world's population, including social distancing and preventing unnecessary meetings with others. No matter how strongly these actions suggested, some individuals may not trust that they can or should follow these recommendations (8). For effective policymaking to prevent the spread of the disease, it is crucial to know how beliefs affect the adoption of preventive measures. Using HBM, an approach used to exam behaviors related to disease prevention or reduction this study answers this question. Here, the relationship between health beliefs and preventive behaviors is investigated using HBM.

Results show that HBM predicts a significant percentage (59%) of preventive behavior, which is high in the psychological and behavioral literature. The results of the study also show that the cue to action, general health beliefs, PSE, PBE, and self-efficacy can predict preventive behaviors. However, PSU and PBR do not have a significant impact on preventive behavior.

According to the findings, among the variables of threat assessment, the perceived severity variable is a positive predictor of protective behaviors (Hypothesis H1). If a person feels that getting COVID-19 disease will profoundly affect their life, they are more likely to engage in protective behaviors. Akter (6) points out that some people do not take the COVID-19 pandemic seriously. Whether or not people engage in preventive

TABLE 1 | Survey items.

Constructs	References
Perceived susceptibility (PSU) ($\alpha = 0.88$) (Mean = 3.40) (SD = 1.05)	(8)
How likely is it that you will get corona if you go out shopping?	
How likely is it that if you go out to work or study, you will get corona?	
How likely is it that if you go out to visit family or friends, you will get corona?	
How likely is it that if you leave home for any other reason, you will get corona?	
Perceived severity (PSE) ($\alpha = 0.78$) (Mean = 4.18) (SD = 0.71)	(8)
How dangerous do you think it is for you if you get corona?	
How much do you think it will cost you if you get corona?	
How much do you think will affect your life if you get corona?	
How much do you think will affect your family if you get corona?	
How much do you think will affect your work or education if you get corona?	
General health beliefs ($\alpha = 0.93$) (Mean = 3.91) (SD = 0.90)	(40, 42)
I am inherently a healthy person and I always follow health issues.	
I am constantly mindful of prevention behavior against disease.	
I read information about safe behavior.	
Perceived benefits (PBE) ($\alpha = 0.78$) (Mean = 4.14) (SD = 0.67)	(8, 22, 25)
The use of protective methods and devices prevents the spread of corona.	
The use of protection methods and devices prevents an epidemic in the village.	
The use of protection methods and equipment reduces the cost of the country.	
The use of protection methods and equipment reduces pressure on medical staff and hospitals.	
The use of protection methods and devices will save the lives of many of our compatriots.	
The use of protective methods and devices prevents the high cost of treatment.	
Perceived barriers (PBR) ($\alpha = 0.79$) (Mean = 3.14) (SD = 0.75)	(8)
The use of these methods and protective devices is cumbersome.	
Using methods and protection devices makes work and activity difficult.	
I am not used to using these methods and protective devices.	
Self-efficacy ($\alpha = 0.76$) (Mean = 3.95) (SD = 0.93)	(8, 52)
The use of protection methods and devices depends only on my own free will.	
Even if I want to, I cannot easily use these protective devices and methods.	
Cues to action ($\alpha = 0.89$) (Mean = 4.17) (SD = 0.79)	(40, 42)
I've seen and heard a lot on TV and radio about the corona, and how to fight it.	
I've seen and heard a lot on social media, such as WhatsApp and Telegram, about the corona, and how fight it.	
I've heard a lot from friends and relatives about corona and how fight it.	
I have seen and heard a lot from officials and health experts about corona and ways to fight it.	
Behavior ($\alpha = 0.86$) (Mean =) (SD =)	(6, 8, 31)
I stay home as much as possible and I do not go out.	
If I go out, I wear a mask.	
If I go out, I wear gloves.	
I do not touch people.	
I regularly use alcohol to disinfect my hands.	
I wash my hands regularly with soap and water.	
I disinfect and wash household items after purchase.	
I do not go to crowded and high risks places as much as possible.	

activities depends on how seriously they take the consequences of the disease. The results are consistent with existing studies (13, 56–58).

Based on the findings, understanding the benefits of performing preventive behavior significantly affects that behavior (Hypothesis H3). People do not change their behavior until they receive something in return for doing so (6).

The more respondents feel that the recommended behaviors (home quarantine and the use of safeguards) effectively prevent coronavirus infection, the more likely they are to implement the behaviors. In other words, if a person believes in the benefits of preventive activities to reduce the risks, they are more willing to engage in them. This result is constant with the existing literature (44, 45, 56, 57).

TABLE 2 | Correlation matrix.

Variables	Perceived severity	Perceived susceptibility	Perceived benefit	Perceived barrier	Self-efficacy	general health beliefs	Cue to action	Behavior
Perceived severity	1							
Perceived susceptibility	0.52**	1						
Perceived benefit	0.33**	0.29**	1					
Perceived barrier	−0.17**	−0.5	0.08	1				
Self-efficacy	0.14*	0.16**	0.37**	0.09	1			
General health beliefs	0.28**	0.19**	0.24**	−0.06	0.20**	1		
Cue to action	0.36**	0.20**	0.37**	−0.004**	0.23**	0.53**	1	
Behavior	0.37**	0.29**	0.44**	0.05	0.33**	0.52**	0.57**	1
CR	0.799	0.890	0.813	0.802	0.783	0.983	0.899	0.867
AVE	0.449	0.669	0.428	0.516	0.550	0.836	0.689	0.452

*$P < 0.05$.
**$P < 0.01$.

TABLE 3 | The structural model results.

Hypothesis	Paths	Coefficient	Standard error	*t*-value	Results
H1	Perceived Susceptibility → Behavior	0.018	0.012	0.294	Not supported
H2	Perceived Severity → Behavior	0.177	0.169	2.156	Supported
H3	Perceived Benefits → Behavior	0.142	0.153	2.179	Supported
H4	Perceived Barriers → Behavior	0.047	0.052	0.861	Not supported
H5	Perceived Self-Efficacy → Behavior	0.141	0.044	2.287	Supported
H6	Cue to action → Behavior	0.347	0.273	4.784	Supported
H7	General Health beliefs → Behavior	0.248	0.050	4.003	Supported

t-value > 1.96 indicates significance.

Perceived self-efficacy is another predictor of protective behaviors (Hypothesis H5). Self-efficacy is an individual's belief in his or her capability to change performance (47); here, the extent to which a person feels that he or she can apply protective methods. If a person believes in their ability to access and use protective equipment, they are likely to engage in protective behavior. This result is consistent with previous studies (22, 44, 45, 57, 59). The cue to action is the most important predictor of people's protective behavior (hypothesis H6). Cue to action is a stimulus that motivates people to take action to prevent the transmission of the disease. These stimuli can be clips or news about the death of people due to COVID-19 or the effects and consequences of this disease on the lives of people, whether via mass media or social networks (6). Seeing or hearing about any of these (cues to action) can encourage people to take protective measures. These findings are consistent with previous studies (56, 57, 60). The present study provides evidence of the effectiveness of public health beliefs in performing preventive behaviors (Hypothesis H7). Public health beliefs refer to a person's values, beliefs, concerns, and readiness for health issues in daily activities. People who are aware of health issues and choose a wellness-oriented routine are more likely to engage in preventative actions than people who are unaware of health issues (61). In this study, young people who have a higher level of awareness about health measures and their impact on health are more likely to engage in preventive behaviors. The effect of PSU and PBR are not significant in the preventive behaviors of rural youth (Hypothesis H2, H4).

Policy Implications

The present study provides important results for the development of policies and guidelines to avoid the further spread of COVID-19. Officials should inform rural youth of the severe consequences of the disease through enhanced news or the provision of educational materials (guidelines and recommendations). Young people need to know that, although the disease is incurable, they can prevent the severe consequences of the disease and reduce its damage. Policies and programs encouraging rural youth to engage in preventive behaviors should include education through mass media, social media, posters, and other advertisements.

Given the importance of self-efficacy, agricultural promotion experts, local associations, councils, and local trustees can talk to rural youth about the ease with which preventative behaviors can be practiced, thus building the confidence and beliefs of rural youth that they can effectively implement preventive measures to prevent disease. Given the vital role of perceived benefits in implementing preventive behavior, the extension efforts should highlight the benefits of preventive behavior, such as protecting not just their own lives but also their loved ones. To improve the efficacy of prevention efforts, extension experts and health officials need to strengthen public health beliefs regarding

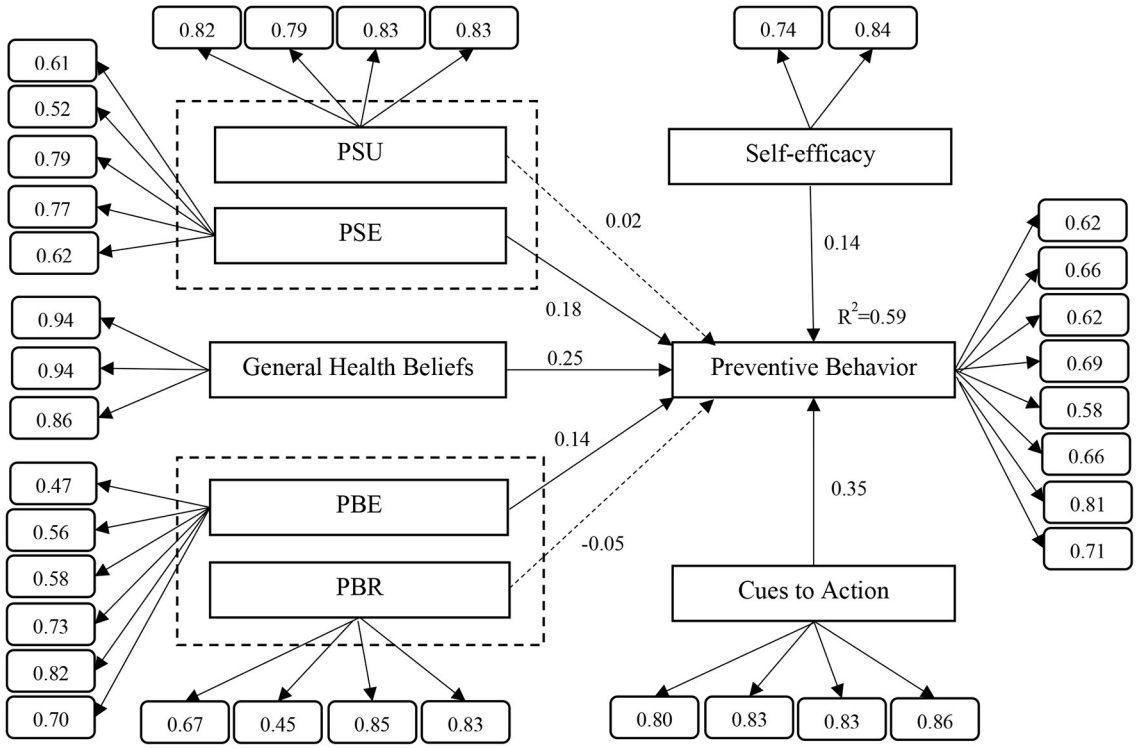

FIGURE 2 | The results of the structural equation modeling (own design; factor loading of each items placed in the small boxes).

COVID-19 through information and awareness campaigns that use publicity and educational materials on preventive activities. Finally, we believe that COVID-19 will create a new role for agricultural extension services in developing countries like Iran. Most variables affecting preventive behavior are triggered by education and awareness; thus, training and awareness about the depth of risk and seriousness of the disease, public health beliefs, stimulants (cues/trigger), and the benefits of preventive behaviors along with the ability of young people to perform these actions are fundamental and necessary. As extension agents have been working in rural areas for years, educating and working with villagers, the simplest and cheapest way to achieve broad outreach in rural areas is to equip extension agents with the materials needed to teach villagers how to deal with COVID-19.

CONCLUSION

The adoption of preventive measures varies across regions, socio-economic status, and age of people. Understanding behavioral differences is crucial for better targeting education, campaigns, and policies toward different groups. Only if the needs of different groups are properly accounted for will adoption rates be enhanced and the spread of diseases such as COVID-19 limited. In addition, people's perceptions are very influential in a rapid change in their behavior toward COVID-19. This study investigates the factors affecting the preventive behavior of rural youth in relation to the COVID-19 pandemic using HBM. The results using structural equations show good explanatory power for self-reported behavior. The HBM model predicts 59% of the variance of preventive behavior against COVID-19 outbreaks, such as wearing gloves and masks, regular hand washing, and regular hand disinfection. All of HBM's independent constructs, except perceived susceptibility and perceived barriers affect preventive behavior. The results show that cue to action is the strongest predictor of behavior.

This study adds new and important knowledge to existing information on the effectiveness of HBM in predicting the preventive behaviors of rural youth against COVID-19. The results of this study are useful for designing better policies and public information campaigns on measures to contain the spread of health diseases such as COVID-19. Further, the results of this study can be used as a basis for further studies on the COVID-19 pandemic. This theory could also be a roadmap for modifying adaptive behaviors to help effectively manage unknown pandemics in the future.

LIMITATIONS AND DIRECTIONS FOR FUTURE RESEARCH

While this study is valuable information to the body of research on COVID-19, it is not without its limitations. This study is a cross-sectional study and its data was collected

in August 2020 in Iran, so caution should be exercised in generalizing the results to other regions and times. Another potential limitation of this study was that the questionnaire was online and as a result, the respondents were the only people who had access to the Internet. While not all villagers have high access to the Internet. Therefore, it is possible that some villagers are less likely to participate in data collection. Another limitation is that behaviors are self-reported. The self-report does not allow the assessment of actual behavior (35). It is suggested that in future studies, the actual behaviors of individuals be examined. In addition, the paradigm of this study is quantitative. It is suggested that combined quantitative-qualitative methods be used in future studies to obtain more accurate results.

DATA AVAILABILITY STATEMENT

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

ETHICS STATEMENT

Ethical review and approval was not required for the study on human participants in accordance with the local legislation and institutional requirements. The patients/participants provided their written informed consent to participate in this study.

AUTHOR CONTRIBUTIONS

MT, TZ, KL, and SS contributed to conception and design of the study. MT and TZ conducted the data collection, performed the statistical analysis, and wrote the first draft of the manuscript. KL and SS wrote sections of the manuscript. All authors contributed to manuscript revision, read, and approved the submitted version.

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We dedicate our work to the nurses and physicians worldwide who are bravely and tirelessly fighting COVID-19.

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Developing a Paradigm Model for Resilience of Rural Entrepreneurial Businesses in Dealing With the COVID-19 Crisis; Application of Grounded Theory in Western of Iran

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Pandemic the COVID-19 is a global threat to rural entrepreneurial businesses with an uncertain ending. Therefore, it is necessary to provide a paradigm model to reduce the negative effects of this crisis, increase the resilience of rural entrepreneurial businesses or even turn this threat into an opportunity for the development of rural entrepreneurial businesses in the long run. This study, using a qualitative approach, investigated the resilience of rural entrepreneurial businesses in dealing with the COVID-19 crisis in Kermanshah province using a paradigm model. Using purposeful and theoretical sampling, 26 cases were selected. The tools used for data collection were open questionnaires (unstructured), individual depth interviews, and taking notes. The results provide a relatively comprehensive model that consists of six basic parts: causal conditions (included economic management, health factors, human resources management, and adaptation factors), the phenomenon (included low resilience of rural entrepreneurial businesses in the face of the COVID-19 crisis), contextual conditions (including social factors; cultural factors and psychological factors), interventing conditions (included business management and legal supports), action strategies (included Planned resilient actions and Unplanned resilient actions), finally, the consequences (included adapting to crisis conditions and increasing resilience in the long run, and also lack of adaptation to crisis conditions and lack of continuity of business survival in the long run). In general, rural entrepreneurial businesses in the face of crisis must, through planned resilience measures, both increase their business resilience in the short term, as well as develop the business and gain a competitive advantage in the long run. Finally, based on the findings and in order to developing resilience in rural entrepreneurial businesses during the COVID-19 crisis, some recommendations were presented.

Keywords: rural economies, business resilience, rural entrepreneurial businesses, crisis, COVID-19

INTRODUCTION

Rural areas are considered as the center of production in developing countries, including Iran, and play a key role in ensuring the independence of each country, especially in the field of food security (1). Rurals have many economic potentials and entrepreneurial opportunities that, if properly planned, can create a dynamic and diverse economy in these areas by flourishing and exploiting them (2). The high growth rate of hidden and overt unemployment in rural society compared to urban society on the one hand and the impossibility of massive investment for the development of large industries on the other hand, has forced the government to develop entrepreneurial businesses in rural communities (3).

Rural entrepreneurial businesses are one of the most important elements of rural economy that through exploitation of entrepreneurial opportunities in rural areas cause job creation and reduce unemployment, increase income and increase productivity and ultimately achieve sustainable rural development (4). In defining rural entrepreneurial businesses, three criteria can be considered: first, that they are located in a rural area and second that they offer and sell rural services and products (5), and third that Third, these businesses are considered entrepreneurial businesses when they are based on the exploitation of entrepreneurial opportunities in the rural environment (6).

Throughout history, natural and man-made disasters and crises on various scales have had adverse effects on businesses (7). In this regard, one of the crises that has recently threatened the survival of businesses and has had an unprecedented impact on them is the COVID-19 pandemic (8). The disease, caused by Severe Acute Respiratory Syndrome Coronavirus-2 (SARS-CoV-2), was discovered in late 2019 in Wuhan, China (9, 10) and on March 21, 2020 by The World Health Organization was introduced to the world as a pandemic (11).

Although COVID-19 directly threatened people's health (12); But the implementation of anti-government policies to control this pandemic had economic consequences that caused drastic changes in the economic environment at the micro and macro levels of society (13, 14); The COVID-19 pandemic has disrupted the operations of many businesses, including rural entrepreneurial businesses, due to its small size and the vulnerability of this type of business (15). Various studies show that rural businesses have lower resilience than other types of businesses in the face of COVID-19 (15–17). Since COVID-19 has had a devastating effect on rural entrepreneurial businesses, it is essential that the resilience of these businesses be developed to control and manage the negative effects and consequences of this crisis. Also, because rural areas are typically geographically isolated and have weaker human, institutional, and financial capital than urban areas; therefore, resilience is doubly important in rural businesses (2).

Resilience is the tendency of a system to maintain organizational structure and productivity, following the disruption of that system [(18): 8]. In other words, resilience creates capabilities for businesses that can survive despite adverse conditions and be on the path of return or even development (compared to before the crisis) (16).

In this regard, the effects of the COVID-19 crisis are very noticeable for rural entrepreneurial businesses in Kermanshah province (western Iran). First, because Kermanshah province has been suffering from unemployment for many years, and second, rural businesses have been largely neglected; While paying attention to this type of business and their prosperity can have a significant impact on solving the problem of unemployment in Kermanshah province. In fact, it can be said that in the context of the COVID-19 crisis, most of the policies have focused on large-scale companies and the industrial sector in urban areas while what is important is the future of microeconomic activities, especially in rural areas (19); Because rural businesses are the most vulnerable sector in times of crisis, which in case of closure not only threatens the livelihood of villagers and rural development, but also causes migration from rural to urban areas and the development of marginalization, and also disrupts urban development (15). Even in non-crisis situations, rural businesses are threatened because of their small scale (2). The current crisis will also destroy the capital that these businesses have raised over the years. Therefore, considering the importance of rural entrepreneurial businesses on the one hand and the critical situation of the outbreak of the COVID-19 in Kermanshah province on the other hand, the purpose of this study is developing a paradigm model for resilience of rural entrepreneurial businesses in dealing with the COVID-19 crisis in Kermanshah province. Therefore, considering the above-mentioned cases, the main research questions are: What are the causal factors influencing the resilience development of rural entrepreneurial businesses during the COVID-19 crisis? What are the contextual conditions affecting the resilience development of rural entrepreneurial businesses during the COVID-19 crisis? What are the interventing conditions affecting the resilience development of rural entrepreneurial businesses during the COVID-19 crisis? What are the action strategies taken to develop the resilience of rural entrepreneurial businesses during the COVID-19 crisis? What are the consequences of the action strategies adopted to develop the resilience of rural entrepreneurial businesses during the COVID-19 crisis? What is the paradigm model for resilience of rural entrepreneurial businesses in dealing with the COVID-19 crisis?

Based on the researches in the field of this study, few and relatively related researches have been done as follows. Beninger and Francis (20) stated in a study that in order to increase the resilience of businesses during the COVID-19 crisis, the integration of nine financial, physical, social, natural, human, cultural, public, political and, most importantly, health capitals is necessary. Beninger and Francis (20) states that in order to increase business resilience, all of these capitals should be used in an integrated manner in planning. Aldianto et al. (21) stated in a study that adaptation factors such as communication technologies as well as knowledge and information factors to deal with the COVID-19 crisis are effective in business resilience. Aldianto et al. (21) emphasize that in order to increase the resilience of businesses, they must constantly monitor the environment. The level of creativity and innovation in businesses

should also be enhanced in order to be more sensitive to environmental changes and to provide creative and innovative responses quickly. In addition to increasing resilience, gain a competitive advantage over taking advantage of emerging environmental opportunities. Le et al. (22) stated in a study that social networks and social capital and business management play a decisive role in increasing the resilience of businesses. Le et al. (22) also stated that physical, natural, financial, human and social resources are effective in increasing the resilience of businesses. Saad et al. (23) stated in a study that human factors, social factors, economic factors, cultural factors, infrastructure factors and institutional support are effective in increasing resilience. Portuguez Castro and Gómez Zermeño (24) stated in their research that communication with relevant institutions, human and social capital, and proper management and policy-making can improve the resilience of entrepreneurial businesses in times of crisis. Portuguez Castro and Gómez Zermeño (24) stated that business managers in critical situations in relation to institutional centers need to connect with universities, other research centers and entrepreneurial ecosystems and use their creative strategies to respond to environmental change. Portuguez Castro and Gómez Zermeño (24) stated that business managers in critical situations in the field of human and social capital should train their staff and also strengthen their social networks. Portuguez Castro and Gómez Zermeño (24) stated that business managers in critical situations in the field of proper management and policy-making should have a vision for the future and business development by identifying and exploiting opportunities. Pappas and Brown (25) in a study stated that to increase resilience during the COVID-19 crisis, entrepreneurial decisions should be made for businesses based on the current situation and existing capabilities and capacities. Pappas and Brown (25) stated that business owners should be aware of environmental changes and adopt strategies commensurate with the resources of businesses to increase their resilience. Ngin et al. (26) stated in a study that short-term responses should be provided first instead of long-term systematic resilient measures, and gradually the ability of businesses to deal with these disasters should be enhanced by strengthening crisis-related infrastructure. Hanson et al. (27) in a study stated that entrepreneurial culture is one of the factors affecting the resilience of businesses. Hanson et al. (27) stated that entrepreneurial culture increases resilient responses by exploiting entrepreneurial opportunities and promoting creativity and innovation. Hiramatsu and Marshall (28) in their research state that businesses that have used catastrophic (crisis) loans have a higher degree of resilience than other businesses that have not used these loans and also more quickly to their initial pre-crisis equilibrium state. They are back and more exposed to opportunities to improve and enhance their business.

Based on the reviewed studies, it can be said that so far few empirical studies have been conducted on the resilience of rural entrepreneurial businesses during the crisis. Also, in the studies, the resilience of businesses in the face of crises such as climate change and environmental crises has been considered more, and the resilience of rural entrepreneurial businesses in the face of health crises has been neglected. Therefore, this study seeks to develop a paradigm model for resilience of rural entrepreneurial businesses in dealing with the COVID-19 crisis with a qualitative approach.

METHODOLOGY

Study Site

The present study is limited to Kermanshah province in terms of location. The capital of Kermanshah province is the city of Kermanshah. This province has an area of 24,549 square kilometers. Kermanshah province is one of the provinces located in the west of Iran (**Figure 1**). Kermanshah province with an area of 24,640 square kilometers is ranked 17th among 31 provinces of Iran in terms of size and occupies 1.5% of the total area of Iran. Kermanshah province has more than 330 km of border with Iraq, this province is limited to Kurdistan province from the north, Lorestan and Ilam provinces from the south, Hamedan province from the east and Iraq from the west. According to the information of the Deputy of Statistics and Information of Kermanshah Management and Planning Organization and based on the latest divisions of the country in this province, there are 14 townships, 31 districts and 86 Counties; **Figure 1**; (29). Kermanshah consists of 14 districts, including Dalahu County, Gilan-e Gharb County, Harsin County, Eslamabad-e Gharb County, Javanrud County, Kangavar County, Kermanshah County, Paveh County, Qasr-e Shirin County, Ravansar County, Sahneh County, Sarpol-e Zahab County, Salas-e Babajani County, and Sonqor County (29–31) (**Figure 1**). The results of many researches indicate that Kermanshah province has many potentials and entrepreneurial opportunities in rural areas (32) and following the exploitation of these rural entrepreneurial opportunities, many entrepreneurial businesses have been established in rural areas of Kermanshah province (33). Various evidences show that the outbreak of COVID-19 pandemic has disrupted many rural entrepreneurial businesses in Kermanshah province (16). Therefore, it is necessary to provide a paradigm model to continue the activity and increase the resilience of rural entrepreneurial businesses in Kermanshah province during the COVID-19 crisis. Rural entrepreneurial businesses have different types that in this study, rural entrepreneurial businesses are businesses that have been established through exploitation of entrepreneurial opportunities in agricultural field in rural areas of Kermanshah province.

Study Design

The present study seeks to provide a developing a paradigm model for resilience of rural entrepreneurial businesses in dealing with the COVID-19 crisis using the grounded theory (GT) method. GT was developed by sociologists Barney Glaser and Anselm Strauss in the mid-1960s and published in their 1967 seminal book, Discovery of Grounded Theory (34). GT is a method of extracting concepts from the heart of data and then combining them to create a theory (35). According to GT, there is no pre-determined hypothesis, but it can be achieved in the process of analysis (36). When there is no clear hypothesis, or in a region where no field research has been done so far, or little research has been done, the method of grounded theory will provide good results by creating a new theory (37). Therefore,

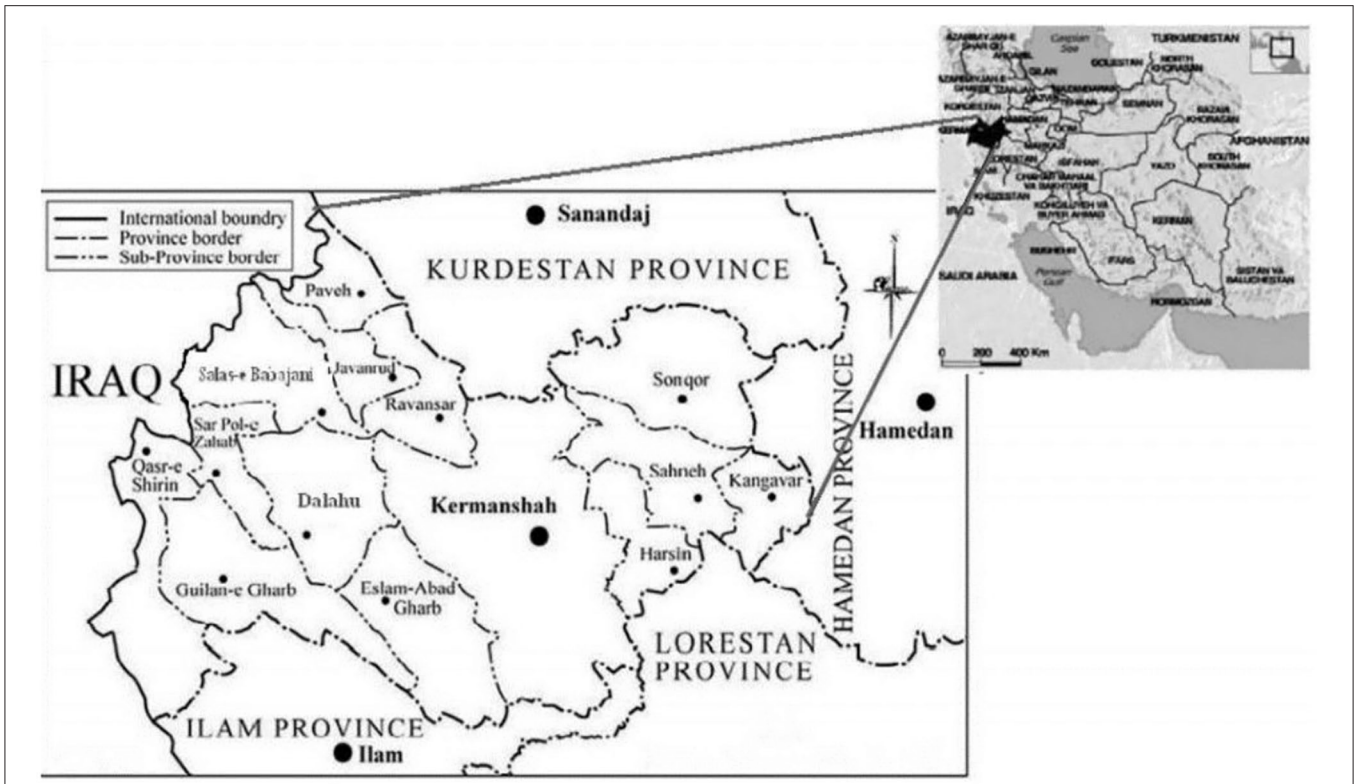

FIGURE 1 | The study area; Kermanshah province, which is located in Western Iran.

since based on the studies, no research has been done on the research issue, especially in the study site, and also, because our goal is to arrive at a theory derived from field data extracted from the field under study, the grounded theory method gives us the best answer. Therefore, this method is most suitable for achieving the objectives of this study.

Data Collection

Participants in this study included all experts and key informants in the field of research, such as experienced managers of rural entrepreneurial businesses in Kermanshah province who were selected through purposeful sampling and theoretical sampling. Criteria for selecting samples in this study included the following; Managers with at least 15 years of experience in rural entrepreneurial businesses, as well as managers with at least a university degree in fields related to business management, managers with a history of other business crises (with history of business management during the crisis such as the earthquake crisis in 2017 in Kermanshah province, the crisis of sanctions or the crisis of the war between Iran and Iraq and other crises). To identify the samples, purposeful sampling method was used first. In this sampling method, because the samples may not be easily identifiable at first, the researcher first identifies the key informants. In the following, the researcher reached another informed person by interviewing the informed sample and receiving the necessary data (38). In other words, after receiving information from the first key person, he was asked to introduce the person or other people who are experts in the field of research. Thus, using the initial participants, the subsequent participants were identified. In theoretical sampling based on the concept of "comparison", data are collected based on emerging concepts (39). In this sampling, data collection is mostly done according to the categories and concepts extracted from previous data and is completed with theoretical saturation (40). Theoretical saturation occurs when no new data is discovered and no new categories are created in the open coding. In other words, theoretical saturation is a point in research where data collection seems repetitive and unproductive (41). Therefore, data collection, and consequently sample's size, continued until when new data/information no longer brought additional insights to the research questions. Therefore, theoretical saturation was obtained through interviews with 26 people. The tools used to collect the data included semi-structured interviews, field notes, and document analysis. It should be noted that each interview lasted an average of 45 to 60 min. With the permission of the participants, their voices were recorded using a tape recorder. Data collection lasted from October 1, 2021 to November 1, 2021. Because the corona virus had spread in Kermanshah province at the time of conducting research, most of the interviews were conducted in face-to-face, in accordance with health protocols and social distance, and some interviews were conducted by telephone.

The process of working in grounded theory consists of several stages. The first is to identify the research plan. The purpose

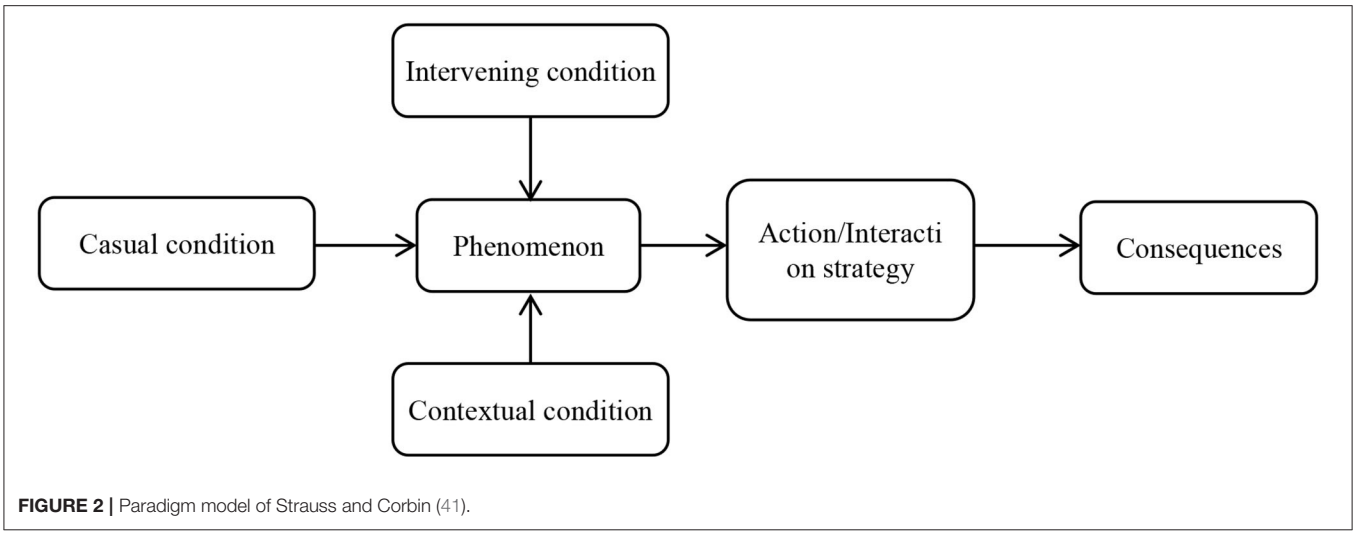

FIGURE 2 | Paradigm model of Strauss and Corbin (41).

of this stage is to identify the questions and constraints of the research (40, 42, 43).

The main focus of the research question is "What is this phenomenon?" (44). In this study, the general question of the research was what measures have been taken by rural entrepreneurial businesses in Kermanshah province to make their businesses resilient against COVID-19?

This study also sought to develop a paradigm model for the resilience of rural entrepreneurial businesses during the COVID-19 crisis. Therefore, the following questions were asked to the participants:

From the participants' point of view, what factors cause the development of resilience of rural entrepreneurial businesses in the face of the COVID-19 crisis? What factors affect the resilience of rural entrepreneurial businesses? What actions have been taken to develop the resilience of rural entrepreneurial businesses against COVID-19? What are the consequences of these actions?

Data Analysis

Simultaneously with data collection, the data analysis process began. In this research, we followed Straussian grounded theory (SGT) and used a coding processor from Strauss and Corbin (44) that includes three stages: open, axial, and selective coding.

Open Coding

Open coding is the first data analysis process that focuses on conceptual analysis and classification of phenomena through extensive data analysis (45). In this type of coding, events are also conceptually labeled and categorized through constant comparison; In this way, concepts that have a common semantic load are placed in one category (46) and are labeled according to the semantic load of that category (34).

Axial Coding

The open codes identified in the previous step are compared and clustered by axial coding, and finally they are categorized in Subcategories (39). According to Liu et al. (47) the main purpose of axial coding is to discover and establish connections between concepts and subcategories and between sub-categories and categories. In other words, axial coding means creating communication and organizing emerging communication between subcategories and achieving a comprehensive theory. Therefore, it is necessary to have a suitable design, which according to Strauss and Corbin (41), this design is the same as the paradigm model in axial coding. Through the paradigm model, casual conditions, phenomena, contextual conditions, interventing conditions, actions / strategies, and consequences are identified and subcategories are related to categories (48). As can be seen in **Figure 2**, the paradigm model defines six categories: causal conditions, phenomena, contextual conditions, interventing conditions, actions and consequences (41).

Selective Coding

While according to Strauss and Corbin (44), axial coding investigates the relationships between concepts and categories that emerge in the open coding phase, selective coding can be described as the way in which categories are linked to the main category (40). In selective coding, the main category is identified and linked to other primary categories, as well as the integration and refinement of the theory using constant comparison and storyline (47). In this research, the main category was selected and related to other categories logically and systematically through storyline writing.

Credibility

Credibility is achieved through long-term communication and interaction with experts and data, which can be achieved through triangulation (49). For many researchers, triangulation is considered the use of data collection techniques (usually three methods) to investigate a similar phenomenon. In other words, triangulation has been interpreted as a means of cross-validating measures and validating the findings. It represents the types of data, researchers, theories, and methods (40). In this study, data triangulation was used among different types of triangulation. Typically, this process involves verifying evidence from a variety of sources to illuminate a theme or perspective (50). Data

triangulation refers to the combination of different data sources that are examined at different times and places, and by different people (51). In this study, data were collected by different people (including faculty members and rural entrepreneurial business managers), at different times (from October 1, 2021 to November 1, 2021) and in different places (different villages in Kermanshah province). In other words, in this study, credibility was validated using triangulation of data sources, including participant verification, researcher debriefing and capitulations, and note-based audit sequences (52). For further confirmation, two groups, including faculty members and rural entrepreneurial business managers were employed to confirm the findings.

RESULTS AND DISCUSSION

Demographic Characteristics of the Participants

73.07% (19 people) of the participants were male and the rest were female. All participants had a university degree in the field related to business management so that 65.38% (17 people) had a bachelor's degree, 26.92% (7 people) had a master's degree and 7.7% (2 people) had a PhD degree. The minimum age of participants was 34 years and the maximum age was 57 years and the average age was 46.19 years. These people also had an average experience of 25.30 years, the minimum experience was 15 years and the maximum experience was 35 years.

Open Coding

In this research, in open coding, the data obtained from the interviews were examined line by line and the concepts were extracted. Based on the findings, 112 codes were initially identified, which in some cases were duplicates, so refinement was done and duplicate concepts were removed or expressed in the form of a concept. After the final refinement, there are 57 concepts left that were classified into different subcategories based on the semantic load. **Table 1** shows the results of open coding.

Axial Coding (Resilience Paradigm Model)

In the present study, in axial coding, causal conditions included economic management, health factors, human resources management, and adaptation factors. The phenomenon included low resilience of rural entrepreneurial businesses in the face of the COVID-19 crisis. Contextual conditions including social factors; cultural factors and psychological factors. Interventing conditions included business management and legal supports. Finally, action strategies included Planned resilient actions and Unplanned resilient actions, the consequences of which included adapting to crisis conditions and increasing resilience in the long run, and Lack of adaptation to crisis conditions and lack of continuity of business survival in the long run (More details will be provided in the lower sections).

Casual Conditions

According to the perspectives of rural entrepreneurs in Kermanshah province, four factors directly cause the resilience of rural entrepreneurial businesses; these factors include economic management, health factors, human resources management, and adaptation factors.

Economic Management

From the participants' point of view, economic management causes the resilience of rural entrepreneurial businesses during the COVID-19 crisis. Participants stated that although COVID-19 directly affects the health of human resources, it has economic consequences for rural entrepreneurial businesses due to the implementation of adaptive and preventive strategies to prevent the spread of COVID-19. Therefore, the participants believed that under these conditions, which face economic problems, the best factor that increases the resilience of rural entrepreneurial business is economic management. Therefore, rural entrepreneurs should seek to increase liquidity through various means including receiving disaster loans (crisis), income diversity, previous financial resources, liquidity management, control and reduce costs, manage and increase sales to improve the resilience of their business.

This part of the results is parallel to findings Beninger and Francis (20); Le et al. (22); Saad et al. (23) and Hiramatsu and Marshall (28). Beninger and Francis (20); Le et al. (22); Saad et al. (23) in separate studies stated that having financial factors will increase business resilience. Hiramatsu and Marshall (28) state in their research that businesses that have used catastrophic (crisis) loans have a higher degree of resilience than other businesses that have not used these loans. In explaining this part of the findings, it should be stated that one of the main consequences of various crises for businesses is economic consequences. In the meantime, those businesses have more resilience that have the ability to better manage the economy in times of crisis. In other words, in times of crisis, businesses must seek to reduce costs and increase their liquidity and revenue, and manage their financial resources to better overcome the crisis. Rural entrepreneurial businesses are usually not in a good financial position due to their small size and their financial resilience is very low, so what develops the resilience of rural entrepreneurial businesses is economic management.

Health Factors

From the participants' point of view, another factor that increases the resilience of rural entrepreneurial businesses is to prevent the spread of the COVID-19 virus, so to increase the resilience of rural entrepreneurial businesses, it is necessary to follow health principles and protocols. In this regard, participants believed that rural entrepreneurial businesses should be equipped to deal with the COVID-19 virus. Participants stated that addressing the following health factors could cause them to deal with the COVID-19 virus in rural entrepreneurial businesses; equipping the business environment with various sanitary devices (proper ventilation, etc), providing disposable health tools to personnel in order to comply with protocols (masks, etc), equipping businesses with early diagnostic tools (Fever gauge, etc), adherence to health protocols; daily staff checkup.

This part of the results is parallel to findings Beninger and Francis (20) and Aldianto et al. (21). Beninger and Francis (20) states that health factors in the COVID-19 crisis provide the basis

TABLE 1 | Open and axial coding.

Axial coding	Open coding		References
Categories	**Subcategories**	**Concepts**	
Causal conditions (A)	Aa. Economic Management	1. Receiving disaster loans (crisis);	7
		2. Income diversity;	8
		3. Previous financial resources;	4
		4. Liquidity management;	9
		5. Control and reduce costs;	6
		6. Manage and increase sales.	6
	Ab. Health factors	1. Equipping the business environment with various sanitary devices (proper ventilation, etc);	4
		2. Providing disposable health tools to personnel in order to comply with protocols (masks, etc);	9
		3. Equipping businesses with early diagnostic tools (Fever gauge, etc).	6
		4. Adherence to health protocols;	10
		5. Daily staff checkup.	8
	Ac. Human resources management	1. Continuous updating of personnel health information in dealing with the corona crisis;	8
		2. Improving the skills of personnel in observing health protocols;	10
		3. Time flexibility in the presence of personnel;	9
		4. Flexibility of location in the presence of staff (doing things remotely if possible).	9
	Ad. Adaptation factors	1. Continuous environmental monitoring, continuous planning and adaptation to environmental changes and their timely implementation;	8
		2. Provide consistent systematic responses (short, medium and long term);	7
		3. Use of crisis adaptive technologies in business model	11
Intervening conditions (B)	Ba. Business management	1. Crisis management and proper accountability;	7
		2. Condition-based planning for the business;	8
		3. Develop and present appropriate strategies for business continuity.	9
	Bb. Legal supports	1) Proper management and policy making;	12
		2) Providing infrastructure adapted to crisis situations (increasing antenna coverage in villages in remote areas);	9
		3) Support policies for low-interest (or even non-interest-bearing) lending;	9
		4) Increase partnership and cooperation between enterprises, government and other private organizations;	8
		5) Develop and provide crisis preparedness and management instructions;	8
		6) Government support in providing health services to businesses;	6
		7) Monitoring the proper implementation of health protocols.	7
Contextual conditions (C)	Ca. social factors	1) Increasing membership in indigenous and non-indigenous social networks with the aim of benefiting from experiences;	5
		2) Increasing trust, participation and cooperation in observing preventive measures among personnel and customers;	6
		3) Increase cooperation throughout the supply chain in the business.	4
	Cb. cultural factors	1) Strengthening the entrepreneurial culture in business with the aim of providing products or services that are creative and adapt to new conditions and gain a competitive advantage;	8
		2) Elimination of incorrect and opposing cultures by controlling and preventing the spread of coronavirus (elimination of handshake, etc.).	6
	Cc. psychological factors	1) Increase staff motivation in relation to business continuity;	7
		2) Increase staff resilience in relation to business continuity;	8
		3) Strengthen the motivation of personnel with coronavirus.	6
Phenomenon (D)	Da. Low resilience of rural entrepreneurial businesses in the face of the COVID-19 crisis	1) Discontinuation of rural entrepreneurial businesses in the face of the COVID-19 crisis	26

(Continued)

TABLE 1 | Continued

Axial coding	Open coding		References
Categories	**Subcategories**	**Concepts**	
		2) Lack of adaptability of rural entrepreneurial businesses in the face of the COVID-19 crisis	25
Action strategies (E)	Ea. Planned resilient actions	1. Development and modification of marketing strategies based on crisis conditions;	10
		2. Human resource training;	6
		3. Develop and provide health instructions;	7
		4. Monitoring the proper implementation of health protocols;	8
		5. Reform of financial management based on crisis conditions;	8
		6. Development of crisis-adapted infrastructure;	8
		7. Exploiting emerging environmental opportunities.	7
	Eb. Unplanned resilient actions	1) Sales of some business equipment and machinery;	5
		2) Sale of part of the company's shares;	5
		3) Temporary deactivation of the business;	6
		4) Reducing the quantity of production;	4
		5) Decreased production quality.	5
Consequences (F)	Fa. Adapting to crisis conditions and increasing resilience in the long run	1) Business continuity;	8
		2) Recovery of business position;	8
		3) Improvement of business position than before of crisis;	9
		4) Business growth and development;	7
		5) More prepared and developed to face future crises.	6
	Fb. Lack of adaptation to crisis conditions and lack of continuity of business survival in the long run	1) More vulnerability in the long run;	7
		2) Bankruptcy and inactivity in the long run.	6

References refer to the number of times a concept is coded and emphasized by participants (53).
Findings of the study.

for increasing business resilience, and Aldianto et al. (21) in a study emphasized the factors of knowledge and information to deal with the Corona crisis. The COVID-19 crisis is of a health nature in itself and directly targets the health of business human capital. Since the biggest asset of any business is the human capital of that business, so to increase resilience, businesses must pay attention to the health of personnel and take measures to strengthen and protect the health of personnel.

Human Resources Management

Participants stated that the nature of the COVID-19 crisis is such that it directly targets the human capital health of rural entrepreneurial businesses. Therefore, to increase the resilience of rural entrepreneurial businesses, factors that protect human capital should be given priority. Participants stated that personnel information on how to deal with COVID-19 should be updated first, and then human capital skills should be improved through training. Personnel should also perform their duties remotely (*via* information technology and virtually) as much as possible, and staff attendance should be shifted in time.

This part of the results is parallel to findings Beninger and Francis (20); Le et al. (22) and Saad et al. (23). As mentioned, human resources are the largest and most valuable asset of any business that any business must protect to achieve increased resilience. Because the COVID-19 crisis directly targets human resource health, businesses must adopt strategies that minimize the risk to their human resources. In other words, human resources in the face of the COVID-19 health crisis must be managed to minimize damage to these valuable human resources and increase business resilience.

Adaptation Factors

From the participants' point of view, crises cause environmental changes, and under these conditions, the organization or business is resilient, which can adapt to the new normal conditions. From the participants' point of view, crises cause environmental changes, and under these conditions, the organization or business is resilient, which can adapt to the new normal conditions. Participants stated that these responses should be systematic and strategic, in other words, short-term responses should be in line with the vision and development of the business in the medium and long term. Participants also stated that they should avoid responses that create consistency in the short term but provide business destruction in the long term. Participants stated

that in order to increase the resilience of rural entrepreneurial businesses, their business model should be redesigned to adapt to the existing conditions. In other words, the factors that adapt to the COVID-19 crisis must be added to their business model. They stated that the factors of adaptation in the COVID-19 crisis are the elimination of face-to-face interactions and the use of IT infrastructure.

This part of the results is parallel to findings Aldianto et al. (21). Explaining this part of the findings, it should be noted that the crisis is upsetting the balance of the environment and environmental changes in businesses. Therefore, in order to increase resilience, businesses must adapt to the new normal conditions, and only in this way can they overcome the crisis. What makes adaptation to new conditions is the use of crisis-adapted tools. In the COVID-19 crisis, this tool includes information technology. In other words, the way to deal with COVID-19 is to reduce face-to-face interactions and increase virtual communication. Therefore, rural entrepreneurial businesses in order to achieve maximum adaptation to the new normal conditions and increase the resilience of their business must redesign their business model and use information technology tools in their new business model.

Phenomenon

The phenomenon in this study is the main issue of the research. The main issue in this study is the low resilience of rural entrepreneurial businesses in the face of the COVID-19 crisis. In other words, since the COVID-19 crisis had severely disrupted and risked rural entrepreneurial businesses, it is necessary to provide a resilience paradigm model for them. Therefore, the phenomenon studied in this study includes low resilience of rural entrepreneurial businesses in the face of the COVID-19 crisis.

Intervening Conditions

Intervening conditions refer to aspects that affect or modify the effects or development of a phenomenon (54). In this study, the intervention conditions include business management and Legal supports. In other words, the interventionist conditions in this study are examined at both macro and micro levels and refers to the policy-making at the macro and micro levels of society.

Business Management

In this study, the intervening conditions at the micro level refer to the decisions, policies and governance at the level of rural entrepreneurial businesses. Participants stated that they adopted decisions and policies such as Crisis management and proper accountability, Condition-based planning for the business, and Develop and present appropriate strategies for business continuity to increase resilience at the business management level.

This part of the results is parallel to findings Le et al. (22) and Pappas and Brown (25). Le et al. (22) stated in a study that business management plays an important role in increasing the resilience of businesses in times of crisis. Pappas and Brown (25) stated in a study that in order to increase resilience in the context of the COVID-19 crisis, entrepreneurial decisions should be made for businesses based on the current situation and existing capabilities and capacities. In explaining this part of the findings, it should be stated that the difference in the success or failure of businesses in any situation is due to the decisions and strategies that are adopted and operated by those businesses. Therefore, proper and situation-based management in times of crisis leads to increased resilience. Therefore, businesses should always monitor their environment and be sensitive to even the smallest changes and provide them with an appropriate strategy to increase their resilience and overcome crises.

Legal Supports

In this study, intervening conditions at the macro level refer to the government's decisions and policies to increase the resilience of rural entrepreneurial businesses. Participants stated that the government has adopted appropriate policies to continue the operation of rural entrepreneurial businesses at the village level, as follows; (1) Proper management and policy making; (2) Providing infrastructure adapted to crisis situations (increasing antenna coverage in villages in remote areas); (3) Support policies for low-interest (or even non-interest-bearing) lending; (4) Increase partnership and cooperation between enterprises, government and other private organizations; (5) Develop and provide crisis preparedness and management instructions; (6) Government support in providing health services to businesses; (7) Monitoring the proper implementation of health protocols.

"Proper management and policy making" means that the government has adopted appropriate policies in response to environmental changes to increase the resilience of rural entrepreneurial businesses, and policies have been based on environmental monitoring. Also, due to the fact that most rural areas in Kermanshah province have weak antennas, the government strengthened the antenna infrastructure in these areas. The government also provided disastrous loans to compensate companies and increase the liquidity of rural entrepreneurial businesses in order to offset some of the losses. To increase the resilience of rural entrepreneurial businesses, the government also provided contexts for increased collaboration and partnership between companies, government, and other private organizations. The government also developed guidelines for how to manage crises and adhere to health protocols, and monitored how to handle them properly.

This part of the results is parallel to findings Beninger and Francis (20), Saad et al. (23) and Portuguez Castro and Gómez Zermeño (24). Beninger and Francis (20) states that macro-level supportive policies are effective in increasing business resilience. Saad et al. (23) stated that the support of relevant institutions during the crisis is effective in increasing the resilience of businesses. Portuguez Castro and Gómez Zermeño (24) stated in their research that the level of communication with relevant institutions can improve the resilience of entrepreneurial businesses in times of crisis. Explaining this part of the findings, it should be said that the government and relevant institutions with appropriate policy-making play a key role in increasing the resilience of rural entrepreneurial businesses. The government seeks to intervene to increase the resilience of rural entrepreneurial businesses by providing financial support, such as disaster lending or the development of crisis-friendly

infrastructure, such as the development of IT infrastructure in less developed villages. The relevant institutions and the government, by increasing the relationship with businesses, should be aware of their latest needs to increase resilience and try to meet their needs through the development of appropriate policies.

Contextual Conditions

Contextual conditions refer to where a phenomenon occurs and the conditions that allow the development of a strategy (40). In other words, contextual conditions refer to those conditions that provide the context for the occurrence of the phenomenon. In this study, contextual conditions include social factors, cultural factors and psychological factors.

Social Factors

Participants stated that contextual social participation has increased the resilience of rural entrepreneurial businesses. Participants stated that by joining indigenous and non-indigenous social networks and sharing their experiences of dealing with the crisis, they have provided the context for increasing the resilience of rural entrepreneurial businesses. Participants stated that increased participation and cooperation in adhering to health protocols has led to virus control and thus increased business resilience. Increased cooperation throughout the supply chain in rural entrepreneurial businesses has also reduced costs and increased revenue, and this cooperation across the supply chain has provided increased resilience.

This part of the results is parallel to findings Beninger and Francis (20); Saad et al. (23) and Le et al. (22). Beninger and Francis (20); Saad et al. (23) and Le et al. (22) in separate studies stated that social factors are effective in increasing the resilience of businesses. Explaining this part of the findings, it should be said that the COVID-19 crisis is a crisis that has affected all communities, so all communities and businesses must cooperate and participate in dealing with this crisis. Given the limited experience in dealing with health crises and the unknownness of the COVID-19 virus, all business managers should share their experiences of coping with the crisis through membership in local and non-native social networks. Increasing cooperation across the supply chain can also reduce the costs of rural entrepreneurial businesses, which increases resilience. The most important end of the COVID-19 crisis is when there is maximum cooperation and participation at the community level in compliance with health protocols. In other words, what has led to the expansion of COVID-19 is the lack of cooperation and participation of communities. Therefore, in order to increase the resilience of businesses, social factors must be strengthened.

Cultural Factors

In this study, cultural factors include entrepreneurial culture in business and elimination of incorrect and opposing cultures by controlling and preventing the spread of coronavirus.

The emergence of crises causes a change in the balance and status of the business environment. On the other hand, environmental changes are the source of the emergence of entrepreneurial opportunities. Participants stated that if rural entrepreneurial businesses have a strong entrepreneurial culture, they can offer creative and relevant products or services for the environment by identifying emerging opportunities and exploiting them in a timely manner. In this way, not only can they improve their resilience, but they can also gain a competitive advantage and turn the crisis into an opportunity for their business to grow and develop. This part of the results is parallel to findings Hanson et al. (27). Hanson et al. (27) in their research stated that entrepreneurial culture in businesses in critical situations is an important factor in business resilience. In explaining this part of the findings, it should be stated that crises are the source of entrepreneurial opportunities due to changes in the environment. A business that adapts faster to environmental change and more quickly identifies and exploits emerging environmental opportunities has a better competitive advantage and more resilience.

Regarding the elimination of incorrect culture in the region, the participants stated that the culture of the rural community is contrary to preventive measures and health protocols. Rural community culture needs to be reformed and revised based on health protocols to control the COVID-19 crisis to provide a context for increasing the resilience of rural entrepreneurial businesses. This part of the results is parallel to findings Beninger and Francis (20) and Saad et al. (23). Beninger and Francis (20) and Saad et al. (23) in separate studies stated that cultural factors are effective in increasing business productivity. Explaining this part of the findings, it should be said that the reason for the continuation of the COVID-19 crisis may be due to the incorrect cultures of individuals in communities. If this crisis is to be tackled, the health culture of the community must first be reformed and the cultures that endanger the health of the community must be eliminated. In this regard, proper health behaviors must be created in society.

Psychological Factors

In this study, psychological factors including increase staff motivation in relation to business continuity, increase staff resilience in relation to business continuity, strengthen the motivation of personnel with coronavirus.

Staff motivation should be stimulated in various ways. For example, some participants pointed out that providing incentive leave can increase people's motivation and thus increase business resilience. Some participants said that the minds of personnel should be more resilient and prepared to deal with the COVID-19 crisis. In other words, personnel must be mentally prepared in advance to deal with this crisis in order to provide a more appropriate response when faced with it. Personnel infected with COVID-19 virus should be motivated. Participants stated that the most important capital of rural entrepreneurial businesses is human capital, which should be motivated and mentally supported under any circumstances.

Action Strategies

Action strategies are programs that can help adapt to a phenomenon, in our context (40), the resilience of rural entrepreneurial businesses in the face of the COVID-19 crisis. In other words, action strategies are the actions that the study

community takes in response to the emerging phenomenon. In this study, action strategies developed by rural entrepreneurial businesses to achieve resilience to the COVID-19 crisis include planned resilient actions and unplanned resilient actions.

Planned Resilient Actions

Planned resilient actions refer to those short-term resilient actions that are taken during the COVID-19 crisis but are aimed at developing and growing the business in a long-term perspective. In this research planned resilient actions include development and modification of marketing strategies based on crisis conditions, human resource training, develop and provide health instructions, monitoring the proper implementation of health protocols, reform of financial management based on crisis conditions, development of crisis-adapted infrastructure and exploiting emerging environmental opportunities. This part of the results is parallel to findings Ngin et al. (26). Ngin et al. (26) stated in a study that short-term responses should be provided first instead of long-term systematic resilient measures, and gradually the ability of businesses to deal with these disasters should be enhanced by strengthening crisis-related infrastructure. In other words, temporary responses should be in line with long-term systematic responses, and any plan to increase business resilience should be parallel to the growth and development of the business in a long-term perspective.

Unplanned Resilient Actions

Unplanned resilient actions refer to those measures that, although in the short run increase the resilience of rural entrepreneurial business, but in the long run lead to business bankruptcy. In this study, unplanned resilient actions include sales of some business equipment and machinery, sale of part of the company shares, temporary deactivation of the business, reducing the quantity of production and decreased production quality.

In this regard, the participants stated that resilient measures should be taken in a long-term perspective that will pave the way for business growth and development. In this regard, the participants stated that resilient measures should be taken in a long-term perspective that will pave the way for business growth and development. For example, redesigning the business model and increasing the factors that adapt to the current crisis, such as taking advantage of information technology opportunities, will increase both resilience during COVID-19 and, in the long run, the growth and development of the business.

Consequences

The consequences of implementing resilient behaviors, in our situation, although they increase resilience in the short run, in the long run fall into two categories: adapting to crisis conditions and increasing resilience in the long run, and Lack of adaptation to crisis conditions and lack of continuity of business survival in the long run.

What is important is that adaptive measures should be taken in a way that, while being adaptable in the short run, also provides the context for the growth and development of rural entrepreneurial business in the long run.

Figure 3 shows the paradigm model of the resilience of rural entrepreneurial businesses in the face of the COVID-19 crisis.

Selective Coding

The purpose of selective coding is to identify the main phenomenon and relate it logically to the different subcategories through the paradigm model. To do this, the researcher uses a storyline to describe and justify the relationships between the categories and presents a visual model of the main research topic (34).

There are different criteria for judging which category should be considered the main category. (55) provides a list of criteria that can be used to determine whether a category is eligible to be selected as the main category:

1. This category should be the main (pivotal) category. That is, it can be related to many other categories and their characteristics, but is more suitable for the main category than other candidates. This criterion of centrality is a necessary condition for placing a category at the heart (center) of the analysis: it indicates that this category describes a major part of the changes in the pattern of behavior.
2. The main category must be observed repeatedly in the data. With high repetition, this category is considered as a stable pattern and is consequently related to other categories by the analyst.
3. The main category is easily related to other categories. These communications are not mandatory; rather, they come into being quickly and abundantly. Because the main category is related to many other categories and is repeated frequently, it becomes more saturated in more time than the other categories.
4. The main category in a substantive study has clear implications for a more general theory.
5. Because the details of a main category are generated analytically, the theory moves forward appreciably.

As mentioned earlier, the research phenomena included two subcategories (Da1 and Da2). According to Strauss (1987) criteria, the most important phenomenon in this research involved the Da1 subcategory. This subcategory is referenced 26 times.

As shown in **Figure 3**, the main phenomenon is caused by four subcategories including economic management, health factors, human resources management, and adaptation factors. These four subcategories include a total of 18 concepts. Economic management was referenced a total of 40 times by the interviewees, which included six concepts (References mean: 6.66). These six concepts include receiving disaster loans (crisis), income diversity, previous financial resources, liquidity management, control and reduce costs, manage and increase sales. Among these concepts, the most important concept was "Liquidity management" with nine references (most references). In other words, in the economic management sub-category, the "Liquidity management" factor has a greater impact on increasing the resilience of rural entrepreneurial businesses during the crisis. Health factors were referenced a total of 37 times by the interviewees, which included five concepts

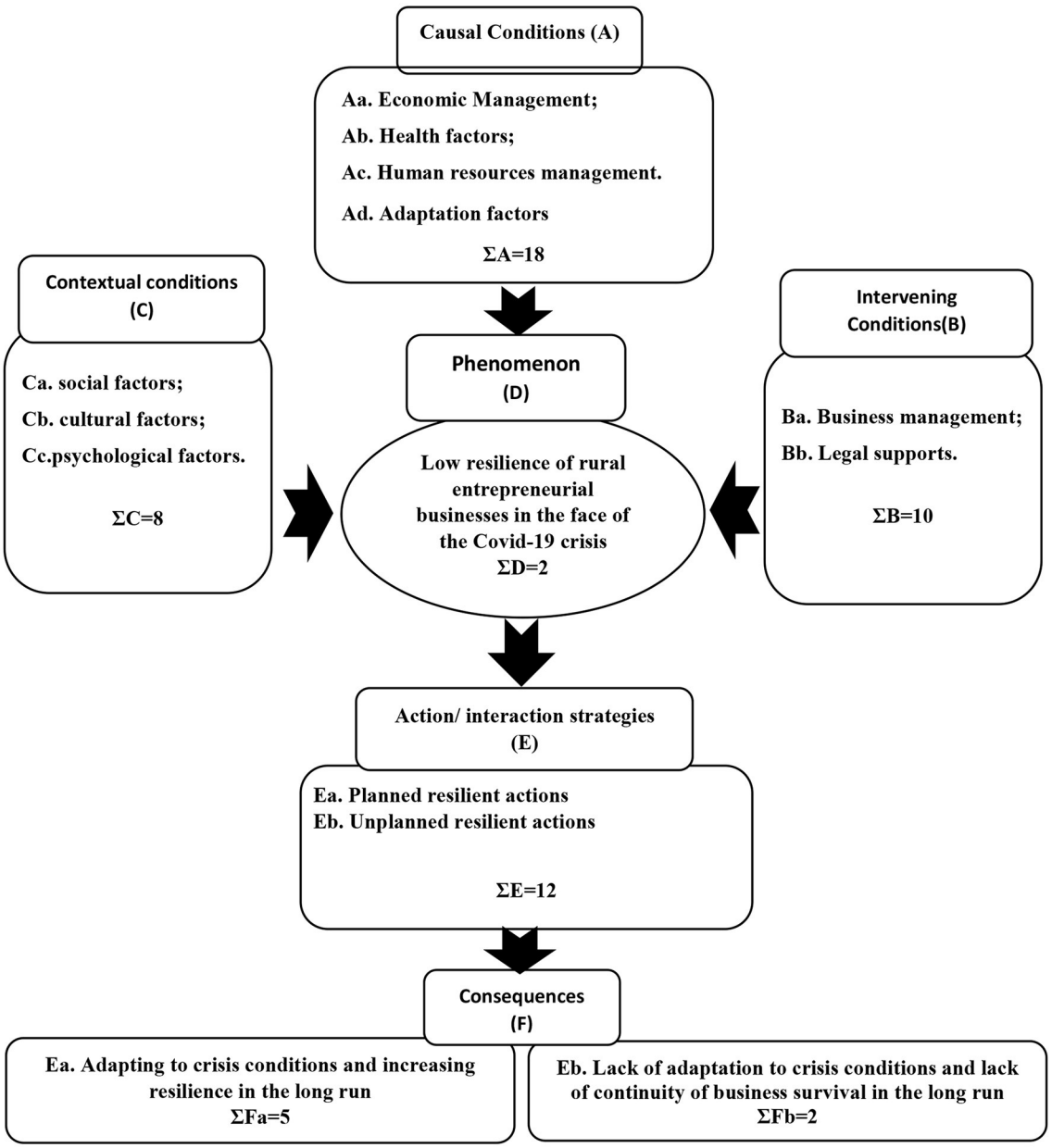

FIGURE 3 | Paradigm model of the resilience of rural entrepreneurial businesses in the face of the COVID-19 crisis.

(References mean: 7.4). These five concepts include equipping the business environment with various sanitary devices (proper ventilation, etc.), providing disposable health tools to personnel in order to comply with protocols (masks, etc.), equipping businesses with early diagnostic tools (Fever gauge, etc.), adherence to health protocols, and daily staff checkup. Among these concepts, the most important concept was "Adherence to health protocols" with 10 references (most references). In other words, in the health factors sub-category, the "Adherence to health protocols" factor has a greater impact on increasing the resilience of rural entrepreneurial businesses during the crisis. Human resources management was referenced a total of 35 times by the interviewees, which included four concepts (References mean: 8.75). Among these concepts, the most important concept was "Improving the skills of personnel in observing health protocols" with 10 references (most references). In other words, in the human resources management sub-category, the "Adherence to health protocols" factor has a greater impact on increasing the resilience of rural entrepreneurial businesses during the crisis. Adaptation factors were referenced a total of 26 times by the interviewees, which included three concepts (References mean: 8.66). Among these concepts, the

most important concept was "Use of crisis adaptive technologies in business model" with 11 references (most references). In other words, in the adaptation factors sub-category, the "Use of crisis adaptive technologies in business model" factor has a greater impact on increasing the resilience of rural entrepreneurial businesses during the crisis. In other words, the factors that directly increase the resilience of rural entrepreneurial businesses include four factors: economic management, health factors, human resource management and adaptation factors. Therefore, rural entrepreneurial business managers seeking resilience should consider these four factors in their planning during a crisis. In general, these four subcategories (Causal Conditions) directly affected the occurrence of the phenomenon and indirectly (through the phenomenon) affected the action / interaction strategies (**Figure 3**).

According to the participants, in addition to causal conditions, the contextual and intervening conditions also affect the phenomenon (**Figure 3**).

Contextual conditions include three subcategories: social factors, cultural factors and psychological factors. These three subcategories include a total of eight concepts. Social factors were referenced a total of 15 times by the interviewees, which included three concepts (References mean: 5). Among these concepts, the most important concept was "Increasing trust, participation and cooperation in observing preventive measures among personnel and customers" with six references (most references). In other words, in the social factors sub-category, the "Increasing trust, participation and cooperation in observing preventive measures among personnel and customers" factor has a greater impact on increasing the resilience of rural entrepreneurial businesses during the crisis. cultural factors were referenced a total of 14 times by the interviewees, which included two concepts (References mean: 7). Among these concepts, the most important concept was "Strengthening the entrepreneurial culture in business with the aim of providing products or services that are creative and adapt to new conditions and gain a competitive advantage" with eight references (most references). In other words, in the cultural factors sub-category, the "Strengthening the entrepreneurial culture in business with the aim of providing products or services that are creative and adapt to new conditions and gain a competitive advantage" factor has a greater impact on increasing the resilience of rural entrepreneurial businesses during the crisis. Psychological factors were referenced a total of 21 times by the interviewees, which included three concepts (References mean: 7). Among these concepts, the most important concept was "Increase staff resilience in relation to business continuity" with eight references (most references). In other words, in the psychological factors sub-category, the "Increase staff resilience in relation to business continuity" factor has a greater impact on increasing the resilience of rural entrepreneurial businesses during the crisis. In general, contextual conditions provided the context for the phenomenon to occur in the study population. Social factors, cultural factors and psychological factors were subcategories that formed contextual conditions. According to the participants, these three sub-categories (contextual conditions) directly affected the occurrence of the phenomenon and indirectly (through the phenomenon) affected the action / interaction strategies (**Figure 3**).

Intervening conditions include two subcategories: Business management and Legal supports. These two subcategories include a total of 10 concepts. Business management was referenced a total of 24 times by the interviewees, which included three concepts (References mean: 8). These three concepts include crisis management and proper accountability, condition-based planning for the business, develop and present appropriate strategies for business continuity. Among these concepts, the most important concept was "develop and present appropriate strategies for business continuity" with nine references (most references). In other words, in the Business management sub-category, the "develop and present appropriate strategies for business continuity" factor has a greater impact on increasing the resilience of rural entrepreneurial businesses during the crisis. Legal supports were referenced a total of 59 times by the interviewees, which included seven concepts (References mean: 8.42). Among these concepts, the most important concept was "Proper management and policy making" with 12 references (most references). In other words, in the Legal supports sub-category, the "Proper management and policy making" factor has a greater impact on increasing the resilience of rural entrepreneurial businesses during the crisis. As mentioned earlier, the two subcategories of Business management and Legal support were intervening conditions that also facilitated the occurrence of the phenomenon. In general, according to the participants, these two sub-categories (intervening conditions) directly affected the occurrence of the phenomenon and indirectly (through the phenomenon) affected the action / interaction strategies (**Figure 3**).

When the phenomenon occurred, the study population took action to cope with the phenomenon. In this study, according to the participants, the measures taken were classified into two subcategories, planned resilient actions and unplanned resilient actions. These two subcategories include a total of 12 concepts. Planned resilient actions were referenced a total of 54 times by the interviewees, which included seven concepts (References mean: 7.71). Among these concepts, the most important concept was "Development and modification of marketing strategies based on crisis conditions" with 10 references (most references). Unplanned resilient actions were referenced a total of 25 times by the interviewees, which included five concepts (References mean: 5). Among these concepts, the most important concept was "Temporary deactivation of the business" with six references (most references). According to the participants, these two sub-measures had two sub-categories in consequences, which are discussed below.

Finally, according to the participants, implementing action/interaction strategies can have both positive (Fa) and negative consequences (Fb). The consequences of planned resilient actions (positive consequences), while adapting to crisis conditions, provide business growth and development in the long run. The sub-category adapting to crisis conditions and increasing resilience in the long run had five concepts that were referenced 38 times (References mean: 7.6). In the meantime, the concept of "Improvement of business position than before crisis" with nine references had the most references, in other words,

this was the most important positive consequence. Negative consequences included unplanned actions that in the short term may have led to adaptation to the crisis, but in the long term would have led to the bankruptcy and destruction of the business. This subcategory had two concepts that had 13 references in total (References mean: 6.5). Meanwhile, the concept of "More vulnerability in the long run" with seven references had the most references, in other words, this was the most important negative consequence. In general, according to the participants, some action strategies such as planned resilient actions can help the resilience of rural entrepreneurial businesses both in the short term and in the long term. If resilient actions are planned, it will lead to business growth and development in both the long and short term. Otherwise, the actions may be resilient in the short term, but in the long run, they will cause business bankruptcy will be. Based on this discussion, the final conceptual model of the research is presented in **Figure 3**.

CONCLUSIONS AND RECOMMENDATIONS

The purpose of this study is to develop a paradigm model for resilience of rural entrepreneurial businesses in dealing with the COVID-19 crisis with application of grounded theory. The outbreak of COVID-19 led to disruption to businesses, especially rural entrepreneurial businesses. Therefore, rural entrepreneurial businesses need to adapt to change in order to create the desired changes to build a better future in order to survive. Therefore, it is necessary to make systematic plans to increase resilience and use planned resilience strategies. Resilience creates capabilities for businesses that can adapt to adverse conditions and continue to survive and return to development. Resilience helps the long-term survival of rural entrepreneurial businesses. As a result, these businesses can continue to operate by using the dimensions of resilience strategies in the context of the COVID-19 crisis, increasing their resistance to the Corona crisis and overcoming the crisis more developed than before. What should especially be addressed to rural entrepreneurial business managers is that adaptive measures should be taken in the long run in the direction of business development and growth, and any tolerant retaliatory action should be avoided.

Grounded theory is a quite powerful tool based on which the factors affecting the phenomenon (the main problem) can be investigated. Therefore, based on this, appropriate recommendations can be provided to solve the problem. Although the infrastructure is currently weak in most villages, the next step is to strengthen the infrastructure, especially in the field of information and communication technology in rural areas. The next step is to upgrade the IT skills of managers and business personnel. Strengthening these infrastructures and upgrade the IT skills of managers and business personnel in rural areas gives rural entrepreneurial businesses the opportunity to redesign their business model based on information technology. The most important consequence is the adaptation of rural entrepreneurial businesses to the COVID-19 crisis and also, the development of information technology infrastructure has led to the development of marketing for the sale of products worldwide. Market development helps both economic management and reducing customer interactions (Reducing customer interactions means observing health factors and proper human resource management). In other words, by strengthening the infrastructure and developing skills, the context for the use of information technology in rural entrepreneurial businesses is provided, and this means the realization of all four subcategories of causal conditions. Social factors, cultural factors and psychological factors should also be strengthened through cyberspace in order to provide a suitable platform for dealing with the COVID-19 crisis.

Grounded theory is a quite powerful tool also because it examines the actions taken as well as their positive and negative consequences one by one. Therefore, with proper planning, negative actions and consequences can be eliminated or reviewed, and positive actions and consequences can be strengthened and expanded. Investigation of the measures taken and their consequences showed that rural entrepreneurial business managers should have a long-term vision for the continuation of their business. In this regard, strategies should be adopted that, while increasing adaptation in the short term, also lead to the growth and development of the business in the long term.

Based on the findings, the following suggestions are made;

- It is recommended that the Continuous data collection, analysis and presentation of information and market trends consumed in the current situation and the coming years with the aim of strengthening futurology and identifying and exploiting future opportunities to gain a competitive advantage;
- Recommends that the level of creative thinking of managers be strengthened with the aim of increasing the ability to adapt to critical situations;
- Recommends that managers' strategic planning skills be strengthened, especially in the field of vision drawing and mission determination;
- It is recommended that the government provide loans and disaster subsidies, as well as business managers to manage cash flow and reduce unnecessary costs;
- It is recommended that the relevant organizations try to increase and update the skills and knowledge of business personnel in how to deal with and adapt to health by holding training classes (mostly virtual);
- It is recommended that business owners provide a safe environment for staff and provide free sanitary equipment to staff in order to protect human capital;
- It is recommended that the IT infrastructure in the villages be strengthened so that businesses can use it to redesign their business model;
- It is recommended that the field of increasing virtual communication between business owners and relevant organizations in the region and the province be maintained and strengthened to share crisis adaptation experiences;
- It is recommended that resilient measures be taken systematically and in a long-term perspective in order to

increase resilience during the crisis and lead to long-term business growth and development;

It is also recommended that the findings of this study be made available to rural business managers through training programs (mainly in cyberspace).For future research, it is proposed to provide a model of adaptation behavior of rural entrepreneurial businesses in the face of the COVID-19 crisis. The most important limitation of the present study can be expressed as the lack of cooperation of some of the study population due to fear of COVID-19.

DATA AVAILABILITY STATEMENT

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

AUTHOR CONTRIBUTIONS

EK and FK wrote the first draft of the manuscript. NN contributed in data collection. All authors contributed to conception and design of the study and performed the statistical analysis, wrote sections of the manuscript, contributed to manuscript revision, read, and approved the submitted version.

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Tourism Development During the Pandemic of Coronavirus (COVID-19): Evidence From Iran

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The coronavirus (COVID-19) epidemic has created a great deal of fear and uncertainty about health, economy, and social life. Therefore, the health, social, and economic impacts of COVID-19 are of great importance. In prone rural communities, tourism industry can contribute to the sustainable economy and social development of the villagers, and as a dynamic economic sector, cause economic, social, cultural, and environmental changes. In this regard, the purpose of this inquiry was to develop tourism during the coronavirus pandemic using the social exchange theory (SET). The present study is a descriptive, correlational and causal inquiry that is conducted using survey technique. The statistical population included tourists visiting Sistan region around Hamoun Wetland in eastern Iran ($N = 850$). In the sampling process, 266 tourists were selected as a sample using random sampling strategy. The study instrument was a researcher-made questionnaire, whose validity was confirmed by a panel of subjectivists and its reliability was approved by a pilot study and Cronbach's alpha coefficients ($0.87 \geq \alpha \geq 0.71$). Based on SET, the proposed causal model was able to explain about 56% ($R^2_{Adj} = 0.562$) of the variance changes in tourism development during the COVID-19 epidemic.

Keywords: tourism, coronavirus, social exchange theory (SET), causal analysis, Sistan

INTRODUCTION

Today, tourism is a phenomena in terms of income generation, which has been emphasized in many countries of the world and a lot of investment is made in this sector (1). It is an industrial tourism that has attracted the attention of many tourists (2). In this regard, geographical, topography, climate and location are the most important elements for tourist attractions that play an important role in economic growth and social development of many regions (3). Iran is one of the largest countries in the Middle East and has its origins in the ancient Zoroastrian religion (4). With a rich heritage, it includes 13 cultural sites in the UNESCO World Heritage List (5), and has a variety of climates, seasons, lakes, plains, caves, and deserts (6) that have led to the expansion of tourism in the country. Sistan and Baluchestan province with an area of about 180,726 square kilometers, after Kerman province, is the second largest province in Iran. Sistan region is located in the north of this province, which comes from the alluvium of Helmand River, which is the largest freshwater lake in the world in times of water. Khajeh mountain is the only high ridge that is located in Sistan and has a special sanctity among the people. Hamoun River of Sistan and its half wells are among the water resources of this region. In June 2015, Kalpurgan pottery, Sistan embroidery,

and Baluchistan needlework have been awarded UNESCO. Sistan tourist areas, including Shahr-e Sokhteh, Hamoun lake, Khajeh mountain and infidels' castle, Bibi Doust, Chehel Dokhtar castle, throne of justice, half well, three mountains, Ramroud Castle, Sam Castle, Rostam Castle, Malek Kiani Khan Citadel, Chehel Dokhtaran, British Embassy, Sardar Mohammad Hussein Citadel, etc. are among the natural and historical tourist attractions of Sistan (7). However, although the tourism industry is growing rapidly, it is not safe from global health emergencies, diplomatic warfare, terrorism, and natural disasters. The outbreak of coronavirus is not the first case to occur in the 21st century (8). Tourism is one of the sectors that has suffered the most from governments following this epidemic. The epidemic led to restrictions on movement and travel (9). The tourism economy has been severely affected by the COVID-19 epidemic, which has caused unprecedented damage to the tourism sector. Measures have been taken to curb its expansion, including lifting travel restrictions, restoring traveler confidence, and reviewing the tourism sector for the future (10). Community suspensions, social distance, home stay orders, travel and mobility restrictions have led to the temporary closure of many tourism-related businesses and a significant reduction in demand for businesses that were allowed to continue operating (11). Restrictions imposed by governments have led to drastic reductions in employment and incomes (10), and these barriers play a significant role in tourism growth (12).

Rural areas have a good capacity to develop tourism activities due to their location and important elements to attract tourists, such as natural landscapes, antiquities, climatic diversity, social customs and traditions (13) and it can be said that the promotion of non-agricultural activities, such as tourism development, can be an effective factor in increasing the welfare of low-income rural families, strengthening the economic base of centers, and reducing migration to cities (14, 15). Tourism study has focused primarily on residents' perceptions, recent studies have focused their efforts on analyzing tourists' perceptions of the effects and promotion of tourism on a destination (16, 17). In addition, researchers have argued that tourists are aware of the importance of tourism impact and tourism development in a destination, especially of the interests of the community or the protection of tourism or environmental awareness and conservation behavior (16–18). Residents of the host community are mainly and directly affected by tourism development (19). At the same time, they play an important role in the quality of tourists' experiences in the community (20). Understanding the relationship between residents and tourists, from the perspective of local residents, is a key element in the sustainable tourism destinations (21).

According to what was stated, the purpose of this research was to investigate the development of tourism during the corona virus epidemic in Sistan, Iran. In this regard, the novelty of this research should be considered from two aspects. First, the place of the research was the pristine bedrock of the subject. The second was its epistemological perspective in the form of a theoretical framework derived from social exchange theory (SET).

THEORETICAL BACKGROUND

Sustainable behavior is an emerging challenge in tourism (22, 23) and can play a key role in meeting the various challenges facing rural areas (24). It also leads to the revitalization of rural areas through protecting the quality of life of residents, preserving traditional cultures, protecting environment, creating employment, and generating income (25).

Social Exchange Theory (SET) is one of the most influential conceptual paradigms and one of the oldest theories for analyzing social behavior and the link between the disciplines of anthropology, social psychology and sociology. It includes interactions that create commitments (26). SET is one of the oldest theories of social behavior (27) that depends on the ability to create high quality relationships under certain conditions (in this study, specific conditions are pandemic of COVID-19) (28) and explains any kind of interaction between people and resources (29). The resources that are exchanged may be not only tangible, but also intangible, such as social facilities or friendship (29). The basic premise is that parties enter into a relationship and maintain their relationship with the expectation that doing so will be rewarding (27, 30). For example, in this research based on SET, if more benefits and positive effects are understood, tourists will be more supported and have interaction (31). Tourists' perception toward tourism and relationship between tourists and hosts are identified as key factors in the tourism and important issues for governments, policymakers, and industry (32). From a psychological perspective, attitudes are specifically defined as a tendency to evaluate individuals, issues, and more (33). One of the advantages of using SET is that it can explain perceptions as well as examine residents' relationships both individually and collectively (34).

Impacts of tourism development are divided into three categories: economic, environmental and social (35). Among the key elements in sustainable tourism are environmental conservation, strengthening communities, and preserving traditional cultural heritage (36) by making changes in moral and social norms and values (37, 38). It is usually associated with a positive impact on the services provided by the community to its residents (39), which allows the creation of new recreational opportunities (40). In particular, creating job opportunities and increasing household income for locals is economically important (41). In fact, economic results are those that are tangible and address financial needs. Socio-cultural consequences are those that address an individual's social needs and self-esteem and are often symbolic and specific (28). On the other hand, tourism has a great deal of responsibility for environmental activities. It is destructive to the environment if these activities are not carried out in the right places and the necessary measures are not taken to prevent damage to the environment (42). Economic, social and environmental effects have a reinforcing effect on the conservation of natural resources and the improvement of various aspects related to the environment (39). From a tourism perspective, SET suggests that people's attitudes toward tourism (ATT) and the consequent level of support for its development will be influenced by their assessments of the consequences of tourism for themselves and

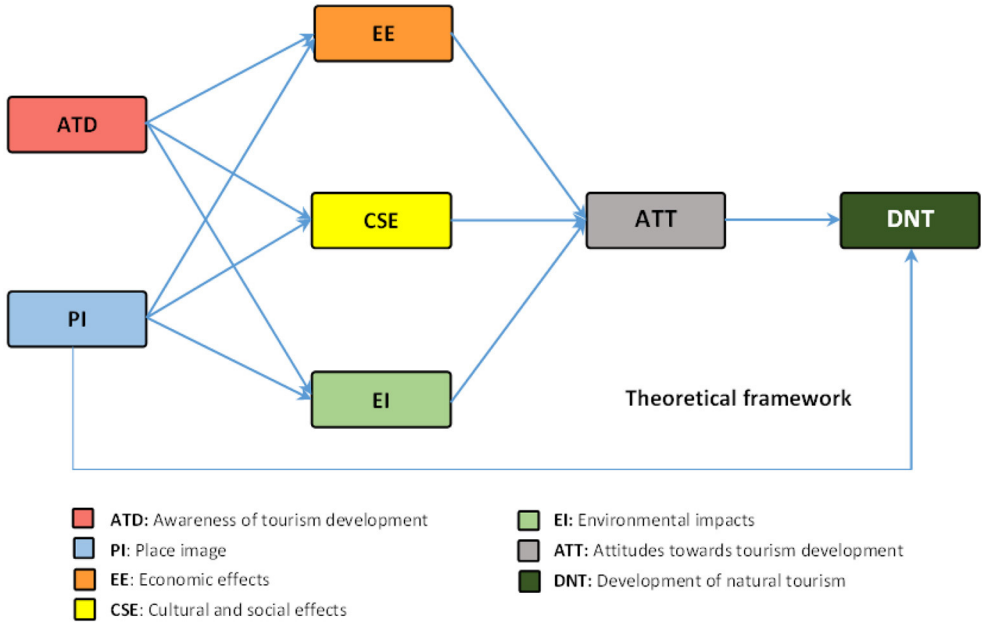

FIGURE 1 | Theoretical framework of the study based on SET in the analysis of tourism development in the pandemic of COVID-19 (44).

their communities (43). Another factor related to understanding the reaction to tourism is the image of the place. If tourism development is to the benefit of the local community, it should also focus on residents' perceptions of places and tourists, which is a relatively stable psychological trait (44). In this regard, **Figure 1** is presented as a theoretical framework of this study.

Some of the studies carried out in this regard are mentioned below.

Stylidis et al. examined the role of residents' place image (PI) in shaping their support for tourism development. The tested model suggested that residents' PI affects their perception of tourism impacts and in turn their support for tourism development. The results emphasized the need for a more flexible, resident-based measure of tourism impacts and showed that a better understanding of the economic, socio-cultural, and environmental impacts leads to greater support. In addition, while tourism development studies have largely ignored residents' image of the location, the findings of this study showed its importance in shaping residents' perceptions of tourism impacts as well as their level of support (45).

Ghazani et al. stated that the villagers believe that promotional education in the field of tourism leads to increased interaction, making more money, not evacuating the village, the prosperity of rural industries such as tourism, agricultural stabilization, and preservation of the rural environment (46).

Hallaj and Karimi Goghari emphasized the need to attract tourists and considered it as a factor to increase the income of villagers, which reduces their migration by creating more jobs for villagers. He states that by encouraging the villagers to preserve historical attractions and natural landscapes and educating them and encouraging them to preserve local customs and traditions in the face of cultural changes and reviving the original and indigenous culture of the village, attracting tourists will flourish (47).

Ghazani et al. emphasized the identification of bottlenecks and taking action to eliminate them for the prosperity of natural tourism. He stated that providing infrastructure facilities such as tourist stations, roadside resorts with suitable amenities, increasing the number of guest houses with local structure and training of local specialists, and increasing the awareness of villagers, the development of tourism can be supported (48).

Lee and Jan examined community-based tourism and its role in sustainable development, emphasizing the sustainability of nature-based tourism. He stated that economic, socio-cultural and environmental sustainability significantly change in the stages of stabilization, development and participation of community-based tourism development (49).

Streimikiene et al. (2021) examined the main forms and factors of strengthening tourism competition by implementing economic, social and environmental goals of tourism destination development. They stated that participants of businesses are interested in new technologies in tourism services that have a positive impact on the environment and local communities (50).

Qin et al. examined the support of residents using SET. They stated that residents' support for tourism is influenced by perceived personal interests and the positive effects of tourism. Residents' tolerance for tourism plays an important moderating role in the relationship between perceived negative tourism effects and support for tourism development. Residents with less tolerance for tourism were more sensitive to the negative effects of tourism, and therefore, tended to express less support for tourism development (51).

Chang examined the effective attitudes on tourism development based on SET and social network theory. They showed that social network (intelligence, friendship, and counseling) plays different roles in the three components of tourism development attitude (cognition, interest, and pragmatism). Integrating the evaluation of the value of profit of SET and the orientation perspective of the relationship between social network theory and understanding the impact of social network relationship links on tourism development attitudes is effective. Intelligence and friendship have a positive and significant effect on tourism development hierarchy (52).

Çelik and Rasoolimanesh used the theory of rational action (TRA) and SET and showed that negative and positive attitudes of residents have a direct effect on tourism-cost-benefit attitudes and indirect effects on tourism support. Also, the cost-benefit attitude plays a mediating role between residents' attitudes toward tourism and its support (53).

Nagaj and Žuromskaite stated that this disease not only affects the health system and people's health, but also the economy. The effects of this disease include restrictions on movement and travel, which have affected both domestic and international

TABLE 1 | Items of research variables and Cronbach's alpha coefficients.

Variables	No.	Items	References
ATD		**Awareness of tourism development (ATD): ($\alpha = 0.77$)**	
	1	I have information about the area I am entering during COVID-19.	(34)
	2	I am aware of the government's managerial role in the development of tourism during COVID-19.	
	3	I have a lot of economic information about tourism development during COVID-19.	
	4	I have a lot of cultural information about the development of tourism during COVID-19.	
PI		**Place image (PI): ($\alpha = 0.83$)**	
	1	The people of Sistan are reliable.	
	2	In case of emergency for me, the people of Sistan will be eager to help me.	(45)
	3	The environment of this region is beautiful to me even in the face of drought.	
	4	In Sistan region, there is a sincere and intimate relationship between tourists and residents of the region.	
	5	I feel safe even when I travel alone in the area.	
	6	Tourism officials do their job well.	
CSE		**Cultural and social effects (CSE): ($\alpha = 0.73$)**	
	1	The quality of public services has improved in the region because of COVID-19.	(56, 57)
	2	With the development of tourism during COVID-19, more recreational opportunities will be available to tourists and locals.	
	3	There are many shopping opportunities in this area for tourists, even during COVID-19 conditions.	
EI		**Environmental impacts (EI): ($\alpha = 0.87$)**	
	1	Tourism during COVID-19 and the presence of tourists have a negative impact on the environment of the region.	(56, 57)
	2	Tourist areas (Khajeh Mountain and Shahr-e Sokhteh, etc.) become very crowded due to the presence of tourists, even during COVID-19.	
	3	Long-term planning by tourism officials in the region can control the negative effects of tourism and COVID-19.	
EE		**Economic effects (EE): ($\alpha = 0.75$)**	
	1	The tourism industry plays an important role in the economy of the Sistan region during COVID-19.	(57)
	2	In my opinion, the economic benefits of tourism during COVID-19 are greater than the negative consequences.	
	3	Tourism during COVID-19 in this area has improved the quality of life of the people.	
	4	The development of tourism in the region during COVID-19 could create more job opportunities for local people.	
DNT		**Development of natural tourism (DNT): ($\alpha = 0.84$)**	
	1	In my opinion, the development of tourism during COVID-19 should continue actively in this region.	(45, 58), self-administrated
	2	I support tourism during COVID-19 and I would like to see tourism flourish in this area.	
	3	In my opinion, the Sistan region should be recognized as a tourist destination.	
	4	I fully support the development of tourism during COVID-19 in the Sistan region.	
ATT		**Attitudes toward tourism development (ATT): ($\alpha = 0.71$)**	
	1	Tourism during COVID-19 around Sistan region should be based on the use and protection of nature and culture of the region.	
	2	Tourism in the lagoon should not disrupt the habitat of plants and animals in the area.	(59), Self-administrated
	3	Tourism development in the region during COVID-19 should focus on environmental education.	
	4	Tourism in the region during COVID-19 promotes environmental awareness among tourists.	
	5	Tourism in the lagoon during COVID-19 should be done in small groups.	
	6	Tourism in the lagoon should be limited during important time periods (bird mating season, etc.).	

FIGURE 2 | The location map of Sistan area in Iran.

tourism; however, this epidemic has reduced greenhouse gas emissions in tourist areas (9).

Samdin et al. addressed the main concerns of tourists in deciding on a destination and travel risk that could affect their safety. They stated that priorities such as safety and health information are the strongest predictors of tourists' decision-making, and the media also play an important role in raising awareness for tourism development (8).

Budayana and Adi stated that in areas that rely on rural tourism, tourism during the epidemic cannot be stopped; because the economics of these societies depend on tourism. In this case, incentives should be provided to innovate to improve rural tourism in rural areas and improve local trade (54).

Based on what has been stated so far and based on the theoretical framework presented in **Figure 1**, the following hypotheses have been developed. In this regard, it can be assumed that there is a significant relationship between tourism development and:

- tourism facilities,
- job creation,
- tourists' attitudes,
- tourist awareness,
- its socio-cultural effects,
- its economic effects,
- the resulting environmental impact and
- tourists' image of location.

RESEARCH METHODOLOGY

The present study is an applied research. The study population included tourists in Sistan region in 2020–2021 ($N = 850$) and the sample size was estimated at 266 people based on Krejcie and Morgan sampling table (55). A simple random method was used for sampling. The research tool in this study was an electronic closed-ended questionnaire whose validity was confirmed using the opinions of experts. The reliability of the questionnaire was calculated among tourists of Khash city (outside the statistical population but similar to it) and using Cronbach's alpha test for variables measured by Likert scale, turning out to be at an acceptable level (**Table 1**). The location of the study was in the Sistan region in the catchment area of Hamoun Lake, eastern Iran (**Figure 2**).

The main dependent variable in the present study is tourism development and in accordance with the presented theoretical framework (**Figure 1**), the independent variables affecting it were awareness, PI, economic, social, cultural and environmental effects and attitudes toward tourism (ATT). For to measuring the variables, five-point Likert scale was used [strongly disagree (1),

disagree (2), undecided (3), agree (4), and strongly agree (5)]. To measure each of the variables, items were extracted from previous related studies. In the absence of a suitable item for measuring the variables, researcher-made items that have been approved by experts were used.

RESULTS AND DISCUSSION

Descriptive Statistics of the Respondents' Individual and Professional Characteristics

The average age of the respondents was ∼30.17 years and most of them (52.6%) were in the age range of 30 years. Also, 66.5% of them were men and the rest were women. About 46% of them had a bachelor's degree or higher, 62.8% of them traveled to Sistan more than once, and 93.6% of them traveled to this region during the drought. Also, Khajeh Mountain with 28.4%, Shahr-e Sokhteh with 22.3%, and Qale-e-No village with 15.5% had the highest visit statistics (**Table 2**).

Correlation Analysis Between Variables

For examining the relationships between variables, Pearson correlation coefficient was used (see **Table 3**). The results reveled that there was a significant positive correlation between PI and ATD ($p < 0.01$; $r = 0.419$). Other variables, including CSE ($p < 0.01$; $r = 0.314$), EI ($p < 0.01$; $r = 0.145$), EE ($p < 0.01$; $r = 0.221$), DNT ($p < 0.01$; $r = 0.293$), and ATT ($p < 0.01$; $r = 0.248$), also had a positive and significant correlation with ATD. Also, the variables CSE ($p < 0.01$; $r = 0.454$), EI ($p < 0.01$; $r = 0.286$), EE ($p < 0.01$; $r = 0.453$), DNT ($p < 0.01$; $r = 0.528$), and ATT ($p < 0.01$; $r = 0.391$), showed positive and significant relationships with PI.

The Effects of Independent Variables on the Dependent Variable

Path analysis technique was used to investigate the relationships between the variables (According the **Figure 1**). The findings of multiple regression analysis revealed that the framework could predict 56% of DNT variance changes, 32% of ATT variance changes, 20% of EE variance changes, 21% of CSE variance changes, and 0.7% of EI variance changes. In order to facilitate the calculations related to path analysis, first the direct effects on the dependent variables were calculated and in the next step, the

TABLE 3 | The variables correlation matrix according to the theoretical framework.

	ATD	PI	CSE	EI	EE	DNT	ATT
ATD	1						
PI	0.419**	1					
CSE	0.314**	0.454**	1				
EI	0.145**	0.286**	0.377**	1			
EE	0.221**	0.453**	0.369**	0.234**	1		
DNT	0.293**	0.528**	0.402**	0.242**	0.737**	1	
ATT	0.248**	0.391**	0.347**	0.273**	0.543**	0.699**	1

***Significant at the level: 0.01 error.*

TABLE 2 | Descriptive statistics of individual and professional characteristics.

Variables	Levels	Frequency	Percent	Cumulative percent	Mean
Age (years)	Young: $X_i < 29$	140	52.6	52.6	30.17
	Middle-aged: $29 \leq X_i < 43$	101	38	90.6	
	Elderly: $43 \leq X_i$	25	9.4	100	
Gender	Female	89	33.5		
	Male	177	66.5		
Education level	Illiterate	1	0.4	0.4	
	Primary education	1	0.4	0.8	
	Middle literacy	6	2.3	3.0	
	High school to diploma	68	25.6	28.6	
	Associate degree	66	24.8	53.4	
	Bachelor's degree	84	31.6	85.0	
	Master degree	36	13.5	98.5	
	Ph.D.	3	1.1	99.6	
	Theological	1	0.4	100	
Travel history	Yes	167	62.8		
	No	99	37.2		
Travel time	Drought	249	93.6		
	Wet year	17	6.4		
Income (US dollars per year)	Low: $X_i < 680$	254	95.5	95.5	
	Medium: $680 \leq X_i < 1,360$	9	3.4	98.9	
	High: $1,360 \leq X_i$	3	1.1	100	

TABLE 4 | Direct effects on DNT, PI, and ATT.

Direct effects on	Independent variables	B	β	*t*	t Sig.
DNT	Constant	−1.858	—	−1.902	0.058
	PI	0.224	0.300	6.796	0.000
	ATT	0.514	0.582	13.173	0.000
	F Sig. = 0.000	**F = 171.134**	**R^2_{Adj} = 0.562**	**R^2 = 0.565**	**R = 0.752**
ATT	Constant	10.848	—	7.939	0.000
	EE	0.599	0.468	8.852	0.000
	CSE	0.214	0.131	2.289	0.023
	EI	0.231	0.113	2.066	0.040
	F Sig. = 0.000	**F = 34.159**	**R^2_{Adj} = 0.323**	**R^2 = 0.331**	**R = 0.575**
EE	Constant	7.719	—	8.049	0.000
	ATD	0.038	0.037	0.619	0.537
	PI	0.315	0.437	7.225	0.000
	F Sig. = 0.001	**F = 21.91**	**R^2_{Adj} = 0.200**	**R^2 =0.206**	**R = 0.454**
CSE	Constant	3.981	—	5.346	0.000
	ATD	0.118	0.150	2.502	0.013
	PI	0.222	0.392	6.549	0.000
	F Sig. = 0.000	**F= 38.121**	**R^2_{Adj} = 0.219**	**R^2 = 0.225**	**R= 0.474**
EI	Constant	7.850	—	12.129	0.000
	ATD	0.019	0.030	0.469	0.640
	PI	0.123	0.273	4.197	0.000
	F Sig. = 0.000	**F = 11.816**	**R^2_{Ad} = 0.075**	**R^2 = 0.082**	**R = 0.287**

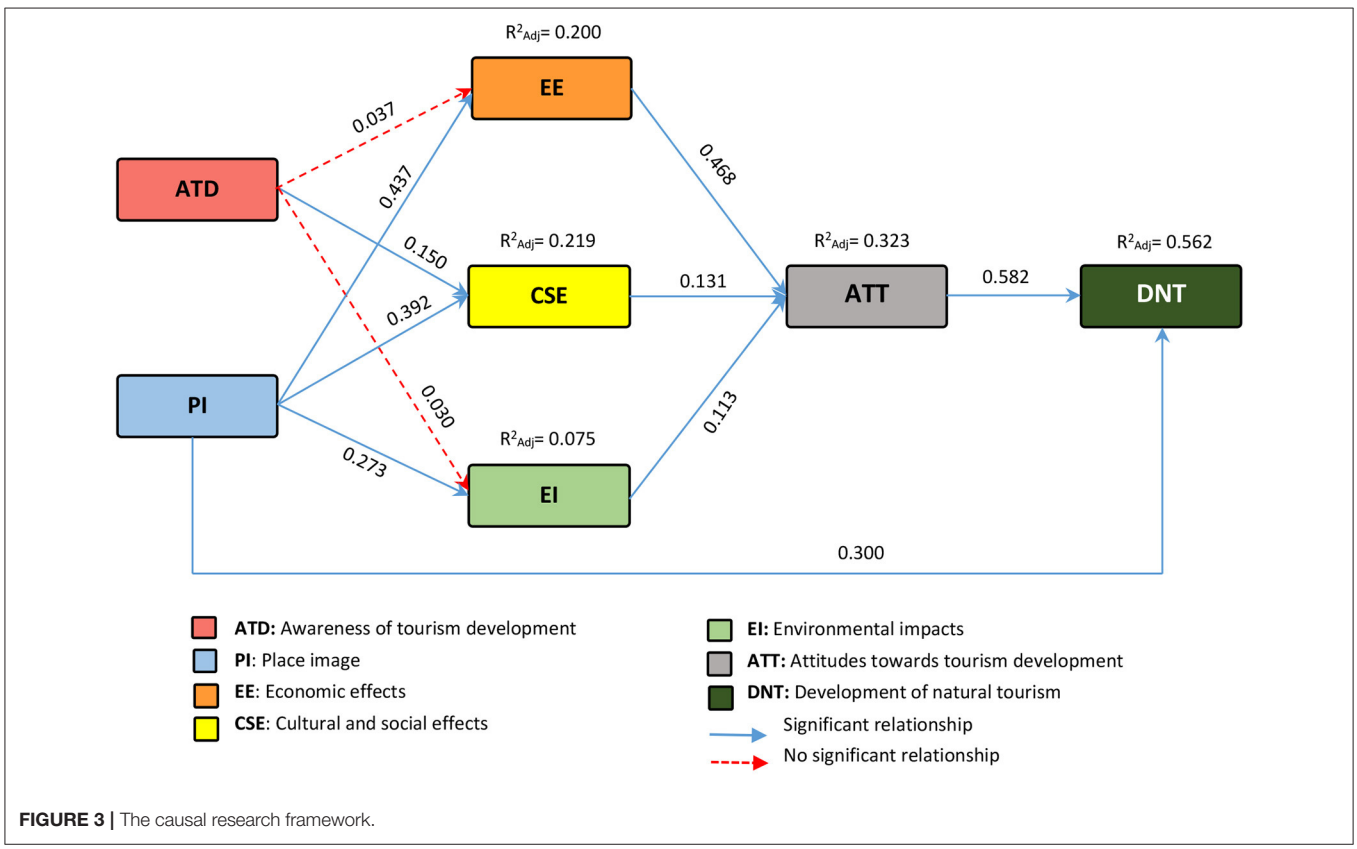

FIGURE 3 | The causal research framework.

TABLE 5 | Indirect and direct effects on DNT.

Variables	Direct effects	Indirect effects	Total causal effects	Correlation coefficients	Non causal effects	Compliance with theoretical framework
ATD	—	0.023	0.023	0.293	0.270	×
PI	0.300	0.166	0.466	0.528	0.062	✓
EE	—	0.272	0.272	0.737	0.465	✓
CSE	—	0.076	0.076	0.402	0.326	✓
EI	—	0.065	0.065	0.242	0.177	✓
ATT	0.582	—	0.582	0.699	0.117	✓
✓	Match the theory					
×	Mismatch with the theory					

ENTER multiple regression analysis method was used (**Table 4**; **Figure 3**).

The study of direct effects on DNT showed that the variables PI ($p < 0.000$; $\beta = 0.300$), ATT ($p < 0.000$; $\beta = 0.582$) had a positive and significant effect on DNT.

In the next step, the direct effects of independent variables on ATT were investigated and the findings showed that EE ($p < 0.000$; $\beta = 0.468$), CSE ($p < 0.023$; $\beta = 0.131$), and EI ($p < 0.040$; $\beta = 0.113$) had significant effects on ATT.

At the third stage, the direct effects of independent variables on EE were investigated and the findings showed that PI ($p < 0.000$; $\beta = 0.437$) had a significant effect on EE. Moreover, the effect of Awareness (n.s., $t = 0.537$) on the dependent variable was not significant.

In the fourth step, the direct effects of independent variables on CSE were investigated and the results showed that Awareness ($p < 0.000$; $\beta = 0.150$), PI ($p < 0.000$; $\beta = 0.392$) had significant effects on CSE.

At the fifth step, the direct effects of independent variables on EI were investigated and the results showed that PI ($p < 0.000$; $\beta = 0.273$) had a significant effect on EI. Also, the effect of Awareness variables (n.s., $t = 0.640$) on the dependent variable was not significant.

Finally, according to the theoretical framework, the effect of PI ($p < 0.000$; $\beta = 0.300$) and ATT ($p < 0.000$; $\beta = 0.582$) on DNT was investigated. The findings revealed a positive and significant effect of all three variables on DNT.

Indirect and Total Effects on DNT

In **Table 5**, the causal effect (sum of indirect and direct effects) and the total causal effect affecting DNT were calculated. Indirect effects on DNT (according to theoretical framework) include indirect effects of ATD [$(0.037 \times 0.468 \times 0.582) + (0.140 \times 0.131 \times 0.582) + (0.030 \times 0.113 \times 0.582) = 0.023$], indirect effects of PI [$(0.437 \times 0.468 \times 0.582) + (0.392 \times 0.131 \times 0.582) + (0.273 \times 0.113 \times 0.582) = 0.166$], indirect effects of EE [$(0.468 \times 0.582) = 0.272$], indirect effects of CSE [$(0.113 \times 0.582) = 0.076$], and indirect effects of EI [$(0.113 \times 0.582) = 0.065$]. As can be seen in **Table 4** and **Figure 3**, in the path analysis performed, all paths (except the effects of ATD on EE and EI) conform to the theoretical framework (SET). In **Table 3**, the value of t was not significant for these two variables and on the other hand, the amount of β calculated for them was <0.05 (60); therefore, these two paths did not conform to **Figure 1**.

The results of **Table 5** showed that the variable of ATT has the most causal effect (0.582) and CSE has the least causal effect on DNT. EE also had the most non-causal effect (0.465) and EE and ATT had the least non-causal effect (both 0.177) on DNT.

CONCLUSION

The present study aimed to develop tourism using SET and PI in the field of DNT with an emphasis on tourists in Sistan region. This study showed that SET can be used to explain DNT because the amount of variance explained by DNT was significant (56%). Due to the impact of SCE on tourists' ATT, it is necessary to consider tourism as a tool for community development. The tourism capacity during COVID-19 should be used to improve the image of recreational services provided, observe health issues, and improve tourists and residents' support of rural tourism development by holding various events in the Sistan region. Given the direct impact of PI on the development of rural tourism during COVID-19, a set of measures should be taken to improve the organic image (image that tourists obtain through their communication with residents) and the induced image of place (image that is indirectly affected by political and financial support of promotional activities). Tourists should be aware of the positive features of the place, security, and health assurance in the place they travel to, which leads to the development of tourism.

The results showed that ATT has the most causal effect and CSE has the least causal effect on DNT. Therefore, it is possible to take a big step in promoting DNT by creating a suitable platform for ATT amplification. Also, the necessary grounds should be provided to strengthen the causal effect of CSE. Finding missing links in this field can be a source for researchers' efforts in this direction.

One of the important findings has been the lack of effect of awareness perception on economic and environmental effects and of course its effect on tourists' attitudes during COVID-19. This result means that the environmental and economic effects of tourism for tourists have not been understood and tangible enough to change their attitudes;

these effects and further development of tourism in the region should be felt in the long run. Other reasons for this can be seen in the small ability of tourists to assess the environmental impact of less developed tourist areas. According to these results, it can be said that the study area is at a good level in terms of social, cultural and institutional capabilities. It is not in a good level in terms of environmental capacity, due to lack of natural resource management and non-compliance with environmental behaviors and environmental health, as well as in terms of economic capacity due to lack of coherent and rational economic plans based on tourism and lack of funding. As a result, the government and stakeholder organizations must consider the credit and financial as well as the infrastructure of the study area. In terms of environmental potential, the promotion of environmental behavior, environmental management, identification and introduction of unique natural areas should be on the agenda.

Although this study provides a kind of causal conceptualization in DNT analysis, it faced some limitations. One of the most important was the COVID-19 pandemic, which made data collection difficult. Also, this research was conducted with a quantitative approach. Undoubtedly, for better results, a more comprehensive result can be achieved by using qualitative research methods as well as mixed methods. In this regard, the following suggestions can be made for future research.

- Analyzing rural tourism development in the post-Corona era;
- Designing an extension model of community-based ecotourism in rural areas and
- Pathology of rural tourism development in the pandemic of COVID-19: Application of grounded theory.

DATA AVAILABILITY STATEMENT

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

ETHICS STATEMENT

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

AUTHOR CONTRIBUTIONS

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

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The Impact of COVID-19 Pandemic on Food Security and Food Diversity of Iranian Rural Households

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With the onset of the coronavirus crisis, disruption of the domestic food supply chain, loss of revenue, and payments that affect food production have led to severe tensions and food security risks in many developing countries. The rural communities are more at risk of food insecurity due to less access to healthcare and social inequality. Therefore, this study aimed to assess the impact of the COVID-19 pandemic on food security and food diversity of rural households. The sample included 375 household heads living in the rural areas of Khorramabad county, which was determined using a three-stage cluster sampling method. Data were collected using standard Household Food Insecurity Access Scale (HFIAS) and Household Dietary Diversity Score (HDDS) questionnaires. The results showed that the food security situation of rural households has deteriorated, and consumption of some food groups changed during the COVID-19 pandemic. The results of the multinomial regression model showed that gender, level of education, monthly income, number of employed members, nutrition knowledge, employment status, livestock ownership, and access to credit were significantly associated with the food security of households during the COVID-19 pandemic. The household head's gender, level of education, monthly income, nutrition knowledge, employment status, livestock ownership, and access to credit were significantly associated with dietary diversity during the COVID-19 pandemic. Based on the findings, providing emergency food assistance and cash payments to food-insecure households can reduce the risk of food insecurity in rural households. It is suggested that government policies focus on identifying vulnerable households in rural areas, especially female-headed households, low-income households, and households without a wage income.

Keywords: food security, dietary diversity, rural households, COVID-19, Khorramabad

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INTRODUCTION

The COVID-19 has formed a pandemic that is very different from previous pandemics and covers almost all countries around the world, especially the major economies. In addition to the negative effects on health, the COVID-19 crisis has put both people's lives and livelihoods at risk (1, 2). COVID-19 threatens the years of progress in health care, hunger, poverty, and education. Since the great depression, the world has been facing the worst recession. Real per capita gross domestic product (GDP) fell by 3.3 percent in 2020, and it is estimated that the economic instability created by the global epidemic has led to the loss of 114 million jobs worldwide (3). COVID-19 also

threatens access to food mainly through the loss of income and assets, which impairs the ability to buy food. The effects of COVID-19 have led to a sharp and widespread increase in global food insecurity, which affects vulnerable families in nearly all countries, and are expected to endure through 2022 and perhaps beyond. The poorest households spend about 70 percent of their income on food and have limited access to financial markets, which makes food security vulnerable to income shocks (4–6). More than half of the world's undernourished are found in Asia (418 million), and a significant portion of these people live in rural areas (7). Thus, food security in rural areas has become a significant issue in global decision-making and is considered a major challenge for national policies and public concerns (8, 9). More than two billion small producers, farmworkers, rural workers, and their families, who represent a large section of the population affected by food insecurity, are affected by the economic shock caused by and their incomes are at risk (10). In developing countries, most of the livelihoods of rural households come from the agricultural sector (11). Hence, rural households are the most affected by poverty and vulnerability and face economic, financial, and social risks (12). According to the clinical studies, the lack of micronutrients is one of Iran's main health and nutritional problems, especially in rural areas, so the rural community is facing food insecurity problems, especially among women and children (13). Results of the previous studies have shown that one-third (32.4%) of all rural households in Iran were faced with food insecurity, which is determined based on per capita calories consumed. They have lower socioeconomic status, experience more food shortages than others, have less chance of buying the healthy and nutritious foods offered, and generally consume fewer types of fruits and vegetables. Also, 50% of rural households in Iran are deficient in iron, calcium, iodine, and a variety of vitamins (14–16). Therefore, they are at risk of a food crisis until measures are taken to protect this vulnerable group. Global and national interventions are necessary to reduce the impact of the COVID-19 pandemic across the food system. Measures taken to maintain and reorganize food supply chains should be complemented by specific solutions using locally available resources and goods (17).

Due to the importance of the different impacts of COVID-19 on food security and nutrient status, some scholars endeavored to assess and calculate these effects. Nechifor et al. (18) claimed 1.3% of the participated households still fall below calorie intake thresholds in sub-Saharan Africa, especially in rural areas. Results also showed that food security remains vulnerable to the growth of the pandemic abroad in Kenya. Yazdanpanah et al. (19) reported that the food security of rural households in southern Iran reduced during the COVID-19 pandemic. The regression analysis results also showed that financial, psychological, physical, and human assets affect the food security of rural households under COVID-19. Pakravan et al. (20) demonstrated that the food security status of Iranian households has improved at the first stages of COVID-19 pandemic disease. In fact, they believed that the impacts of the COVID-19 should be analyzed in different periods that include short-term and long-term time. Ceballos et al. (21) assessed the short-term effects of COVID-19 on the food security of rural households in Guatemala. They found that during COVID-19, food security and food diversity among rural households decreased due to rising prices, decreasing incomes, and reduced access to food in local markets. Egwue et al. (22) reported that most of Nigeria's rural households were food insecure during COVID-19. The results also showed that marital status, education level, cooperative membership, and annual income of heads of households positively affected food security. In contrast, the household head's age and household size negatively affected the food security status of rural households. Cardarelli et al. (23) contended that although the COVID-19 pandemic initially reduced access to food and disrupted food supply, in the long run, rural households' access to food has increased through federal aid. Ouoba and Sawadogo (24) reported that the COVID-19 pandemic disease had reduced households' incomes in Burkina Faso by increasing their likelihood of entering poverty. They showed that the households could adjust to the shock (COVID-19) during a long-term period. Rahman et al. (25) contended that during COVID-19, the incomes of certain groups of people declined, which may have contributed to the growth of the poverty rate. Also, quarantine, movement and social restrictions, agro-food systems, supply–value chains, and market levels were affected. Also, the overall state of food consumption was affected by the COVID-19 pandemic throughout the country and affects all parts of the population.

This paper assesses the impact of the COVID-19 pandemic on food security and food diversity of rural households in the Khorramabad township. Whereas, most of the previous studies have tried to assess food security in urban areas, in this study, we tried to focus on local levels, where people are more vulnerable and affected by the hazard. The findings of this study can help better understand the rural population's needs during crises such as the COVID-19 epidemic. This can help better plan and take preventive measures for such populations after understanding their needs. In addition, it can help deprived people to have a minimum level of preparedness and food security in such a crisis in the future. Therefore, this study tries to address the following objectives:

- To determine the food security status of rural households before and during COVID-19 in Khorramabad township
- To assess food diversity status of rural households before and during COVID-19 in Khorramabad township
- Identify the factors associated with food security and food diversity of rural households before and during COVID-19 in Khorramabad township.

METHODOLOGY

The Study Area

This cross-sectional research was conducted between July and August 2021 in rural areas in Khorramabad county in Lorestan Province. Khorramabad county has a total population of 506,741 people, and 124,417 of them live in rural areas (26). The county lies between the latitudes 48°16′ N to 48°24 N and longitudes 33°26′ E to 33°34′ E covering an area of 6,450 km^2 (**Figure 1**).

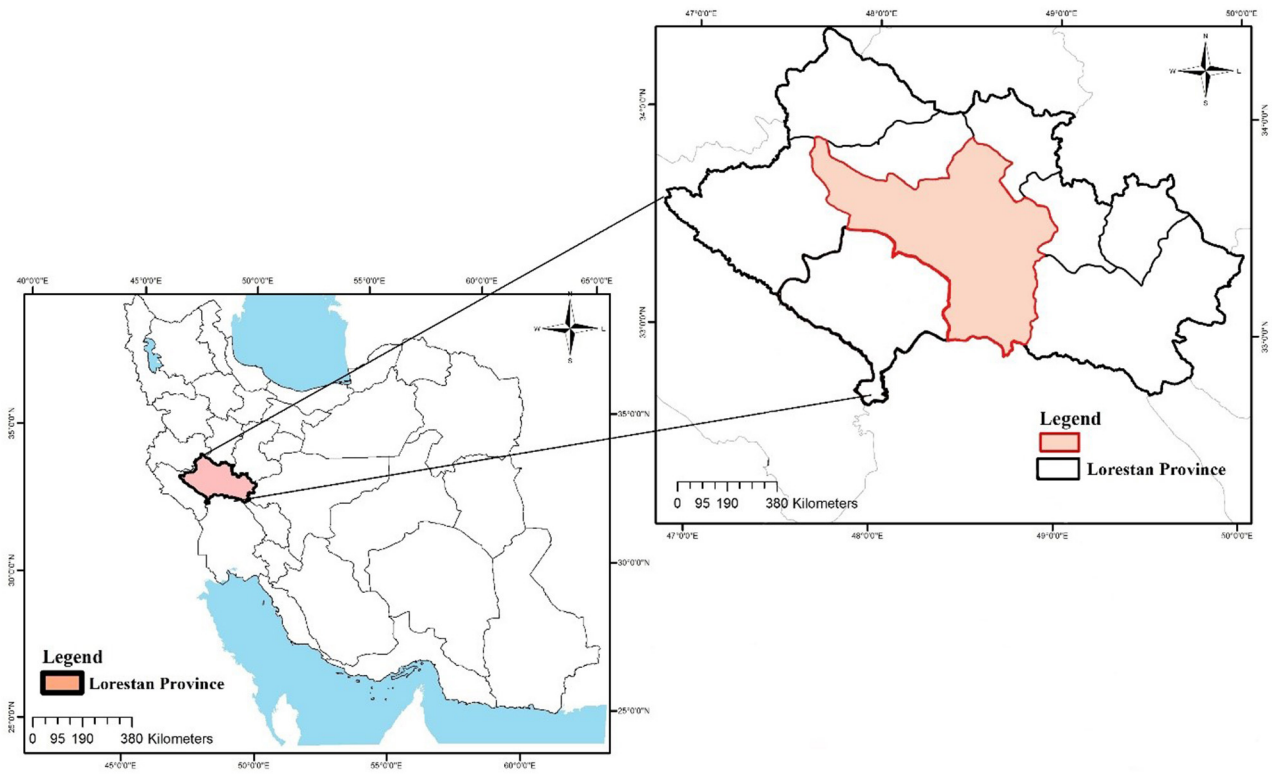

FIGURE 1 | Study area.

Data Collection

The study population included 375 household heads living in rural areas of Khorramabad county. The correlational research model was used in the research. Cochran's formula was used to calculate the finite sample size as follows:

$$n = \frac{\frac{t^2pq}{d^2}}{1 + \frac{1}{N}\left(\frac{t^2pq}{d^2} - 1\right)} \quad (1)$$

In this formula, n is the sample size, t equals 95% (the error rate equals 1.96), N is the population size, p represents the presence of trait and equals 50%, q is the lack of trait. It equals 50%, and d stands for the probability of error and equals 0.05. After the values were put in the Cochran's formula, the sample size was estimated to be 375 individuals. The questionnaire used in this study consists of three parts. The first part includes questions related to personal, economic, and social characteristics that were gathered from previous studies, and the second part includes the International Standard Household Food Insecurity Access Scale (HFIAS) (27), which has been validated by Salarkia et al. in Iran (28). The third part measures household food access using the Household Dietary Diversity Scale (HDDS).

Data Analysis

The collected data were analyzed using SPSS version 24 software. This study used frequency, mean and standard deviation for descriptive statistics, Pearson's, a paired sample t-test, chi-square, multinomial regression, and chi-square tests were used for inferential statistics.

Measuring Food Security

The Household Food Insecurity Access Scale

Different dimensions of food security make it possible to use different indicators and scales to assess food security; hence, no single indicator can simultaneously evaluate the four dimensions of food security (29). The various methods and tools used in food security assessment indicate its operational concept's complexity (30). The Household Food Insecurity Access Scale (HFIAS) is a recently developed approach that measures households' perception of their access to food and does not include food consumption or nutritional outcomes (31). Household food insecurity was determined using HFIAS on a nine-item scale over a reminder period of the past 4 weeks (30 days) (27). For each positive answer, the person used the four-point scale (never, rarely, sometimes, often) to provide additional information for the frequency, and their total score is from 0 to 27. A high HFIAS showed a high level of food insecurity for households (32). The prevalence of household food insecurity was classified into four levels: food secure, mild, moderate, and severe food insecurity. The percentage of each category was analyzed using the indicator Guide version 3 (27).

TABLE 1 | Results of the HFIAS questionnaire of the studied households.

Question items	Never		Rarely		Sometimes		Often		Mean
	N	%	*N*	%	*N*	%	*N*	%	
Worry about food	59	15.8	81	21.7	101	27.1	134	35.4	1.23
Unable to eat preferred foods	70	18.6	96	25.7	106	28.2	103	27.5	0.99
Eat a limited variety of foods	72	19.3	91	24.4	114	30.5	98	25.8	0.96
Eat foods that you did not want to eat	117	31.2	83	22.1	99	26.5	76	20.2	0.94
Eat a smaller meal	133	35.4	88	23.6	84	22.4	70	18.6	0.81
Eat fewer meals in day	138	36.7	101	27.1	75	19.9	61	16.3	0.84
No food to eat of any kind in the household	199	53.1	89	23.5	57	15.3	30	8.1	0.53
Go to sleep at night hungry	230	61.3	86	23.1	35	9.3	24	6.3	0.47
Go a whole day and night without eating	236	63	96	25.6	26	6.9	17	4.5	0.44

Measuring Dietary Diversity

The Household Dietary Diversity Scale

The dietary diversity is a qualitative scale to measure household access to various foods and reflects the nutrient adequacy in the diet of all household members for productive life (33). The dietary assessment questionnaire was according to the FAO instructions for measuring dietary diversity of households (34). The HDDS is described as the number of food groups a household consumes in the specified period (usually based on the previous 24 h). The following 12 food groups are used to measure the HDDS indicator: white tubers and roots, cereals, legumes, nuts and seeds, vegetables, fruits, meat, eggs, milk and milk products, fish and other seafood, oils and fats, spices, sweets, beverages, and condiments. Dietary diversity was summarized to create dichotomous occurrence variables for each food group and indicators associated with each group (35). The HDDS variable was measured by adding the count of food groups consumed by the household, and scores ranged from 0 to 12 (36). A lower score indicates lower household dietary diversity (37).

RESULTS

Food Security Status

Table 1 shows the food security status of rural households before and during the COVID-19 pandemic. The results showed that there is a significant difference between food security items before and during the COVID-19. The worry about not having enough food has increased among rural households, and eating a variety of foods has limited. According to the mean of questions 8 and 9, rural households' hunger level was higher in the COVID-19 condition than before. **Figure 2** shows that there was a significant difference between the food security status of rural households before and during the pandemic. About 34.5% of rural households were severe food insecurity before the COVID-19 pandemic, which increased to 52.5% during the COVID-19 pandemic. The percent of rural households that were food secure decreased from 21 to 14% during COVID-19. There was no significant difference between mild and moderate food insecurity during the COVID-19 pandemic compared to before. Also, the results showed that about 52.5% of rural households need urgent assistance to struggle with inappropriate food insecurity conditions.

Socioeconomic and Demographic Characteristics of Participants

Table 2 shows the scale for measuring all variables used in this study. Further, describing and explaining the variables, we present them in two categories of discrete and continuous variables as follows.

Descriptive Statistics of Continuous Variables

Table 3 shows the scale for measuring all variables used in this study. Further, describing and explaining the variables, we present them in two categories of discrete and continuous variables as follows.

Descriptive Statistics of Discrete Variables

Descriptive analysis of the categorical variables is described in **Table 4**. About 89% of the household head were male, whereas 41% of them had secondary education. More than 90 percent of households are nuclear. The findings showed that about 96% of the respondent households did not participate in nutrition training classes. About 81% of the respondent households were not under a supporting center's coverage, whereas only 30% of household heads had a permanent job. Almost 65% of households were in the first income group in terms of monthly income, and 92% of households had no personal savings. About 43% of the households had access to credit, and 49% participated in home loans.

Dietary Diversity Status

Table 5 shows the households' dietary diversity status before and during the COVID-19 pandemic. The households' dietary diversity score showed that the total average of food groups of the studied households is 7.75. Consumption of meat, fruits, and eggs among households has decreased during the COVID-19 pandemic, despite the increase in consumption of cereals, legumes, sweets, spices, condiments, and beverages. Also, the

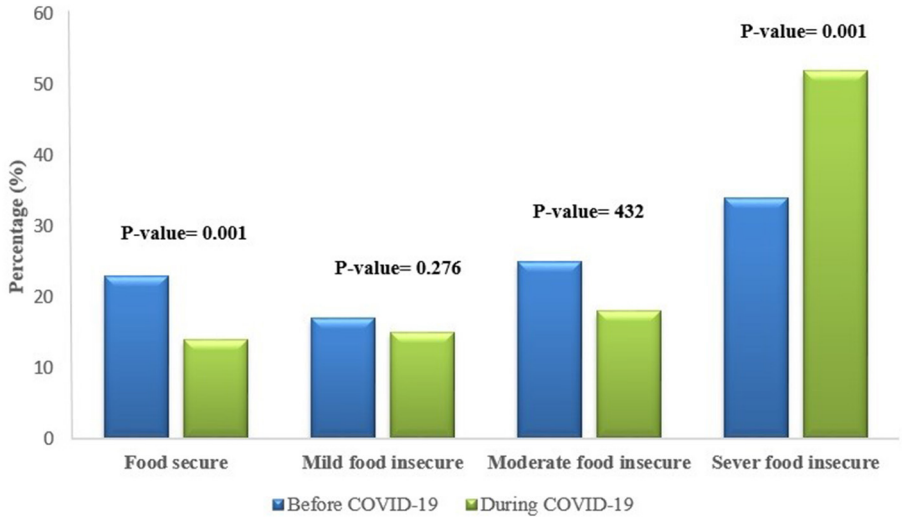

FIGURE 2 | Food security status of rural households before and during COVID-19.

TABLE 2 | Description of the variables studied in the research.

Variables	Measurement	Description
Dependent variables		
Food security status	0–27	Household food security in last 4 weeks (food security = 0, sever food insecurity = 27)
Dietary diversity status	0–12	Number of food groups consumed by a household in last 24 h
Independent variables		
Age	Number	Age of household heads (number of years)
Education level	1–4	household heads' education level (1 = no formal education 2 = primary education 3 = secondary education 4 = tertiary education)
Household size	Number	Total members in the household (number of person)
Household type	1–2	The household type included (1 = nuclear: father, mother, unmarried family members, 2 = extended: father, mother, married family members, grandsons, grandpa, grandma = 2)
Household head's gender	1–2	Gender of household's members head (1 = male 2 = female)
Household head's employment status	1–3	Household head's occupation (1 = employed 2 = unemployed 3 = seasonal)
Children under 18 years	Number	Total children under 18 years in the household (number of people)
Being under the coverage of a supporting center	0–1	Household being under the coverage of a supporting center, for example financial aid organizations, NGOs (if supporting = 1, otherwise = 0)
Access to credit	0–1	Access of households to credit (credit received = 1, otherwise = 0)
Household head's monthly income	1–4	Household head's income group based on Rial, Iran's currency (1 = 0–14,000,000, 2 = 14,000,010–28000000, 3 = 280,000,010–42,000,000, 4 = 420,000,010-56,000,000)
Household employed members	Number	Total employed members in the household (number of person)
Personal saving	0–1	Whether a Household head have a personal saving in a bank (has personal saving = 1, otherwise = 0)
Participate in home loans	0–1	Whether Household head has participate in home loans (has participate = 1, otherwise = 0)
Land personal's ownership	0–1	Household head's land personal's ownership (has land personal's ownership = 1, otherwise = 0)
Farm size	Number	Farm size of a household (number of hectares)
Livestock ownership	Number	Livestock ownership of household (number of units)
Distance to market	Number	Distance to market of household (number of a kilometer)
Nutrition knowledge	1–5	Household head's nutrition knowledge) 1 = very low 2 = low 3 = medium 4 = high 5 = very high)

HDDS score of households before COVID-19 (8.06) is higher than during COVID-19 (7.11). The highest level of food group consumption is related to cereals with an average of (1.23), and the lowest belongs to fish consumption and other seafood (0.10).

Figure 3 shows that rural households before COVID-19 have a better situation compared to the during COVID-19 time in terms of consumption of food groups (meat, eggs, and fruits). Also, one of the most important outputs of this chart is the low consumption of fish and seafood before and during the COVID-19 pandemic.

TABLE 3 | Descriptive statistics of continuous variables.

Variable	Mean	minimum	Maximum	SD
Age	47.25	22	75	9.46
Household size	4.20	2	13	1.16
Household employed members	0.42	0	4	0.77
Children under 18 years	1.01	0	4	1.13
Farm size	4.23	0	55	10.68
livestock ownership	5.89	0	110	12.55
Distance to market	26.74	2	65	10.45

Multinomial Regression Model Results

A multinomial regression model was used to estimate the association of socioeconomic factors with the level of food security of rural households. **Table 6** shows the results of this model for food security status before and during the COVID-19 pandemic. Before running the multinomial regression model, the variance inflation factor (VIF) index was used to assess the multicollinearity of independent variables. Since the VIF values for each variable were <5, there is no multilinear concern between the variables. Also, based on the likelihood ratio test ($p = 0.000$), the model has strong explanatory power. This model showed that the variables of the household head's gender, level of education, monthly income, number of employed members, personal saving, size of household, and nutrition knowledge have a significant association with the level of food security of rural households before COVID-19 pandemic. The household head's gender, level of education, household head's monthly income, number of employed members, nutrition knowledge, household head's employment status, livestock ownership, and access to credit are directly associated with the food security of rural households during the COVID-19 pandemic.

Table 7 shows the association of socioeconomic factors with the level of dietary diversity of rural households. Before

TABLE 4 | Descriptive statistics of discrete variables.

Variable	Category	*N*	%	Mode
Household type	Nuclear	345	92	☑
	Extended	30	8	
Household head's gender	Male	334	89.2	☑
	Female	41	10.8	
Household head's level of education	No formal education	62	16.7	
	Primary education	132	35.2	
	Secondary education	155	41.3	☑
	Tertiary education	26	6.8	
Household head's employment status	Employed	114	30.5	
	Unemployed	156	41.6	
	Seasonal	105	27.9	☑
Participate in family nutrition training class	Yes	15	3.8	
	No	360	96.2	☑
Being under the coverage of a supporting center	Yes	71	18.8	
	No	304	81.2	☑
Access to credit	Yes	163	43.6	
	No	212	56.4	☑
Household head's monthly income	Group 1	243	64.9	☑
	Group 2	108	28.8	
	Group 3	19	5.1	
	Group 4	5	1.3	
Personal saving	Yes	29	7.6	
	No	346	92.4	☑
Participate in home loans	Yes	186	49.6	☑
	No	189	50.4	
Land personal's ownership	Yes	16	4.3	
	No	359	95.7	☑

TABLE 5 | Food groups status rural households.

Food groups	Household heads									*p*-value
				Before COVID-19			During COVID-19			
	N	%	mean	*N*	%	mean	*N*	%	mean	
Cereals	367	97.8	0.98	363	96.8	0.97	374	99.8	1.23	0.002
White tubers and roots	165	44.1	0.44	144	38.5	0.39	156	41.7	0.42	0.182
Vegetables	346	92.2	0.90	353	94.2	0.94	346	92.3	0.88	0.089
Fruits	229	61.2	0.65	264	70.5	0.71	185	49.5	0.49	0.005
Meat	204	54.4	0.46	210	56.1	0.58	181	48.3	0.46	0.001
Eggs	207	55.3	0.57	237	63.2	0.62	193	51.4	0.50	0.034
Fish and other seafood	35	9.4	0.09	32	8.5	0.08	36	9.7	0.10	0.537
Legumes, nuts and seeds	182	48.5	0.49	181	48.3	0.49	223	59.6	0.61	0.003
Milk and milk products	272	72.5	0.74	272	72.6	0.72	278	74.1	0.73	0.588
Oils and fats	309	82.5	0.82	310	82.7	0.87	355	94.8	1.45	0.216
Sweets	294	78.3	0.77	271	72.3	0.76	301	80.5	0.85	0.024
Spices, condiments, and beverages	300	80.2	0.81	294	78.5	0.79	340	90.6	0.97	0.035
Total mean food groups			7.75			8.06			7.11	
Min			2							
Max			12							

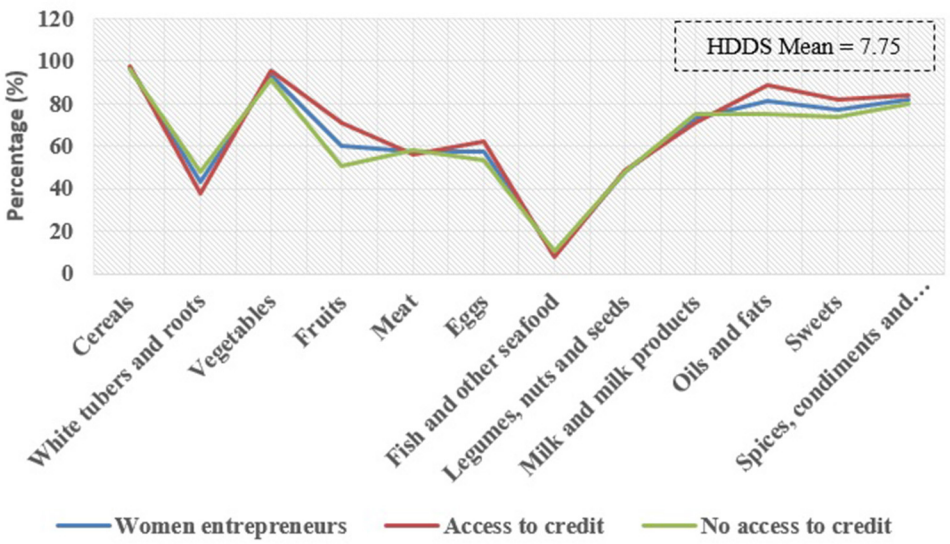

FIGURE 3 | Dietary diversity status of rural households before and after the COVID-19 pandemic.

estimating the model, the collinearity between the variables was checked using VIF. The value of the VIF coefficient for all variables in the model was less than five. The results of the multinomial regression model showed that the variables of the household head's gender, household head's level of education, household head's monthly income, household size, and nutrition knowledge were directly associated with the dietary diversity score of rural households before the COVID-19 pandemic. Also, the results showed that the household head's gender, level of education, monthly income, nutrition knowledge, employment status, livestock ownership, and access to credit have a significant association with the level of food security of rural households during the COVID-19 pandemic.

DISCUSSION

The main aim of this study was to examine the impact of the COVID-19 pandemic on food security and food diversity of rural households. In the first step, the food security situation of rural households was assessed. The results showed that 14% of rural households have food security, and 52.5% need urgent assistance

TABLE 6 | Factors associated with food security before and during COVID-19 using multinomial regression.

Variables	VIF	Before COVID-19			During COVID-19		
		Coefficient	Odd	*p*-value	Coefficient	Odd	*p*-value
Intercept		−4.080		0.066	−2.433		0.329
Household head's gender	1.141	0.988	1.022	0.001	0.059	1.067	0.001
Size of household	1.355	−0.322	1.044	0.032	−0.87	1.034	0.121
Household type	1.231	0.165	1.028	0.765	0.345	1.008	0.532
Participate in home loans	2.187	0.561	1.076	0.065	0.230	0.801	0.087
Children under 18 years	1.206	−0.078	1.027	0.241	−0.088	1.132	0.212
Livestock ownership	2.144	0.546	2.998	0.079	0.126	1.750	0.010
Access to credit	1.258	1.008	1.562	0.023	0.657	0.421	0.003
Farm size	1.342	0.109	1.223	0.058	0.109	0.615	0.234
Distance to market	1.203	−0.018	0.532	0.368	−0.022	3.854	0.896
Education level	1.175	1.021	1.404	0.841	0.309	2.312	0.001
Number of employed members	1.288	0.980	0.512	0.014	0.280	0.736	0.014
Nutrition knowledge	1.142	1.143	1.205	0.005	0.463	1.005	0.004
Household head's monthly income	1.344	1.015	1.053	0.003	0.854	1.133	0.000
Personal saving	1.432	0.845	1.023	0.030	0.232	1.021	0.843
Being under the coverage of a supporting center	2.312	0.360	1.070	0.621	0.654	0.698	0.027
Household head's employment status	1.432	1.01	1.125	0.410	0.850	1.243	0.009

TABLE 7 | Factors associated with dietary diversity before and during COVID-19 using multinomial regression.

Variables	VIF	Before COVID-19			During COVID-19		
		Coefficient	Odd	*P*-value	Coefficient	Odd	*P*-value
Intercept		−4.080		0.066	−2.433		0.329
Household head's gender	1.243	−0.134	1.324	0.001	−3.834	1.211	0.001
Size of household	1.243	0.272	1.211	0.032	0.079	1.068	0.121
Household type	1.367	0.012	1.030	0.765	0.034	1.213	0.532
Participate in home loans	2.578	0.341	1.405	0.065	0.018	1.435	0.087
Children under 18 years	1.421	−0.046	1.612	0.241	−0.250	1.654	0.212
livestock ownership	2.187	0.036	2.017	0.079	0.145	1.0576	0.010
Access to credit	1.345	1.045	0.657	0.023	0.743	0.324	0.003
Farm size	1.421	0.054	0.523	0.058	1.432	0.089	0.234
Distance to market	1.176	−0.015	0.324	0.368	−0.209	0.456	0.896
Education level	1.230	1.085	2.401	0.841	1.765	1.126	0.001
Number of employed members	1.324	0.987	0.531	0.414	0.467	0.123	0.314
Nutrition knowledge	1.423	1.237	1.006	0.005	0.798	2.056	0.004
Household head's monthly income	1.211	0.135	1.087	0.003	3.309	1.080	0.000
Personal saving	1.542	−0.819	0.765	0.130	0.099	1.012	0.843
Being under the coverage of a supporting center	2.165	0.543	1.098	0.621	0.065	1.126	0.027
Household head's employment status	1.219	−0.788	1.376	0.410	1.002	1.567	0.009

to struggle with inappropriate food insecurity conditions. This finding is consistent with the results of other studies (19, 25, 38). In developing countries, most of the livelihoods of rural households come from the agricultural sector (39, 40). Hence, rural households are most affected by poverty and vulnerability and face economic, financial, and social risks (41). COVID-19 disrupts various stages of the food supply chain and simultaneously affects farm production, food processing, access to inputs, transportation, logistics, and consumer's demand. Decreased exports of food and agricultural products due to the closure of borders and health quarantines are other consequences that can lead to the accumulation and cheaper products. Another problem is labor shortages due to the fear of transmitting the virus, which ultimately leads to the waste of the product (42–44). Thus, the income of many rural households has been reduced due to restrictions and quarantine measures and business closures

(45). Access to valuable foods has been reduced and replaced by high-calorie, low-value foods, which have led to obesity along with cell starvation, increasingly putting rural people at risk for coronavirus disease and other diseases (46, 47).

Our results on the dietary diversity of rural households showed that the consumption of some food groups changed during the COVID-19 pandemic. Consumption of meat, fruits, and eggs among households has decreased during the COVID-19 pandemic. This finding aligns with several recent studies that reported rapid changes in diets and food consumption habits during the COVID-19 pandemic (46, 48, 49). During the COVID outbreak, due to the increase in the price of animal protein sources, the access of low-income decile groups to these items has decreased (50). Even the results of recent studies by the Ministry of Health and medical education in Iran have also shown that due to the increase in prices by up to 35%, the consumption of some food items including red meat, chicken, milk, dairy products, and fruits has decreased in Iranian households that the continuation of this issue can lead to food insecurity and malnutrition. Therefore, serious government oversight is essential to control food prices; protein sources should be available to people at a reasonable price, especially vulnerable groups. During the COVID-19 pandemic, it is very important to have a proper function of the immune system following proper nutrition, which the body fights against the disease in case of COVID-19 infection, and even after getting a COVID-19 vaccine, the vaccine response is very much related to the immune system function (51).

Also, the results showed that the consumption of cereals and legumes among rural households increased during COVID-19. The results of the previous studies also confirm this finding (52, 53). Rural households prefer to use legumes as a cheaper source of protein in the diet. Legumes are a good alternative to meat, milk, and eggs for a lower price. However, that does not mean that people can stay healthy, get the protein, and provide the protein their bodies need. Proper nutrition plays an important role in strengthening the immune system. Basically, in people whose immune systems are weakened due to poor nutrition, the body's resistance to the virus is usually lower, and the severity of the disease and the recovery period may even increase (46). Also, increasing grain consumption among rural households can cause them to gain weight during the COVID-19 pandemic. This finding is consistent with the previous studies (52, 54) that have reported increased cereal intake during the COVID-19 epidemic, which leads to more meals per day and weight gain.

We found that the consumption of sweets and sugars among rural households increased during the COVID-19 pandemic, which can increase the risk of COVID-19 infection by stimulating the immune system. In line with this, the results of a study in Norway showed that due to the psychological stress caused by COVID-19, the consumption of high-sugar foods has increased among households (55). Some people struggle with sugar and unhealthy foods as a way to replace stress (56). Eating sugary and highly caloric foods can also affect feelings such as loneliness during social isolation (57, 58).

The results showed that the head's gender was directly associated with food security and dietary diversity during the COVID-19 pandemic. Other scholars have also reported a female-headed households were more likely prone to food insecurity (59). The female-headed households faced challenges such as lower-income, limited access to capital, land ownership, market, and new technologies (60, 61). Also, most female-headed households in rural areas lack access to information and natural resources, which significantly affects increasing food insecurity (62). They tend to be in more precarious positions, earn lower-income, and epidemic may also expose them to higher levels of stress and violence (63–65). Therefore, gender-sensitive design and implementation of social protection interventions are crucial to ensure that rural women can participate in and equally benefit from these interventions.

Household head's employment status was positively and significantly associated with the food security of rural households. In other words, if the household head has a full-time job, less likely to experience a complete decline in income during the COVID-19 pandemic. Previous studies have confirmed the household head's employment status as a determinant of household's food security studies (38, 66, 67). Households with the unemployed head of households having either no fixed income or no income at all are more likely to have food insecurity (68). The purchasing power of these households is reduced due to a lack of sufficient income, so they cannot have sufficient access to food.

Household heads' monthly income was significantly related to the food security of rural households. Household heads put the food security situation of the family in a favorable position through the income from the income-generating activities. Some studies have shown a direct relationship between the income of household heads (in the agricultural and nonagricultural sectors) and food security (59, 69–71). High-income household heads are more likely to use food-based coping strategies during the COVID-19 epidemic to improve household nutrition. Therefore, their income can have a significant impact on the economic accessibility of the household. Higher-income households have greater food security because they have more choice in buying their household food (20). As income increases, household purchasing power increases, and they can prepare more food to meet their nutritional needs.

The education level of household heads was directly related to household food security. The higher education level of household heads likely provides more opportunities to find an appropriate job, thus enabling them to earn enough income to meet different nutritional needs (72). In rural areas, education influences food security through access to information on healthy nutrition in COVID-19 pandemic and quarantine conditions. Educated household heads are more likely to have more nutritional knowledge and know the importance of having all the nutrients and micronutrients in the family diet to maintain the immune system functioning to prevent and treat COVID-19 disease. They can also diversify household incomes, which increases the food supply of households (73).

The results showed that livestock ownership directly and significantly relates to household food security. Livestock ownership can reduce household food insecurity by increasing available disposable income that could be used to buy food and

thus increase access to food. It also might directly increase the availability of livestock products for home consumption (74, 75).

The results showed that nutrition knowledge was significantly related to food security and diversity before and during the COVID-19 pandemic. This finding is in line with several recent studies that reported that increasing the level of nutritional knowledge of the head of the household can help perform appropriate nutritional behavior during the COVID-19 pandemic and improve the level of food diversity of households (20, 76). Adequate knowledge on the importance of a healthy diet during COVID-19 which can be optimal nutrition and dietary intake is the only sustainable way to survive in the current situation. A proper diet can ensure that the body can correctly defeat the virus (77). Basically, in people whose immune systems are weakened due to poor nutrition, the body's resistance to the virus is usually lower, and the severity of the disease and the recovery period may even increase (78).

LIMITATIONS

In this study, several limitations need to be considered in future studies. First, because of the cross-sectional design, this study does not allow to draw causality, despite the use of retrospective data. Second, rural people are reluctant to provide their information due to a lack of trust in government agencies. However, we minimized their fears and built trust by clearly and openly communicating with them and providing transparency about using the data. Third, because the study was conducted during quarantine, access to research samples was difficult due to health protocols. Fourth, because many villagers did not wear masks and did not maintain social distance, communicating with them and distributing questionnaires was associated with problems such as fear of contracting the coronavirus. Finally, some heads of household did not remember the previous information, and we had to replace another household to complete the questionnaire.

CONCLUSION

The results of our study showed that during the COVID-19 pandemic, food insecurity has increased among rural households, and they were concerned about not having enough food. Therefore, to prevent a food security crisis in rural communities, the government needs to develop support packages to support insecure households. Also, using the capacity of existing NGOs to identify and support food-insecure households in the current crisis can be very helpful. The government should provide sufficient funds to cover food-insecure rural households with free food baskets. The identification of these households will be possible using the capacity of the Iranian Welfare Database, which determines basket items and their necessities with the cooperation of nutritionists in the institutions in charge of nutrition in the country. Also, the results showed that the consumption of food groups was limited among rural households during the COVID-19. Due to quarantine and business closures, many rural households' incomes have been reduced to zero. Access to valuable foods has been reduced and replaced by high-calorie, low-value foods, which have led to obesity along with cell starvation, increasingly putting rural people at risk for coronavirus disease and other diseases. Therefore, the government can solve this problem with the right policies and allocating subsidies to the lower-income deciles so that the sources of protein and micronutrients enter the food basket of the people. Also, appropriate training and information by healthcare providers, the use of the capacity of health centers, health houses, and the social media in the field of healthy cooking training, and the use of nutritious and low-calorie foods and nutritional methods effective in improving the immune system among rural households can be effective in improving these conditions. Finally, government policies should focus on increasing the resilience of rural households to reduce their vulnerability to crises such as COVID-19. Therefore, the use of technology and cyberspace and changing the nature of some rural workshops and businesses should be on the agenda of the related institutions of rural policies to achieve a roadmap to strengthen businesses and employment of rural groups in the post-COVID-19 situation. Also, planting food crops and home gardening can be considered an option to increase the resilience of rural households in the medium term.

DATA AVAILABILITY STATEMENT

The datasets presented in this article are not readily available because due to the nature of this research, participants of this study did not agree for their data to be shared publicly, so supporting data is not available. Requests to access the datasets should be directed to ghanbari.re@lu.ac.ir.

AUTHOR CONTRIBUTIONS

RG: conceptualization, methodology, validation, resources, and data mining. FM: supervision, formal analysis, methodology, writing–original draft, and interpretation. SG: conceptualization, methodology, advisor, and investigation. MP-C: advisor, investigation, validation, questionnaire preparation, and writing, reviewing and editing. All authors contributed to the article and approved the submitted version.

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How Do Collective Efficiency and Norms Influence the Social Resilience of Iranian Villagers Against the COVID-19? The Mediating Role of Social Leadership

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The main purpose of the present research was to investigate the effects of collective efficacy and norms on the social resilience against the COVID-19 with the mediating role of social leadership. To this end, a cross-sectional survey was carried out in the Kerman and Fars provinces of Iran. Finally, 206 villagers were selected as the sample for collecting the required information. The research tool was a close-ended questionnaire whose validity and reliability was evaluated and confirmed. The results of testing direct hypotheses using structural equation modeling revealed that collective efficacy, social leadership, and norms had significant positive effects on social resilience against the COVID-19 pandemic. Comparison of the standardized effects demonstrated that collective efficacy is the most powerful predictor of the social resilience of villagers. Furthermore, testing indirect (mediation) hypotheses revealed that social leadership can successfully mediate the effect of collective efficacy on social resilience against the COVID-19. Investigating the moderated indirect hypotheses showed that governmental supports moderated the effect of collective efficacy on social resilience. Taken together, the independent variables could account for 62% of social resilience variance change. In the end, the practitioners, decision-makers, and interveners of the COVID-19 management programs in rural communities were provided with some applicable recommendations to be able to foster social resilience against the COVID-19.

Keywords: collective efficacy, norms, social resilience, social leadership, COVID-19

INTRODUCTION

When the COVID-19 outbreak was introduced as a pandemic by the WHO in early 2020, there were widespread waves of concern and tension at the local, national, and international levels. This epidemic and its high rate of infection have had devastating and damaging impacts on the quality of life of human societies around the world (1). COVID-19 was first observed in Wuhan, China, and spread out rapidly in various countries of the globe. In addition to its impacts on the health and economic systems of global societies, COVID-19 has also posed serious psychological, physical, environmental, and cognitive dimensions (2, 3). The disease has also led to significant changes

in health care, transportation, and education systems (4, 5). The COVID-19 pandemic has forced many social groups to change their lifestyles to reduce its negative impacts (6, 7). Villagers have also been one of the vulnerable groups to coronavirus shock who have tried to improve their resilience to the negative impacts of the disease by using different strategies (8). Such shocks have had direct and indirect effects on rural and agricultural areas (9). In some cases, the timing of the outbreak has been one of the most important barriers to buying and selling agricultural and non-agricultural products of villagers (10). Because of the transportation restrictions and COVID-19 lockdowns, the products produced by the villagers remain in the village or on their farms. These delays in the timely sale of products lead to corruption or economic losses (11).

During an epidemic, factors such as mortality, social distancing regulations, and mobility reduce access to labor in rural areas. Thus, it negatively affects an important part of the food security chain in rural areas (12). A review of the research literature (12–15) shows that rural communities' decisions about coping and resilience with different shocks are a complicated process. This process generally depends on various factors such as comprehensive psychological, economic, and social factors (5, 16–20). However, most of these studies include various shocks such as water scarcity (18), drought (19), floods (17), landslides (20), and climate change (16), but specifically in the field of COVID-19, few studies have focused on the role and importance of psychological and social factors. In other words, very few studies have been conducted on the resilience of rural communities to the COVID-19 pandemic, especially in developing countries. To bridge this gap, it was logical to research the resilience of rural communities against the COVID-19 pandemic and its social and psychological determinants.

Socio-psychological factors play a very important role in the resilience of rural communities against epidemics such as COVID-19 (12). It should be mentioned that the study of these socio-psychological factors in rural communities plays a key role in highlighting and managing issues related to the wider consequences of pandemics such as fear. Such consequences can be observed in various areas such as livelihood, employment, health services, and security (6). From the perspective of corona shock resilience, it should be emphasized that examining the socio-psychological factors of villagers can help to adopt new adaptation strategies or modify existing adaptation options (21). Socio-economic intervention policies and programs in rural areas are likely to fail during the COVID-19 epidemic if rural socio-economic resilience strategies and determinants are not addressed (6, 12), in this regard, identifying and examining the key socio-psychological factors that can be effective in directing policies and programs of resilience against the COVID-19 pandemic are of great importance in developing countries. As mentioned earlier, many studies have been conducted on socio-psychological factors predicting resilience and adaptation to various shocks (especially environmental shocks) [see (5, 17–19)]. However, to our best knowledge, no study examines the socio-psychological factors affecting the resilience of rural communities to the COVID-19 pandemic. Therefore, in this study, an attempt was made to fill this research gap by examining the socio-psychological factors affecting the resilience of rural communities against the COVID-19 pandemic in Iran. To achieve this aim, we used a conceptual framework, the development stages of which are discussed in section Theoretical Background and Development of Hypotheses. In balance, this study is original from several perspectives. First, to our best knowledge, no similar study has been conducted in Iran and around the world. Second, using a literature review, a socio-cognitive framework was designed to predict the social resilience of villagers in this study, which seems to play a key role in strengthening social resilience. Third, the variable of governmental support was considered as a moderator of the relationships of social leadership, collective efficiency, and norms with social resilience. Furthermore, social leadership mediated the relationships of collective efficiency and norms with social resilience. These mediating and moderating variables resulted in a model that could explain the mechanisms of social resilience formation more accurately.

THEORETICAL BACKGROUND AND DEVELOPMENT OF HYPOTHESES

Resilience Against the COVID-19 Pandemic

Resilience theory entered the research literature of many scientific disciplines from the ecology field (1, 16, 22, 23). In its evolution, this theory used the foundations of theories such as complexity theory, agent-based theory, and systems of systems theory (24). This theory is based on the basic assumption that different social, economic, and ecological systems face a series of uncertainties that make it difficult to predict patterns and trends (22, 25). In other words, in these systems, there is a variable set of shocks and serendipities such as floods, droughts, and diseases that are part of the facts (1, 26).

There are many definitions of the concept of resilience. Many of these definitions define resilience of a system as the capacity of that system to withstand and/or adapt to disturbances over time (25, 27, 28). This resistance and adaptation should be such that the system maintains its functions and has no problem in providing services to the stakeholders involved in that system (16, 23). Borrion et al. (25) argue that resilient systems have three salient features: (1) they have a high capacity for resistance to change and adversity, (2) they have a high ability in self-organization, and (3) they have a high ability to learn and adapt. The variety of definitions and the wide range of applications of this concept have led to the presentation of different dimensions and indicators to measure this phenomenon in various studies [see (1)]. In a study, Kumpfer (29) introduced five sub-indicators for measuring resilience: cognitive factors, spiritual factors, behavioral factors, physical factors, and emotional factors. Maleksaeidi et al. (16) claim that adaptability, diversity, learning, diversity, and self-organization opportunity are key dimensions for the resilience of farm-households against climate change. Some researchers [see (30–33)] consider social capital as one of the most important dimensions of societies' social resilience to shocks.

Beyond all the physical and structural aspects that can be considered in defining and explaining the concept of resilience, the social dimensions of resilience/social resilience have been less considered in studies (1, 34). Social resilience can be interpreted as the level of the human capacity to anticipate, resist, manage, adapt, and recover from crises (35). In the event of new and devastating shocks such as COVID-19, communities' spirit of participation and social cohesion can have a significant effect on reducing vulnerability and the harmful effects of epidemics. Accordingly, social resilience against the COVID-19 pandemic can help sustain the functional capacity of communities such as rural communities (1, 32, 33). According to Alizadeh and Sharifi (1) and Ghazani et al. (36), social cohesion, social trust, social participation, and social relationships were introduced in this study as four main dimensions of social resilience of rural communities against the COVID-19. Social cohesion refers to the degree of interaction, cooperation, conflict, and differences between local/rural people in the context of the COVID-19 pandemic. The degree to which local people trust relatives, locals, strangers, and governmental and non-governmental entities in the management of COVID-19 is called social trust. The degree of subjective and objective participation of local people in the process of managing the coronavirus epidemic is social participation. It should be noted that social relationships refer to the level of communication and cooperation between the various stakeholders of the disease management process. In this research, according to the main purpose, social resilience against the COVID-19 was considered as the main dependent variable. Therefore, the effect of predicting variables (collective efficiency, norms, social leadership, and government support) on it was measured and analyzed.

Collective Efficacy

According to the social identity models of collective action, collective efficiency is one of the most important predictors of individuals' behaviors in the face of various crises and shocks (37–39). This concept is usually used in conjunction with the concept of self-efficacy (40). Self-efficacy is a person's belief in his or her ability to succeed in a particular situation (41, 42). Bandura (40) argues that the collective efficacy of individuals can affect members' goals of behavior, resource management, and social trust. In general, collective efficiency refers to individuals' perceptions of the effectiveness of collective actions or tasks to solve a particular problem (43, 44). In other words, the greater the perceived collective efficacy in dealing with COVID-19 among the community (villagers), the greater their social resilience to this shock. Although the effectiveness of collective efficacy in improving the resilience of different social groups has been emphasized by others [see (45–47)], primary searches show that no study has examined the effect of perceived collective efficiency on the resilience against the COVID-19 in rural communities. The study of Yazdanpanah et al. (12) is one of the few related studies in this field. However, in this study, they have examined the effect of collective efficacy on COVID-19 coping styles, not social resilience. In this regard, this variable was considered as one of the key variables explaining the social resilience of villagers. It should be noted that in the present study, the perceived collective efficiency in the field of COVID-19 in addition to the direct effect indirectly (through social leadership) affects the social resilience of the villagers. Based on the abovementioned debates, we hypothesize that:

H1: Collective efficacy has a significant influence on social resilience against the COVID-19.
H2: Collective efficacy has a significant influence on social leadership against the COVID-19.

Norms (Social and Moral)

Norms are thought models or guidelines by which we control and evaluate the actions of ourselves and others. Internal norms are norms that if not observed, there is no formal and specific punishment. External/social norms are norms that are predetermined for members of society. Fear of punishment and inner desire motivate members of society to follow the norm (48). If norms are not stable in society or are in conflict with some other social orders, people in the society will follow the norms less (49). A review of the research literature shows that different types of subjective (social) and moral norms have been used to analyze the behavior of individuals in the face of various shocks [see (18, 50)]. According to researchers (51–53), subjective (social) norms are one of the drivers of preventive behaviors for COVID-19. Subjective norms of COVID-19 refer to the level of external pressure perceived by villagers to take specific actions such as the use of preventive measures (53). In other words, subjective norms refer to the perceived evaluation of a person's behavior by the community and/or those around him/her. The greater the perceived behavioral control, the greater a person's resilience against the COVID-19 pandemic. In addition to subjective norms, researchers [see (50, 54, 55)] also emphasize the moral considerations as a significant driver of preventive behavior and resilience against the COVID-19 pandemic. In such circumstances, individuals may view health protocols and participation in COVID-19 management as a personal commitment or moral responsibility for themselves (55). It can be concluded that normative considerations may play a vital role in explaining and predicting preventive behaviors and adopting resilience strategies against the COVID-19 pandemic. Therefore, this variable is considered as one of the factors affecting the resilience of villagers against the COVID-19 pandemic. It is worth mentioning that given that norms may theoretically lead to the strengthening or weakening of shared/social leadership, the variable of shared leadership was considered as a mediator between norms and resilience against the COVID-19 pandemic. Thus, we hypothesize that:

H3: Norms have a significant influence on social resilience against the COVID-19.
H4: Norms have a significant influence on social leadership against the COVID-19.

Social Leadership

Researchers have come up with very different definitions of the concept of shared leadership. In this study, the concept of social leadership and shared leadership are considered synonymous. This concept was first developed in 1954 by Gibb. One of the most

well-known definitions of shared leadership has been provided by Pearce and Conger (56). These researchers consider shared leadership as the collective or mutual influence of members of society on each other (57, 58). Shared leadership is a process of interactive influence between members of communities. The purpose of this type of leadership is to help each other achieve the collective goals of the community or group (58). In a meta-analytic study, Mukundi Gichuhi (59) examined the relationship between shared leadership and organizational resilience. The results of this study showed that shared leadership is one of the important variables that can positively affect resilience in different organizations and communities. This result has been supported by other researchers [see (1, 60)]. Specifically, in the case of the COVID-19 pandemic, it can be said that the shared/social leadership reflects the degree of influence and cooperation of the members of the rural community with each other in the field of the COVID-19 pandemic. By strengthening shared leadership in rural society, the resilience to disease shock increases (1). Thus, shared/social leadership in the context of COVID-19 was introduced as one of the main potential predictors of the social resilience of the villagers against the shock of COVID-19. Thus, we hypothesize that:

H5: Social leadership has a significant influence on social resilience against the COVID-19.
H6a: Social leadership mediates the relationships among collective efficacy and social resilience against the COVID-19.
H6b: Social leadership mediates the relationships among norms and social resilience against the COVID-19.

Governmental Supports

According to the International Fund for Agricultural Development (3), governmental support is always an important part of post-shock agricultural and rural development interventions programs that can significantly contribute to the resilience of social systems. Lee and Lemyre (61) and Ratnasingam et al. (62) state that government support can affect the resilience responses and behaviors of individuals in the face of the risks and shocks. In other words, government support allows individuals to have minimal required options for economic responses, at least in the early stages of shocks such as COVID-19 (63, 64). The shock of COVID-19 also left a lot of social, economic, and environmental damage in rural communities of different countries, especially developing and underdeveloped countries (12). Rural and agricultural communities in these countries generally have low incomes, therefore, they are widely grappling with the negative consequences of this crisis (3). Government support, however, can increase their resilience to the COVID-19 shock and make them less vulnerable to the effects of the epidemic (64). In this regard, government support was also considered as one of the factors that can affect social resilience. However, in this study, government support was considered as a moderator of the relationship between collective efficiency, norms, and shared leadership with social resilience. Thus, we hypothesize that:

H7a: Governmental support moderates the link between collective efficacy and social resilience against the COVID-19.
H7b: Governmental support moderates the link between social leadership and social resilience against the COVID-19.
H7c: Governmental support moderates the link between norms and social resilience against the COVID-19.

Figure 1 demonstrates the proposed research framework of social resilience against the COVID-19 in rural communities.

METHODOLOGY

Research Typology

This research is an applied and quantitative study. Therefore, its results can be used by various end-users such as villagers, academic researchers, planners, and decision-makers at different levels of the COVID-19 pandemic management programs. In other words, it contributes to the development of resilience programs for rural communities in developing countries such as Iran.

Study Area, Population, and Sampling Method

The population of this study was the villagers of Sirjan and Eghlid counties in the Kerman and Fars provinces of Iran. These two provinces are located in the south of Iran. There were three main reasons for choosing cases from this area. First, increasing the social resilience against COVID-19 disease was one of the main research priorities of the Government of the Islamic Republic of Iran. In other words, since the onset of the disease, the Iranian government has encouraged researchers to examine the social resilience of villagers and the factors affecting it. Second, according to the Ministry of Agricultural Jihad, the level of social resilience against Corona was low among villagers in Fars and Kerman provinces. In this regard, conducting research that can identify some of the socio-psychological variables affecting it was of great importance. Third, due to the mobility constraints imposed at the time of this study, the authors were only able to collect data from these two provinces and did not have access to the other provinces. According to the 2016 census, 101,934 people live in the villages of these two counties (35,159 villagers in Eghlid and 66,775 villagers in Sirjan). Cochran's formula was used to estimate the required sample size. Cochran's formula estimated the required sample size at 206 people. The samples were selected using a multi-stage sampling method. In the first stage, the villagers of Sirjan and Eghlid were purposefully selected as the study population. The most important reason for choosing these two counties as the study population was the ease of access of researchers to the study community. In the second stage, to select a representative sample from each of these two counties, several sub-counties were randomly selected. In the third stage, one village was randomly selected from each of these sub-counties. In other words, the respondents were selected from among the villagers based on the sub-counties.

Measurement of Constructs

The four constructs [social resilience against the COVID-19 pandemic (SRCS), social leadership in epidemic conditions (SLEC), collective efficiency in disease control (CEDC), and

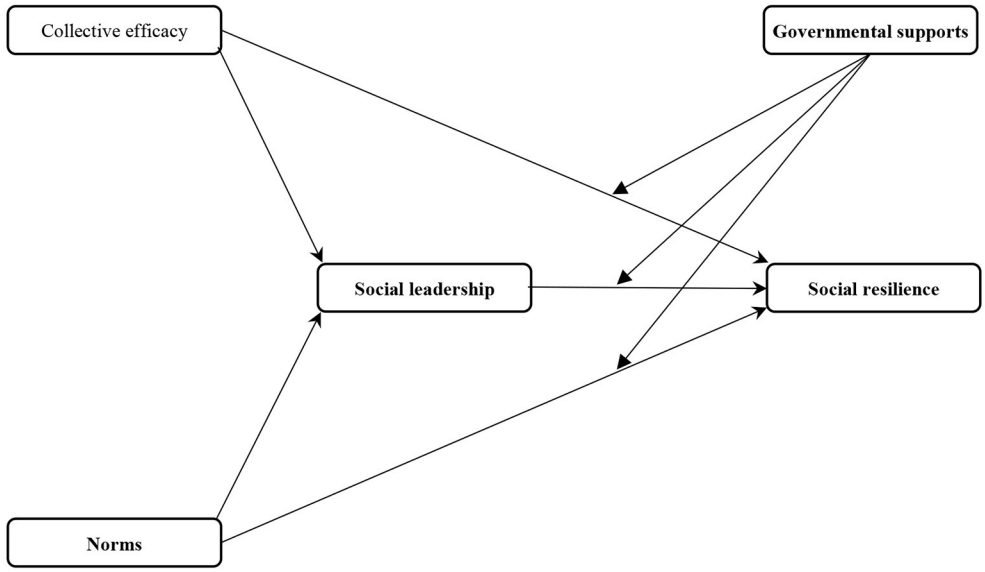

FIGURE 1 | Research model.

norms about the COVID-19 (NC)] used in **Figure 1** were measured through a five-point Likert scale (1: strongly disagree to 5: strongly agree). A five-level Likert scale was also used to measure governmental supports (GS) as the fifth construct used in the theoretical framework. However, the labels used to measure its items were 1: very low to 5: very high. To measure SRCS, SLEC, CEDC, NC, and GS 14, 3, 3, 3, and 5 items were applied, respectively (**Table 1**). The items of SRCS were adapted from Ghazani et al. (36). The items of CEDC, NC, and GS with some changes and corrections were taken from the study of Yazdanpanah et al. (12), and Savari and Gharechaee (66). It should be mentioned that all the items used to measure the variables NC and SLEC were adapted from Salas Vallina et al. (58) and Chiu et al. (65).

Validity and Reliability of Research Tool

The tool used to collect the required information on the social resilience of villagers and the factors affecting it was a researcher-made and close-ended questionnaire. The face and content validity of the questionnaire was evaluated and confirmed using the opinions of an expert group. These experts raised some points on the questionnaire and we tried to address them point by point. Then, a pilot study was conducted with 30 villagers. After the pilot test, Cronbach's alpha coefficients were used to evaluate the reliability. **Table 1** shows the reliability of the items measuring the variables used in the framework. At this stage, some corrections were made to the questionnaire. After removing the ambiguities and shortcomings of the questionnaire based on the results of the pilot study, the questionnaire was applied for the main cross-sectional survey of villagers in Sirjan and Eghlid counties. After conducting a cross-sectional survey to collect the required data, the composite reliability indices, loading factors of items (in the first-order confirmatory factor analysis), and average variance extracted (AVE) were employed as the main reliability and validity analysis criteria.

Data Collection and Analysis

Data collection was done by the first and second authors. In data collection, they used two groups of data collection. The first group was employed to collect information from the villagers of Eghlid County and the second group was employed to collect information from the villagers of Sirjan County. Each of these groups consisted of four members with experience in collecting cross-sectional information. Data collection was performed from November 15 to December 15, 2021. According to the estimated sample size, 206 villagers were interviewed in different villages. Eight questionnaires were discarded due to deficiencies in the answers. Finally, 198 questionnaires were analyzed. Data analysis was performed using Smart PLS_3 software.

RESULTS

Correlation Between Variables

Table 2 summarizes the correlations among the variables used in the theoretical framework. The results of correlation analysis implied that the variables social leadership ($r = 0.689$; $p < 0.01$), collective efficacy ($r = 0.671$; $p < 0.01$), norms ($r = 0.625$; $p < 0.01$), and governmental supports ($r = 0.601$; $p < 0.01$) were positively and significantly correlated with SRCS. Comparison of correlations between variables shows that collective efficacy and social leadership have the highest correlation values with social resilience against the COVID-19 pandemic, respectively. In addition, collective efficacy ($r = 0.519$; $p < 0.01$) and norms ($r = 0.456$; $p < 0.01$) also had significant positive correlations with

TABLE 1 | Items measuring SRCS, SLEC, CEDC, NC, and GS and corresponding alpha coefficients.

No.	Items	Sources
SRCS (Social participation): (α = 0. 73)		(36)
1	Since the beginning of the Corona epidemic, I have tried to participate in social activities to solve my village's problems.	
2	Since the beginning of the Corona epidemic, I have tried to help the activities of relevant institutions such as health centers, rural administration centers, and the Islamic Council voluntarily.	
3	Since the beginning of the Corona epidemic, I have been actively involved in implementing health and disease-related initiatives.	
4	I welcome the presence of government agencies and their agents in the village to facilitate the fight against Corona.	
SRCS (Social trust): (α = 0.77)		(36)
1	I have always been encouraged by the help of other villagers to get out of the Corona crisis.	
2	I have always been encouraged by my family members to get out of the Corona crisis.	
3	The presence of village elders alongside the people during the Corona period has created trust and empathy among the people.	
SRCS (Social cohesion): (α = 0.81)		(36)
1	During the Corona epidemic, the villagers do not hesitate to help each other.	
2	All villagers are united in eradicating the disease and breaking the transmission chain.	
3	To deal with the negative effects of the coronavirus, I consult with friends and other villagers.	
4	The problems of the medical staff in the village during the Corona epidemic are like our own problems and I try to help them as much as I can to solve these problems.	
SRCS (Social relationships): (α = 0.82)		
1	Village government agencies are pursuing programs to cope with the COVID-19 pandemic.	(36)
2	People had good contact with government and local institutions and their representatives during the Corona epidemic.	
3	Village public institutions are actively involved in raising awareness and quality of health services.	
Social leadership in epidemic conditions (SLEC): (α = 0.73)		(58, 65)
1	I try to spend time guiding those around me and the villagers about the COVID-19 pandemic.	
2	I teach new things I know about the COVID-19 disease.	
3	I take the lead to increase the participation of others in collective activities to deal with the crisis.	
Collective efficiency in disease control (CEDC): (α = 0.71)		(12)
1	I believe that we need mutual help from other members of society to eradicate the epidemic.	
2	Reducing the side effects of the COVID-19 pandemic is easy for me.	
3	I believe I can control the effects of the COVID-19 pandemic in the village.	
Norms about COVID-19 (NC): (α = 0.82)		(66)
1	If I follow the COVID-19 health protocols, I will be approved by those around me.	
2	Participating in epidemic management is a moral duty for each of us villagers.	
3	Active participation in the COVID-19 management practices is commonplace among villagers.	
Governmental supports (GS): (α = 0.74)		(12)
1	Receiving assistance from the government to provide agricultural/livestock inputs.	
2	Extension of the loan repayment period.	
3	The strict control of entry/exit from villages.	
4	Severe quarantine and closure of high-risk jobs.	
5	Being provided with governmental subsidies for livelihood assistance.	

social leadership. Nevertheless, the correlation value obtained for collective efficacy was higher than the corresponding value for norms.

Measurement Models of the Constructs

Table 3 represents the results of measurement models of the constructs. Based on the results of this section of structural equation modeling, the loading factors for all items used to measure social leadership, collective efficacy, norms, governmental supports, and social resilience against the COVID-19 pandemic were above the acceptable value of 0.4. According to Hair et al. (67), acceptable loading factors in the measurement models are usually >0.4. The values obtained for CR and AVE indices for all variables were higher than 0.7 and 0.5, respectively. This result means that CR and convergent validity have been at the appropriate level. In addition, the rho-A criterion was also employed to evaluate the reliability of the construct. According to Azar et al. (68), the acceptable cut-off value for this criterion

TABLE 2 | Correlations among the study variables.

	SRCS	SLEC	CEDC	NC	GS
SRCS	1				
SLEC	0.689**	1			
CEDC	0.671**	0.519**	1		
NC	0.625**	0.456**	0.524**	1	
GS	0.601**	0.362**	0.656**	0.485**	1

SRCS, Social resilience against the COVID-19 pandemic; SLEC, Social leadership in epidemic conditions; CEDC, Collective efficiency in disease control; NC, Norms about COVID-19; GS, Governmental supports.
***Sig. level: 0.01 error.*

TABLE 3 | Evaluation of measurement models and the reliability, validity, and normality of assessment.

Items/variables	SRCS	SLEC	CEDC	NC	GS
SRCS1	0.947				
SRCS2	0.415				
SRCS3	0.938				
SRCS4	0.925				
SLEC1		0.685			
SLEC2		0.764			
SLEC3		0.621			
CEDC1			0.682		
CEDC2			0.757		
CEDC3			0.717		
NC1				0.678	
NC2				0.767	
NC3				0.645	
GS1					0.695
GS2					0.503
GS3					0.615
GS4					0.585
GS5					0.700
CR	0.89	0.73	0.76	0.74	0.76
rho-A	0.92	0.76	0.73	0.75	0.86
AVE	0.70	0.50	0.51	0.50	0.51

SRCS, Social resilience against the COVID-19 pandemic; SLEC, Social leadership in epidemic conditions; CEDC, Collective efficiency in disease control; NC, Norms about the COVID-19; GS, Governmental supports.

is 0.7. Because all rho-A values were >0.7 in the present study, the reliability of constructs and items measuring them were proved. Fornell-Larcker Criterion was applied to evaluate the discriminant validity of the construct. Statistically, if the AVE for each variable is greater than the highest squared correlation value of that variable with the other variables, it can be argued that discriminant validity has been confirmed (68). The results of this study showed that the AVE values of all structures are higher than the greatest squared correlations. Therefore, discriminant validity was confirmed. Overall, the results of **Table 3** show that the collected data can be used for structural analysis.

Testing Hypotheses Using a Structural Model

At this stage, the conceptual framework was run using SmartPLS3 to test the hypotheses using a structural model. Because in the conceptual framework of the present study, there was a mediating variable (social leadership) and a moderating variable (governmental supports), structural equation modeling was run to test the hypotheses in two stages. In the first step, a structural model was implemented to estimate the standardized path coefficients. However, at this stage, the significance of the path coefficients is not specified. Therefore, in the second step, the bootstrapping method was employed to estimate the significance of the path coefficients. The bootstrapping method uses the T-statistic to estimate the significance of the paths. **Table 4** and **Figure 2** demonstrate the summary testing direct and indirect (mediation and moderation) hypotheses.

The results of testing direct hypotheses showed that the effects of collective efficacy on social resilience against the COVID-19 pandemic ($\beta = 0.542$; $p < 0.01$) and social leadership ($\beta = 0.766$; $p < 0.01$) are positive and significant. These results support H1 and H2. Estimation of the direct effects of norms on social resilience and social leadership revealed that this variable positively and significantly affected social resilience against the COVID-19 pandemic ($\beta = 0.198$; $p < 0.01$) and social leadership ($\beta = 0.162$; $p < 0.01$), supporting H3 and H4. The final direct hypothesis was related to the effect of social leadership on social resilience against the COVID-19. The results implied that social leadership positively and significantly affected social resilience against the COVID-19 ($\beta = 0.162$; $p < 0.05$), supporting H5.

As was mentioned earlier, we hypothesized that social leadership mediates the relationship between collective efficacy and norms with social resilience against the COVID-19 pandemic. The results of this part of the analysis revealed that the indirect (mediation) effect of collective efficacy on social resilience is positive and significant ($\beta = 0.092$; $p < 0.05$). In other words, the present study has sufficient evidence to support H6a. However, the indirect (mediation) effect of norms on social resilience against the COVID-19 was not statistically significant. Therefore, H6b was rejected. We hypothesized that governmental supports moderate the effects of collective efficacy, social leadership, and norms on social resilience against the COVID-19. The results demonstrated that among these three variables, only the effect of collective efficacy on social resilience (which is moderated by governmental supports) was statistically positive and significant. Therefore, H7a was supported by our results. However, the moderated effects of collective efficacy and norms on social resilience against the COVID-19 were not statistically significant. In other words, H7b and H7c were rejected (**Table 4**). The results of testing moderated mediation structural model demonstrated that the independent variables were able to predict 62 and 42% of the variance changes of SRCS and SLEC, respectively.

DISCUSSION

This study examined the effects of collective efficiency and norms on the social resilience of rural Iranians against

TABLE 4 | Summary of testing hypotheses.

Hypothesis	Path	Beta values	*t*-value	*P*-value	Result of a hypothesis test
Direct hypotheses					
H1	Collective efficacy -> Social resilience	0.542	9.807	0.001	Supported
H2	Collective efficacy -> Social leadership	0.766	14.822	0.001	Supported
H3	Norms -> Social resilience	0.198	3.579	0.001	Supported
H4	Norms -> Social leadership	0.162	2.884	0.004	Supported
H5	Social leadership -> Social resilience	0.120	2.230	0.026	Supported
Indirect (mediation) hypotheses					
H6a	Collective efficacy -> Social resilience	0.092	2.159	0.031	Supported
H6b	Norms -> Social resilience	0.020	1.701	0.089	Rejected
Indirect (moderation) hypotheses					
H7a	Moderating effect 1 -> Social resilience	0.126	2.162	0.031	Supported
H7b	Moderating effect 2 -> Social resilience	0.014	0.376	0.707	Rejected
H7c	Moderating effect 3 -> Social resilience	0.106	1.642	0.101	Rejected

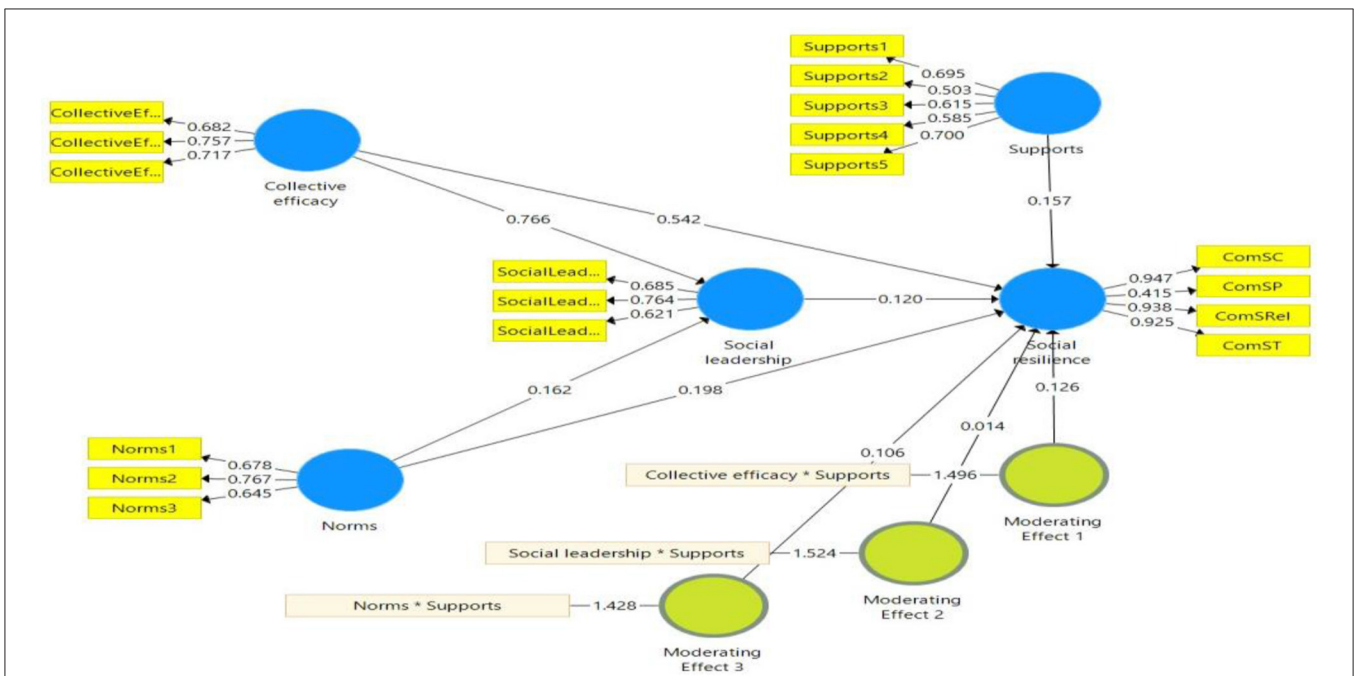

FIGURE 2 | The moderated mediation structural model.

the COVID-19 pandemic. In the process, social leadership in epidemic conditions mediated the relationship between "collective efficiency in disease control" and "norms" and social resilience. Governmental support was also considered as a moderator of the relationship between three independent variables (collective efficiency in disease control, norms about COVID-19, and social leadership in epidemic conditions) with social resilience against the COVID-19 pandemic. H1 and H2 tests showed a positive and significant effect of collective efficiency in disease control on social resilience against the COVID-19 pandemic and social leadership in epidemic conditions. In other words, the higher the perceived collective efficiency in disease control, the higher the social resilience against the COVID-19 and social leadership in epidemic conditions. Studies by researchers such as Elcheroth and Drury, Lin and Chung, and Stevenson et al. (45–47) supported the positive effect of collective efficacy on social resilience. The result of the H2 test (effect of collective efficiency in disease control on social leadership in epidemic conditions) has also been confirmed by Bamberg et al. (38) and Schulte et al. (39). Considering the positive and significant effect of collective efficiency in disease control on social resilience against the COVID-19 and social leadership in epidemic conditions, it can be concluded that by strengthening the perceived collective efficacy of villagers toward

the COVID-19 pandemic, their social resilience to the crisis can be increased. Alizadeh and Sharifi (1) state that some crises, such as COVID-19, are crises at the macro level, and resilience against them requires collective actions and social strategies. In other words, it is usually not possible to respond to them by increasing individual efficiency. In such cases, strengthening the perceived collective efficiency in communities or stakeholders can be a good way to strengthen social resilience. In this regard, it is suggested that collective efficiency in disease control be institutionalized in rural communities using awareness and enlightenment programs. This can be done by the executive arms of health care systems in rural areas. Improving perceived collective efficiency in disease control can not only lead to higher social resilience against the COVID-19 in communities but also positively impact social leadership.

The results of the structural model of the study demonstrated that norms about COVID-19 have a positive and significant effect on social resilience and social leadership in epidemic conditions, which support H3 and H4. This result means that as the desired norm increases, so do the social resilience against the COVID-19 and social leadership in epidemic conditions. Many studies have supported the positive effect of norms on coping behaviors and resilience of societies [see (50, 54, 55)]. In addition, the result obtained for H4 is in line with the findings of Bamberg et al. (38) and Kianmehr et al. (69). Considering the positive and significant effect of norms about COVID-19 on social resilience, it can be inferred that by improving the existing norms in the rural community regarding the corona epidemic, their resilience in the face of this crisis can be improved. According to Yu et al. (50), in analyzing the norms of communities in dealing with the shocks, its two main dimensions, namely social and moral dimensions, should be considered. Therefore, it can be said that one of the practical ways of developing social resilience against the COVID-19 is to strengthen social and moral norms. Ideally, norms act as controllers of behavior. For example, many villagers consider it a moral duty to follow health protocols, violating which may endanger the lives of their fellow villagers in the village and elsewhere. In some cases, individuals are very observant of health protocols because they feel that if they do not do so, they will be punished by the community and those around them. Such control by the norms over the behavior of the villagers during the epidemic will ultimately lead to an increase in their social resilience against the COVID-19 pandemic. In this regard, it is suggested to strengthen the moral and social norms in the field of the COVID-19 pandemic in rural communities using three strategies: (1) fostering personal norm/responsibility of individuals toward their peers; (2) awareness of the benefits or consequences of strict adherence to health protocols; and (3) punishing those who violate the norms of society during COVID-19 pandemic. These three strategies can be carried out by the elites and key informants of villages and field staff of health care systems. It should be noted that mass media and social networks can also play a key role in the successful implementation of the first and second strategies.

The results of the structural model also implied that social leadership in epidemic conditions has a positive and significant effect on social resilience against the COVID-19 pandemic. Thus, the H5 was also supported. The greater social leadership during the COVID-19 pandemic, the greater the social resilience of rural communities to shock. This result has been supported by others [see (1, 7, 60)]. Alizadeh and Sharifi (1) state that social leadership increases the influence and cooperation of members of the rural community with each other in the field of the COVID-19 pandemic. This factor facilitates adaptation strategies reduces copying costs and ultimately leads to social resilience to shock. In this regard, it is recommended that the spirit of collective leadership be strengthened in rural communities. Building mutual trust and collective identity are one of the first steps in developing collective leadership during the COVID-19 pandemic. In other words, all members of the rural community and practitioners of health care systems must act in a way that strengthens internal trust and collective identity. Commitment to consider successes and failures as the result of the collective work of all members of society and to strengthen and enhance the quality of human interaction in the process of forming and sustaining social resilience against COVID-19 are key issues. Continuous and effective communication through various communication channels can be the second step to strengthen social leadership during the COVID-19 pandemic. In this regard, it is suggested that members of rural communities try to activate the most effective and accessible communication channels among themselves and increase the quality of communication between them. Electronic communications and social networks can be used effectively for this purpose.

In H6a and H6b, the mediating role of social leadership in epidemic conditions was tested. The results revealed that the indirect (mediated) effect of collective efficiency on social resilience is positive and significant, which supports H6a. This result means that social leadership in epidemic conditions mediates the relationship between these two variables. However, the indirect (mediated) effect of norms on social resilience against the COVID-19 was not significant (H6b was not supported). In other words, social leadership in epidemic conditions cannot be considered as a mediator of the relationship between norms and social resilience. The results obtained from testing these two hypotheses can be useful in theory and practice. Using collective efficacy reinforcement methods (described in the first paragraph of this section) will increase social resilience against the COVID-19 pandemic. In addition, strengthening the collective efficacy by facilitating social leadership will also lead to the social resilience of villagers against the shock. This is a key result that can be used in social and psychological intervention programs during the COVID-19 pandemic.

The results of testing H7a, H7b, and H7c showed that H7a is the only hypothesis supported by the data. In other words, governmental supports only moderate the effect of collective efficacy on social resilience against shock (H7a was supported). However, this variable did not moderate the effects of social leadership and norms in social resilience (H7b and H7c were rejected).

Given that governmental support positively and significantly moderated the effect of collective efficiency on social resilience, it is suggested that the number and variety of governmental support be increased in the rural areas during the COVID-19

pandemic. Studies by other researchers such as Yazdanpanah et al. (12) and Ratnasingam et al. (62) have also pointed to the importance of government support in vulnerable agricultural and rural communities. Since the outbreak of COVID-19, Iran's rural communities, which are mainly weak economically, have faced new problems due to their inability to market and sell their products. The pressures of international sanctions have also made their economic conditions very fragile and vulnerable. In such circumstances, government support is one of the most important strategies to strengthen social resilience against shock.

CONCLUSIONS

This study resulted in four important conclusions that could be used to encourage social resilience against the COVID-19. The first conclusion was that although three variables collective efficacy, social leadership, and norms have significant direct effects on social resilience against the COVID-19, collective efficacy is considered the most important direct predictor. Second, social leadership can mediate the relationship between collective efficacy and social resilience. Third, governmental support can only moderate the effect of collective efficacy on social resilience. In other words, the effects of social leadership and norms on social resilience are not moderated by governmental support. Fourth, social leadership variables are predicted by collective efficacy and norms. The most important original contribution of this research is to present an innovative moderated-mediation model that explains the mechanism of relationships between predictors of social resilience accurately and realistically. Also, as the main take-home messages of the study, two points should be highlighted: First, social leadership can mediate the effects of norms and collective performance on social resilience. Second, governmental support can only moderate the effect of collective efficiency on social resilience.

It should be noted that the present study had several limitations. First, the present study investigated the social resilience of Iranian villagers toward COVID-19. However, the resilience of rural communities against this disease has economic, physiological, institutional, and even psychological dimensions. It is recommended that future researchers consider other dimensions of resilience as well. Second, the independent variables included in the model of this study were able to predict 62% of the variance changes in social resilience against the COVID-19 pandemic. This shows that other variables that are not present in the model can still increase the explanatory power of the model. In this regard, it is suggested that future researchers contribute to the development of the framework by introducing new variables in the model. Third, the present study uses a self-reporting questionnaire to collect data on social resilience against the COVID-19 and the factors affecting it. This may affect the outcome of the research. In this regard, it is recommended that future researchers at least use complementary methods of data collection along with the self-reporting method. Fourth, social resilience against the corona virus certainly requires the collective actions of the villagers. However, this variable and its determinants have not been examined in present study. Future researchers are recommended to focus on this variable and the role its determinants.

DATA AVAILABILITY STATEMENT

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

ETHICS STATEMENT

Ethical review and approval was not required for the study on human participants in accordance with the local legislation and institutional requirements. The patients/participants provided their written informed consent to participate in this study.

AUTHOR CONTRIBUTIONS

NV, EG, MA, and JS contributed to the conception and design of the study and performed the statistical analysis. MA and NV wrote the first draft of the manuscript. EG and NV contributed to data collection. All authors contributed to manuscript revision, read, and approved the submitted version.

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Analyzing Russian Media Policy on Promoting Vaccination and Other COVID-19 Risk Mitigation Measures

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The coronavirus disease 2019 (COVID-19) pandemic has resulted in many tangible and intangible losses. To manage the risk of the pandemic and to mitigate its further spread, governments of many countries applied various pandemic risk mitigation measures. Media campaigns played a particularly large role during the pandemic, too. In addition, social media grew in importance because of the spread of technologies and as a result of the increased attention to information about COVID-19. Media information strongly influenced both the public perception of COVID-19 risk and decision-making processes and choices, which people made regarding risk reduction measures during the pandemic. Moreover, media information has had a major impact on the effectiveness and efficiency of various countries' risk management actions. Therefore, the purpose of this article is to investigate the influence of the Russian media on the population's perception of risk, and to address the question about which linguistic and psychological methods they used to shape different media discourses about the COVID-19 pandemic. Thus, we analyzed media discourses as a part of the case study of COVID-19 risk management in the Russian Federation. The theoretical basis of the study includes mass communication theories. The methodological basis consists of linguo-cognitive analysis of empirical materials for specific political-philosophical, linguistic-publicistic, and sociopsychological functioning.

Keywords: COVID-19 discourse, media influence, information and communication strategies, coronavirus measures, public perceptions, linguo-cognitive analysis, Russia

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INTRODUCTION

The coronavirus disease 2019 (COVID-19) pandemic has caused numerous tangible and intangible losses, as well as various negative cascading effects on national and global economies. To reduce the risk of the virus spreading, governments of different countries introduced various risk mitigation measures, which ranged from partial restriction of the economy to complete lockdown. The effects of these measures also varied in effectiveness and efficiency.

The media played an important role during this public health crisis and had a significant impact on people's behavior during the pandemic as well as on their adoption of risk reduction measures. In addition, the media gained more importance during this crisis because of the increased attention to various pieces of information about the virus, its spread and mitigation, and the availability of various theories about its origins and causes. The media landscape was characterized by the spread of information from both official and unofficial sources, as well as of various kinds of contradictory statements, rumors, misinformation, and even misleading news. Thus, the media has strongly

influenced the perception of COVID-19 risk and led to various misconceptions, assumptions, and different assumptions.

The scientific novelty of the study lies in its topic, given the increased importance of social media, which has not been extensively addressed in previous studies. The volume of research findings on this topic is currently growing. It also consists of combining studies on media discourses and risk perception with further application of the analysis of news stories and social media messages for the specifics of their political-philosophical, linguistic-publicistic, and sociopsychological functioning. The research question of this article focused on different discourses and how these discourses shape risk perceptions and influence people's decision-making and choices during the COVID-19 pandemic. An empirical material was collected from a case study of the Russian Federation, which is relevant because of the rich media landscape characterized by different discourses and because of various measures, including its own developed vaccine, that were taken to manage the risk of COVID-19 and reduce the risk of the virus spreading.

The methodology of this study included various steps*:*

- Clarification of the theoretical assumptions, conceptual framework, and methodological basis of the study.
- Selection and systematization of text materials.
- Determination of the sociohistorical specificity of COVID-19 discourse in Russia.
- Consideration of media communication strategies.
- Analysis of the country's media sphere in terms of its influence on public awareness of COVID-19.

Our research had the following hypothesis*:* Russian COVID-19 media discourse is a structurally and instrumentally developed and widely represented phenomenon with a significant functional potential and is a linguistic and sociocultural resource. The significance of this study is determined by the fact that the materials of this study systematize and supplement the available information about the cognitive mechanisms of discourse interpretation and the functional potential of sociopsychological mechanisms. The materials of this study also determine the directions of future research, focused on the study of methods of complex linguo-cognitive interpretation of contemporary COVID-19 discourse.

THEORETICAL BACKGROUND

The relevance of the analyzed problem has predetermined its broad consideration in the modern scientific community. For example, when investigating media influence during the pandemic, the authors focus their attention mainly on studies Q25 on framing as one of the main information mechanisms. The emphasis of scientific studies is placed on reviewing and identifying the most popular frames in the global media environment (1), determining the influence of framing in the context of promoting certain risk mitigation measures both in the United States (2) and Russian information spaces (3). It is also worth mentioning several studies examining in detail the rumors, myths and hypotheses associated with COVID-19 and their direct connection to the perceptions of the pandemic. Thus, aspects considered range from climate and natural factors (4, 5) to the dis- and misinformation disseminated in social and mass media sources (6).

Therefore, the theoretical basis of our study was expanded and included several aspects of the intended analysis of COVID-19 media discourse in the Russian Federation. These aspects included political-philosophical, linguistic-publicistic, and sociopsychological aspects. This theoretical framework defined our theoretical-analytical study and the choice of categories for the subsequent analysis of the empirical material.

The concept of discourse plays an important role in our research and is defined as text consisting of communicative language units, sentences and their combinations into larger unities that are in a continuous semantic connection, which allows us to perceive it as an integral entity [(7), p. 8]. On this basis, more relevant to this study, the notion of COVID-19 discourse is defined as a set of speech products, recorded in writing or from memory, which represent meanings that define actions and events in the context of the COVID-19 pandemic [(8), p. 11].

We further identify the political-philosophical, linguistic-publicistic, and social-psychological aspects of this discourse.

The political-philosophical aspect examines the general attitude of the state to the role and functions of the media in the constructed national system. To this end, we turned to a review of the main normative theories of mass communication appropriate for this study:

- Authoritarian theory demonstrates the sociopolitical conditions for the media in which they can only be sustained if they take a loyal position and remain neutral *vis-à-vis* the government or are deliberately used as an instrument of repressive state power (9).
- Libertarian theory assumes that people are free to publish whatever they like but that they are responsible for all the consequences of their activities that violate human rights and the legitimate demands of society (9).
- Social responsibility theory presents the media as an independent and self-regulating resource with important functions in society (especially regarding the objective and pluralistic reflection and the promotion of democratic politics) and with certain obligations to it (9).
- Development media theory advocates media support for the existing regime and its efforts to ensure economic development, which helps society, thereby ignoring freedom of speech and of the press (10).
- Democratic-participant media theory is based on rejection of commercialization and monopolization of private media and centralization and bureaucratization of public broadcasting institutions, established in accordance with the norms of social responsibility, advocating diversity and horizontal communication links (10).

The linguistic-publicistic aspect is the most significant for this study. It consists of the analysis of thematic and lexical diversity in the context of agenda-setting and cognitive mechanisms of discourse interpretation (media influence) applied. This combination directly shapes the main direction of information policy within the framework of a general official or unofficial strategy.

The term "agenda-setting" refers to a set of media products that influence which issues, persons, and topics are perceived as the most important of the day (11). Thus, the media can write about some issues and ignore others by choosing the appropriate emphasis of description and argumentation.

In connection with the linguistic-publicistic aspect, one of the objectives of this study is to identify and analyze the main cognitive mechanisms of discourse interpretation, whose main purpose is to organize the processes of audience perception at an almost unconscious level, focusing its attention on the necessary information in the most appropriate place and time for this resource:

- Framing is used as a technique of forming and activating specific associations in the audience's memory to focus their attention on certain thematic features and thereby influence their subsequent behavior.
- Priming is based on a set of facts that are specifically selected and presented as a coherent image of an event that fits the perception of the media and the needs of the audience.
- Storytelling involves the presence of a certain narrative structure in the text, shaped in such a way that the events and facts described form a cause-and-effect relationship. This description leads the audience to conclusions that are convenient for the media source [(12), p. 218–235].

The sociopsychological aspect of the conducted research is in the specification of the linguistic-publicistic one, as it allows for revelation of certain properties of people's perceptions and cognitive models. Therefore, one of the tasks is to understand the influence of media discourse on COVID-19 risk perception and the level of awareness among people, as well as the forms of this media discourse, including the following:

- Informing is a type of information, devoid of manipulative techniques, about events and phenomena that an audience needs to know.
- Infecting is carried out by mass non-directed transmission of a mood that has a large emotional charge, the intensity of feelings and passions.
- Indoctrinating implies an active and personalized impact of the media source on the audience based on its emotional readiness to receive a certain attitude to action.
- Persuading is the formation of a certain system of attitudes and principles of personality based on both logical evidence (to a greater extent) and sense-value associations.
- Imitating is a sociopsychological mechanism of communication, which provides the reproduction of certain patterns of behavior by the audience, considering its experience and the circumstances of reproduction (13).

The considered theoretical basis allowed us to formulate the necessary categories for the subsequent analysis of the empirical material and organize the structure of the entire study.

METHODOLOGY

During the study, we applied various research methods to understand media discourses and their impact on risk perception [the continuous sampling method, content analysis, critical discourse analysis (with the use of the MaxQGA software package), and statistical analysis].

Empirical data were obtained from various media messages and social media content. To identify media items for analysis, we used the continuous sampling method, which is a multistep approach to capture all occurrences of items of interest to the researcher. In the first step, we selected media messages according to a predetermined principle. Initially, from the variety of journalistic texts, we had to select examples relevant to the object of study chosen in this article, namely the Russian COVID-19 media discourse.

The period of publication of the material in the media was the main criterion for selection. We chose different time periods, beginning with the first report of the COVID-19 pandemic in the media in January 2020 and finishing with the most recent publications at the time of this study (July 2021). Then, it was decided to distinguish these stages statistically, i.e., according to the morbidity dynamics reported by the Federal Service for Surveillance of Consumer Rights Protection and Human Welfare (Rospotrebnadzor) (14). In this study, the empirical material was collected starting from the period with a steady increase in the number of incidents to the period with a steady decrease in the number of incidents (reaching its plateau).

Media popularity was the second criterion. We selected 110 media publications with the highest citation index, i.e., an index of citations between publications, tracing the impact of an article upon later ones (15). This included three media agencies, RIA, Interfax, and RBC (16). Furthermore, 20 articles for the period of the first constraints and 30 articles for each of the waves of coronavirus were selected. This material was selected gradually and analyzed concurrently, so that we could trace and capture all the encountered trends and patterns. By doing so, we managed to obtain and formulate reliable conclusions without addressing an excessive amount of the material. It was also important for us to collect the most popular articles among the audience to be able to more accurately track the effectiveness of the media methods used. Therefore, each item of the empirical material collected has more than 20,000 unique views.

We analyzed the content of the messages by content analysis, a research method used to describe the content of communication objectively, systematically, and quantitatively. The effectiveness of this method was shown in other studies analyzing great amounts of COVID-19 information materials for media framing as one of the main cognitive mechanisms of discourse interpretation (1). Thus, from the received volume of texts, we identified each element corresponding to the subject of our study, revealing the distribution of the selected material into predetermined thematic clusters (danger of COVID-19, coronavirus in Russia and the world, political decisions, introduced restrictive measures, vaccination, and public perception and behavior) considered as the most relevant topics for contemporary Russian COVID-19 discourse and, therefore, acting as semantic units of the research. Determining the presence of the above-mentioned clusters and considering possible differences in their distribution (and consequently their effectiveness), we applied the method of content analysis at two levels: for the abstracts and for the whole text. Thus, this method

allowed us to calculate and characterize the main emphases of information sources (during each research period independently from each other), grouping them into categories suitable for further interpretation.

An important task of this study was to examine the strategies of informational influence of the media. Since sociopolitical practices, discourse, and public awareness on COVID-19 are in a dialectical relationship with other social dimensions and it seems necessary to emphasize this relationship, we turned to critical discourse analysis to characterize models of state-society interaction on COVID-19. In this stage, we also used the capabilities of the MaxQGA software package for the most effective textual research, which allowed us to compare and trace the relationship among features of the emerging COVID-19 discourse in Russia and the sociopolitical circumstances discussed above.

An analysis of public perception of COVID-19 risk was performed based on the available empirical data from 27 sociological surveys conducted among the Russian population during the time period that we selected for analysis. The main source of this empirical data is the non-governmental research organization Levada-Center. Here, we conducted statistical analysis to tackle this issue. On the first stage, this method was useful in adjustment and standardization of parameters of this study so that we could better identify and investigate deviations from the established norm. These parameters were formulated on the basis of the predetermined thematic clusters, encountered trends and patterns in the empirical material, arising hypotheses, and aspects of results interpretation. As mentioned above, the sociological material was also selected and analyzed gradually according to these factors. By doing so, in the second stage, we managed to obtain and formulate reliable conclusions without addressing an excessive amount of the material. As a result, we determined the change in correlation between the selected variables and the exact impact of these changes (where applicable): Russian media policy regarding public awareness and fear of COVID-19, trust in official information, the government and its risk mitigation measures, and public attitudes toward vaccination. The analysis of data from the content analysis, as well as from the Levada Center, allowed us to interpret and develop final conclusions about the influence of discourses on COVID-19 risk perceptions.

RESULTS

Description of Case Study

Any analysis of COVID-19 media discourse is impossible without a detailed consideration of the sociohistorical conditions of its implementation. Therefore, we divided the media discourse into several periods when different risk mitigation measures were implemented. These periods are as follows:

The First Constraints (20 January–10 February)

On January 31, 2020, the first two cases of coronavirus infection were registered in Russia, but even before that, the federal and regional governments of the Russian Federation had already taken measures to prevent the entry of the coronavirus into the country and to contain its further spread. Thus, the first test systems to detect coronavirus were developed and put into production, passenger rail and air traffic was restricted, and a state of emergency was introduced in several border regions.

The First Wave of the Pandemic (17 March–21 June)

This period of the spread of coronavirus infection in Russia can be characterized as a very contradictory phase. On the one hand, the state provided material support to some groups of the population, medical personnel, and affected enterprises. Also, compared to several other countries, the Russian Federation managed to get through the first wave of the COVID-19 pandemic with relatively low rates of infection and mortality. On the other hand, this result was achieved, as in many other countries, thanks to unpopular social and economic policy decisions, such as the introduction of a new concept of "self-isolation", which implied a 6-week period of unemployment (with employer-paid wages) and strict quarantine measures (permit system, administrative responsibility, mandatory use of masks and gloves, etc.). The implementation of such risk mitigation measures led to public protests in several regions.

The Second Wave of the Pandemic (7 November–15 January)

The fall of 2020 was marked by an increase in the incidence of COVID-19. At the same time, widespread vaccination against COVID-19 began in all regions of Russia, which, however, proceeded at a rather slow pace compared to other countries (about 5%) (17).

The Third Wave of the Pandemic (5 June–23 July)

In June 2021, there was a new spike in the incidence of COVID-19 (also due to the spread of the Indian and British strains). In response, the government proposed several new measures to contain and overcome the coronavirus. First, to speed up vaccination rates in some regions, compulsory vaccination for several professions was introduced. This contradicted previous statements by politicians about the voluntary nature of vaccination. At the same time, the population was confused by the lack of alternatives to Sputnik V (foreign vaccines were not registered, CoviVac quickly ran out, and the effectiveness of EpiVacCorona was not confirmed). Second, a new pass system was introduced. This system did not allow people to visit public places without a QR-code. The introduction of this system caused several public protests.

The results of our analysis allowed for making the following conclusions about various periods of reporting about the COVID-19 pandemic.

The First Constraints

In the second half of January and first days of February 2020, particular attention was paid to the mechanisms of media influence and behavioral economics techniques to raise awareness of the COVID-19 risk and influence perceptions of the virus and risk reduction measures.

During this period, the focus of COVID-19 discourse in Russia was on the situation in China and the world (including

evacuation of Russian citizens). Thus, Russian media resources were able to take advantage of this external unfavorable epidemiological situation and, on its basis and without the need to violate the principle of truthfulness of the illustrated picture, to build certain aspects of their own information strategy. Within this agenda, the media sources were aimed at the increasing danger and contagiousness of the new infection. This was realized through frequent references (in about 80% of the articles) to statistics on the number of cases and deaths in China and in many other countries where cases of infection have been registered.

The use of indoctrinating (60%) in combination with priming (44%) while covering coronavirus-related events led to increased awareness of the importance and relevance of the COVID-19 pandemic topic:

- *Scientists from an Australian research institute have successfully grown a new coronavirus. <. . . >Already 132 people have fallen victim to a new coronavirus in China, and almost 6,000 have been infected* (in this example, there is no need to publish negative statistics in an article covering another event; this demonstrates the aim of an information source to create and reinforce the image of the coronavirus danger).

Data from a Levada-Center poll of the Russian population showed that in January only 15% of respondents thought that the topic of COVID-19 was important. However, in February 2020, this number rose to 40% (18). Only 1% of all respondents said they knew nothing about the COVID-19 pandemic (19). Media campaign also influenced people's perceptions of the seriousness of concerns about the COVID-19 pandemic. Initially, most people noted that they had little concern about the COVID-19 pandemic and hoped that the virus would remain localized and would not spread across the country. However, in February 2020, the number of people concerned about the virus rose to 30%. In March 2020, the number of those concerned rose to 44% (19, 20).

It is also important to consider other topics and events that are potentially more controversial and important for the audience and, therefore, have a possibility to be displaced from the central information focus. It should be noted that the selection of these topics was decided to be made in this stage as well as at the stage of the first wave of the pandemic. This approach makes it possible to analyze both the actual goals of media activity at the time and the information base being formed for planned ambiguous events and decisions. Thus, such topics include, first, proposals to amend the Constitution of the Russian Federation (January 15) and to nullify previous presidential terms (March 10, 2020).

If we dwell on each of these topics in more detail, it is worth noting that the message about the amendments to the Constitution, to a lesser extent, implies the implementation of a parallel information campaign aimed at redirecting the audience attention. Thus, this is primarily because the population is highly aware of the proposed initiative (84% of respondents, with 13% considering this event to be the most important during the period under review); it has incomplete understanding (68%) but high approval of the amendments (over 50% for each individual item) (21–23).

On the other hand, the proposal to nullify the previous presidential terms was met with much skepticism (40% of respondents supported this initiative, while 34% were against it; it is also important that only 24% of the respondents were going to attend a referendum on the adoption of these amendments, which, in general, made the legitimacy of the project more difficult) (24). Therefore, it is interesting that despite its ambiguity and importance, this topic was little reflected in the media focus and became the most memorable event for only 3% of respondents ("coronavirus pandemic" 67%, "discussion of the amendments" 13%) (23).

Another media topic was the restrictions imposed in Russia to prevent the entry and spread of the coronavirus in the country. It is also worth mentioning such important issues for the media environment of this period as difficulties in the healthcare system (related both to shortages of certain goods and the first cases of coronavirus infection in Russia). On this basis and with the use of persuading (40%) and framing (56%), the media sources aimed at creating an atmosphere of confidence and offering a solution to the problem; they were forming:

- *Both infected persons are Chinese. They are now under treatment and are completely isolated* (in this example, an information source emphasizes nationality (meaning imported but not spreading infection) and the measures taken on the cases described).

Moreover, this strategy was meant to increase the level of public trust in the government, which, as stated above, was crucial to this period. Thus, this activity stands out against the general background of the danger of coronavirus and is contrasted with other countries (especially China, Italy, and the United States). For this purpose, information sources aimed at extensive coverage of risk mitigation measures introduced by Russia, as well as controlled situation with cases of COVID-19 in the country and the evacuation of citizens from abroad (also underlining the humanitarian aid offered to affected states).

As mentioned earlier, in February 2020, the number of people concerned about the virus rose to 30%, but 17% still rated the risk of COVID-19 as a low level of serious danger (19, 20). All of this was also reflected in the population's trust in disaster risk reduction authorities and their ability to control the risk of COVID-19 (25). The level of trust increased because of media campaigns about successes in Russia to control the spread of the COVID19 virus. Moreover, the high level of trust also corresponded to a high need for security, especially during periods of crisis (26).

The media campaign of the period of the first constraints achieved the desired results. However, there were some major problems caused by this activity that could be avoided. Thus, despite the media reports during this period being characterized by both positive and negative sentiments (47 and 53% respectively), the main focus was placed on the increasing danger and contagiousness of the new infection. On the one hand, because an emphasis was put on the threat to the population, this issue managed to become quickly and firmly embedded in the minds of the audience. On the other hand, this was overflowed

and led to the major increase in people's psychological tension, i.e., a feeling of psychological strain accompanied by discomfort, uneasiness, and pressure (27, 28). Therefore, media activity should have monitored the changing audience perceptions and attitudes, and, by reaching the most appropriate level of its awareness, shifted the concentration onto the second aspect, which is on creating an atmosphere of confidence, as it suggests more diverse and less destructive methods of influence.

The First Wave of the Pandemic

The second phase of the COVID-19 discourse we analyzed includes the period from the second half of March to June. These months saw a significant increase in COVID-19 cases; in addition, a number of risk mitigation measures, ambiguously perceived by society, were introduced.

It is appropriate to analyze and compare the peculiarities of this information campaign, considering the conditions of its implementation, which have been discussed earlier. In March, prior to the period analyzed, 44% of respondents feared contracting coronavirus, 47% thought the healthcare system was ready for the pandemic, and only 24% had little trust in official information (20, 29, 30). Based on this, as well as previous experiences with COVID-19 discourse, media sources continued their own information strategies; and the presented situation can be again characterized as dangerous but contained and controlled by the government. Thus, the main reassuring topics of media discourse during this time were internal decision-making processes, successes, and failures in the fight against the pandemic, and discussion of containment measures and their implementation, mainly in Moscow but also in other regions, such as self-isolation and the attitude of various publicly known personalities toward it.

Regarding the phase of the first constraints, the analysis of the mechanisms of media influence and psychological techniques, among which the quantitative representation differs, again comes to the fore. Thus, the media framing (77%) of that time shows the correctness of risk reduction actions and existing problems, such as the need for and effectiveness of restrictions, which are justified, for example, by an argument to avoid the scenarios of other countries:

- *The rate of coronavirus incidence in Russia has been reduced significantly, said the head of the Federal Medical and Biological Agency, Veronika Skvortsova. "In fact, we have already been at a plateau in the number of new cases for the last week"* (framing also implies using "masking" terms, for example, "plateau").

Media mechanisms and techniques such as framing, priming (22%), and indoctrinating (56%) were also competently used in discussing the increase in the number of infected and deceased people:

- *In early March, WHO declared a pandemic outbreak of coronavirus infection spreading worldwide from China. According to the organization's latest figures, about 750,000 people have already been infected and more than 36,000 have died. The total number of COVID-19 patients in Russia has reached 2,337 (1,613 in Moscow), and 121 of them have been cured.*

Thus, according to the media, the low mortality rate is explained by the fact that healthcare is organized systematically and patients with COVID-19 can receive the necessary treatment. When describing a fatal case, the emphasis is placed on the fact that the patient had comorbidities or was an elderly person. The high morbidity rate is also due to the increased frequency of testing for coronavirus and the reluctance of the population to comply with self-isolation. In contrast to other countries, not only statistics on the number of cases and deaths are reported but also the number of people cured. In arguing the need for quarantine, mortality figures are also provided.

Compared to the period of the first constraints, other psychological techniques, such as imitating (17%), were used for the first time in this period. The following case is an example of it: the head of the government and the chief doctor of the infectious diseases hospital decided to observe self-isolation, and most citizens decided not to violate anti-quarantine restrictions during the May holidays:

- *Most Russians are not planning to violate their self-isolation regime during the May holidays, but to spend time at home or in the countryside* (this example emphasizes a mass positive example of appropriate social behavior).

The results of these strategy influenced people's reactions; however, the desire to legitimize the measures taken by government proved highly ambiguous. Thus, Levada-Center results show that the media campaign was successful in demonstrating the need for risk mitigation measures. In April, 48% of respondents fully approved the COVID-19 containment solutions. In May 2020, the figure was already 66%. This increase demonstrates the success of the information policy (31, 32). Surprisingly, however, the government's rating was 10 points below the pre-pandemic levels (from 69% in February to 59% in May 2020) (33). This can be explained by a combination of reasons.

First, media activities were designed to again emphasize the dangers of the coronavirus. On the one hand, this media campaign was successful in raising awareness of the coronavirus risk. In April 2020, already 57% of respondents said they were afraid of coronavirus infection. Interestingly, the so-called saturation limit was reached shortly thereafter. After this limit, there were no noticeable fluctuations in the increase in the number of people fearing coronavirus (30).

On the other hand, as mentioned above, because of the emphasis on the threat to the population, its overabundance and saturation limit and the high level of public trust in the official information led to the major increase in people's psychological tension. Thus, from January to May 2020, a stable growth was demonstrated by sales of sedatives (+40%), and people have four times more often turned to psychologists compared to the same period of 2019 (27). This negative condition has also increased as a result of the global economic downturn and loneliness as a consequence of reduced social contacts.

This problem has a significant negative impact both on society as a whole and on its political and other components, in particular. For example, depression, as one of the forms of mental disorder, has become one of the main causes of decline in people's ability to work: labor productivity is reduced four-fold, the number of all kinds of accidents increases because of reduced concentration, and the number of sick leaves related to psychological problems reaches 30–50% of the total. As a result, this also worsens the negative factors described above (34). All of this was also reflected in the economic component: for example, as a result of the rush in demand for food and basic necessities, there was a shortage of them. It is interesting to note that in media sources this was, however, framed with the unscrupulousness of some producers exporting scarce products needed in the country.

Social tension developed on this basis (defined as a negative emotional state in society caused by pressure from the natural or social environment) was the third reason for the decreased level of political trust during this period. Critical points in the expression of this tension and consistent protest activity were political [noted in the period of first restrictions, the proposal to nullify the previous presidential terms and amend the Constitution (35)], economic [the crisis drop of GDP by 12 points (36)], and other factors [such as restrictive measures, disapproved by 32% of respondents (32)].

The first and second phases of the COVID-19 discourse demonstrated the unpreparedness of the media leadership to adapt to the new crisis conditions. Despite achieving the planned goals (i.e., raising the level of COVID-19 awareness and the level of public trust in the risk mitigation measures taken), the media failed to minimize the negative impact of the implemented information policy. As noted earlier, the key missing tool was the monitoring of public perception.

The Second Wave of the Pandemic

The peak of the second wave of the pandemic in Russia came in November 2020–January 2021. The focus of media attention was naturally on the rise of COVID-19 and the beginning of large-scale vaccination, with a significant informational role given to Moscow as the leader in political decision-making and the anti-COVID campaign.

The main distinguishing feature of the discourse on COVID-19 during this period was a particularly large amount of indoctrinating (80%) and an overall negative background of the information presented (64%):

- *Protsenko previously reported that a third of patients with COVID-19 die within the first 72 hours of hospitalization. He explained that this is most often due to hypoxia and thromboembolism. Meanwhile, those patients who died later, died in most cases from septic complications. The bacteria that lead to death from these kinds of complications develop rapidly in the infected body* (in this example, indoctrinating is realized through a detailed description of the negative implications of the disease in a publication that does not require such redundant information).

Elements of the discourse elicited a corresponding reaction from the audience. In this case, a parallel can be drawn with the periods of the first constraints and the first wave of the pandemic. Thus, information sources were again aimed at reinforcing the danger of the coronavirus through frequent references to statistics on the number of cases and deaths in Russia and the world. As noted earlier, the number of those who fear getting infected reached 57% in April, and then declined in the following months but peaked again to 64% in October 2020 (37). There are three possible reasons for this fluctuation. First, the saturation limit mentioned above may have been reached as a result of an overabundance of information about COVID-19 in the media. Second, there were relatively few cases of coronavirus during these summer months, which may have had a relieving effect. Third, and more interestingly, news of the first vaccine registration (August 2020) was perceived by a preponderance of distrustful, doubtful, and fearful people (38), which may have had a similar effect on the image of the COVID-19 pandemic.

It was the first Russian vaccine that was offered to the audience as a solution to the looming problem, representing the reliability of the Russian healthcare system and the controllability of the situation. To this end, a special role is played by constraints, which, while continuing to be described as necessary, gradually reveal a shift in functional emphasis toward a negative alternative to the vaccination process being promoted:

- *Earlier, the head of the city assessed the system developed in China, according to which entire neighborhoods were isolated within epidemiological measures taken against COVID-19. According to Sobyanin, it is completely inapplicable to Russia, although it is an "effective method" of combating the spread of coronavirus* (in the context of promoting vaccination, framing is used to describe the effectiveness and potential application of stricter quarantine measures).

This information strategy was to convince audiences, tired of continuing and increasing restrictions, that vaccination is the best choice for them. However, this approach had little effect on the overall vaccination rate, since, first, most people agreed with the introduction of and compliance with COVID-19 restrictions. Thus, compared to May 2020, the percentage of people approving the COVID-19 risk mitigation measures did not change significantly in October 2020 (with most respondents supporting both their introduction and repeal) (39, 40). Second, distrust in the vaccine offered was a greater factor in the population's decision to get vaccinated (38, 41).

Here of some interest is a survey that does not fall within our analyzed time period. According to the experts who took part in it, low vaccination rates among the population (about 5% at the time of the survey) are primarily due to anti-vaccination attitudes of the general population, lack of trust in existing Russian vaccines, and lack of awareness about the importance of vaccination (42). This poll partially contradicts other data in the point about the anti-vaccine stance, and in the fact that the distrust of the population persisted despite the appearance in the media of information about Sputnik V trials (38).

In this context, the survey on the reliability of official information about the number of people infected with

coronavirus is also interesting. While in March only 24% of respondents thought this information was unreliable, in October 2020 it was already 61% (39). We have no evidence on whether this had a negative effect on the adoption of the anti-COVID campaign. However, this reveals a prospective correlation "trust in the vaccine, trust in the government, COVID-19 fear (trust in official information)".

Compared to the previous phases, during the second wave of the pandemic, although an updated but proven strategy was used to legitimize government decisions against the background of an increased coronavirus danger, the main goals of information policy (i.e., promotion of the domestic vaccine) were not achieved. Again, we can observe that the focus of the media was placed on the increasing danger and hardness of the situation, even when attempting to create an atmosphere of confidence [for example, offering the choice between two unpopular and unfavorable measures (vaccination and restrictions)]. As a result, this period also saw an increased number of complaints of anxiety, stress, and other forms of psychological distress (43). The need to tackle this problem was also noted at the Russian legislative level (36).

Therefore, it was considered as promising to use more positive methods of influence. For example, the media should include information about the number of vaccinated (in Russia and the world) in combination with statistics about the number of cured, which will strengthen the positive association "vaccination = cure" and attract the attention of the audience to the mass positive example of behavior (the psychological mechanism of imitating). Of particular importance is also the frequent mention of information about the final stages of vaccine trials, which, according to the analysis of social surveys, many people lack to make a positive decision about vaccination (on the other hand, the publication of such results, for example, for the Sputnik V vaccine turned to be mostly unnoticed).

The Third Wave of the Pandemic

At the time of this study, the third wave of the pandemic was underway. This influenced the selection of the empirical material in the limited period of June-July 2021. As in the previous period, the focus of information sources was on the increasing number of COVID-19 cases and promotion of the need for vaccination. A particularly large number of media reports focused on the situation in Moscow.

The discourse of this period, in comparison with the periods that we described earlier, is characterized by the presence of both common and distinctive features. Common is the use of psychological indoctrinating (68%) and the method of framing (73%). They are devoted, among other things, to accentuating the danger of COVID-19 and forming an image of a difficult but controllable situation:

- *"In any case, if you fall ill and have symptoms of a respiratory infection, gastrointestinal distress, high body temperature, you should stay home and get tested for SARS-CoV2. And to prevent this from happening, get actively vaccinated and continue taking precautions," Pshenichnaya stressed* [in this example, an information source forms the favorable image of risk mitigation measures, emphasizing the negative implications common for a number of diseases and underlining the effectiveness of vaccination against them (even without mentioning COVID-19)].

However, in this direction, there is a noticeable deterioration in audience perceptions (roughly persisting since January 2021): thus, 43% of respondents are afraid of contracting the coronavirus, while 55% are not afraid (44). As in the previous period, there are several possible reasons for this fluctuation: overabundance of information about COVID-19 in the media and relatively few cases of coronavirus during previous months. Here we do not consider the factor of distrust in vaccination, as despite that most respondents were still not ready to get vaccinated, and this figure dropped by 7 points to 55% from its peak (19).

Also, because of this low level of trust and vaccination rate of the population, special attention is paid to the promotion of this aspect. Thus, as noted earlier, to speed up vaccination rates, compulsory vaccination for several professions as well as a new QR-code pass system were introduced. The possibility of avoiding these new restrictive measures and the disease itself is directly related to the readiness of the population to be vaccinated:

- *She added that social monitoring systems and QR-codes, and an order for mandatory vaccination against COVID-19 for 60% of workers in several industries had been introduced because of a desire to avoid strict quarantine*.

In this context, it is interesting to note the extremely rare mention of statistics on illnesses and deaths, which correlates with the interpretation of the data we obtained in the previous stages.

Since vaccination represents the greatest importance in the formed information agenda, it is reasonable to consider the results of surveys in this direction. Thus, as of July 2021, 43% of respondents were going to or had already been vaccinated against the coronavirus; 59% of respondents had been vaccinated to reduce the risk of severe disease; 15% of respondents were vaccinated because of work orders, and 14% were to have full access to all facilities (45, 46). These statistics demonstrate the prevalence of a competently constructed information campaign over artificially created difficulties resulting from the introduction of harsh restrictive measures. In this context, it is also important to note that these measures had an extremely negative impact on the perception of government decisions, whose approval rate dropped to a low of 40% during the pandemic (July 2021) (47).

At the same time, most respondents were not ready to get vaccinated (55%). This figure correlates directly with the prevalence of fear of getting infected (20% difference) and the level of approval of government activities (25% difference), which most likely indicates an individual's commitment either to the triangle "COVID-19 fear (trust in official information), trust in government, trust in the vaccine" or vice versa. It is important to note that the main reason for refusing vaccination was the fear of side effects and the lack of final test results (19).

This is directly related to another incompetent activity of media sources. Thus, the effectiveness and demand for Russian vaccines are demonstrated in contrast to their foreign counterparts. This should especially be avoided, as such "Russia vs. West" discourses have a negative impact on the goal of communicating the need for vaccination. Such discourses continue the narrative of contrasting Russian medicine with its foreign counterparts and lead to additional prejudices and doubts. On the contrary, the complex favorable and accepted image of vaccination should be created, based on which the advantages, importance, and safety of domestic vaccines should be subsequently explained.

DISCUSSION

Our results allow for us to develop recommendations for media strategy in terms of the considered political-philosophical, linguistic-publicistic, and sociopsychological aspects.

The Political-Philosophical Aspect

The Russian information system, in general and in the case of the COVID-19 pandemic, is characterized by the role of the state, which aims to achieve certain economic, political, and social goals and objectives. Such a system makes it possible to achieve planned indicators, which makes the overall information strategy appropriate, especially during catastrophes and crises. Our results show that such a strategy creates a calming and reassuring atmosphere with a proposed solution in the form of the promotion of accepted political decisions (compliance with restrictive measures, vaccination, etc.). On the other hand, the study also demonstrates the need for additional monitoring and control of:

- the index of audience perceptivity and sentiment, which directly affects the state of the public (for example, psychological and social tensions resulting also in economic and political volatility), and
- the index of audience awareness, expressed in attaining a certain level of trust in official information. In this aspect, we also consider it expedient to form the information base not only for the planned but also for the expected actions and events in advance, which helps to prepare the audience for the perception of the expectedly ambiguous information. For example, within a certain period prior to the news about the creation of the first Russian vaccine, information sources should have reported the successes of the health sector, the effectiveness of vaccination in preventing other diseases, etc.

The results also show that discourses against dependency, foreign influence, or the formation of an opposition "Russia-West" should be avoided. Such discourses have a negative impact on the goal of communicating the need for vaccination. Such discourses continue the narrative of contrasting Russian medicine with its foreign counterparts and lead to additional prejudices and doubts. On the contrary, the narrative should be followed to create an image of the benefits, importance, and safety of both domestic and foreign vaccines.

The Linguistic-Publicistic Aspect

Particular attention in this aspect is paid to the mechanisms of media influence. The analysis of these mechanisms has shown the effectiveness in achieving certain goals in the analyzed periods, which determines the legitimacy of its further use. Thus, within the framework of the above-mentioned strategy, framing (63%) plays a decisive role in presenting contradictory information in favor of the correctness of the state policy, as well as in refuting the criticism of foreign representatives. Priming (36%), on the other hand, acts more as a method of shaping and maintaining the image of the spreading and extremely dangerous COVID-19 pandemic and promoting domestic vaccines.

On the other hand, the analysis of the empirical material, however, revealed very few examples of storytelling (1%) (which is also relevant to few cases of imitating applied). This demonstrates the emphasis in information activities on selecting and describing a material about specific non-personalized events and actions. However, perhaps more attention should be paid to consideration and demonstration of human subjective feelings, experiences, and stories, which would make the broadcasted material more lively, understandable, and close to the audience. For example, this method is promising for application with several particularly popular topics including: messages about famous personalities, information about possible future (consequences of coronavirus, and encouraging stories from the first vaccinated people (as an option)).

It is also important to consider the frequent mention by information sources of statistics about the number of cases and deaths, as well as numerous countries in which cases of infection have been reported. Since this technique helped achieve the planned results, we consider it promising to include information about the number of vaccinated (in Russia and worldwide) in combination with statistics about the number of cured, which will strengthen the positive association "vaccination = cure" and attract the attention of the audience to the mass positive example of behavior (the psychological mechanism of imitating). Of particular importance is also the frequent mention of information about the final stages of vaccine trials, which, according to the analysis of opinion polls, is not enough for many people to make a positive decision about vaccination (despite the longstanding but unnoticed publication of these results, for example, for the Sputnik V vaccine). On the other hand, promotion of Russian vaccines should be moderate, not reaching the saturation limit and, consequently, resistance of the audience to the information offered.

Another component of the linguistic-publicistic aspect of information activity is the agenda being formed, in which the main topics were, of course, the growing number of infections and measures being taken to contain the COVID-19 pandemic (restrictive measures, vaccination), including focus on the situation in Moscow. It is also worth mentioning other popular topics that can be effectively used in further information campaign: forecasts about present and possible future pandemics, and possibilities to avoid or easily overcome a disease (with the help of traditional medicine, etc.).

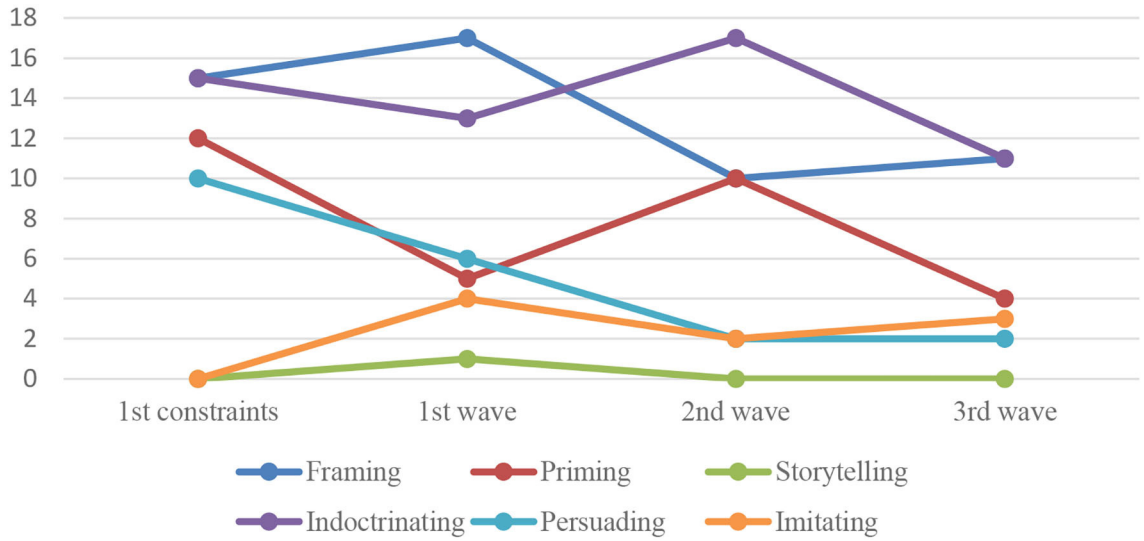

FIGURE 1 | Distribution of media mechanisms over the study periods (number of cases).

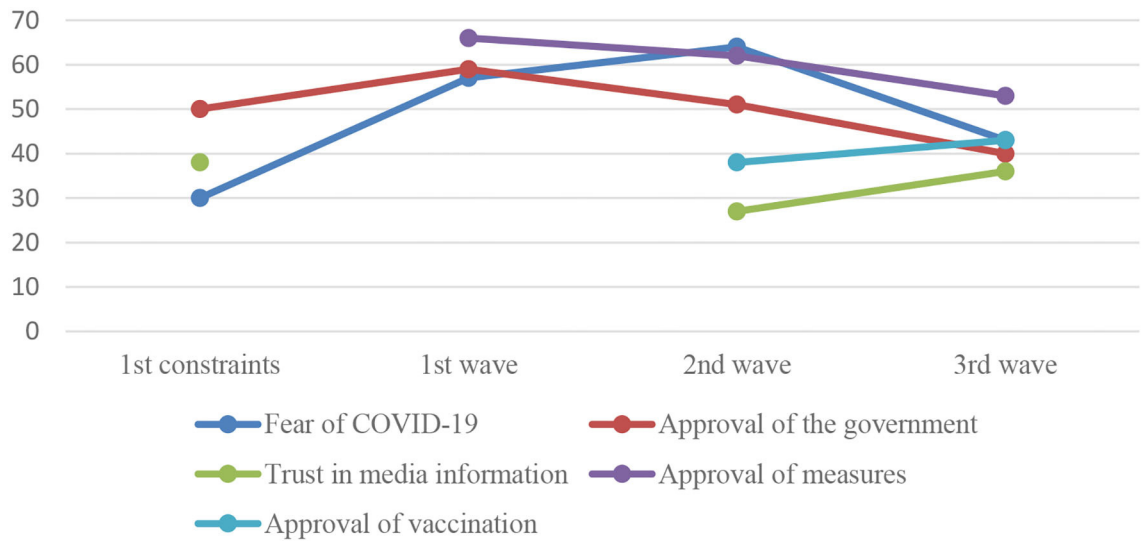

FIGURE 2 | Fluctuation of public perception over the study periods (%).

The Socio-Psychological Aspect

In this aspect, we have analyzed the socio-psychological mechanisms used by the media sources to influence certain characteristics of the audience's psyche and, thus, to popularize certain social actions. The greatest number of examples in the selected practical material includes indoctrinating (66%), often used in combination with priming (publication of statistical data), including for forming an image of a dangerous epidemiological situation and explaining the need for vaccination. Interestingly, the role of indoctrinating can be seen in how, after ignoring the entire group of -psychological mechanisms after the development of the first vaccines and turning to them during the second and third waves of the pandemic, there was an increase in the population's approval of the vaccination.

The next most popular mechanisms were persuading (23%) and imitating (11%), whose function was to increase acceptance of restrictive measures and vaccination. In contrast to indoctrinating, these methods were not used during all of the periods analyzed, which may be due to a lack of media confidence in their effectiveness. On the contrary, as noted above, imitating can be used to draw the audience's attention to a mass positive example of vaccination behavior (with the publication of statistical data) in a new but proven way. An

important addition to the previous recommendation could be the publication of scientifically proven facts and opinions of experts and medical professionals (competent in infectious diseases), also indicating the number of vaccinated (persuading, imitating). All this can significantly increase public awareness of the importance and necessity of vaccination (and gradually more relevant revaccination).

Therefore, this article presents a multicomponent study on contemporary Russian COVID-19 media discourse, which includes both study on and generalization of traditional literature on the problem of mass communication and independent analysis of actual empirical material for the specifics of its political-philosophical, linguistic-publicistic, and sociopsychological functioning. Detailed statistics are presented in **Figures 1**, **2**.

DATA AVAILABILITY STATEMENT

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

AUTHOR CONTRIBUTIONS

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

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Dynamic Conservation in Risk Society: A Case Study of COVID-19 Pandemic Risk in Kashan Qanat Irrigated Agriculture

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In the present age, the world agricultural heritage can inspire agroecology and sustainable agriculture. But various risks have threatened, eroded and forgotten this heritage, so dynamic conservation of this heritage is essential. In this study, "Qanat Irrigated Agricultural Heritage Systems, Kashan, Iran" which has been registered worldwide in the face of corona pandemic risks has been selected as a case study. In this qualitative research, in addition to field observations and documentary studies, 25 in-depth interviews and 39 semi-structured interviews with experts and key informants was done and grounded theory and content analysis have been used. In the process of interviews and analyzes based on "risk society theory", risks and wicked problems and related solutions have been identified and finally based on cultural theory, "clumsy solution space" has been summarized and presented for dynamic conservation. Based on the findings of this study, paying attention to a kind of reward for ecosystem services, developing online sales of agricultural products in rural areas of Kashan and also creating twinning with similar areas can help solve wicked problems. Also, paying more attention to the regulations for the protection of qanats, as well as the laws for home business insurance, can strengthen sustainable development in this rural area. Due to the wide range of different dimensions of agricultural heritage, it is suggested that in future research, clumsy solution spaces for each of these dimensions be created and developed separately.

Keywords: agro-biodiversity, traditional agriculture, GIAHS, COVID-19 pandemic, sustainable rural development, agroecology

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INTRODUCTION

The persistence of agricultural heritage systems reflects the ability and ingenuity of farmers who have passed on their experiences from generation to generation in order to adapt to unpredictable environmental changes (1). It should be noted that such environmental and cultural treasures are of fundamental value for the future of mankind. The guardians of these systems show a lasting commitment to the protection and respect of nature, ancestral agriculture and its valuable treasures, although modern agriculture continues to threaten sustainability and heritage.

Due to the special climatic conditions and history of agricultural civilization, Iran has many examples of agricultural heritage. In the introduction to the Persian translation of the book Agroecology, Gliessman wrote that traditional Iranian farmers are famous for their ability to design and manage sustainable agroecosystems and are among the first agroecologists. The vast knowledge

of these people in the protection of water resources, agriculture in arid areas, irrigation systems, domestication of crops and livestock, which are just examples of their unlimited capabilities, have been used for years as models of wise management of natural resources in restrictive conditions (2). So far, three examples of systems related to Iran's agricultural heritage have been registered globally in the important global agricultural heritage systems (GIAHS). Iran has registered the "Qanat Irrigated Agricultural Heritage Systems, Kashan" in 2014, the "Qanat-based Saffron Farming System in Gonabad" and the "Grape Production System in Jowzan Valley" in 2018, and the other three systems Estahbanat Rainfed Fig Orchards Heritage System, Ancient Traditional Gardens of Qazvin and Traditional Walnut Production Systems in Tuyserkan also Proposed. None of Iran's agriculture heritage systems has yet had a comprehensive and effective action plan for dynamic conservation, and various components of these systems, including indigenous knowledge and prevented the formation of dynamic conservation of agricultural heritage in recent years is the existence of various and emerging hazards, which are addressed in this article with approaches related to the theory of risk society. However, after the advent of the COVID-19, global attention turned again to the theory of risk society (3). At the same time, the effects of the Corona pandemic in the fields of agriculture and agroecology were considered (4, 5). In this study, in addition to a general study of the impact of risk community parameters on agricultural heritage, a special look has been taken at the dangerous effects of COVID-19.

Agricultural Heritage

Traditional agriculture in diverse environments has been created by indigenous peoples and local communities and has been shaped by the dynamic interaction of people and nature over time. These landscapes are rich in biodiversity, agricultural biodiversity, cultural and moral values and embody human genius (6, 7). Agricultural heritage systems produce food and human needs and provide their livelihoods locally and nationally, and are intelligent agroecological systems that benefit from the management and conservation of biodiversity and soil and water resources, and provide a variety of ecosystem services. Agricultural heritage systems and landscapes represent the human heritage on the planet and are evidence of the maturity, creativity and innovation of human beings in the dynamism and evolution of agroecological methods and the sustainable management and exploitation of nature. Ensuring sustainable food and livelihoods for indigenous and local communities, preserving natural ecosystems and basic resources, protecting animal and plant biodiversity, increasing the resilience of human communities to climate and environmental stresses, educating on issues related to sustainability and resilience to global change And the creation of visual beauty can be considered as one of the most important functions of agricultural landscapes and its ancient and sustainable systems (6, 8). Agricultural heritage patterns are an evolved, multilayered concept that connects indigenous and local communities, the environment, culture, history, and indigenous knowledge, and depicts the interaction between man and nature in a natural context. Agricultural heritage landscapes and traditional systems around the world are rapidly deteriorating due to modernization and changes resulting from unsustainable technologies and economic methods. Currently, the tangible and intangible values of agricultural heritage are identified and registered by UNESCO as Cultural Heritage Landscapes and the World Heritage List (GIAHS), and various conservation programs are proposed to protect them.

According to the FAO (2002) definition, the world's most important agricultural heritage systems (GIAHS) are "Remarkable land use systems and landscapes which are rich in globally significant biological diversity evolving from the co-adaptation of a community with its environment and its needs and aspirations for sustainable development".

Dynamic Conservation

Important global agricultural heritage systems are representations of the many traditional sustainable agricultural systems that have historically spread throughout the world and are preserved and protected by indigenous and local communities. The persistence of these systems in successive eras reflects the ability and ingenuity of farmers who have used a variety of strategies to adapt to environmental and climatic constraints and their unpredictable changes and have passed on their experiences from generation to generation (1) and Have left treasure of valuable culture for the future in this process; Thus, examples of GIAHS are considered as the centers of life and growth of agricultural heritage and are an inspiring source for sustainable agriculture in the new era. Since the richness of knowledge and experience related to sustainable resource management is evident in many important global agricultural heritage systems, it is essential to consider the protection and care of these systems as national and global treasures, while providing ample opportunity for growth and provide their dynamics (9, 10). In practice, the concept of—ample opportunity for growth and dynamism- inspires the patterns of dynamic conservation that are being designed today for each instance of GIAHS.

The concept of dynamic conservation is rooted in the idea that conservation is achieved not only in monuments, museums and untouched forests, but also in the daily lives of indigenous communities and according to their needs and expectations. GIAHS are a living and dynamic system that evolves over time, and absolute protection and prevention of any change and dynamism in these systems will reduce their capacity to adapt to new conditions, and this will lead to vulnerability and deterioration of agricultural heritage systems. In fact, over time, social, economic, and environmental needs change, creating a spirit of innovation and creativity, enabling individuals and communities to preserve traditional practices, products, and services and adapt them to new conditions. This process does not diminish the importance of agricultural heritage, and in this way, the fundamental values of historical systems and processes are created. For this reason, one of the pillars of strengthening GIAHS in each region is the capacity for innovative, product development, culturally identifiable services, handicrafts and local food, ecotourism, agricultural tourism, as well as a thriving market (9).

However, in many parts of the world, despite ongoing conservation efforts, many agricultural heritage sites and their associated ancient systems are affected by the negative consequences of modern agriculture, rapid urbanization, the quality of economic growth, and the weakening and degradation of basic agricultural resources. Water, soil, and biodiversity are at serious risk (11, 12). Such conditions further highlight the need for dynamic conservation of agricultural heritage systems.

Rich biodiversity as well as cultural diversity have historically been intertwined with agricultural heritage, and while they are considered the most important tourist attractions, they have inherently led to the dynamic conservation of these systems (13).

Risky Society

The expansion of attention to society relations and risk is largely due to the theory of risk society proposed by the German sociologist Ulrich Beck. Despite his opposition, over time he found many like-minded people in various disciplines, including the environment (14). In most of his works, especially in his first work, Risk Society, which may be called his most influential book, Beck has argued that in the transition from industrial society, risk society is taking shape (15–21).

In the decade following the introduction of this theory, Beck and Giddens criticized, improved, expanded and integrated its various dimensions, and finally more development and explanation was achieved in the field of this theory, and some parameters were proposed about it (22, 23). The passage of time has provided numerous evidences and examples of this theory that are consistent with his theory. These examples and events began with the Chernobyl explosion, and today, with the advent of the COVID pandemic, the problems and turmoil created for human societies are being analyzed by some analysts based on the theory of risk society.

Although there are hypotheses about the role of humans in the emergence of the COVID-19 virus, if we ignore these hypotheses, the current human life style and lifestyle is such that it accelerates the progression of the virus, the amount of damage has increased and made human society vulnerable. This vulnerability has also paved the way for the application of risk society theory in these circumstances. In fact, phenomena such as the expansion of complex socio-economic communications through the most advanced means of transportation, high population density in metropolitan areas and massive trade in goods and materials around the world, which on the one hand shows human genius over other living things; It has caused a widespread and rapid spread of the virus among humans and has endangered the future of mankind. Corona is not limited to poor countries and has so far spread to more than 200 countries and its socio-economic consequences have affected almost all regions of the world; as the aftermath of phenomena such as the 2008 economic crisis and ISIS engulfed the entire world. Finally, it is interesting to note that among the warnings Beck gave more than two decades ago, in addition to referring to nuclear accidents and terrorist threats, he warned of a plague that would cause much more serious problems than we thought (17).

Qanat Irrigated Agricultural Heritage Systems, Kashan

An qanat as shown in **Figure 1** is a collection of several wells and an underground water channel that, with a slope less than the slope of the earth's surface, the water in the layer (or layers) of the highlands of the earth with the help of gravity and Without using any extra energy, it collects with natural flow and brings it to lower points. In other words, the qanat can be considered as a kind of underground drainage through which the collected water is brought to the surface of the earth and is used for irrigation or drinking (23, 26, 27). This ancient technology was more prevalent in the Middle East, especially in Iran, and spread to North Africa, Spain, and South Asia. This method of water management can be considered as a sustainable method that can play a prominent role in water scarcity in the modern world (28, 29). There are more than 27 terms for qanats that are used in different countries: "Qanat" and "Kariz" in Iran, "Falaj" or "Aflaj" in Oman, "Kariz" or "Karez" in Afghanistan, Pakistan, Azerbaijan and Turkmenistan, "Ain" in Saudi Arabia, "Kahriz" in Iraq, "Kanerjing" in China, "Foggara" in Algeria, "Khattara" or "Khettara" and "Rhettara" in Morocco, "Galleria" in the Spain, "Qanat Romoni" in Syria and Jordan, "Foggara" and "Khettara" and "Iffeli" in North Africa, "Galerias" in the Canary Islands, "Mambo" in Japan, "Inguttati" in Sicily. Some other terms used for qanats are: Ghundat, Kona, Kunut, Kanat, Khad, Koniat, Khriga, Fokkara, etc. (30).

Numerous examples of the longevity and stability of the qanat are available. For example, according to some researches, Ghasabeh (Gonabad) qanat in Iran has a stable flow for about 2,500 years. In addition, according to the scientific interpretation today, the qanat is in line with the approaches of "smart agriculture to climate" and at the same time, with climate change, regulates its discharge so that resilience is maintained and the pressure is more than Environmental capacity should not be applied to the land where the qanat is located. Throughout the arid regions of Iran, water for permanent habitat and agriculture was supplied by the ancient qanat system from groundwater aquifers in valleys and the conduction of water along underground tunnels by gravity, often over miles. The traditional management system still enables the equitable and sustainable distribution and distribution of water in these areas. The qanat system provides exceptional evidence of cultural traditions and civilizations in arid desert areas. These features led the UNESCO World Heritage Committee to unanimously declare the 11 qanats of Iran a World Heritage Site.

The names of registered qanats, "Ghasabeh Gonabad, Baladeh Ferdows, Zarch Hassan abad Yazd, water mill Mirza Nasrollah Mehriz, Jupar Kerman, Akbar abad and ghasem abad Barvat Bam, Moon in Ardestan, Vazvan and Mozd abad of Isfahan and Ebrahim abad of Arak" in six provinces Razavi Khorasan, South Khorasan, Yazd, Kerman, Markazi and Isfahan are included and of course it should be mentioned that Kashan Fin Garden, which is irrigated through the Sulaymaniyah qanat spring, has also been registered by UNESCO (25). Water is supplied to a large number of Iranian gardens by qanats, and the risks that threaten qanats actually threaten Iranian gardens (26).

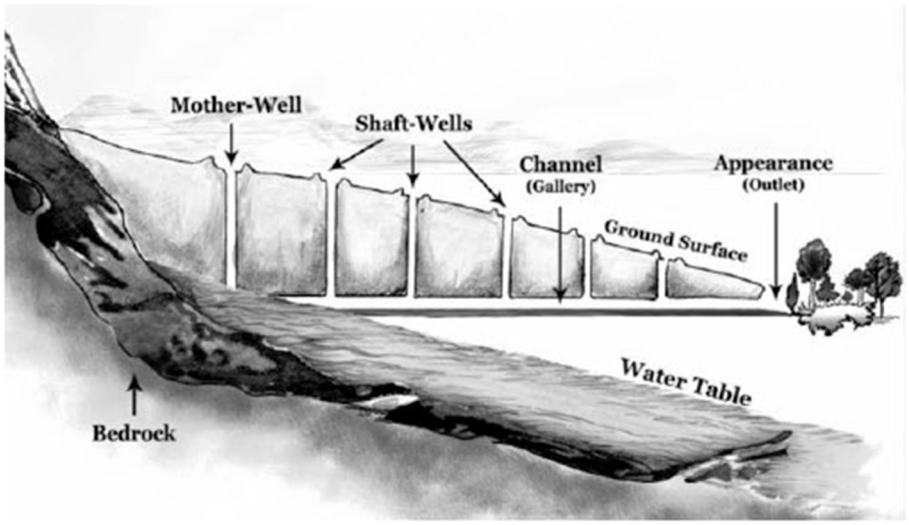

FIGURE 1 | Profile of a typical qanat (24, 25).

Despite the fact that qanats have historically formed very large oases, today they are under severe threat due to socio-economic pressures and technological changes. Of course, the special value of the qanat for the sustainable extraction of water has been considered by the United Nations and some other institutions, and they support and encourage the rehabilitation, protection and maintenance of the qanats in various ways (31).

One of the oldest qanat-based civilizations in central Iran as shown in **Figure 2** is the 7,500-year-old Silk civilization, the remains of which are located in Kashan and near the Fin qanat (Sulaymaniyah spring), and research shows that the Fin qanat is the result of turning the spring into the qanat has been used by the inhabitants of this region throughout history, and of course the conversion of a spring into an qanat is one of the hypotheses about the emergence of the first qanats (24). This region was registered as an important world agricultural heritage in 2014, and the complete file of Kashan GIAHS under the title "Qanat Irrigated Agricultural Heritage Systems, Kashan, Iran" has been published by the FAO and provides valuable information about the features of global interest (25).

Throughout history, the genius and empowerment of the local community has used a variety of tools to deal with risks such as water scarcity, and carpet weaving is a prime example of this. Kashan carpet has a world-wide reputation. Carpet weaving has been one of the pillars of Kashan GIAHS resilience and prosperity. Throughout history, whenever the qanats of Kashan faced water shortages and naturally the activity and income of farming decreased, the focus of the people of this GIAHS on the art of carpet weaving increased. In fact, carpet weaving was done with raw materials that were available from previous years or purchased from other regions, and to some extent, the reduction of agricultural income was compensated. In addition, the cost of maintaining the qanat has been high in some areas, and the income from carpet weaving has also helped maintain the qanat. Especially at times when the qanat was damaged due to natural disasters such as floods and earthquakes, and its repair required higher than usual costs. In the Corona pandemic, carpet weaving has flourished at home due to the increase in housekeeping and the decrease in many incomes in this area. Of course, the purchase of carpets has decreased and problems such as carpet weavers' insurance are raised, but in general, carpet weaving has also played its resilient role in this period of the history of this GIAHS.

At the end of the introduction and after introducing the basic and introductory concepts, it is necessary to emphasize: Based on the literature review, it was found that many studies on dynamic conservation of agricultural heritage in rural communities have identified and explained their components and relationships. In fact, the need to address the concept of risk became apparent. In other words, there is a gap in addressing the concept of risk in the field of dynamic conservation against wicked problems, and in this research, an attempt is made to fill this gap to some extent.

Also, the obvious innovation of this research is in applying the "risk society" approach in dynamic conservation in the face of complex problems. On the other hand, given the emerging risks associated with the Corona pandemic that threaten sustainable rural development, it is necessary to pay attention to such new risks in such areas and has an innovative aspect.

The question of this research is what are the solutions to face the risks and wicked problems in Kashan GIAHS as a predominantly rural area during the Corona pandemic? Some of these problems generally hinder sustainable development in the region, while others are directly related to COVID-19. In order to better understand the problems and their solutions, it is necessary to understand the different dimensions of agricultural heritage and also to identify the relationship between the risk society, dynamic conservation and GIAHS, which have also been addressed.

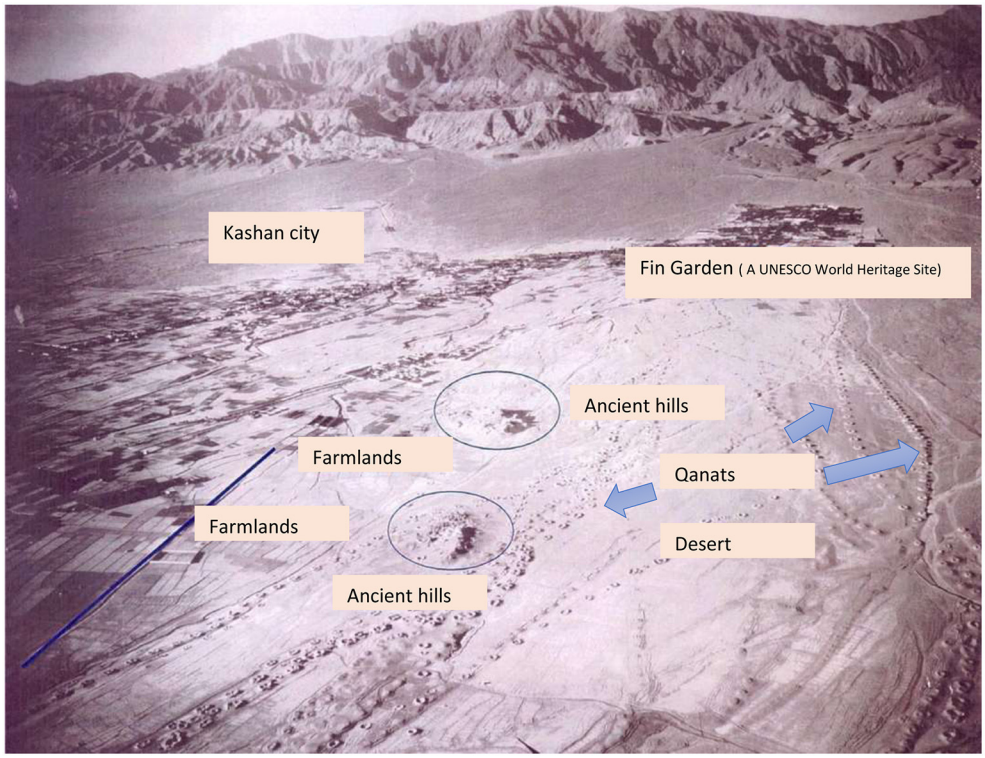

FIGURE 2 | Aerial photograph of Kashan region around 1937 (25, 32).

To achieve the goals of this study, it is necessary to know, study and examine the situation of a rural community as a case study. This area should be a rural area with valuable agricultural heritage. Such an area needs to be relatively stable throughout history and to be exposed to new risks in the present era. According to the definition provided by GIAHS, such areas have the mentioned characteristics, it is enough that this area is in a significant position in terms of exposure to corona-related risks. According to the explanations provided in the sections "Qanat Irrigated Agricultural Heritage Systems," and "study area" Kashan GIAHS was selected for this purpose.

MATERIALS AND METHODS

Study Area

Kashan GIAHS as the study area in this study is located in the north-south corridor of Iran and on the way from Tehran to Isfahan and part of the southern cities of the country. Traffic in the area has increased, which has also increased the problems associated with controlling the outbreak of corona in the area. Kashan GIAHS is located in a large area and has 65 villages that have been divided into 4 parts in terms of country divisions. **Figure 3** shows the location of Kashan GIAHS.

"Qanat Irrigated Agricultural Heritage Systems, Kashan" is located in Isfahan province and the hot and dry region of Iran. This region is one of the oldest human habitats in Iran and is known as one of the roots of qanat-based agriculture in the world. The selection of agricultural and horticultural species in this region is based on water use efficiency and quality. Indigenous knowledge of qanat management and water distribution in this region is very rich and is a clear example of the ability of the local community to participate in the management of water and soil resources. This management system has various economic, legal, environmental, technical and social dimensions, and its flexibility and dynamism have guaranteed the sustainability of this race for centuries. The dominant agricultural system in the region is family agriculture and livelihood, and related activities in this region are directly and indirectly related to the qanat.

Due to the importance of the qanat in this region, special culture and beliefs have been formed around the qanat, and one of them has been the determination of gender for the qanats. In this arid region, agricultural biodiversity, which is one of the pillars of agricultural heritage, is very rich and no specific product has been introduced as the main product or the most important product. One of the remarkable visual effects in the landscape of Kashan GIAHS is the flower gardens of Mohammadi red rose, which is very famous in the region. Roses and essential oils of these flowers also have significant sales in domestic and foreign markets. The attractiveness of these flower gardens is such that during the tourist season and during the relevant festivals, many tourists visit the flower gardens of Ghamsar region. In GIAHS Kashan, other agricultural systems that are not based on irrigation with qanats are also mentioned, of which the "Chale Sombak" is a clear example. In this arid area, farmers dig

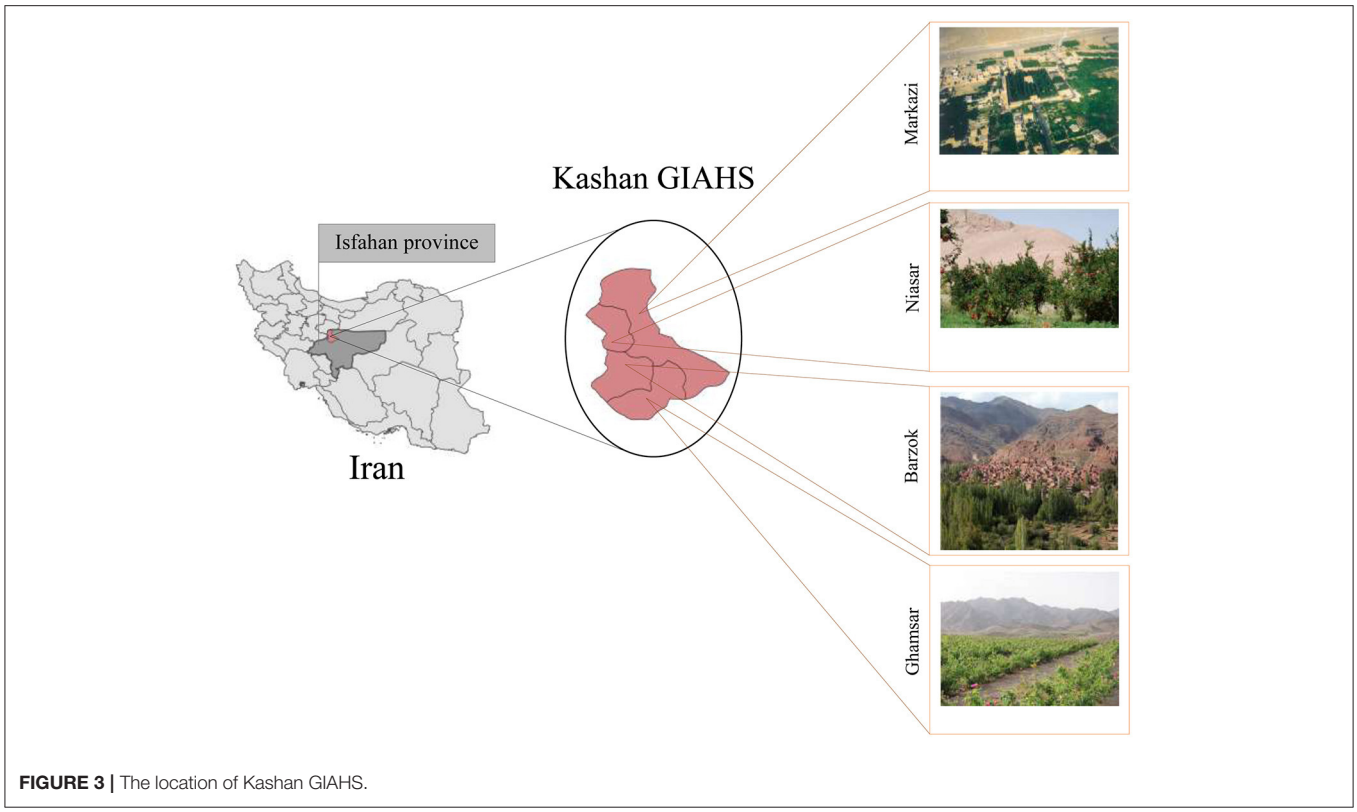

FIGURE 3 | The location of Kashan GIAHS.

holes in the sand dunes to approach groundwater and use soil moisture to grow various crops, especially watermelon (25). In Kashan GIAHS, geographically, three areas can be considered desert, foothill and mountainous, the highest villages are located at an altitude of 2,500 m and the lower villages are located at an altitude of 1,000 m above sea level. Altitude difference is one of the factors in the formation of agricultural biodiversity and is one of the best criteria for biodiversity zoning (33). This feature of altitude difference has caused more enrichment of agricultural biodiversity in Kashan in a relatively small area.

It is about 75% of the water requirement in Kashan which are supplied from qanats. This signifies the critical role of qanats in the food security of the region even today. In total, about 100,000 tons of field crops are produced in Kashan, in an area of about 7,350 hectares. The total production of fruits in the region amounts to 32,000 tons, in an area of about 7,000 hectares. There are about 20,000 farmers in Kashan, who are linked to qanat directly or indirectly. Besides directly contributing to food security by providing reliable irrigation water, qanat irrigated agricultural heritage system helps to sustain food security through retaining and protecting the resource base and being source of fresh water.

Indigenous and important biodiversity species, high value crops, fruits and trees have developed and survived thanks to Qanat technology: the pomegranates, rose flowers, almonds, plums, walnuts, apricots, vines, pistachios, quince, olives, apples, cherry, figs, sour cherry, saffron, pears, peaches, and date plums. There are about 240 selected plant species recorded from the Kashan region. One of the most important varietal biodiversity cherished in the history is the pomegranate, called the "fruit of paradise," "the seeds of hope," whose legends and myths were told and transferred from generation to generation. Last but not least, allowing to growing plants in a dry area has permitted to breed local sheep races and shaping habitats for 25 different species of fish, crabs, aquatic plants, invertebrates, and aquatic insects (25).

Research Method

This research has been done with a qualitative method and the steps taken are shown in **Figure 4**.

The first two phases of this study were conducted in parallel: the "Studies and Cognition" phase and the "Visits" phase. During 5 trips and field studies from 2018, area identification, field visits, completion of authors' observations and initial interviews were performed and at the same time reviewing the backgrounds related to this research, library records and studies, articles and reports, done. The results of the studies identified some of the issues that should be followed up during the visits, and during the visits, there were encounters with issues that needed to be further studied. Also, in this stage, the initial interviews were conducted in the form of in-depth interviews with 25 people, which provided some of the ideas needed to organize the studies and design the principles of semi-structured interviews in the later stages of the research.

Then, the issues raised in this study, including the risks related to Qanat Irrigated Agricultural Heritage Systems, Kashan, and experiences and ideas of dynamic protection against these

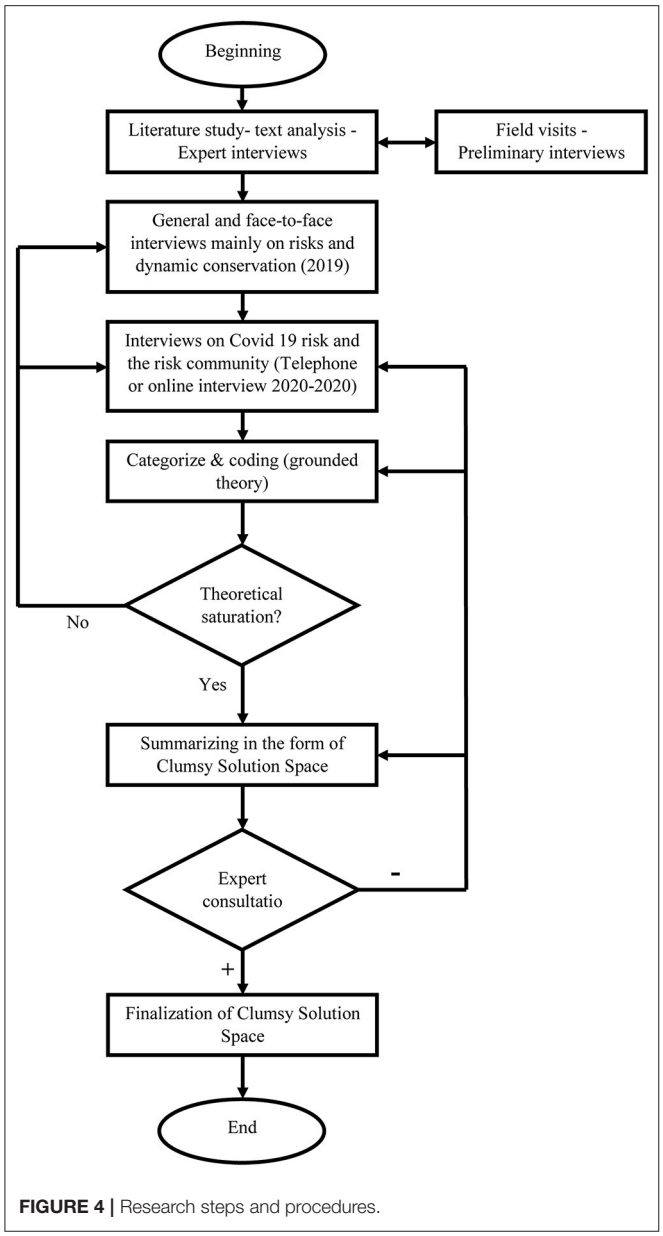

FIGURE 4 | Research steps and procedures.

risks, were discussed through semi-structured interviews with key informants. The interviews took place in two phases, one phase which was mainly about risks and dynamic protection before the corona pandemic in the first half of 2019 as a face-to-face interview, but the second phase which was mainly related to the corona pandemic and dynamic protection against it. During the years 2020 and 2021, due to the quarantine conditions of Quid 19 and the prohibition of traffic, telephone or video calls were made. It should be noted that the location of Kashan GIAHS in the busy south-north route of Iran caused the prohibition or restriction of traffic during the second phase of this study in this region.

The snowball method was used to understand the complexities of the issue and how to form a dynamic conservation against the existing risks, especially the COVID-19 pandemic, through leading farmers and key informants in the form of semi-structured interviews. Grounded theory was also used in this study as in similar studies (34, 35). The initial interviewees, who were 14 key informants, were searched and introduced in several ways. The channels of introduction of these interviewees were: Kashan city governmental agricultural department, famous qanat and agriculture experts in Iran, in-depth initial interviews conducted in the first phase of the research, review of virtual social networks in the villages of this region and village councils. Finally, 39 key informants from the local community were interviewed to reach the theoretical saturation stage according to the grounded theory. These interviewees covered 34 villages in the region, and in practice all four main regions of Kashan were also covered.

After fully organizing the results of the interviews, the results of content analysis were used to summarize the research and create a space for clumsy solutions. The main output of the research was presented.

RESULTS AND DISCUSSION

Dimensions of Agricultural Heritage From Different Perspectives

Based on the first phase of the research, including documentary studies and in-depth interviews with experts, different dimensions of agricultural heritage were identified based on different perspectives. These dimensions are summarized in the **Figure 5**. This summary has paved the way for a better understanding of the status and roots of Kashan GIAHS for the next stages of research.

In recent decades, with the introduction of the concept of sustainable development in international circles and given the position of small and family farmers in the production of food needed by the people of the world, attention to the importance and necessity of protecting agricultural heritage systems and landscapes has increased. Traditional and family agriculture and with the aim of preserving and improving the functions and values of this agricultural method and in order to achieve the goals of sustainable development, some international organizations focused on the issue of agricultural heritage and in the meantime as shown in **Figure 5**. The Food and Agriculture Organization of the United Nations (FAO) and the United Nations Educational, Scientific and Cultural Organization (UNESCO), in cooperation with the International Council on Monuments and Sites (ICOMOS), can use various mechanisms to identify, register and dynamically conserve this precious human heritage. From this precious human heritage in Iran, the whole region of Kashan has been registered through GIAHS, and in addition, the Finn qanat garden in Kashan has been registered as one of the Iranian gardens by UNESCO. From another point of view, agricultural heritage is divided into two parts, studied and researched, and not researched. Kashan's agricultural heritage has been researched in the way of registering riots as well as other studies and research on the characteristics of this riots is ongoing. Kashan GIAHS has been studied as an urban and rural area

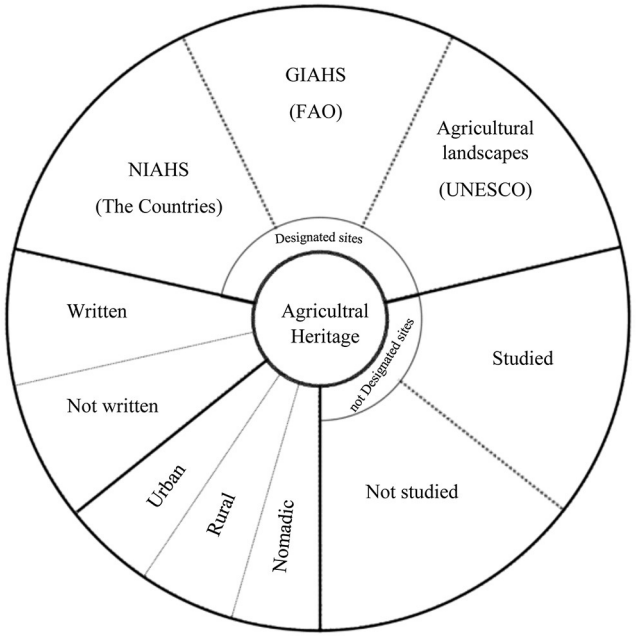

FIGURE 5 | Different dimensions of agricultural heritage.

and its urban gardens can be considered as urban agricultural and agro-ecological heritage. Although in Iran and in Persian, numerous sources of agricultural heritage have been published or manuscript sources from the past centuries that have not yet been published, specifically and focused on the Kashan region of written agricultural heritage in this study and research Previous study has not been found, and in fact other Persian books and teachings and skills that are now in the memory of older farmers or passed down from generation to generation can be further studied.

Of course, it should be noted that a very valuable and complete source in 30 chapters about the excavation and management of the qanat in 1010 has been written by the Iranian author Hasb Karaji. The title of this book is "Extraction of Hidden Waters". Based on the findings of this study and based on interviews with national and local experts, this book, despite addressing the practical details, has not been widely used by people who have been digging and managing the qanat. One reason for this is that the book was written in Arabic, which was the scientific language of Iran at the time.

Pillars and Relationship of Risk Society, Dynamic Conservation, and Agricultural Heritage

In the previous sections, the various sections related to the concepts of risk society, dynamic conservation and GIAHS were explained in **Figure 6**. Based on the first phase of the research, including documentary studies (22, 36, 37) and in-depth interviews with experts, the appropriateness of this the sections are also summarized together. The new conditions that arise in the risk society have four important characteristics: (1) the sources of support that were used in the past are threatened today; (2) people no longer trust science and expertise; (3) hierarchy and status between lay people and experts are expected to decline; and (4) people are more informed, confident and knowledgeable (38). We consider the problems that arise in such situations as wicked problems. As Ritte and Webber described such problems in 1973, their nature is different at any given time and place, they are dynamic, complex, and multidimensional, they themselves are the result of problems, and they create other problems. And they are not solvable with a particular knowledge, and a set of knowledge and skills is needed to deal with them. In this type of problems, it is not possible to reach a solution by trial and error and generalize it to other situations, because due to the dynamics of these problems, the conditions and results of actions are constantly changing.

The dynamic conservation approach seeks to improve the overall performance of the agricultural heritage system, inspired by nature and based on agroecological processes, indigenous knowledge related to adaptation management and social learning processes, and thus bring greater prosperity to society. It should be noted here that the overall performance of the system should be enhanced without undermining the cultural identity, values of the local community, social relations, agricultural biodiversity and the ecological integrity of the system. This situation can be achieved if there is public awareness, a real and conscious agreement between the local community and other stakeholders and the cultural considerations of the respective communities (9). In this regard, a methodological framework for dynamic protection of agricultural heritage systems has been designed and presented through the FAO, and this framework covers various dimensions of agricultural heritage (9).

Designing dynamic conservation action plans requires an in-depth understanding of the complex social relationships, social impact and structure of local community social institutions. The scope includes several issues including ethnicity, local responsibilities, settlement characteristics, group membership, identity, gender relations, leadership, political institutions; Cultural contexts around the world, such as language, values, rights, knowledge, aesthetics, methods of production, distribution and allocation of labor, include technologies, all of which will have socio-ecological implications for the systems concerned (39, 40).

For dynamic conservation, the use of pre-determined and bottom-up programs will not be useful and it is necessary to formulate a dynamic protection action plan and implement it, from a suitable platform for partnership and formation of communication and dialogue between various stakeholders, including national trustees, National agricultural heritage systems (NIAHS) and customary owners of agricultural heritage systems should be used and in improving this process, educational institutions and non-governmental organizations will also play an effective role (9). Dynamic conservation action plan based on the analysis of threats and challenges in an agricultural system, review of national and local laws and policies affecting the various dimensions of a crop, existing strategies and actions and future plans to be implemented by local

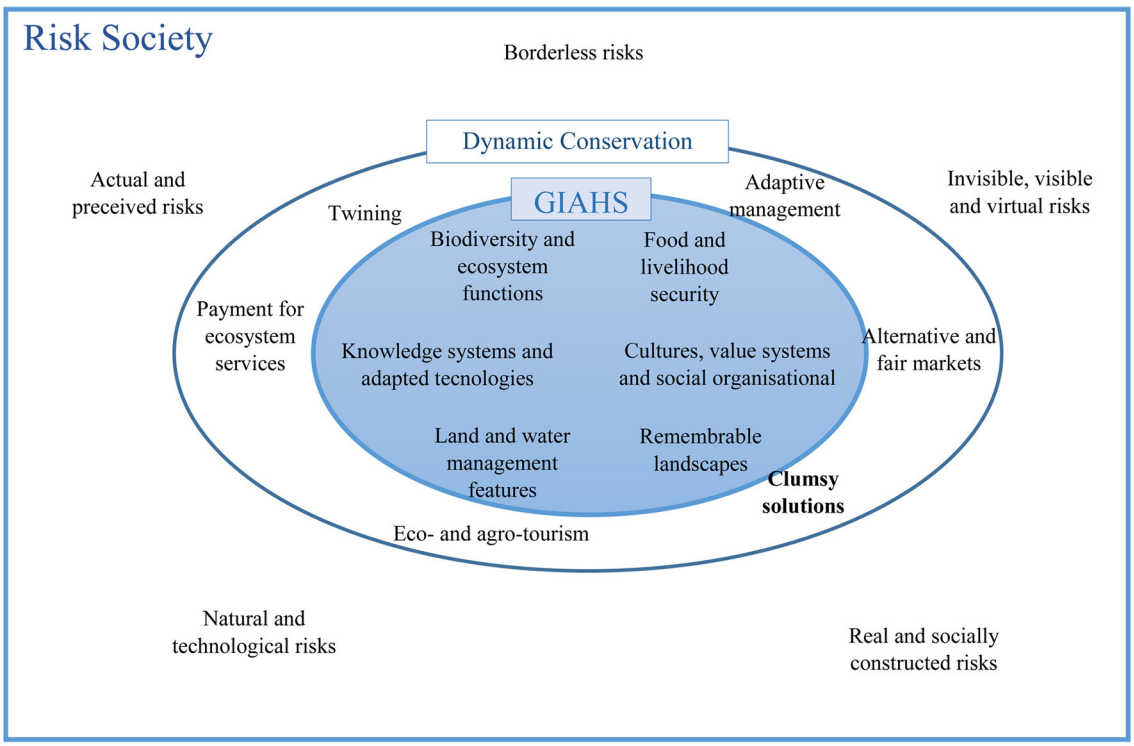

FIGURE 6 | Risk society, dynamic conservation, and agricultural heritage.

and national stakeholders to enhance conservation Dynamically executed, compiled. Therefore, in this study, key informants of the local community have been the main basis for recognizing and developing dynamic conservation measures.

Clumsy Solution Space

In the face of wicked problems, clumsy solutions are often suggested, which in this study, in addition to other elements of dynamic conservation that have been used in research and other experiments, have been given special attention. The application of these solutions has been increasingly reinforced by empirical evidence (41, 42). They are used for adaptation and development in society (22, 43, 44). A clumsy solution is a set of solutions that combines different perspectives and solutions in a flexible and creative way. The perspectives commonly used in this collection are based on cultural theory and include three different perspectives. Following the egalitarian approach, solutions to wicked problems can be found by promoting a decentralized and self-sustaining society characterized by high empathy and collective intelligence to protect fragile nature. Individualists, on the other hand, address wicked problems by facilitating individual responses such as creative competition and technological innovation. They believe that nature is flexible, while the hierarchy sees the need for stronger regulations and considers nature controllable (42, 44).

In order to face the various risks that have emerged with the advent of COVID-19, some general paths have been formed around the world, such as greater adaptation to technology, especially effective technologies in telecommuting, online sales, etc. Solutions in the local community of Kashan GIAHS has been formed, which has been identified through semi-structured interviews with key informants, and can be related to Clumsy's solutions for wicked problems.

The most obvious measures that make up Clumsy Solution Space for resilience of Kashan qanat-based agricultural heritage are presented in this section. It should be noted that among the 39 key informants interviewed, 7 were over 70 years old who had relatively higher experience, 26 were between 40 and 70 years old and 6 were under 40 years old. Most were interested in gaining experience in newer topics such as growing new crops, domestication wild plants and developing ecotourism.

During this research, basic information based on literature review, authors' observations and semi-structured interviews with key informants that have been mentioned so far have been obtained. This information was then organized based on grounded theory and content analysis was performed. Solutions related to dynamic conservation through cultural theory were then summarized in three perspectives, and their combination formed the space for Clumsy solutions. The general results of the documentary studies, the opinions of the interviewees and the analyzes performed can be seen in **Figure 7**, and the relevant explanations are provided below. In the explanation section, considering that the main source of each solution was the interviews conducted, the general and common theme among

some of the interviewees is mentioned. Given that a number is assigned to each interviewee, the number of the relevant interviewees is also included.

Egalitarianism

- Twinning agricultural heritage systems: As experienced in GIAHS (9), Twinning through the development of cooperation and friendship can help the two sister communities in the face of problems such as the risks of COVID-19 and finding solutions Help.

Interviewees Nos. 5, 2, and 24: We have no information or connection with other GIAHS sites in the world, contact with them may lead to the formation of new ideas for us and if our circumstances are similar, we may be able to exchange experiences and etc.

Although none of the interviewees when referring to the problems of the region made any direct reference to the need to establish Twinning with other GIAHS sites or agricultural heritage areas, the solution to the problems they stated in various sources such as Twinning, it has been suggested (45, 46). The use of "Twinning" capabilities is one of the factors that can strengthen the dynamic conservation in a GIAHS area. In fact, twinning expresses the unity and identity that is created by different local communities and is a very flexible platform and the most interesting type of partnership that can be formed between small communities, villages, cities and towns, etc. This capacity also enables the younger generation to connect with their counterparts in different countries, thereby increasing their self-confidence and ability.

- Information on how to take advantage of the support of national and international organizations for GIAHS: Accurate and practical information to farmers about the potential of international institutions to support heritage agriculture and the experiences of other GIAHS in this regard, the conditions for further resilience Prepares in the face of risks.

Interviewees 33, 29, and 20: We do not have any information to be able to use global support and facilities. How did the rest of the GIAHS sites do this? Do the laws of the country allow this?

Farmers and local associations do not have much information about the structure and conditions of various types of support and funds that can directly or indirectly strengthen and protect heritage systems. In some cases, based on misconceptions in this regard, they do not take any action to benefit from the help and support. Also, most do not know where to find information. Based on the experiences gained in different GIAHS areas, subsidies, supports and funds can play a significant role in the formation of dynamic conservation and risk management (11, 12, 47). It should be based on research and inquiries from national and international authorities and should be fully up-to-date, practical and usable. Improve the level of capability and capacity building in Kashan GIAHS.

Reviving the historical experiences of qanat management: Applying the genius and ability of the local community inspired by the historical experiences of participatory agricultural management based on qanats can continue the experience of historical stability of this GIAHS.

Interviewees Nos. 1, 17, 20, and 39: The experiences of our fathers and old farmers and builders and managers of qanats. If not recorded, these experiences may soon be out of reach, but if these experiences as well as old agricultural species are available to us and generations Next, so this heritage can be preserved.

Kashan GIAHS qanats have been preserved throughout history based on local knowledge and the participation and genius of local people (48). This protection could not have been sustainable for hundreds of years if it had not been accompanied by dynamism. Although the formation of a "risk community" in recent decades has damaged the various structures of Kashan GIAHS, but according to the answers of local interviewees and experts, creating and strengthening structures to use genius and collective ability inspired by historical experiences in this region can Make this GIAHS more stable. The experiences of qanats diggers have been recorded to some extent (24) but its agricultural dimensions as well as conservation of heritage seeds and seedlings and agricultural biodiversity of this region have been almost neglected.

Hierarchy

- Review of laws and regulations for the exploitation of agricultural water resources: Review of laws should be done with more serious attention to the achievements and historical sustainability of qanat agriculture and not only under the influence of knowledge and experience that originates from abroad. In these laws, the regulations for drilling wells and constructing dams in the area of qanats should also be reviewed and tightened.

Interviewees Nos. 6, 11, and 15: If we had dug wells in qanat areas according to what the engineers recommended and the law allowed us to do, our qanats would have dried up as they have dried up in other areas. These laws cannot protect the qanats.

During the past centuries, Qantas has been one of the most important sources of water supply in the Iranian plateau (31) but after considerable application of water pump technology in Iran and also the prevalence of deep wells. Over time, regulations and laws also facilitated the use of wells. These events coincided with the implementation of Principle Four (1949–1971) of the then President of the United States Truman (49). In many cases, this issue led to the formation of risks and sometimes irreparable damage to the qanats. Even in cases such as the village of Shadian, which is one of the desert villages of GIAHS in Kashan, the local community has been completely distrustful of the experts and the issuance of well drilling permits in accordance with the law. Interestingly, they believe that the availability of fresh water and the better condition of their qanat compared to the surrounding villages is due to this resistance to drilling wells. However, some of the desert villages in this GIAHS have lost their freshwater qanats or have been severely damaged, while most of the wells that were drilled in the same villages a few decades ago as the water became saltier over time, they also needed to increase the depth. The salinization of well water over time also makes the soil of the region saltier, and this is exactly the opposite of the process

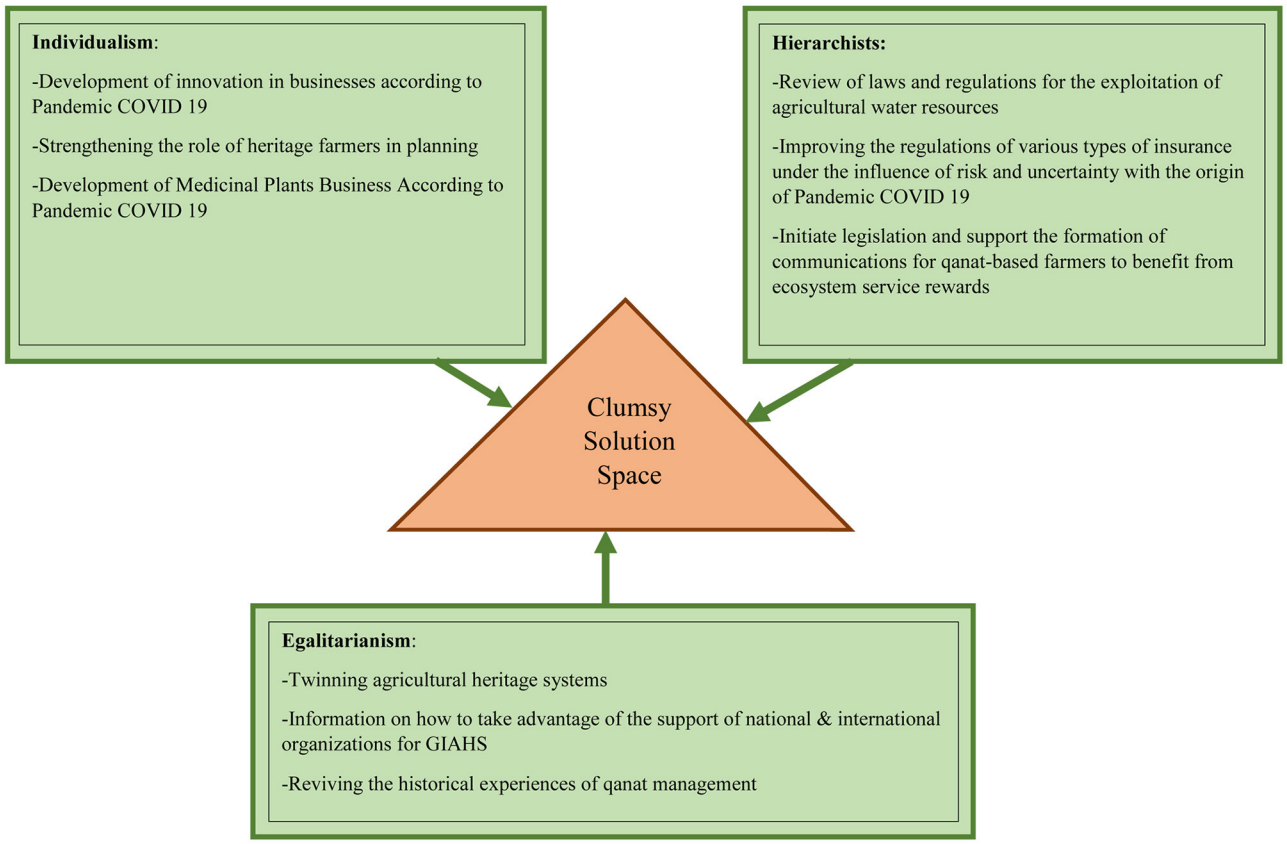

FIGURE 7 | Clumsy solutions space.

created by freshwater qanats in this area (50). The combination of these factors has led to a relative distrust of regulations and expertise related to drilling wells and the use of water resources in the region, which indicates the need to pay attention to this issue.

Improving the regulations of various types of insurance under the influence of risk and uncertainty with the origin of Pandemic COVID-19: Increasing uncertainty and risk in businesses such as agriculture, agricultural tourism, ecotourism, carpet weaving can be partially compensated by developing different types of insurance.

Interviewees Nos. 4 and 35: Insurance does not provide adequate coverage for the problems that exist in our area during the Corona, and especially for jobs that are sometimes done at home (such as carpet weaving).

Insurance can increase resilience in agricultural communities (51, 52). Insurance for Iran has been one of the services that has become more popular in the country in recent decades and may have been less popular in more traditional areas. corona risks highlighted the need to address this issue in areas such as agriculture, agricultural tourism, nature tourism, carpet weaving, etc. Turns to carpet weaving and other household chores increased during the Corona, but such occupations encountered difficulties in obtaining insurance, which is common for conventional occupations. It is noteworthy that, Kashan handmade carpets (ghali) were historically valuable and had a national and world reputation (53). Also, according to the findings of this study, the income from the sale of carpets as a supplementary income in the years of qanats water shortage and also at a time when events such as floods caused damage to qanat and repairing qanat required a lot of money, plays a very important role. GIAHS has been an important factor in strengthening resilience in the agricultural community based on Kashan GIAHS. Therefore, supporting this profession is necessary for the formation of dynamic conservation in Kashan GIAHS, and this necessity has become more apparent in the Corona period.

- Initiate legislation and support the formation of communications for qanat-based farmers to benefit from ecosystem service rewards: In Iran, there are no relationships under which heritage farmers can benefit from their ecosystem service rewards, such rewards can be Assist communities in meeting old and emerging risks.

Interviewees 8, 21, 29, and 38: Many people explain that the qanat prevents the advance of the desert or the desert villages and oases are beautiful, etc., but when the qanats are spent, we are alone and with our own capital and We have to protect the qanats with great difficulty.

qanat, especially in desert ecosystems, increases biodiversity, whether in the form of agricultural biodiversity or wild biodiversity (54). Also, qanats, which usually flow from the mountains, are less saline than the water of wells in desert areas, and over time, the salinity of desert soils decreases, and thus can prevent the expansion of desert boundaries (55). Despite the ecosystem services mentioned as examples, these services are not compensated in Iran for local communities such as Kashan GIAHS farmers, and it seems that in order to solve the complex problems of this region and strengthen dynamic conservation, formulate structures and regulations in this field. It is also effective and important.

Individualism

- Development of innovation in businesses according to Pandemic COVID-19: Development of innovations based on business and online sales of products and digitization and application of new technologies while meeting the requirements of sustainability, it is necessary. Also, agricultural tourism, rural tourism and ecotourism can be given more attention because they are outdoor tourism and may have lower risks of spreading diseases such as corona disease. Adapting global e-tourism experiences can also boost innovation in this area.

Interviewees Nos. 14, 26, and 36: If it were not for all kinds of online and offline sales, we would have suffered heavy losses during the Corona or we would have had to sell part of our land. If tourism in our gardens and orchards is properly advertised and well managed, we may be able to sell our products to tourists again after the corona or when the corona is less common.

Before the start of the COVID-19 pandemic, innovations had begun, especially in the methods of selling the product in Kashan. For example, some farmers have welcomed such sales based on suggestions from online sales sites for certain agricultural products. Such innovations became more effective during the COVID-19 pandemic. There have been valuable experiences in countries such as Japan regarding the effectiveness of tourism programs for dynamic conservation of GIAHS (56). These experiences and frameworks can also be used during the corona pandemic years.

- Strengthening the role of heritage farmers in planning: Considering the historical role of these farmers in maintaining social, economic and environmental sustainability of the region, strengthening the role of leadership for them and creating the ground for informal-planning, it is recommended.

Interviewees Nos. 18 and 33: No one pays attention to our opinions, the rules and programs are only announced to us.

It seems that the administrative structures that decide on agricultural frameworks and programs do not pay much attention to the opinions and experiences of farmers. Meanwhile, farmers in Kashan and other GIAHS areas throughout history have succeeded in creating and maintaining impressive and sustainable agricultural systems with global value. Therefore, at least in such areas, more attention can be paid to the advisory role of leading farmers for policy-making.

- Development of Medicinal Plants Business According to Pandemic COVID-19: Kashan GIAHS, based on its rich agricultural biodiversity, has a high potential for the production of medicinal plants as well as the collection of natural and wild medicinal plants. The domestication of wild plants with qanat water, which has similarities to the quality of spring water, has also been considered profitable in the COVID-19 pandemic and can be developed. Due to the prevalence of traditional medicine in large cities close to this GIAHS, more people can engage in this type of business.

Interviewees 5, 7, 25, and 34: Many of the medicinal plants that we grow or are wild in our area, wild plants such as "Dracocephalum kotschyi Boiss" (zarringiah) are good for boosting the body's immunity, and the sale of our products during the corona is very It has become more.

Most of the time, farmers who cultivate medicinal plants are younger, and turning to such species, which are economically valuable and sometimes scarce, can lead to the dynamism of the region's agricultural system and the formation of dynamic conservation. It is also interesting to note that according to interviews with farmers, in some cases the income from 1 year of cultivation of medicinal plants is more than 10 times the income of species that are normally cultivated in Kashan.

CONCLUSION

Although rural communities, a significant number of which are located in developing countries and in GIAHS areas, have had successful experiences in sustainable development and dynamic conservation of their heritage, today they face severe shocks that pose community risks. Such shocks have created wicked problems. One of the newest and most obvious of these shocks is the shocks associated with the COVID-19 pandemic. It is important to study the behavior and adaptation of these communities to these shocks and provide solutions in this regard. In this study, an attempt was made to achieve such solutions.

The COVID-19 pandemic further highlighted the power and diversity of risks and the application of risk society theory. Such risks can threaten the various pillars of human civilization, including the valuable heritage that humans have provided in agriculture over thousands of years. In this study, while formulating the various dimensions of agricultural heritage, the theory of risk society was used to create dynamic conservation of qanat Irrigated Agricultural Heritage Systems in Kashan. For this purpose, in addition to documentary studies, field visits and in-depth interviews with experts, key informants of the local community were interviewed. Different stages of research eventually led to the formation of Clumsy Solution Space.

Based on the findings of this study, strengthening the online sales of various rural products of Kashan, especially medicinal plants, as well as rural and community-based tourism can increase its resistance to various shocks by increasing the economic prosperity of the region, especially if in defining regional brands Introduction of identity and characteristics of GIAHS should also be considered. Also, strengthening relationships with other institutions and communities at the

national and international levels with examples such as twinning can be a window to share experiences and resources and be effective in adapting to the difficulties of the risk society.

Following some managerial suggestions can also lead to the realization of some clumsy solutions. These include reviewing the rules for exploiting water resources and protecting qanats, strengthening home-based business insurance, defining ecosystem rewards for farmers in rural villages in Kashan, who provide ecosystem services, and governing to facilitate international funds and assistance. The findings of this study can be used in developing an action plan for dynamic conservation of Kashan GIAHS and be inspiring for other regions as well.

This Clumsy Solution Space can play an important role in sharing and developing the experience and views of different sections of the local community of Kashan GIAHS to face the COVID-19 pandemic. Also, these solutions, perspectives and ways to reach them can inspire other communities with agricultural heritage to protect this valuable human heritage. Many areas of Iran that have valuable agricultural heritage have qanat-based agriculture, and such areas exist in other parts of the world. Experiences such as exploiting qanat -based tourism can be similar in other rural areas. Localized and applied. Of course, not all solutions are related to the qanat, and issues such as strengthening the medicinal plant business in the Corona pandemic in other rural communities, especially in areas where potential customers of traditional medicine products are found, can also be adapted and exchanged experiences.

Given that this study deals with the qualitative dimensions of risks, complex problems and related solutions, for future research, it is suggested that quantitative risk assessment research be defined in GIAHS areas and based on risk prioritization and related solutions, define the importance of different solutions in the dynamic conservation action plan of each GIAHS.

DATA AVAILABILITY STATEMENT

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

ETHICS STATEMENT

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

AUTHOR CONTRIBUTIONS

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

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Social, Environmental and Economic Impact Assessment of COVID-19 on Rural Tourism

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Today, various solutions have been proposed to improve the economic situation of villages and deprived areas, among which tourism is known as the best solution for those areas with the necessary potentials for tourism development. On other hand, the COVID-19 pandemic had significant effects on human life worldwide. The prevalence of COVID-19 has caused a lot of damage to different sectors of the global economy, but without a doubt, the rural tourism industry should be considered among the economic activities that have suffered the most from this virus. In this study, with the aim of investigating these effects on the rural tourism industry, it has been analyzed and compared in three important economic, social and environmental dimensions before and after the outbreak of the COVID-19. This quantitative study was used survey method. The statistical population of the study consisted of local stakeholders of rural tourism and experts of the relevant organizations in Natanz county of Iran. The results of confirmatory factor analysis indicate that the constructs used in the model have appropriate and acceptable fit. The results of the study also, showed that the prevalence of COVID-19 has adverse consequences including reducing the desirable economic and social effects of tourism mentioned among both groups of experts and rural stakeholders. from rural tourism stakeholders' opinion, environmental variables of the tourism areas before and after the COVID-19 was different, and in the absence of tourists in this area, the destructive environmental effects have strongly decreased.

Keywords: sustainable rural tourism, economic effects, social effects, environmental effects, COVID-19

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INTRODUCTION

Todays, it is not sufficient speak only about agriculture to meet the needs of rural communities. The agricultural sector cannot be assessed on the basis of production, income and employment; since, in addition to production, agriculture should also be evaluated on the basis of some other concepts such as protection, recreational activities and leisure, non-consumption values, etc (1). In fact, it is necessary to use the innovation variable to find new options for livelihood in traditional rural and agricultural areas (2). Tourism is considered as the set of phenomena and connections resulting from the interaction between tourists, capital, host governments and communities, universities and non-governmental organizations in the process of attracting, transporting, receiving and controlling tourists and other visitors (3).

According to Brandt land report in 1987, for development to become a sustainable paradigm (4), tourism development can be considered sustainable just when it can continue indefinitely in an environment, no harms suffer humans and environment, and also does not harm the development of other social activities and processes (5).

Nowadays, one the tools of sustainable growth and development is tourism, which is increasingly spreading around the world. At present, many countries that are concerned about their economic and social development consider the tourism industry as an important and fundamental necessity. Placing this category in the household basket calls for increasing communities' awareness of sustainability, the limitations resulting from the overuse of resources and energy, communities' attitudes about the environment and its relationship with tourism (6). Tourism must be developed not only with the requirements of tourism development, but also in accordance with the natural environment. Hence, the positive effects of this industry should also be revealed on the environment. It is important to strengthen the scientific concept of ecological tourism, to recognize the concepts of sustainable development, to respect for tourism and environmental resources in the whole society, and to develop propaganda on the value and importance of tourism resources (7). Tourism has changed dramatically over the last 40 years (8, 9) and is clearly recognized as an independent scientific category.

Tourism for decades, around the world has grown rapidly. Tourism is a major driver of growth in many countries and regions (10). The tourism industry is one of the fastest growing industries in the world economy and enjoys government support in various countries (11). This is of great importance so that the tourism industry is the fourth top industry in the world after the automotive, construction and food industries (12). Tourism is an important export sector and can act as a driver of economic growth (13). This is why policymakers and planners in any country need careful planning to increase revenue through tourism policies, however, this should not jeopardize sustainable tourism development (14). Various studies conducted in different parts of the world show that along with rapid growth, the negative effects of tourism also have been spreading.

Due to the continuous development of the tourism industry, its harmful effects become more severe and more diverse from year to year (15). Therefore, it is important to study and identify the effects and consequences of tourism activities.

LITERATURE REVIEW

Rural tourism has long been considered a potential tool for socio-economic development and rural revitalization. The development of rural tourism has become a common policy in developed and developing countries (16).

The effects of tourism development in various dimensions, including negative socio-cultural effects, have been considered and emphasized in literature. Economic effects of tourism (17) include items such as: unequal distribution of income, rising prices and poverty (18), increased corruption, reduced capacity of residents to meet living needs, and increased environmental costs (19), harm to natural heritage and ecological-cultural Security (20), negative impacts on environment, society, culture and even economy (21), improving participation and learning opportunities between people (22), and finally capital and cultural security (19).

One of choices with significant tourist attractions, especially the traditional lifestyles and cultural values, are the surrounding rural areas, which have been able to meet the expectations and demands of postmodern tourists and has made the development of rural tourism a common policy in developed and developing countries (16).

Given the decline of agricultural production systems in the last decade, the importance of preserving, maintaining and managing indigenous, ancient and ecological sites has attracted global attention, since the preservation of these areas has considerable potential to contribute to sustainable livelihoods, to attract tourists and to conduct scientific research (23). Ecological tourists can be both supporters and motivators of ecotourism resources (7). Tourism phenomenon can have different positive and negative effects on the rural environment. In other words, studies have shown that how rural tourism can be used as an effective tool for economic growth when agriculture cannot be the only source of livelihood (24).

The success of the tourism industry depends on recognizing, understanding, and the support quality of local residents and hosts. Therefore, understanding the reaction of the local community and the host to the effects of tourism is essential to achieve the ideal support of rural communities for sustainable tourism development (25). Recognizing the effects of tourism to achieve to sustainable development will not be possible without the involvement of stakeholders (26).

The research background on the effects of tourism in rural areas dates back to the late 1960s and early 1970s (27, 28). The experiences of research in the past decades show that researchers divided the effects of tourism into positive and negative parts and studied them in economic, social and environmental dimensions (29, 30). In general, the effects of rural tourism can be defined as the results of a relatively complex process between tourists, hosts, and host settlements (31).

At present, the emerging disease of COVID-19 has been able to affect many popular activities. Since late 2019, Coronavirus epidemic (COVID-19) has had unprecedented and profound negative effects on global society and economy. The disease has been declared a global threat by the World Health Organization (WHO) which propagated rapidly in 205 countries, almost all around the world (32).

The spread of Covid was increasing until March 11, when the President of the World Health Organization declared COVID-19a pandemic disease and the world entered a new phase of the disease (33). As the new dimensions of the disease was distinguished, governments started new policies, including quarantine of infected cities, staying at home, social isolation, banning communities, and closing educational institutions. These led to slowing the socioeconomics trend of communities' life (34).

TABLE 1 | Summary of results obtained from the economic effects model (confirmatory factor analysis).

Structure	Item	Indicator	Standard coefficient	Standard error	T Value
Economic	Increase of job creation in the touristic area	EA1	0.94	0.1	9.77
	Employment status of women in touristic jobs	EA2	0.89	0.1	10.78
	Local community satisfaction with tourism revenue	EA3	0.95	0.12	10.19
	Purchasing power of people working in tourism	EA4	0.72	0.09	8.12
	Increase in unemployment of people active in tourism activities in the region	EA5	0.78	0.07	10.79
	Reduction of seasonal and permanent unemployment rates in the touristic area	EA6	0.62	0.06	10.14
	Creation of small job opportunities for the residents of the touristic area	EA7	0.63	0.06	10.73
	Creating job opportunities in the touristic area	EA8	0.78	0.17	10.79
	Improvement in the level of wages in the touristic area	EA9	0.95	0.16	8.37
	Activities of small and medium local investors in the region	EA10	0.76	0.11	9.86
	Status of bank facilities and loans for tourism	EA11	0.9	0.08	10.81
	Establishment of small and medium local economic enterprises in the region	EA12	0.38	0.04	10.65
	Tax increase due to local government spending in the region	EA13	0.71	0.07	10.54
	Investment in touristic villages	EA14	0.44	0.04	10.8

COVID-19 has had a significant impact on human life around the world. The WHO's report in May 10, 2021 shows that the Corona has resulted in the death of almost 5.9 million people and more than 427 million confirmed cases worldwide (35). The United Nations World Tourism Organization (UNWTO) reported that since April 20, 2020, all major tourism destinations have imposed travel restrictions in response to the Corona epidemic. Tourism is one of the industries that is negatively affected by this epidemic. Lockdowns in many countries, widespread travel restrictions, and the closure of airports and national borders reduced the number of international tourists arriving in the first quarter of 2020 to 67 million. This decrease means a loss of approximately $ 80 billion in tourism revenue, compared to the same period in 2019 (36). COVID-19 has became a complex and pervasive disease that humanity is suffering from. This epidemic has had a profound effect on social and economic systems, health and development. It also has had socio-psychological effects on individuals, families, social groups, companies and nations all around the world (37–39).

In a study examining the threat of the Corona virus and real-time impact on the tourism threat, Baum and Hai (2020) showed that the outbreak of the Corona virus had a significant impact on the tourism industry and a 100 percent reduction in the industry's revenue in some regions of Asia, Europe and North America.

In another study, at the time of the Corona, Wan et al. (7) Examined the negative effects of the Corona virus on the tourism industry and changes in the lifestyle of tourists and the behaviors and preferences of travelers. The results showed that the COVID-19 virus crisis was affecting travel and tourism patterns, and that in the future, tourism industry activities will be based on smart tourism, and that these changes will force businesses in the industry to reconsider their service design to survive.

Tourism is a commercial industry that has suffered a lot from the COVID virus. The outbreak of COVID-19 has caused a great deal of damage to various sectors of the global economy. But without a doubt, the tourism industry should be considered as one of the economic activities that has suffered the most from the virus. In this study, these effects on the tourism industry have been studied and this has been analyzed and compared in three important economic, social and environmental dimensions before and after the outbreak of COVID-19 virus. The results of this study provide suitable suggestions for managers and tourism experts of the city as well as many decision makers in this field to plan to reduce the negative effects of rural tourism.

METHODOLOGY

Research Type

The data needed to analyze the research questions were collected using a questionnaire. The questionnaire was extracted using research hypotheses as well as previous articles evaluating the effects of tourism. The questionnaire has three categories of questions in the field of economic, social, and environmental variables. To assess the reliability of the questionnaire, Cronbach's alpha method was used using SPSS software version 26. Its face validity was confirmed by the professors of the Department of Agricultural Extension and Education in Shiraz University. In order to answer these questions, 5-Point Likert Scale have been used.

The aim of this study was to evaluate the social effects of COVID-19 pandemic on sustainable rural tourism in Natanz city. Data analysis of this research was performed in two parts: descriptive and analytical or inferential statistics. In this study, a questionnaire was used and SPSS26 and LISREL software were used to analyze the data.

The study area in this study was the tourism hub of Natanz city, which shines like a green jewel between the dry and desert cities around it and is one of the most important historical and tourist cities in Iran and attracts many tourists annually. Natanz county is subdivided into two districts: the Central District and Emamzadeh District. This county is consisted of four cities: Natanz, Badrud, Khaledabad & Tarq. The most important tourist villages from both parts including Abyaneh (one national works of Iran), Barzroud and Hanjan, Toroghroud and Kesheh

TABLE 2 | Summary of results obtaine+d from the social effects model (second-order confirmatory factor analysis).

Structure	Item	Indicator	Standard coefficient	Standard error	T Value
Social	The level of residents' trust in government agencies	SA1	0.96	0.19	10.82
	The level of residents' trust in private institutes and companies	SA2	0.94	0.16	10.82
	The level of residents' trust in the local council and the local village administration	SA3	0.89	0.16	10.82
	Competition among the villagers in attracting tourists	SA4	0.85	0.1	10.81
	The situation of tourists helping the poor villagers	SA5	0.9	0.08	10.81
	Status of holding traditional ceremonies and celebrations	SA6	0.47	0.04	10.81
	The mood and vitality of the villagers	SA7	0.28	0.03	9.77
	Status of construction activities, including roads and welfare centers	SA8	0.75	0.07	10.82
	Preservation of traditional buildings in the touristic area	SA9	0.45	0.04	10.81
	Cultural pride and confidence of the locals	SA10	0.32	0.03	10.81
	Disturbance situation with the arrival of tourists for the villagers	SA11	0.8	0.07	10.82
	Motivation for more literacy among villagers to communicate with tourists	SA12	0.46	0.04	10.78
	Trust to neighbors and friends for help when needed	SA13	0.87	0.09	10.82
	Compromission of local people in times of conflict	SA14	0.53	0.05	10.79
	Interest in meeting and living with people with different dialects and languages	SA15	0.84	0.08	10.82
	Participation in activities and tasks that are not within the scope of duties	SA16	0.48	0.04	10.82
	Interest in living with people of other religions or denominations	SA17	0.95	0.18	10.82
	Voluntary participation in the construction of public buildings in the area	SA18	0.54	0.05	10.82
	Participation in programs for the development of the region	SA19	0.53	0.05	10.79
	Participation to strengthen charity organizations and foundations	SA20	0.54	0.05	10.82
	Help to solve problems for locals	SA21	0.54	0.05	10.81
	Satisfaction of the people of the region with the level of support for the expansion of cultural and local activities	SA22	0.81	0.07	10.82
	Welfare of the villagers due to the construction of roads and public facilities	SA23	0.52	0.05	10.82
	Preservation of cultural and historical values and patterns of the region	SA24	0.53	0.05	10.79
	Weakening of indigenous culture in the region	SA25	0.96	0.18	10.82
	preservation traditional customs and rituals in the region	SA26	0.81	0.07	10.82
	Lack of maintenance and restoration of archeological and historical monuments in the region with the presence of tourists	SA27	0.28	0.03	9.77
	Change in the clothing type of local villagers with the presence of tourists	SA28	0.28	0.03	9.77
	Change in the language and dialect of the local people with the presence of tourists	SA29	0.28	0.03	9.77

and Matinabad were selected for sampling.The city of Natanz, with 1,800 historical monuments throughout the year, has been located on the main North-South main route of Iran, and has welcomed many travelers, tourists and Orientalists throughout Iran's history. In 2017, this figure reached 47,500 tourists from foreign countries (40).

Sample Size and Statistical Population

Sampling was done from the two central parts and Imamzadeh Agha Ali Abbas of this city (Abyaneh, Borzroud and Hanjan villages, Toroghroud, Kesheh and Matin Abad). The villages of Abyaneh—which is registered as one of the national monuments of Iran—are Torghroud, Kesheh, Hanjan, Borzroud and Matinabad (41). The statistical population of the study included two groups of villagers, tourism stakeholders, residents of tourism target villages in one hand, and experts and providers of tourism services in Natanz city in other hand.

The present study is a kind of quantitative applied research in which the cross-sectional survey method has been used. Two methods of library study and face-to-face interview with participants were used to collect data. Random sampling method was used to select the samples. Cochran's formula was used to determine the sample size required for the present study. According to the latest census of the Statistics Center of Iran in 2016, the number of households in the tourist villages of Natanz was about 610, which was obtained using the Cochran's formula and taking into account the error rate of 0.06, the sample size was estimated 235. Equation 1 shows the values of each of the Cochran's formula parameters and the sample size determination process.

$$n = \frac{Nz^2pq}{Nd^2 + z^2pq} \quad (1)$$

TABLE 3 | Summary of results obtained from the environmental impact model (second-order confirmatory factor analysis).

Structure	Item	Indicator	Standard coefficient	Standard error	T Value
Environmental	Appropriate medical services in the area and the health of local stakeholders	EnvA1	0.38	0.04	10.81
	Quality of hygiene in the touristic area	EnvA2	0.95	0.18	10.82
	Sanitary disposal of waste in touristic villages	EnvA3	0.53	0.05	10.79
	Extinction of animal species and activities such as hunting in touristic villages	EnvA4	0.28	0.03	9.86
	Degradation of plant species in touristic villages	EnvA5	0.28	0.03	9.86
	The amount of manipulation in the natural environment to attract tourists	EnvA6	0.34	0.03	7.87
	The effects of tourism on destruction of natural resources	EnvA7	0.28	0.03	9.86
	Damage to orchards around touristic villages	EnvA8	0.28	0.03	9.86
	Traffic situation in touristic villages	EnvA9	0.31	0.03	9.91
	Noise pollution	EnvA10	0.32	0.03	9.92
	The naturalness and virgin pristine nature of touristic villages	EnvA11	0.95	0.13	10.82
	Maintaining land use in the touristic areas	EnvA12	0.53	0.05	10.79
	Construction of roads and make life easier for local stakeholders	EnvA13	0.44	0.04	10.82
	Increase in beautifulness the landscape of touristic villages	EnvA14	0.56	0.05	10.82
	Observance of capacity threshold and environmental tolerance in the touristic areas	EnvA15	0.51	0.05	10.78
	Observance of the environment cleanliness in touristic areas	EnvA16	0.54	0.05	10.79
	Preservation of ancient and historical monuments in touristic areas	EnvA17	0.55	0.05	10.79
	Preservation and protection of ecosystems and national parks	EnvA18	0.54	0.05	10.79

TABLE 4 | Standard values and fit indicators of social impact assessment model.

Indicator	Standard level	Fitted model values
Chi Square / Degree of Freedom(X^2/df)	3≥	2.03
Normed Fit Index (NFI)	90≤	0.94
Non-Normed Fit Index (NNFI)	90≤	0.96
Comparative Fit Index (CFI)	90≤	0.91
Goodness of Fit Index (GFI)	90≤	0.86
Adjusted Goodness of Fit Index (AGFI)	≤90	0.94
Increasing fitness index (IFI)	90≤	0.95
Root mean square residual (RMR)	0.05≥	0.065
Root mean square error of approximation (RMSEA)	0.08≥	0.067

Also, the number of experts in different departments (roads and buildings, Red Crescent, municipality, private companies, agricultural jihad, natural resources, cultural heritage, governorate) based on Cochran's formula, 110 samples were obtained, which is also based on the number of experts in each department was distributed and completed.

Research Limitation

In this study, restrictions on the spread of the corona virus, access to tourists, locals and data collection, as well as travel to tourist areas faced difficulties.

RESEARCH ANALYSIS AND RESULTS

Participants in the study in terms of gender included 38 women (34.5%) and 72 men (65.5%). The average age was 42 years and their age range was 28 to 55 years. In terms of education, most of them had bachelor degree.

The frequency distribution of local stakeholders based on gender showed that 68 (28.9%) of the participants in this study were rural women and 167 were male (71.1%). The average age of local stakeholders was 45 and their age range was between 10 and 76 years. The average level of education of local stakeholders was 9 years. The highest frequency of jobs was related to agriculture and animal husbandry with 82 people. The highest frequency of income included people working in the tourism industry (30%).

Confirmatory Factor Analysis Results

To evaluate the social effects of COVID-19on rural tourism better and more accurately, structural equations and confirmatory factor analysis were used with LISREL 8.8 software. After evaluating the correlation coefficients between the variables used in the research, based on the answers provided by the villagers or local stakeholders, the data entered the confirmatory factor analysis, since this sample group had statistical logic in terms of number and ratio of respondents to questionnaire items. Obvious variables were entered into confirmatory factor analysis to measure the economic effects of the research. The standardized factor load of the indicators in t-factor analysis and their significance level with respect to the first order value are given in **Table 1**, According to the obtained results, the amount of factor load of the structures of economic effects is >0.3 and the value of t is >1.96, so all the structures used in this dimension

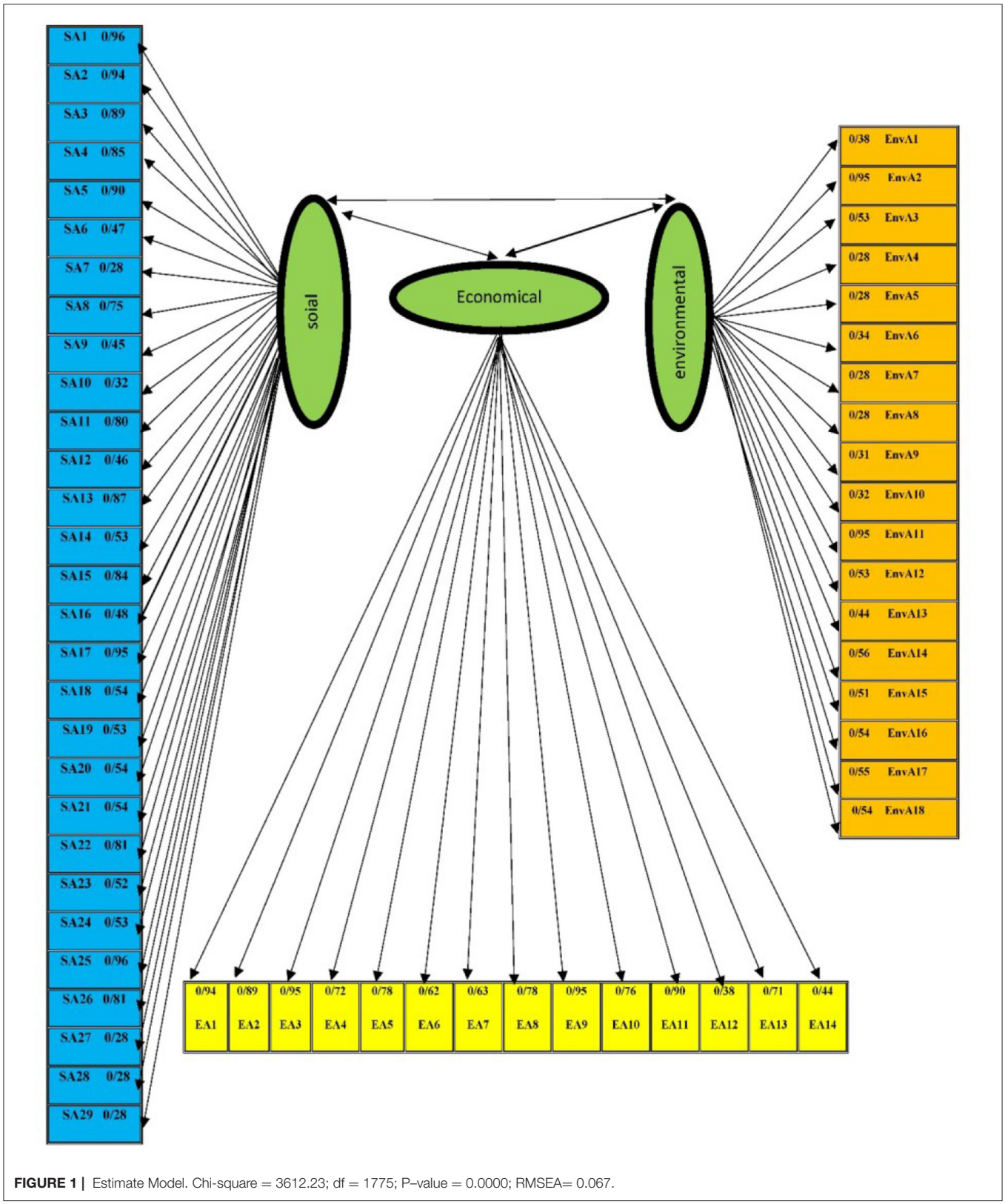

FIGURE 1 | Estimate Model. Chi-square = 3612.23; df = 1775; P–value = 0.0000; RMSEA= 0.067.

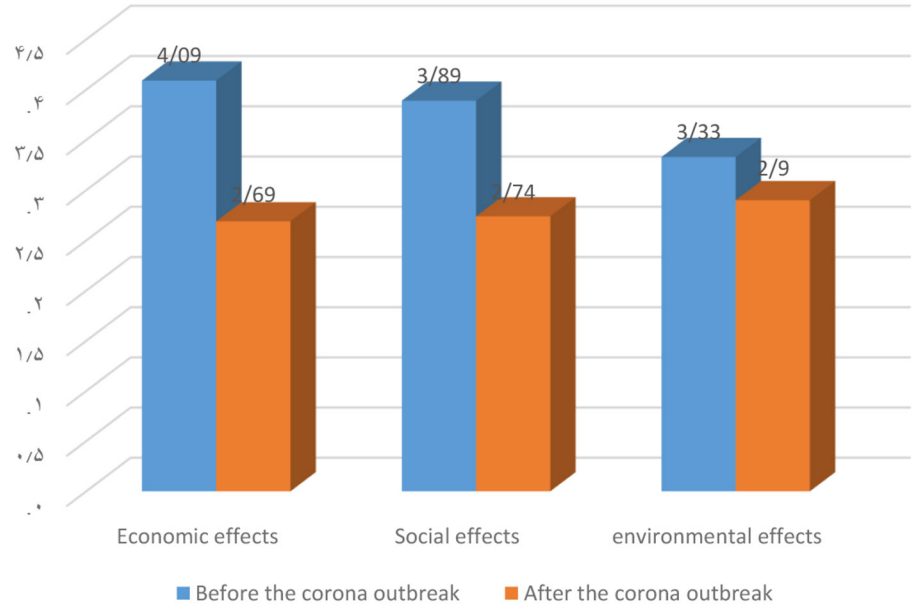

FIGURE 2 | Assessing the economic, social and environmental impacts of the Corona outbreak in experts' opinion.

are approved due to the acceptable reliability in the model. Based on the obtained coefficients of factor loads, some of the most important economic effects can be mentioned as follows: increase in employment in the tourism field with a standard coefficient (0.94), the employment of women in tourism occupations (with a standard coefficient of 0.89), Local community satisfaction with tourism revenue (with a standard coefficient of 0.95), improving the level of wages in the touristic area (with a standard coefficient of 0.95).

Also, according to the results mentioned in **Table 2**, the amount of factor load of social impact structures is >0.3 and the value of t is >1.96, so all the structures used in this dimension remain in the model due to their acceptable reliability. Based on the standard coefficients, these items have a higher level: the level of residents' trust in government agencies (standard coefficient: 0.96), the level of residents' trust in private institutions and companies (standard coefficient: 0.94), the status of tourists' assistance to the poor villages (standard coefficient: 0.85), interest in living with people of other religions or denominations (standard coefficient: 0.95), disappearance of indigenous culture in the region (standard coefficient: 0.96).

The results of the study showed that factor load amount of the environmental impact structures is >0.3 and the value of t is >1.96, so all structures used in this dimension are approved and remain in the model due to their acceptable reliability. According to **Table 3**, the quality of hygienic affairs in the touristic area (standard coefficient: 0.95), the pristine nature of touristic villages (standard coefficient: 0.95), the preservation of archeological and historical monuments in touristic areas (standard coefficient: 0.55), more beautiful landscape of touristic villages (standard coefficient: 0.56), observance of environmental cleanliness in touristic areas (standard coefficient: 0.54) have a higher order.

The evaluation of the proposed indicators approved that in general, the proposed structural equations model is a suitable model (**Table 4**). A summary of fit indices of the confirmatory factor analysis model is presented in **Figure 1**.

Comparison of the Average Opinions of Experts and Local Stakeholders in Three Dimensions of Social Effects

Using statistical techniques, the opinions of experts and villagers were examined in terms of impact assessment in three dimensions of economic, social and environmental dimensions. **Figure 2** shows the comparison of the average responses of tourism effects before the Corona outbreak and after that. Accordingly, the economic, social and environmental effects of tourism in the region have decreased after the outbreak of the virus. In other words, from the perspective of experts, the prevalence of this virus has caused negative effects in all three dimensions in the region.

Figure 3 shows the average economic and social impact of tourism before and after the Corona outbreak on the views of local stakeholders. In both dimensions of economic and social effects, the tourism situation is more favorable for local people, and Corona has caused negative effects on these two variables in the region. Based on differences between average delivered in **Figure 3**, three aspect including economic, social and environmental effects significantly different before and after the coronavirus outbreak. But in the environmental dimension, this is completely different. Local stakeholders believe the Corona outbreak has reduced the negative environmental impact

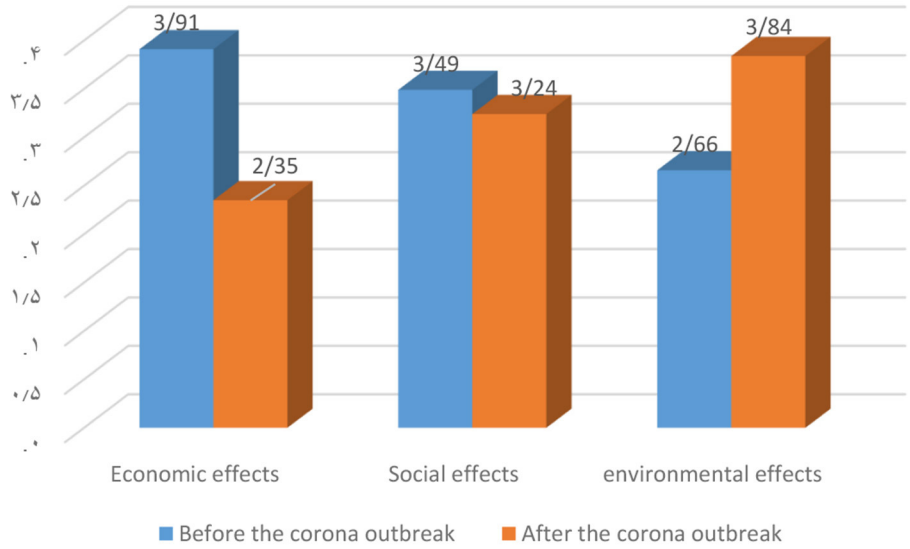

FIGURE 3 | Economic, social and environmental impact assessment chart, before and after the CORONA outbreak from the perspective of local stakeholders.

of tourism in the region. There is a disagreement between experts and local stakeholders in the environmental dimension. Apparently, the environmental negative impacts of tourism in the region include some issues such as: the quality of medical services, health and hygiene, collection and disposal of the wastes, the preservation of ecosystems, national parks and protected areas, preservation of archeological and historical monuments of the region, the extent of destruction of the natural space of the village and reduction of environmental pollution by rural people has been more evident.

Comparing these two above-mentioned graphs, it can be concluded that the difference in economic effects before and after the outbreak of the virus among local stakeholders' opinion is greater than experts. Also, the difference in social effects before and after the outbreak of this virus among experts is more than local stakeholders. Perhaps this disagreement can be due to the fact that local stakeholders in the rural environments are more associated with the environment, tourists and the tourism industry and have a more accurate and complete understanding of the environment, and in contrast, experts have considered the economic and revenue aspects more than other ones.

CONCLUSION

The results of confirmatory factor analysis tests show that the obvious variables used in the model to measure the three dimensions of social impact of tourism as a result of Coronavirus outbreak have desirable and appropriate standard coefficients. Therefore, based on the study of good fit indices, it can be concluded that the structures used in the model have a suitable and acceptable fit. It can also be concluded that in general, the proposed confirmatory factor analysis model is a suitable model and the social impact assessment index can be measured correctly in all three dimensions. Also, based on the general and specific objectives of this research, the following important results can be inferred:

Comparison of Average Economic Effects Before and After Coronavirus Outbreak Between Experts and Villagers

Comparison of the average economic and social effects of tourism before and after the outbreak of Corona virus showed that the views of experts and villagers are in line with each other. Both groups of respondents agreed on the negative economic effects of tourism after the Corona outbreak. But these negative effects are more tangible in experts' responses and it seem that they perceive the current bad economic situation more than villagers. These effects include the loss of employment among rural men and women, the diminishing role of women in monetization, the decline in rural incomes, and so on. For this reason, the need to pay attention to planning and compensatory measures on the employment situation and the economy of tourism stakeholders is becoming more apparent. One of the measures that can be taken during the Corona outbreak to improve the economic situation of the villagers is to develop alternative and complementary jobs. For example, managers and planners can provide opportunities for the development of virtual activities to the villagers or to facilitate a way for the sale of villagers' products through cyberspace.

Comparison of Mean Social Effects Before and After Coronavirus Outbreak Between Experts and Villagers

Both groups participating in the study had similar views on the negative effects of Corona on social factors of tourism and believed that the Corona virus has reduced the positive effects of social relations, including reduced participation and solidarity

among rural people. Under normal circumstances and before the outbreak of the virus, according to experts and local stakeholders, the arrival of tourists have had short-term and long-term negative effects on the sociocultural dimension of rural communities. They have been able to cause negative social effects such as the destruction of cultural customs and traditions. The prevalence of Coronavirus and the decrease in tourist arrivals have been able to reduce these effects. It is suggested that for healing this problem in touristic areas, some strategies could be run, such as holding training courses for how to deal and associate with tourists, as well as culturalization to preserve traditional customs. On the other hand, the outbreak of Coronavirus has caused villagers to be trapped in their homes, which can be solved by holding programs in villages such as rural and seasonal festivals, public sports or cultural and recreational events in compliance with the entire hygienic guidelines. This can prevent the demoralization of the villagers.

Comparing the Mean of Environmental Variables Before and After the Outbreak of Coronavirus From the Perspective of Experts and Villagers

The views of the two groups participating in the study were not similar on environmental impacts. The overall average of environmental effects from the perspective of villagers before Corona has shown a much lower number than experts, and this indicates that the villagers in general were dissatisfied with the environmental impact of rural tourism, especially about the quality of hygienic and health services, the destruction of the village, the pollution of the environment, the crowds and the excessive traffic of tourists. It can be concluded that with the prevalence of Corona and the lack of tourists entering the area, the destructive environmental effects have been minimized. The amount of traffic has decreased and the crowds and pollution caused by the arrival of tourists have also decreased. But according to experts, on average, these effects are less discussed. In order to prevent the negative environmental effects of tourism in rural logic, it is possible to limit and control the number of tourists by careful planning according to the capacity of the village. It is possible to diminish environmental degradation by using educational brochures in rural areas as a reminder for tourists, as well as using indigenous rural people as rangers, and preserving natural resources and pristine rural environment. It is beneficial to help the protection of valuable touristic areas, historical buildings and the village landscape by using specialized people.

DATA AVAILABILITY STATEMENT

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

ETHICS STATEMENT

Ethical review and approval was not required for the study on human participants in accordance with the local legislation and institutional requirements. The patients/participants provided their written informed consent to participate in this study.

AUTHOR CONTRIBUTIONS

FE: data gathering and literature review. RN: supervisor and research design. Both authors contributed to the article and approved the submitted version.

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Impacts of COVID-19 Pandemic on Micro and Small Enterprises: Evidence From Rural Areas of Iran

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Since 2020, the outbreak of the COVID-19 crisis has caused a great deal of social and economic damages to micro and small-scale enterprises (MSEs). This research examined the most common damages of this crisis in active and inactive rural MSEs and also assessed different kind of responses the managers and owners of theses MSEs have received dealing with these damages. The sample population of this study consisted of all managers of 72 active and 38 closed rural MSEs in the Dastjerd village, Hamedan, Iran. These MSEs were mainly garment small factories. This research utilized a mixed approach (quantitative-qualitative) to study the research objectives in depth. First, in qualitative part, semi-constructed interviews and field visits were done. Then, using quantitative, results of the qualitative section, previous studies and the existing literature, a researcher-made questionnaire was created. Based on qualitative part information through interviews, damages of rural MSEs during COVID-19 pandemic were categorized into three classes, including damages related to production, and financial and marketing issues. Also, two categories of managers' responses that could be labeled as passive and adaptive behavior were identified. Findings showed that active rural MSEs have taken more adaptive measures and tried to find appropriate ways to reduce or overcome damages. Active MSEs were mainly owned and managed collaboratively by more literate and experienced managers. Also results revealed that rural MSEs' managers reacted to different kinds of damages based on their ability, knowledge, and experience. Based on research results, managers' knowledge and skills can help them find more adaptive solutions to keep the firms stable and overcome damages. It can be concluded that COVID-19 pandemic has a great impact on rural MSEs and they need more financial support and managerial advice to overcome this kind of crisis situation.

Keywords: rural business, adaptive behavior, passive behavior, COVID-19 crisis, Iran

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INTRODUCTION

In late 2019, the World Health Organization (WHO) reported the coronavirus outbreak in Wuhan, China, and later in March 2020 declared it as a global pandemic (1–4). This is the third widespread pandemic of the 21st century (5, 6) which led to a series of public health measures and interventions, including limitation on activities of education institutes, sport, cultural events, and non-essential retailers, to reduce the spread (7). Such interventions have adversely

affected the global economy, leading to job losses and very high unemployment rates (8–12). Also declining direct international investment and consequently reduction of Gross Domestic Product (GDP) are consequences of these public health interventions in many countries around the globe (10, 13).

The COVID-19 crisis has far-reaching consequences for MSEs which include declining demand, increase costs, liquidity, and supply challenges. In general, some studies [e.g., (14, 15)] show that the adverse effect of the pandemic on MSEs has been more severe than larger units. Unemployment, financial losses, and layoffs are the most notable impacts of the economic shock of COVID-19. Generally, because of the scale of performance and limited financial resources, smaller firms are highly vulnerable and have low recovery capacity (15). Also, many smaller enterprises have not benefited enough from the government's relief plans due to their low awareness and limited access to information and resources (12, 16–18). These issues make them more vulnerable and less resilient in comparison to big corporations (19–21).

Recent studies (10, 15, 17) show that in the COVID-19 pandemic, MSEs have been dealing with declined demand, interrupted supply chain, export orders cancelation, shortage of raw materials, and disruption in transportation. And generally, because of low access to financial and managerial resources (12, 22), most of small enterprises are not ready to overcome the crisis damages.

Although there is no accurate information on the extent of the damages made to Iran's micro and small enterprises, the Iranian Unions Association estimated that the COVID-19 crisis has disrupted and damaged 57 business categories. They also attest the manufacturing enterprises, including garment production factories which have endured the most severe damages. Some MSEs in Iran fired at least one worker in the COVID-19 crisis and some managers do not expect their economic conditions to improve in the next 2 years (8). Also based on a study conducted by Institute of Trade Studies and Research in Iran, the COVID-19 crisis has affected the supply chain, demand and liquidity, labor supply, consumption of goods and services, and has reduced consumers' income (23). Although government support for MSEs is very important, in the end, the reactions and decisions made by MSEs' managers can have a significant impact on the future of their enterprises. Given the circumstances, MSEs may determine various responses such as decreased production due to lack of sales market, training of employees to go through the crisis period as well as fired workers (15, 24).

The COVID-19 crisis has also had a strong impact on rural communities. Rural communities, especially in developing countries, are the most vulnerable regions due to low income and high level of dependency on production resources (25). Based on this vulnerability, rural MSEs have more difficulties in crisis situations like the economic shock of COVID-19 (26). Due to the high hidden and real economic problems such as unemployment rate in rural communities (27), rural MSEs have great potential for job creation, unemployment reduction, and income increase through agricultural and non-agricultural activities (28). MSEs could also lead to the development of the local economy in rural areas (29, 30).

During the COVID-19 pandemic, many researchers tried to investigate the effects of COVID-19 pandemic on rural communities in their studies. Recent studies have mainly focused on the effects of the COVID-19 crisis on rural economic development, health, tourism, unemployment, mortality, community resilience, food security, etc. (31–37), but few studies have concentrated on the role of rural enterprises' managers and their competencies in making proper and quick decisions through this pandemic (38–40). Certainly, managers play a great role in making appropriate decisions in crises (41, 42). Also managers' competency is a key factor in crisis management (38). Therefore, it is important to know how business managers behave and make decision during these critical situations. In this research, we paid more attention to how rural MSEs' managers responded to different types of damages during theCOVID-19 pandemic, and how managers of active and closed rural SMEs behaved during this pandemic. Basically, the objectives of the current study include:

- Investigate different types of damages that rural MSEs have suffered more.
- Assessing managers' passive and adoptive behavior to crisis situation of the COVID-19 pandemic.
- Understand the personal and demographic characteristics of managers that affect their behavior.
- Comparing managers' responses of active and closed MSEs during pandemic.

METHODOLOGY

Study Area

The study area of the research is Dastjerd village, located in the Bahar county of Hamedan province. This village is an old and historical village with a population of more than 2,000 people. In Dastjerd village the main occupation of the people is agriculture, animal husbandry and tailoring. There are many semi-industrial sewing firms in this village that provided employment opportunities for many young rural people (**Figure 1**). Most of these sewing firms are specialized in Children's clothing production and more than 20% of national demand and 90% of Hamedan province demand for Children's clothing is being produced in this village.

Data Collection Instrument and Analysis

In the Qualitative Part

This research utilizes a mixed approach (qualitative-quantitative) to study the research objectives in depth. In qualitative phase, a semi-constructed in-depth interview through field visit was conducted in the study area in January 2021. Twenty-four producers among the active and closed firms, and four related experts were selected through purposive sampling technique. This phase helped us to identify different types of damages rural MSEs have suffered more and also managers' behavior in response to the COVID-19 pandemic.

Interviews took place in the form of a guided interview. The interviewees were asked to talk about most damages their firms sustained and their responses to their confrontation with

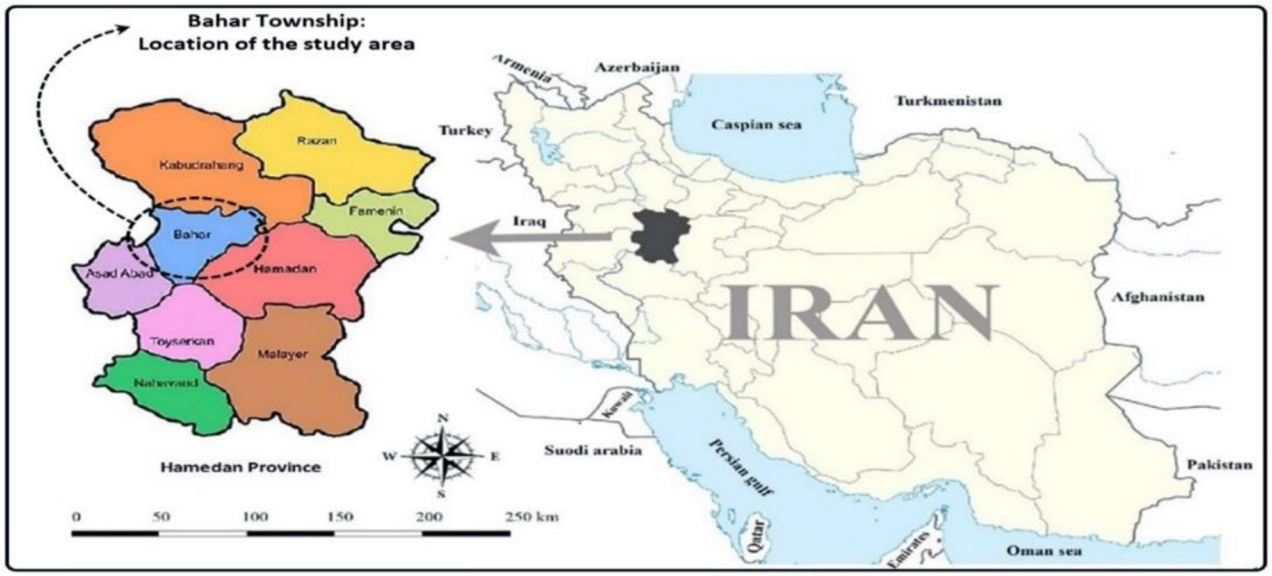

FIGURE 1 | Geographical location of the study area.

the crisis. These conversations were guided systematically to address the topic from different angles. Due to the prevalence of the COVID-19 crisis at the time of interviews, to keep social distancing, 11 face-to-face interviews and the rest of the phone calls were conducted to observe the social distance. The average time of phone call interviews was 30 min. All conversations were accurately recorded and analyzed using content analysis techniques. Content analysis is a systematic approach to compress a large number of texts and words into predefined content categories based on rules of coding (43). In this study, this approach was used to create damage categories based on coded keywords. With help of content analysis, we could categorize three classes of damages and also list the most common responses of the MSEs' managers in the COVID-19 crisis situation. In this part, a methodological triangulation technique was used for increasing the validity and reliability of findings. Triangulation involves the use of several kinds of methods or sources of information to obtain overlapping data and it is a tool for improving the accuracy, credibility, and validity of findings (44).

Analyzing Quantitative Data

The second part of the research was a quantitative study with a researcher-made questionnaire using the first part findings, previous studies, and the existing literature. Since no previous research study has been done on the impact of the COVID-19 crisis on rural businesses in Iran, the qualitative part was designed to understand the extent of damages and undertaken responses by affected MSEs. Ultimately, the questionnaire was developed through using these results and exploring the related literature. Therefore, the damages to the firms were identified through interviews in qualitative part and the related literature (14, 45). Then they were categorized into three classes including Damage Related to the Firm (DRF), Damages Related to Products (DRP), and Damages Related to Marketing (DRM).

The research population in this part consisted of all 110 managers of active and closed MSEs in the study area. The sample was taken by the census technique and all active (72 people) and closed (38 people) MSEs' managers were selected to gather data. Closed MSEs were those that were marked temporarily closed after the COVID-19 pandemic and had no activity at the time of field study (February 2021).

The research questionnaire consists of three sections:

1- DC: The demographic and background factors including age, gender, education, work experience, etc. (18 items).
2- Damage to MSEs, including DRP (four items), DRF (six items), and DRM (five items) (**Table 1**).
3- Response: This section examined managers' behaviors including two types of adaptive and passive responses (**Table 2**). The items were rated on a five-point Likert scale scoring system. The face and content validity of the questionnaire was confirmed by a panel of experts. The reliability of the questionnaire was also assessed with Cronbach's alpha (α) after a pilot test. In the Quantitative part, spss22 software was used to analyze data (**Table 1**).

RESULTS AND DISCUSSIONS

Demographic Characteristics

Active Firms

Demographic and personal characteristic analyses of 72 active firms in the village of Dastjerd determines that the age of the managers is between 21 and 57 years old, and the average is 40 years old. Active producers have 15 years of work experience on

TABLE 1 | Description of different types of damages of MSEs in the COVID-19 pandemic.

Category	α	Description of Damage	Reference(s)
DRP		Decrease in firm's production in comparison to its routine operation	Self-developed
	0.92	A decline in the quality of products because of the shortage of raw materials	Self-developed
		Inability to trade as per unit's regular routine	Self-developed
		Reduced income and cash flow in comparison to pre-pandemic averages	Samantha (18) Ratten (14)
DRM		Inability to communicate with business customers	Samantha (18)
	0.93	The lack of access to market information in the short-term	Self-developed
		Loss of firm's customers	Samantha (18)
		The poor performance of the market in advertising the firm's products	Self-developed
DRF		Losing the savings and financial resources to cover unexpected costs	Samantha (18) Ratten (14)
	0.90	Inability to pay bank loans and mortgages	Faulkner et al. (46)
		Inability to pay the staffs' salaries	Self-developed
		Insufficient cash flow for covering the firms' daily costs	Vera (45)
		Stricter requirements for receiving loans	Self-developed

TABLE 2 | Description of responses in adaptive and passive behaviors of MSEs' managers in the COVID-19 pandemic.

Behavior category	α	Description of responses
Passive		Adjustment of the labor force to lessen costs
behavior	0.82	Getting help from family members and relatives to reduce the labor cost
		Reducing the working hours of the firm to reduce costs
		Collaborating with other units to consolidate workshops and reduce costs
		Changing the career temporarily to provide the livelihood of family
		Attempting to migrate to town or cities to find other jobs
Adaptive behavior		Request a loan to cover the costs and compensate for financial losses
	0.73	Assigning or leasing part of the space and resources of the workshop to other businesses
		Producing alternative goods such as masks, and hospital guns with a better market in the crisis conditions
		Getting customized/ tailoring orders
		Consult with experts and informed people to find alternative and more suitable businesses
		Trying to learn new knowledge and skills to enter other businesses and markets

average. Generally, they have high school diplomas (40 people), 6 have a university degree, and 26 have only acquired basic literacy. In terms of work experience, the average is 15 years.

Ownership analysis of active firms shows that 48 firms have group (partnership) management, and 24 firms operate individually (sole proprietorship). Regarding learning new skills to improve business and management, 40 producers have not learned any new skill and knowledge dealing with complication of the COVID-19 crisis in the last 12 months, while 12 producers have acquired some new skills, and 18 producers have got some skills that are not directly applicable to the firm's management. Based on the data, at the time of the research, active firms have approximately 4 workforces, while at least two people have been laid off from 2020.

Closed Firms

Descriptive analysis of closed firms shows the age range of managers is between 19 and 55 years old, with an average of 35 years old. Most of them have high school diplomas (21 people), while 16 people have acquired basic literacy, and only 1 has a university degree. On average, they have 13 years of work experience in the firms. Regarding the type of ownership of the firms in this group, results reveal that 29 firms are sole proprietorships and managed individually, while only nine firms are partnerships (mostly family businesses) and managed collaboratively. Moreover, four workers have been laid off after closing firms. **Table 3** briefly shows managers' personal and DC in two categories of active and closed firms.

Damages Caused by COVID-19 Pandemic in Active and Closed MSEs

This section examines the type and extent of damages caused by the COVID-19 pandemic in active and closed firms and analyzes the most common adopted responses in active and closed MSEs separately.

Closed Firms

Table 3 presents the descriptive results of the analysis on closed firms. The results indicate that the most extensive damages to closed firms are related to DRP and DRM, with average scores of 3.66 and 3.65, respectively. Also, DRF ranked third in magnitude, with an average score of 3.14 (out of 5 points).

Ranking of the damages (third column) reveals that the decline in production was the first and foremost damage to the closed firms. It means that these firms could not keep the production volume which has led them to fall behind in the market cycle. The second disadvantage of closing companies is related to sales and marketing that can be associated with the managers' lack of access to information and inability to predict the short-term impact of the COVID-19 crisis on the market. Therefore, lack of foresight knowledge and ineffective communication customers of companies could lead to loss of customers and eventually complete closure of the unit. Generally, damages to production and marketing are highly correlated to

TABLE 3 | Mean and ranking of different damages in closed MSEs.

Rank		Damages	Mean	S.D
1	DRP	Decrease in firm's production in comparison to its routine operation	3.78	0.413
2		A decline in the quality of products because of the shortage of raw materials	3.65	0.480
3		Reduced income and cash flow in comparison to pre-pandemic averages	3.63	0.488
4		Inability to trade as per unit's regular routine	3.57	0.500
		Mean total	**3.66**	
1	DRM	The lack of access to market information in the short-term	3.73	0.446
2		Inability to communicate with business customers	3.63	0.541
3		Loss of firm's customers	3.57	0.500
4		Poor performance of the market in attracting the firm's products	3.52	0.556
		Mean total	**3.65**	
1	DRF	Loss of savings and financial resources to cover unexpected costs	3.28	0.611
2		Inability to pay back the bank loans and mortgages	3.18	0.691
3		Inability to pay the staffs' salaries	3.10	0.559
4		Stricter requirements for getting loans	2.76	0.589
		Mean total	**3.14**	

DRM, Damage related to marketing; DRP, Damage related to production; DRF, Damage related to finance.

the lack of marketing opportunities that would directly affect the unit's production capacity.

The descriptive results of the last part also confirmed that the managers of the closed firms were mainly less educated compared to active firms. It might have affected their capability of observing the market changes and impacted their analytical thinking and strategic decision-making skills. Finally, the results of financial damages also determine that the closed firms have had fewer financial revenues due to damages related to production and marketing which led to "Insufficient cash flow for covering the firms' daily costs." As a result, these firms could not pay salaries and had to lay their workers off. Results (**Table 4**) confirm that the number of laid-off workers in these firms is two times more than workers fired in the active firms.

In the following, the responses are examined in closed firms (**Table 5**). The responses are classified as adaptive and passive. Research results show that the average of passive and adaptive responses is equal (4.30), which means the closed firms have taken as many passive measures as adaptive ones. At the beginning of the pandemic, as the orders started to be canceled and new orders declined, the initial response of these firms was "temporarily change of job to provide for the family livelihood." At that time, the temporary shutdown was mandatory, and by March 2020, all unnecessary businesses like garment factories had to stop their activities.

TABLE 4 | Personal and demographic characteristics of managers in active and closed MSEs.

Descriptive components	Active	Closed
Number of firms	72	38
Average age (year)	40	35
Average workforce	4	0
Ave. no. of Workers fired	2	4
Work experience (year)	15	13
Level of education	Limited ability to read and write: 26 (%36/1) High school: 40 (%55/6) College degree: 6 (%8/3)	Limited writing and reading: 16(%42/1) High school: 21(%55/3) College degree: 1(%2/6)
Type of ownership	Partnership: 48 (%66/7) Sole proprietorships: 24(%33/3)	Partnership: 9(%24/7) Sole proprietorships: 29(%76/3)

When the temporary shutdown ended up and the firms restarted their activities, some of these firms chose to "reduce their labor force to decrease the costs," since they had been closed for a while and did not have enough revenue. Alternatively, some other firms chose to "Reduce the firm's working hours to overcome the costs." They made these responses while they had no vision of what would happen in the following months. These 38 closed units were solely relying on orders coming from the capital, Tehran. Consequently, without receiving new orders during the pandemic, they could not continue their activities and had to shut down.

The results also showed that these firms had to take passive measures temporarily, and the adaptive responses were not successful. Therefore, most of these firms' managers and workers had to go to nearby cities to find civil service jobs such as doorman, salesman, security, cashier and similar job positions. Also, the responses analysis showed that closed firms also tried to make adaptive measures, but none of these decisions could save these firms from closure. It might be because of the coincidence of the pandemic with a dramatic increase in raw materials prices. For instance, the yarn price doubled and, in some cases tripled up. In this condition, firms even were not able to fulfill the previous orders.

Based on the research results, the main features of closed firms' managers include the lack of skills and knowledge other than just sewing, lack of alternative financial resources (i.e., second job, saving accounts) to manage workshop costs, and lack of interest in requesting loans. It should be noted that most of these firms were sole proprietorships and individually managed and had no business advisor.

Active Firms

The results of damage analysis on active firms (**Table 6**) indicate that they have also sustained many damages over the past year. The most incurred damages relate to sales and marketing with an average score of 2.8 followed by production-related and financial-related damages with average scores of 2.63 and 2.21, respectively. The most critical identified damage to active firms

TABLE 5 | Mean and ranking of adaptive and passive behaviors in closed MSEs.

Rank		Behaviors	Mean	S.D
1	Adaptive behavior	Producing alternative goods such as masks, hospital guns with a better market in the crisis conditions	3.47	0.903
2		Getting customized/ tailoring orders	3.33	1.363
3		Request a loan to cover the costs and compensate for financial losses	1.47	1.64
4		Consult with experts and informed people to find alternative and more suitable businesses	0.84	1.370
5		Trying to learn new knowledge and skills to enter other businesses and markets	0.75	1.31
6		Assigning or leasing part of the space and resources of the workshop to other businesses	0.37	1.05
		Mean total	**1.87**	
1	Passive behavior	Reducing the working hours of the firm to reduce costs	1.90	1.365
2		Receiving help from family members and relatives to reduce the labor cost	1.47	1.678
3		Adjustment of the labor force to lessen costs	0.91	1.65
4		Changing the occupation temporarily to provide the livelihood of family	0.76	1.65
5		Attempting to migrate to town or cities to find other jobs	0.23	0.759
		Mean total	**1.05**	

TABLE 6 | Mean and ranking of different damages in active MSEs.

Rank		Damages	Mean	S.D
1	DRM	Lack of access to market information in the short-term	2.86	0.860
2		Loss of firm's customers	2.69	0.798
3		Poor performance of the market in attracting the firm's products	2.56	0.885
4		Inability to communicate with business customers	2.51	0.919
		Mean total	**2/80**	
1	DRP	Reduced income and cash flow in comparison to pre-pandemic averages	2.69	0.987
2		Decrease in firm's production in comparison to its routine operation	2.68	0.801
3		A decline in the quality of products because of the shortage of raw materials	2.58	0.726
4		Inability to trade as per unit's regular routine	2.58	0.851
		Mean total	**2.63**	
1	DRF	Losing the savings and financial resources to cover unexpected costs	2.29	0.680
2		Insufficient cash flow for covering the firms' daily costs	2.41	0.745
3		Stricter requirements for getting loans	2.16	0.650
4		Inability to pay back the bank loans and mortgages	2.09	0.479
5		Inability to pay the staffs' salaries	2.09	0.653
		Mean total	**2.21**	

DRM, Damage related to marketing; DRP, Damage related to production; DRF, Damage related to finance.

was the damage related to sales and marketing. Active firms have been dealing with "the lack of access to market information in the short-term." Since this crisis is an unprecedented event, both active and closed firms have not been able to predict the market even for a few months ahead. This uncertainty has also caused "inability to communicate with business customers" and eventually led to "loss of firm's customers." Damage to production rate is the second-ranked damage in terms of frequency and intensity. Lack of market certainty and security and the ongoing loss of customers have led to "reduced income and cash flow" and "decreased firm's production." Ultimately, active firms have suffered financial damages; however, it is less extensive than the other two categories. Going through marketing and production damages significantly affected their financial conditions and has led to "losing the savings and financial resources to cover unexpected costs." Due to loss of financial resources, covering the daily costs of units and loan payments have been challenging for these firms.

After analyzing the extent of damages, the responses taken over last year (2020) by active firms were examined (**Table 7**). In the early stages of the epidemic, when government restrictions were increasing, executives of active firms changed their product lines to "produce better-market alternatives in crisis situations such as masks, hospital guns, and custom tailoring" that could support their help their livelihoods during a crisis. Having said that, it is evident that these firms were actively looking for alternative markets to avoid shutting down their production lines. The active firms have taken the least passive responses. Most of these firms are partnerships and are being managed collaboratively. This fact might have impacted the type of responses that they undertook during the COVID-19 crisis. For example, some firms initially decided to "collaborate with other units to consolidate workshops and reduce costs. This shows that these firms have been more open to collaborative decision-making. Then, they chose "reducing the firm's working hours to reduce costs" and "getting help from family members and relatives to reduce the labor cost" as subsequent passive responses to fight the consequences of the crisis.

Differences Between Active and Closed MSEs

Studying the differences between active and closed firms reveals that active firms have generally encountered less financial, production, and marketing damages since the averages of all three types of damages are <3 (out of 5). It confirms more resilience of these firms compared to closed firms. Additionally, other results (the second column of **Table 8**) verify that active firms have taken fewer responses (either adaptive or passive). Moreover, there is a statistically significant difference between

TABLE 7 | Mean and ranking of adaptive and passive behavior in active MSEs.

Rank		Behaviors	Mean	S.D
1	Passive behavior	Changing the occupation temporarily to provide the livelihood of family	4.34	1.02
2		Adjustment of the labor force to lessen costs	3.89	1.18
3		Reducing the working hours of the firm to reduce costs	3.68	0.873
4		Getting help from family members and relatives to reduce the labor cost	2.55	1.94
5		Attempting to migrate to town or cities to find other jobs	2.44	2.16
		Mean total	**3.38**	
1	Adaptive behavior	Trying to learn new knowledge and skills to enter other businesses and markets	3.81	1.64
2		Producing alternative goods with a better market in the crisis conditions such as masks, hospital guns	3.47	2.02
3		Consult with experts and informed people to find alternative and more suitable businesses	3.15	1.77
4		Assigning or leasing part of the space and resources of the workshop to other businesses	3.05	2.06
5		Request a loan to cover the costs and compensate for financial losses	2.55	1.92
6		Getting customized/ tailoring orders	2.13	1.96
		Mean total	**3.04**	

TABLE 8 | Comparison of active and closed firms in sustained damages and token responses.

	Type	Mean	Mean rank	Mann-Whitney *U*	Sig. (2-tailed)
DRP	Active	2.6	38.91	357.000	0.000
	Closed	3.66	75.35		
DRF	Active	2.21	37.34	253.500	0.000
	Closed	3.14	78.15		
DRM	Active	2.80	40.20	442.500	0.000
	Closed	3.65	73.04		
PB	Active	3.38	87.16	211.000	0.000
	Closed	1.05	38.79		
AB	Active	3.04	77.26	498.500	0.000
	Closed	1.87	44.01		

AB, Adaptive behaviors; PB, Passive behaviors; DRF, Damage related to finance; DRP, Damage related to production; DRM, Damage related to marketing.

these two types of producers regarding incurred damages and undertaken responses.

CONCLUSION

This study investigated the major damages that rural MSEs have faced due to the limitation and complication of the COVID-19 pandemic in Dastjerd village in Hamedan province, Iran. Also, it assessed different kinds of responses the managers and owners of these MSEs have received while dealing with these damages. All rural MSEs surveyed in this research were in the field of sewing garments. During the COVID-19 crisis, some of them (34.5%) had to stop their activity and close their workshops. Accordingly, in order to compare the most common damages and managers' behavior in two groups of active and closed MSEs, both groups have been considered with a mixed paradigm of qualitative and quantitative research. Research findings in the qualitative part contributed to our knowledge about different types of damages inflicted upon both groups of active and closed MSEs due to the COVID-19 limitation. Based on the qualitative part and information through interviews, we categorized all kinds of damages into three classes including DRF, DRP, and DRM. It revealed that, during the COVID-19 pandemic and its' challenges, rural MSEs were vulnerable due to the poor financial strengths and managerial skills and limited sales market and communication networks. Mueller et al. (25) and Malherbe et al. (26) also found that rural small businesses especially in developing countries were more vulnerable during COVID-19 pandemic. Workers' illness, workshop closure, lack of demand, lack of liquidity, and also rising costs were the most common causes that led the MSEs facing other damages. Shaf et al. (10); Bansal (15), and Eggers (17) also found that MSEs have been dealing with declined demand and interrupted supply chain through COVID-19. The results showed in both closed and active MSEs, the most damages were related to sales and marketing issues. However, the level of all damages was lower in active firms.

In qualitative phase, different kinds of managers' decisions in the COVID-19 crisis situation were also identified. According to information obtained in this regard, two categories of responses were identified, that could be labeled as passive behavior and adaptive behavior. Temporarily changing the occupation, labor adjustment, and reducing the working hours to reduce costs are the samples of passive behavior. Also in adaptive behavior, trying to learn new knowledge and skills to enter other businesses and markets, request loans to cover the costs, and producing alternative goods with a better market were mentioned. Based on the findings, active MSEs have received more adaptive responses and tried to find appropriate solutions to reduce or overcome damages. Furthermore, results revealed that MSEs' managers reacted differently based on their abilities, knowledge and experiences. Some MSEs decided to shut down their firms after a short period of time due to poor financial capacity and lack of skills and information in crisis management. Conversely, managers with more knowledge and experience were better able to manage this crisis and prevent the closure of their firms. This can indicate the importance of managers' knowledge and skills during the crisis. Dirani et al. (38) and Al-Dabbagh (39) had also emphasized on managers competencies during crisis like COVID-19 pandemic.

Research findings also highlighted that there is a difference between ownership form among two groups of active and closed MSEs so that the ownership of most active MSEs (66.7%) were shared ownership, while only 24.7% in closed MSEs were shared ownership and most of them (76.3%) were sole proprietorships. Accordingly, it can be concluded that shared firms may have more capacities, especially for financial support to overcome difficulties in crisis situations.

Finally, as stated in our article, the COVID-19 pandemic has had a great impact on rural MSEs and some of MSEs' managers had to close their firms because of different damages related to the process of production, marketing, and financial issues. It can mainly be concluded that rural MSEs need more financial support and managerial advice to overcome this kind of crisis situation. Based on research results, managers' knowledge and skills can help them find more adaptive solutions to keep their firms stable and overcome damages. Therefore, in addition to government support, training and development of managers' capabilities and crisis management skills are essential. This study helps government agencies identify the common damages to rural MSEs and the success rate of their adaptive behaviors in dealing with this pandemic.

DATA AVAILABILITY STATEMENT

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

AUTHOR CONTRIBUTIONS

AY and SG designed and directed the original research. FS collected data and managed the interviews. AY and FS helped in analyzing data and developed the main text. NN helped in translating some part of text from Persian to English. HA helped in scientific editing. AY and HA provided instruction and comments for enriching the main text. All authors contributed significantly to the creation of this manuscript and have read and approved the final manuscript.

SUPPLEMENTARY MATERIAL

The Supplementary Material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fpubh.2022.844825/full#supplementary-material

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