



Research article

The effects of COVID-19 on livelihoods of rural households: South Wollo and Oromia Zones, Ethiopia

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ABSTRACT

Even though the COVID-19 pandemic is a global phenomenon that is heavily affecting the lives, livelihoods, and wellbeing of the entire population, the degree and severity of its effects are different among groups and sectors. In developing countries, where there is poor infrastructure coupled with a low level of education and a high incidence of poverty, the pandemic would result in increased unemployment, decreased income for daily labor, increased food insecurity, depletion of saving and relief measures, and disrupted the marketing system, among others. Recently, some studies have been conducted in Ethiopia regarding the impact of the pandemic on the people and the country as a whole by reviewing the literature and mobile call surveys. However, those studies fail to capture the representative sample and empirical data to forward informed decisions. To this end, the present study has investigated the effect of COVID-19 on the livelihood activities of smallholder farm households in South Wollo and Oromia administrative Zones, Ethiopia. A multistage random sampling procedure was employed to draw 275 respondents out of 32,214 household heads. Data were collected through interview schedules, key informants and case studies from September to November 2020. Descriptive statistics, econometric analysis and qualitative approaches were employed to analyze the data. The major livelihood activities in the study area are crop production (97.4%), livestock rearing (77.4%), daily work (47%), small business (31.4%), livestock trading (30.7%), remittance (24.8%), labor migration (14.8%), sale of firewood (11.1%) and income from Productive Safety Net Program (PSNP) (17%). The study shows that the livelihoods of 88.89% of the households were affected by the pandemic. The pandemic significantly affected and forced households to cease their livelihood activities such as daily labor (34.82%), small business trade (26.3%), livestock trading (23.7%), income from remittance (21.49%) and labor migration (11.48%). This implies that the pandemic particularly affected non-farm and off-farm livelihood diversification strategies. Therefore, the government and other rural development partners should focus on immediate and long-term intervention strategies to recover the most affected households through social security programs, creating market linkage and revolve funding mechanisms.

1. Introduction

The first patient case of Corona Virus Disease (COVID – 19) is reported in Huwan, China on 12 December 2019 (Wu et al., 2020). Different socioeconomic and environmental factors have been contributing to the spread of the pandemic (Ahmed et al., 2021). As of November 28, 2020, the virus spreads to 216 countries and territories, with confirmed cases of 61,299,371 and deaths of 1,439,784 globally, 1,487,650 confirmed cases in Africa; and 108,438 confirmed cases and 1,686 deaths in Ethiopia (World Health Organization (WHO), 2020). The COVID-19 has critical implications on the global food system (Swinnen

and McDermott, 2020). The lockdown and the containment measures had disrupted the food supply chain and other economic activities of the global community (Alvi et al., 2021; Pu and Zhong, 2020; Swinnen and McDermott, 2020). According to Swinnen and McDermott (2020), the World Bank estimated that the world economy will shrink by five percent during 2020. The COVID-19 pandemic compounded challenges of food security and sustainable livelihoods in developing countries (Rasul, 2021). The agricultural supply chain is disrupted by the pandemic (Pu and Zhong, 2020; Rasul, 2021). Its containment measures diminished the livelihoods of vulnerable people (Gerard et al., 2020; Kassegn and Endris, 2021; Ouko et al., 2020) with multifaceted impacts (Alvi et al., 2021).

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The COVID-19 has a mixed effect on the economies of developing countries (Swinnen and McDermott, 2020). In this regard, large industries had severely affected by the pandemic during the lockdown due to their reliance on hired labor. On the other hand, small and micro enterprises were less affected by the lockdown due to their operation by family labor.

The evidence shows that the COVID-19 pandemic has put pressure on the economic activities of different countries. However, its effect varies across geographical locations, economic status, and demographic compositions (Kassegn and Endris, 2021). The study conducted in India depicts that the marginalization of women for accessing agricultural information is exacerbated as a result of the pandemic (Alvi et al., 2021), and in turn put them at adverse long-term risk (Agarwal, 2021). The pandemic resulted in increased unemployment, decreased income for daily labor, increased food insecurity, depletion of saving and relief measures in India (Harris et al., 2020; Kesar et al., 2020). Similarly, the study conducted in Kenya and Uganda reveals that more than two-thirds of the respondents experienced income shocks due to the pandemic (Janssens et al., 2021; Kansime et al., 2021). Moreover, different findings in other countries such as China (Pu and Zhong, 2020; Wu et al., 2020); South Asia (Rasul, 2021); Bangladesh (Mandal et al., 2021); Caribbean (Blazy et al., 2021), and Nigeria (Aromolaran and Muyanga, 2020) reveals that the COVID-19 pandemic has substantially affected the livelihoods, consumption patterns, and food security status of the people. As it is elaborated by Aromolaran and Muyanga (2020), the pandemic negatively affected farming households through decreased availability of labor, raised the cost of farm labor, and declined the sales of agricultural products.

Ethiopia has a low density of health care workers (0.96 for 1000 people) and poor health infrastructures that challenge the containment of the pandemic (Ayenew et al., 2020). As a result, the COVID-19 pandemic has resulted in multi-dimensional effects across the country's economy (Beyene et al., 2020). The pandemic exacerbated the prevailing food insecurity and undermined the livelihood of the people in Ethiopia (Kassegn and Endris, 2021). The Ethiopian Economic Association (EEA) estimated that Ethiopia's Gross Domestic Product (GDP) will downfall by 127 billion Ethiopian Birr (ETB) in the 2019/20 Fiscal Year (FY) due to the COVID-19 pandemic (Beyene et al., 2020). According to the estimate of the EEA, the country's GDP growth will reach 0.6 percent under a severe scenario of the pandemic in 2020/2021. The pandemic heavily affected the livelihoods of the households in Ethiopia, by which the income is reduced by more than half (Wieser et al., 2020). The subjective income measures indicated that a large proportion of households have been exposed to job loss or reduced incomes during pandemics (Hirvonen et al., 2021). The negative impact of the pandemic will be severe on the welfare of vulnerable households (Beyene et al., 2020). The COVID-19 pandemic is likely to have confrontational effects on agrarian households in Ethiopia (Kassegn and Endris, 2021). Smallholder farmers are one of the vulnerable groups who might be hindered from working on their land, accessing markets to sell their products, or buying seeds and other essential inputs (Food and Agriculture Organization of the United Nations (FAO), 2020). About 30% of the rural wage labor were lost their job (Wieser et al., 2020).

The impact of COVID-19 on rural households in Ethiopia is not well assessed. As the knowledge of the researchers, a few studies were conducted on the issue of the pandemic. Among these, the assessment of Beyene et al. (2020) focused on the forecasting of the pandemic on the economy of the country, which fails to examine the empirical evidence on the impact of the COVID-19 pandemic. In addition, Wieser et al. (2020) conducted monitoring of COVID-19 impacts on households using the mobile cell phone call survey. The participants were only mobile phone owners. This study fails to include all possible households to be affected by the pandemic. According to the Ethiopian Socioeconomic Survey (ESS) 2019, only 40% of the rural people access mobile phones in Ethiopia (Wieser et al., 2020). In this regard, representative samples are not included in the study. Challenges and opportunities to tackle the

spread of COVID-19 in Ethiopia are analyzed by Ayenew et al. (2020). The scope of the study by Ayenew et al. (2020) is delimited to identifying challenges and opportunities in combating the pandemic, whereas, the impact of the COVID-19 on the general wellbeing of the country is not addressed. Moreover, authors such as Kassegn and Endris (2021) reviewed the socioeconomic impacts of COVID-19, Desert Locust, and Flood in Ethiopia. However, their study lacks empirical data regarding the effects of COVID-19 on the livelihoods of households.

The above findings imply that the effects of COVID-19 on the livelihoods of the smallholders are yet not well analyzed using proper empirical data and representative samples. On the other hand, the pandemic has been spreading drastically in the way that its effect could be severe in the long run (World Health Organization (WHO), 2021). Therefore, it is evident to provide empirical findings regarding the effects of the COVID-19 pandemic for policymakers and other stakeholders for making an informed decision. Hence, this study tried to investigate the effects of COVID-19 on the livelihood activities of smallholder farmers in Ethiopia.

2. Conceptual framework of the study

Livelihood thinking dated back to the work of Robert Chambers within the mid-1980s. Chambers developed the idea of "Sustainable Livelihoods" with the intention to enhance the efficiency of development cooperation (Kollmair and Gamper, 2002). A livelihood is defined as a set of capabilities, assets, and activities required for a way of living (Chambers and Conway, 1992). The framework shows that livelihood analysis comprises of five pillars, namely, vulnerability context, livelihood assets, transforming structures and processes, livelihood strategies, and livelihood outcomes (Department for International Development (DFID), 2002).

Each pillar is interrelated i.e., the effect on one pillar affects other pillars. For example, if a shock happens in households, their livelihood assets, livelihood strategies, and outcomes will be affected. The same is true for other pillars. The vulnerability context refers to shocks, seasonality and trends. Natural and/or man-made shocks and stresses severely affect different actors involved in the food supply chain (Béné, 2020). Smallholder farmers are one of those actors in the food supply chain. In this study, the COVID-19 pandemic is taken as a shock. The agricultural value chain is vulnerable to the COVID-19 pandemic (Morton, 2020). The various forms of restrictions imposed by the government in response to COVID-19 are an example of those shocks/stresses that affect the ability of smallholders to effectively engage in their livelihoods (Béné, 2020). This pandemic resulted in a multifaceted effect on the livelihood activities of smallholder farmers. The major livelihood activities that are affected by this pandemic were assessed based on the given framework (Figure 1).

The COVID-19 pandemic also affected the livelihood strategies of smallholder farmers. The main livelihood strategies practiced in the study area are agricultural intensification, livelihood diversification, and migration. The study conducted in India revealed that the COVID-19 pandemic put a negative impact on the production, sales price, and income of smallholder farmers (Harris et al., 2020). The agricultural intensification strategy of the farmers is hampered by the disruption of the agricultural input supply chain (Boef et al., 2021). Accordingly, the current study assessed the major effects of the COVID-19 pandemic on the livelihood strategies of smallholder farmers. The livelihood diversification encompasses on-farm, off-farm and non-farm activities (Ncube, 2011). According to Ncube (2011), on-farm activity refers to the engagement of households in the production and marketing of crops and livestock. Off-farm activity refers to engagement in wage labor (either in cash or kind) on other's farms. The non-farm activity also refers engagement of individuals or households in non-agricultural activities like cottage industries, petty trade, etc. For this study, crop production and livestock rearing are on-farm livelihood activities. Daily labor, renting of assets, sale of firewood and trading of livestock are off-farm

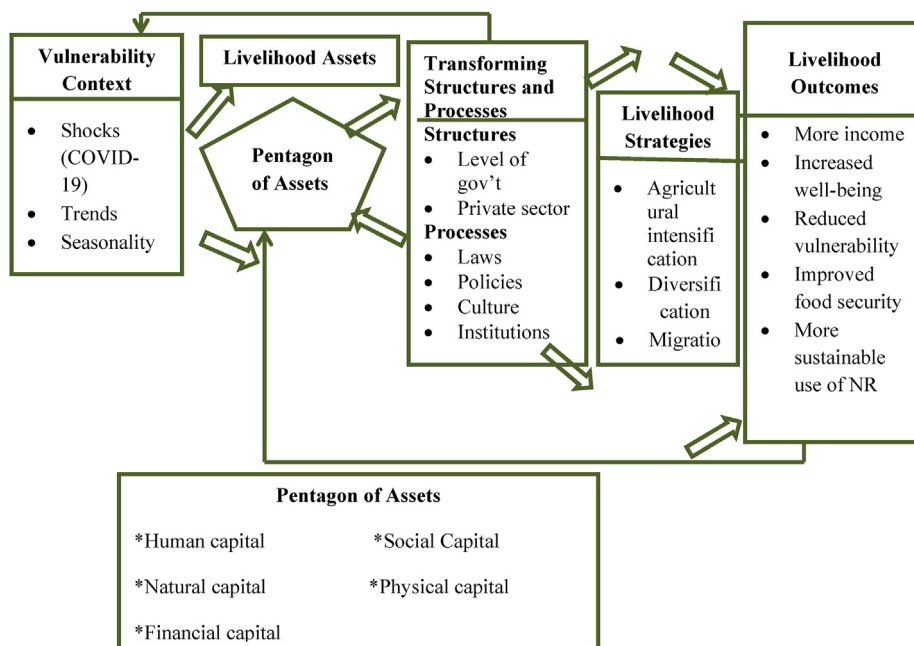


Figure 1. Sustainable livelihoods framework, adopted from DFID, 2002.

activities. Handcraft, small business trade (petty trade), remittance income, and income from the productive safety net are non-farm activities.

The effect of the COVID-19 pandemic on all of these pillars would significantly affect the livelihood outcomes i.e., the income, food security status, vulnerability, and general well-being. The findings reveal that farmers' income is decreased due to the COVID-19 pandemic (Gu and Wang, 2020). The study conducted in Uganda reveals that the well-being of rural households is decreased as a result of the lockdown due to the COVID-19 pandemic (Mahmud and Riley, 2021). The COVID-19 induced lockdowns prompted the biggest disruption of livelihoods (Varshney et al., 2021). In order to mitigate and recover from this pandemic, interventions in structures and processes are required. This pillar is very important in devising strategies to respond to the COVID-19 pandemic with existing resources and local conditions. The responses to the COVID-19 pandemic will be emanated from deep and careful analysis of livelihood assets, strategies, and the vulnerability context. Therefore, this study adopted a sustainable livelihood framework (Department for International Development (DFID), 2002) to analyze the effects of the COVID-19 pandemic on livelihood activities of smallholder farmers in the study area.

3. Materials and methods

3.1. Description of the study area

This study is conducted in South Wollo and Oromia administrative Zones in Amhara regional state (Figure 2). Dessie, which is located 400 km away North-East direction of Addis Ababa, is the center of the South Wollo administrative Zone. Kemissie is also the center of the Oromia administrative Zone and is located 330 km away North-East direction of Addis Ababa. The study area has three agro-ecological zones (Dega, Woynadega, and Kolla)¹. The altitudes are range from 1842-1915 and 2470–2553 m above sea level for Kemissie and Dessie, respectively (Abegaz and Abera, 2020). According to Abegaz and Abera (2020), Kemissie and Dessie receive a mean annual rainfall ranging from

725.1mm to 1361.6mm, and 851.3mm–1612.6mm, respectively. The mean annual temperature varies from 18.7°C to 20.9°C and 18.8°C to 19.3°C at Kemissie and Dessie, respectively (Abegaz and Abera, 2020). Crop production is the dominant source of livelihood in the study areas. Besides, livestock rearing, daily labor, small business, migration and remittance are the other important income sources for farming households in the study area.

3.2. Sampling techniques and sample size

We employed a multi-stage sampling procedure. Firstly, South Wollo and Oromia Zones were selected purposively since these Zones are the mandate area of Wollo University. Secondly, three Woredas from South Wollo and Oromia Zone were drawn purposively based on the agro-ecological zones (Kolla, Weynadega, and Dega). In this regard, one Woreda from each agro-ecological zone was selected. Thirdly, a total of six kebeles (two kebeles from Each Woreda)² were selected randomly. Fourthly, probability proportional to sample size (PPS) sampling technique was employed to select sample households proportionally from the six kebeles. The sampling units of the study were rural households whose ages are greater than or equal to 18, who are living in rural areas, and the head of household regardless of sex. Therefore, farming households that fulfill these criteria were included in the sampling frame. Finally, 275 sample respondents were selected from the list of 32,214 household heads in six kebeles using simple random sampling technique.

The sample size was determined using Yamane's formula as presented in Eq. (1).

$$n = \frac{N}{1 + Ne^2} \tag{1}$$

where, n is the sample size, N is the population size, e is the level of precision (6%) margin of error (Yamane, 1967). From the total of 275 interviewed households, the response of 270 respondents was used for the analysis, whereas the remaining 5 questionnaire was discarded due to incomplete responses.

¹ Kolla (agroecological zone equivalent with lowland between 500-1500 m above sea level); Weynadega (middle land, between 1500 to 2300 m) and Dega, highland, between 2300 and 3200 m) (National Meteorological Agency (NMA), 2007).

² Woreda is administrative division in Ethiopia equivalent with district while kebele is the lowest administrative division in a woreda (National Meteorological Agency (NMA), 2007).

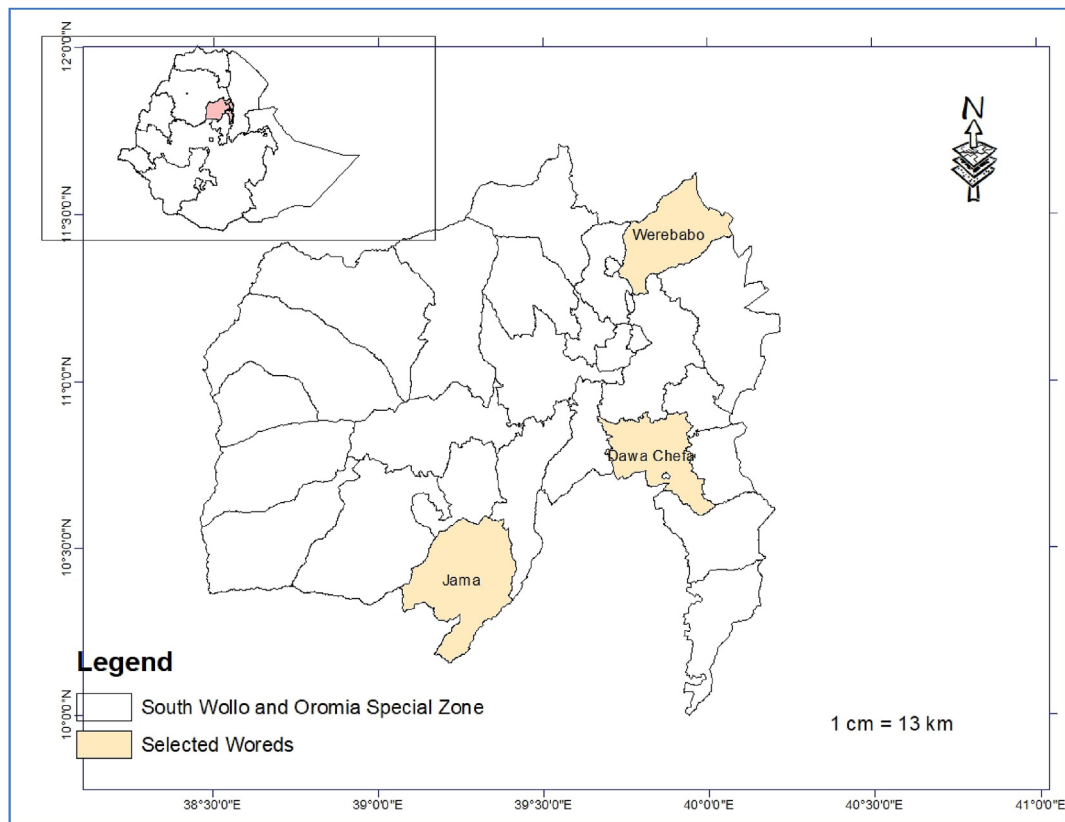


Figure 2. Map of the study area.

3.3. Data types, sources and collection methods

The data were collected between September and November 2020. The study was employed qualitative and quantitative data from both primary and secondary sources. The primary data on different socio-economic characteristics were collected directly from sampled households, key informants, and case study participants. Secondary data were also collected from different secondary sources, like Zonal and Woreda level offices and annual reports.

A semi-structured interview schedule was used as a data collection technique wisely keeping the recommended protective measure even though collecting data through direct contact with respondents was challenging in relation to the current pandemic condition. The basic reason to employ an interview schedule is that majority of the smallholder farmers neither read-write to employ the questionnaire nor have access to mobile phones to collect the data. So, the possible option was employing interviews by taking the recommended physical distancing and using protective materials like face masks and sanitizers. To collect relevant data, firstly, respondents were asked about which livelihood activities they have been engaged in (before and during the COVID-19 outbreak). After livelihood activities were identified, the respondents were further asked to describe the effects of COVID-19 on each livelihood activity. The respondents were also asked to describe livelihood activities that ceased temporarily or permanently as a result of the COVID-19 pandemic.

Key informants from different organizations were also interviewed and consulted on the potential effects of the COVID-19 pandemic. A total of 32 key informants were interviewed from kebele development agents, Woreda office of agriculture, Zonal agricultural department, and other NGOs working on agricultural production and other livelihood aspects of smallholder farmers. Mobile conversations were also employed to collect data from different key informants; hence all key informants have access to mobile phones. Furthermore, three case studies from each kebele, having a total of 18 case studies were conducted on how the COVID-19 pandemic has been affecting the livelihood activities of smallholder

farmers. Respondents for case studies were selected using purposive sampling technique with the help of local experts based on the problems they have confronted as a result of the COVID-19 pandemic. The objective of including these case studies was to supplement and triangulate the survey results. Moreover, direct observation of smallholder farmers' activities on how they are carrying out the agricultural production activities and other livelihood activities was conducted. While collecting the household survey, we conducted a direct observation accidentally on a certain proportion of respondents included in the study regarding their day-to-day routine activities and challenges faced due to COVID-19.

3.4. Methods of data analysis

The quantitative data were analyzed using simple descriptive statistical tools such as minimum, maximum, percentage, mean, and binary logistic regression model; while the qualitative data were analyzed through qualitative approaches such as narration, explanation, interpretation, and triangulation. It is known that the effects of coronavirus will continue for an unknown period of time. Therefore, the application of impact measurement techniques like, Propensity Score Matching (PSM) models were not appropriate. Rather, the results were descriptively and qualitatively well narrated and interpreted in detail based on available quantitative and qualitative data. The results were presented using tables and charts. In this study, the livelihood status of households is said to be affected if at least one livelihood activity of a particular household is compromised/diminished partially or totally. Accordingly, household's livelihood status is classified as affected or not affected. Moreover, a binary logistic regression model was used to estimate the relationship between household socioeconomic variables and the effect of COVID-19 on the livelihood status of smallholders.

3.4.1. Econometric model specification

The dependent variable is the household's livelihood status as a result of the COVID-19 pandemic. The livelihood status of respondents will be

either affected or not affected due to the outbreak of the COVID-19 pandemic. The binary dependent variable scored as 1 if at least one livelihood activity was affected and 0, otherwise. The binary response variables use limited dependent variable models, of which, the logit and probit models are the common ones. The sign of the coefficients across the two models is the same, and the same variables are significant across these two models (Wooldridge, 2000). Logistic regression is often chosen if the predictor variables are a mix of continuous and categorical variables and/or if they are not nicely distributed. Besides, logistic regression makes no assumptions about the distributions of the predictor variables (Karl, 2021). To this end, our study consists of both continuous and categorical variables. Therefore, the logit model is selected for this study. The binary logistic regression model is derived from the linear probability model (Gujarati, 2004), and it is specified as presented in Eq. (2).

$$L_i = \ln\left(\frac{P_i}{1 - P_i}\right) = \beta_1 + \beta_2 X_{1i} + \beta_3 X_{2i} + \beta_4 X_{3i} + \dots + \beta_n X_{(n-1)i} \tag{2}$$

Where, L_i = natural logarithm, P_i = Probability of being affected, $1 - p_i$ = probability of being not affected, β_1 = constant term, $\beta_2, \beta_3, \dots, \beta_n$ = coefficients of explanatory variables, X_i = Explanatory variables which are hypothesized to be included in the model (Gujarati, 2004).

3.4.2. Testing of econometric problems and model fit

Before running the regression analysis, a test of econometric problems is conducted. For this study multicollinearity test was conducted to test the presence of near-perfect linear combinations of two or more predictor variables with one another. As the degree of multicollinearity increases, the regression model estimates of coefficients become unstable, and standard errors for coefficients can get widely inflated. Accordingly, Variance Inflation Factor (VIF) was used to check the existence of multicollinearity. As the rule of thumb, a VIF greater than 10 indicates the existence of a multicollinearity problem (Maddala, 1992). Moreover, the model goodness-of-fit is checked through Hosmer and Lemeshow test. The detailed test results are provided in a supplementary file (Appendix A).

3.4.3. Definitions and measurements of variables

The effect of COVID-19 on livelihood activities of smallholder farmers is estimated to be influenced by the independent variables presented in Table 1.

3.5. Ethical approval and consent to participate

Prior to starting the survey, the study design was explained to Wollo University office of research and publication directorate. The respondents were informed regarding the confidentiality of data obtained

for this study. The objective of the study was fully explained to respondents to obtain consent. Information was collected after securing consent from study participant.

4. Result and discussion

4.1. Major livelihood activities in the study area

The result of the study shows that smallholder farmers in the study area practice different livelihood strategies such as on-farm, off-farm and non-farm activities. Among on-farm activities, crop production and livestock rearing are the dominant ones (Figure 3). Crop production remains the major source of livelihood for 97.4% of households while 77.4% of them earn their livings from livestock rearing.

A significant number of households are also involved in off-farm activities such as daily work, labor migration, renting of productive assets (Oxen and land), sale of firewood and trading of livestock. As it is presented in Fig.3, 47%, 30.7% and 14.8% of households rely on daily work, trading of livestock and labor migration, respectively as sources of income. In concomitant to this, it is worthy to note that non-farm activities such as small business trading, earning incomes from remittance, participation as beneficiary of the Productive Safety Net Programme (PSNP), and as handcrafters also serve as livelihood sources (Figure 3).

4.2. The effects of COVID-19 on the livelihood activities of smallholder farmers

The COVID-19 pandemic has significantly put superfluous pressure on the livelihoods of the smallholder farmers. The findings depicted in Table 2 posit that the livelihood activities of 88.89% of the respondents are affected by the COVID-19 pandemic one or another.

Crop production across the study Woredas has been affected by the pandemic in different ways with the highest number of households affected in Worebabo Woreda (68.88%) (Table 2). This is due to the fact that the residents in the Woreda are reliant on cash crops such as 'Khat' and horticultural crops through renting in/sharing extra land in normal cropping seasons. On the other hand, the number of households who ceased crop production activities as a result of the pandemic is relatively high in Dawachefa Woreda (6.41%) followed by Worebabo Woreda (4.60%). In simple terms, the effects on crop production were majorly resultants of shortage of labor, inaccessibility of agricultural inputs, lack of transport and sufficient market for their produces due to the movement restrictions. These findings are in line with a study conducted in Senegal and Burkina Faso which revealed that disruptions in the supply chain could reduce planting area and/or crop productivity (Jha et al., 2021). Crop production could be affected due to the challenges of accessing inputs, delay in planting seasons, and inability to hire labor (Middendorf et al., 2021). The pandemic had hit asset renting such as

Table 1. Definition and measurement of independent variables.

No.	Explanatory variables	Measurements	Type of data category	Expected sign
1.	Age of respondents (Age)	Number of years	Continuous	+
2.	Gender of respondent (Gender)	1 = male and 0 for female	Dummy	+/-
3.	Family size of respondents (TotalFamSiz)	Number of family members in the household	Continuous	+
4.	Educational status of respondent (Educationalstatus)	1 = literate (read and write), otherwise = 0	Dummy	+/-
5.	Land holding size (LandSizeha)	The size of land a household owns in hectare	Continuous	-
6.	Use of irrigation	1 = user, otherwise = 0	Dummy	+
7.	Number of oxen (OXenNumber)	Number of oxen owned for draft power	Continuous	+/-
8.	Frequency of DA contact (DAContact)	No. of DAs contact per year before COVID-19	Continuous	+
9.	Access to remittance (Remitt)	Access remittance (1 = if yes, otherwise = 0)	Dummy	+
10.	Market distance (Wakingminute)	The distance from home to the nearest market in minutes.	Continuous	+
11.	Membership to farmers' cooperatives (Coopmember)	Membership status to farmers' to cooperatives (1 = yes, 0 = otherwise)	Dummy	-

Source: own hypothesis, 2020

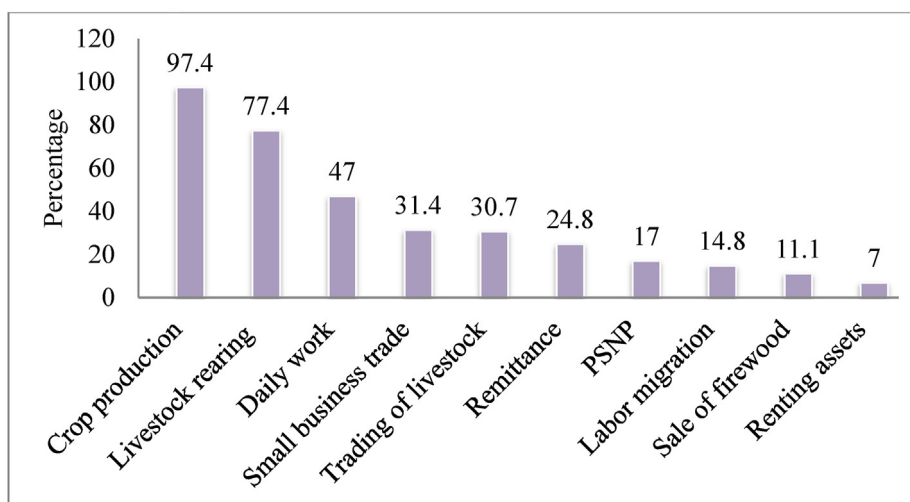


Figure 3. Major livelihood activities among rural households.

Table 2. Livelihoods affected by the pandemic by study Woredas

Livelihood activities	Percentage of households affected				Percentage of affected households who completely ceased their livelihood activities			
	Dawa- Chefa (n = 92)	Jama (n = 88)	Wore-babo (n = 90)	Total (n = 270)	Dawa- Chefa (n = 78)	Jama (n = 75)	Wore-babo (n = 87)	Total (n = 240)
Crop production	57.60	59.09	68.88	61.85	6.41	1.34	4.60	4.17
Livestock rearing	21.74	69.32	36.66	42.22	3.84	2.67	4.60	3.75
Daily work	28.26	36.36	56.66	40.00	28.21	30.67	56.32	39.17
Small business	21.74	37.50	28.88	29.25	23.07	38.66	27.60	29.58
Trading of livestock	5.43	50.00	24.44	25.92	6.41	53.34	21.84	24.66
Remittance	17.39	18.18	15.55	17.03	19.23	29.33	24.14	24.17
Labor migration	3.26	0	36.66	13.33	3.84	0	24.14	12.91
Sale of firewood	7.60	3.40	18.88	10.00	5.13	2.67	17.24	8.75
PSNP	1.08	10.23	14.44	8.51	1.28	9.33	12.64	7.92
Handcraft	4.35	2.27	6.66	4.44	5.13	2.67	4.60	4.17
Renting assets	1.08	3.40	7.77	4.07	1.28	2.67	4.60	2.92

Source: Own survey, 2020

land and ox, labor moment restriction, input distribution, working in a group for rotational labor sharing activities, and products marketing thereby few households were forced to cease this business activity. Some key informants also supported this evidence as the pandemic has affected labor availability and has restricted working together especially at the time of weeding. Contrary to this, some of the respondents and key informants reported that the pandemic provided a great opportunity to focus solely on crop production activities without moving to markets and other areas, although labor and input shortages were still hurdles.

Box one

A respondent from Oromia Special Zone of Shekla Kebele said “When the outbreak started, I was intensively working on agricultural activities with my family members between March and July of 2020. After understanding the major transmission channels of the pandemic is through physical contacts, I started going to the farm field in the morning after having breakfast only with my family members helping me hold the farm tools. We do not allow other people who are not members of the family to engage in our activities. It made us feel safe from the fear of catching the sickness. All in all, the pandemic has also helped us realize the opportunities of fully concentrating on farming activities.”

The pandemic's effects on the number of households whose livelihood depended on livestock rearing was noted to be serious in Jama Woreda (69.32%) where it was more than triple comparing to the number of households affected in Dawachefa (21.74%) and almost double from those in Worebabo (36.66%). Likewise, the effect on livestock and livestock products trading on households in Jama Woreda (50.00%) is as nine times higher comparing to those in Dawachefa Woreda (5.43%) and close to double of the number of households affected in Worebabo Woreda (24.44%). In explaining the reasons of severity among Jama residents, they indicated that they were engaged in fattening of small ruminants and oxen for holiday markets, inter alia, Easter. Nevertheless, the movement restrictions limited their access to markets and halted their livestock and sale of livestock by-product, and barring them from procuring the necessary inputs. Consequently, about 53.34% of the affected households in Jama Woreda were forced to cease their livestock rearing and by-products trading completely (Table 2). The findings by Middendorf et al. (2021) also corroborate these findings by affirming that livestock rearing and marketing could be greatly affected due to the inability to get access to feed and markets to sell livestock and livestock by-products.

On the other hand, the number of households who engaged in daily labor work in Worebabo Woreda were the greatest sufferers (56.66%), of which virtually all (56.32%) halted their activities as a result of the pandemic. The severity of the effects of the pandemic on daily laborers was grave for those in Worebabo due to their lack of resources

particularly in terms of land and education, and the woreda's dependence on the production of *Khat* which demands high number of laborers. Morton's (2020) also affirms that the restrictions on gathering at hiring points affect daily workers employment.

Box two

A resident from Deye kebele of Worebabo Woreda asserted that; "I am 42 years old having 6 family members. I own 0.75ha of land and cultivate Sorghum, Teff, and Khat. The land is not as much productive. To diversify my livelihood, I involve in small business and daily labor. My small business focuses on carpenters and trading of construction wood. However, the pandemic restricts working on these businesses as trading of construction wood requires labor movement and access to daily laborers. During the pandemic, no one demands daily laborer due to the fear of further contacts and infection. As a result of which, the construction sector stopped and my livelihood from small businesses and daily work collapsed. Honestly, the pandemic is threatening the life of the family."

Small business trade activities were affected by the pandemic across all study Woredas with the highest number of affected households in Jama Woreda (37.50%) whereas, the highest in terms of ceasing small business trading completely was recorded among households in Dawachefa (38.66%). This is due to the fact that certain business activities were banned by the government to avoid social gatherings; while some lacked the necessary inputs and customers due to movement restrictions, and others due to financial shortage. The report by the UN on Ethiopia projected that workers employed in micro, small and medium-sized enterprises and informal sectors will be severely affected (United Nations (UN), 2020). In the study area, households are engaged in small business activities such as trading cereals and vegetables, working in a small cafeterias, and kiosks in rural villages. The price of vegetables and poultry could largely reduce due to the contraction of a large demand driver– tourism (Nechifor et al., 2021). The study conducted in Pakistan on socioeconomic impact of COVID-19 confirmed that the income for about 64% of respondents decreased due to the pandemic (Ali et al., 2020).

Similarly, income from remittance is affected across the study Woredas with relatively higher proportions of affected households in Jama Woreda (29.33%) not receiving any incomes from remittance after the pandemic started. The decline in remittance income is a result of service workers in the remittance exporting countries who were also subjected to increasingly severe social lockdown policies to slow the spread of COVID-19. The lockdown affected the income of migrants which in turn has affected those households who receive remittance. The study participants explained that significant numbers of households in the study Woredas are reliant on remittances from migrants in Arab countries. Supporting this finding, the United Nations report projected a drop-in of 10–15% in remittances - around USD 570–850 million which directly diminishes the consumption levels of affected households in Ethiopia (United Nations (UN), 2020).

In this study, labor migration is defined as the movement of labor from their permanent residence to another area in search of jobs seasonally within the country. Internal labor migration occurs inside a particular country, and between regions, especially from economically poor areas and rural parts to major cities (Bell et al., 2010). The findings show that households who are highly affected (36.66%) and forced to cease (24.14%) due to the movement restriction were majorly from Worebabo Woreda. However, this was found to be not true for those in Jama Woreda as the area is relatively more productive and the unavailability of seasonal migrants to other areas in the country in search of jobs. The report of UN-Ethiopia (2020) projected that the pandemic could result in a loss of 10–15% of employment.

The sale of firewood was affected across all study areas with the highest effect in Worebabo Woreda (18.88%) which is as two times as high among those in Dawachefa and as five times high for those in Jama Woreda. Besides, about 17.24% of them were forced to cease this livelihood activity after the outbreak. This visible effect was strongly recorded among households in Worebabo Woreda as compared to the other Woredas. This was mainly due to the fact that the Woreda is located far away from the main road, thereby transportation access and the transportation costs were triple. In parallel to this, handcraft is highly affected greatly in this same Woreda due to lack of market during the lockdown. As the respondents explained, renting of assets such as land and ox is challenging due to labor shortage and farmers' tension to perform livelihood activities like they used to. The evidence by another also confirms that most COVID-19 related problems emerged in relation to sales and marketing activities (Benedek et al., 2021).

PSNP practices are also affected across all study area, though relatively = the highest effect on households was recorded in Worebabo Woreda (14.44%) where about 12.64% of them were forced to cease their engagements in PSNP activities. PSNP has been carried out in groups, and was ceased due to social distancing and budget limitations during the pandemic. Other studies conducted by Egger et al. (2021), and Gerard et al. (2020) reported concerns on the implementation of PSNP during the pandemic as benefiting from government or NGO supports during crisis is reduced (Egger et al., 2021).

4.3. The association of household demographic and socioeconomic characteristics with the effect of COVID-19 on livelihood activities

The results of demographic and socio-economic characteristics show that 77.7% of the respondents are male-headed and remaining 22.3% are female-headed households. Regarding educational status, 61.1% of the respondents are literate (can read and write) and the remaining 38.9% are illiterate. The marital status of household shows that 78.5% are married, 10.4% are widowed, 9.2% are divorced, and 1.9% are single. Oxen ownership is expected to determine the livelihood status of smallholder farmers. As it is presented in Table 3, 72.3% of the respondents own the oxen, and the remaining 27.7% of the respondents don't own the oxen. Households averagely own one ox (Table 3). Use of the irrigation is important to diversify their livelihoods and increase the income of households. In the study area, vegetables, fruits, and cereals are cultivated through the use of irrigation. As it is presented in Table 3, 54.9% of respondents are irrigation users. Mostly the vegetables and fruits are irrigation-based agricultural practices. The pandemic significantly affected vegetable and fruit producers. The key informants and case study participants in Worebabo and Dawa Chefa Woredas reported that the pandemic significantly affected the marketing of vegetables and fruits. This result is consistent with the finding of Gu and Wang (2020) that reported the pandemic heavily affected the marketing and price of vegetable producers in Shanghai, China. Similarly, Tamru et al. (2020) as cited in Morton (2020) confirmed the disruption of the vegetable trading due to the lockdown.

Box three

A 40 years old man from Bulbulo kebele in Worebabo Woreda said that "My livelihood sources are vegetable marketing and Khat production. The outbreak of the COVID-19 pandemic highly affected these livelihood sources. No one buys vegetables due to the perception that vegetables transmit the Corona Virus. The entire Khat which was expected to earn me \$600 per annum is also totally lost. My previous saving is running out as I am using it to feed family. Currently, I am faced with the difficulty of managing the means to keep together my 5 family members."

Table 3. Demographic and socio-economic characteristics of respondents.

Categorical variables	Category	Frequency	Percentage
Sex	Female	60	22.3
	Male	210	77.7
Educational status	Illiterate	105	38.9
	Literate	165	61.1
Marital status	Married	212	78.5
	Single	5	1.9
	Divorced	25	9.2
	Widowed	28	10.4
Use of irrigation	User	148	54.9
	Not user	122	45.1
Oxen ownership	Owned	195	72.3
	Not owned	75	27.7
Access to remittance	Accessed	57	21.1
	Not accessed	213	78.9
Membership to cooperatives	Member	180	66.7
	Not member	90	33.3
Continuous variables	Minimum	Maximum	Mean
Age	20	80	44.0
Family size	1	12	5.3
Land holding size (ha)	0	2.5	0.8
Oxen number	0	4	1.2
Remittance received	0	60000	1577.8
Walking distance	15	240	91.1
Frequency of DA contact in a year	0	45	2.1

Source: Survey result (2020).

Among the respondents, only 21.1% have access to remittance (Table 3). During the time of the survey, the average remittance amounts 1577.8 Ethiopian birrs (which is equivalent to \$35.32 USD, as of August 10, 2021 exchange). Access to remittance is deemed to cover the short-falls of household income resulting from the pandemic. Although, as the pandemic is a global phenomenon, it has affected remittance senders which reduced the remittance at home. In the study area, 66.7% of respondents are members of farmers' cooperatives (See Table 3). Membership to cooperatives will have a contribution to access agricultural inputs and marketing of agricultural products.

The mean age of respondents is 44 years, with the minimum and maximum ages of 20 and 80, respectively (Table 3). This average age implies majority are in the productive age groups. Smallholder farmers with large family sizes were expected to be affected by the pandemic adversely due to the reason that being a large size may increase the probability of contacts and infections. In addition, it is expected that households with large family sizes are more likely to face a shortage of food as a result of diminished household income during the pandemic. The findings show that the average family size is 5, though might not be large, the maximum size was recorded to be 12.). Respondents also own land up to 2.5 ha with an average holding size of 0.8 ha. Walking distance to the nearest main market takes from 15 min to 240 min. Averagely smallholder farmers walk for 3 h to reach the nearest main market to undertake marketing activities (Table 3). Smallholder farmers have made contact with Development Agents (DA) on average twice a year. Consultation with DA is critical for smallholder farmers to access updated agricultural information. The frequency of DA contact varies from farmer to farmer. As it is presented in Table 3, there are farmers who contact DAs up to 45 days a year.

Table 4 highlights important findings regarding the relationship of socioeconomic characteristics of households with the effect of COVID-19 on the livelihood status of smallholder farmers. The dependent variable is the livelihood status of smallholder farmers due to the pandemic. The livelihood status may be either affected (1) or not affected (0). In this study, the livelihood status is said to be affected if at least one livelihood

Table 4. The effect of COVID-19 on the livelihood status of smallholder farmers.

Variables	B	S.E.	Sig.	Marginal effect
Age	-0.013	0.028	0.655	0.001
Gender (1 = Male headed)	1.727	0.720	0.016	0.041
Total family size	-0.122	0.140	0.384	0.004
Educational status (1 = literate)	-0.913	0.569	0.109	0.033
Land holding size (ha)	-2.062	0.645	0.001	0.067
Use of irrigation (1 = user)	-1.289	0.534	0.016	0.047
Oxen numbers	0.496	0.305	0.104	0.016
Access to remittance (1 = yes)	-0.953	0.829	0.250	0.025
Market distance in minute	-0.015	0.006	0.017	0.001
Frequency of DA Contact	0.790	0.228	0.001	0.026
Membership to cooperatives (1 = yes)	-0.436	0.535	0.414	0.015
Constant	5.560	1.766	0.002	
Observation = 270				
Chi-square = 61.335				
Prob > chi = 0.0000				
-2 Log likelihood = 127.034				
R-square = 0.405				

Source: Survey, 2020

activity experiences a negative effect as a result of the pandemic. To analyze the association, 11 predictor variables were used, of which five variables are significant. The variable Woreda (dummy) is excluded in the model due to multicollinearity problem. Marital status is also rejected from the model due to its insignificance in the model to increase the significance of other variables using the model reduction rule. The detailed analysis of significant variables is presented as follows.

4.3.1. Gender

There is a statistically significant association between the gender of household heads and the effect of the COVID-19 on their livelihood status. The result reveals that male-headed households were affected more than female-headed households by a factor of 1.727. The marginal effect of 0.041 indicates that a unit changes in the gender of the household head from female to male increases the probability of livelihood being affected by the COVID-19 by 4.1% holding other factors constant. However, the empirical evidence shows that female-headed households are engaged in off-farm and non-farm livelihood activities which are vulnerable to the COVID-19 pandemic (Central Statistical Agency (CSA), 2017; Middendorf et al., 2021). The result of this study is contrary to the expected hypothesis and previous findings. This could be due to the reason that male-headed households may be engaged in diversified livelihood activities before the outbreak of the pandemic. Hence, male-headed households have better resources including the labor force to engage in diversified income generating activities compared to their female-headed counterparts. Consequently, the COVID-19 pandemic may collapse those livelihood activities due to the movement restrictions and other containment measures.

4.3.2. Landholding size (ha)

The COVID-19 pandemic will affect households differently based on the size of their landholdings. The result shows that households with large landholding sizes are less affected by the COVID-19. The findings show that the effect of COVID-19 on livelihood status will decrease by a factor of 2.062 as the landholding size increases by 1 ha. The marginal effect of 0.067 implies that a unit increase in landholding size will reduce the probability of livelihood status being affected by the COVID-19 pandemic by 6.7% holding other factors constant. This could be resulted due to the fact that households with large landholding sizes may accumulate assets to be resilient from shocks and stresses. In addition, having a large landholding size could enable farmers to invest in live-stock production that enables them to access their own forages and feeds. Therefore, households with large landholding sizes may be diversified

their on-farm activities using family labor. However, the findings of [Aromolaran and Muyanga \(2020\)](#) contradicts this finding that the COVID-19 reduced availability and increased cost of farm labor, which in turn, resulted in a decline in land area cultivated. But some key informants and respondents described that the COVID-19 provided the opportunity to use family labor due to the lockdown of schools. In this case, households having large family sizes will be benefited to allocate their labor to farming activity.

4.3.3. Use of irrigation

The use of irrigation determined the effect of COVID-19 on the livelihood status of smallholders negatively and significantly ($p < 0.05$). Its sign is against the expected hypothesis. The results of the present study reveal that the use of irrigation practices will reduce the probability of affecting livelihood status as a result of COVID-19 by a factor of 1.289. The marginal effect of 0.047 indicates that a unit increase in the use of irrigation will reduce the probability of livelihood status being affected by the COVID-19 pandemic by 4.7% holding other factors constant. The use of irrigation is expected to diversify agricultural production activities.

4.3.4. Market distance in minutes

It is about the time it takes to reach the nearest main market in walking minutes. The market distance determined the effect of COVID-19 on the livelihood of smallholders negatively and significantly ($p < 0.05$). The result reveals that as the walking distance increases by 1 min, the effect of the COVID-19 pandemic on household livelihood status will reduce by a factor of 0.015. The marginal effect of 0.001 shows that a unit increase in walking distance to the nearest market will reduce the probability of livelihood status being affected by the COVID-19 pandemic by a factor of less than 1% holding other factors constant. This may be resulted due to the reason that households near the main market may be engaged in non-farm and off-farm livelihood activities. Consistent with this finding ([Kumar et al., 2020](#)) revealed that the COVID-19 pandemic has a significant impact on the livelihoods of peri-urban households.

4.3.5. Frequency of DA Contact

This variable refers to the frequency of smallholder farmers that contact Development Agents (DA) to access agricultural information regarding new production practices and the like. Households were asked to respond how frequently they were contacting DAs in a year before the outbreak of the COVID-19 pandemic. This was hypothesized that the outbreak of the COVID-19 pandemic will limit the frequent contact of households to access updated agricultural information. Accordingly, the frequency of DA contact before the outbreak of the pandemic determined the effect of COVID-19 on the livelihood of smallholders positively and significantly ($p = 0.001$). The result reveals that as the farmer's contact with DA before the outbreak of the pandemic increases by one day in a year, the probability of current livelihood being affected by the pandemic will increase by a factor of 0.790. The marginal effect of 0.026 indicates that a unit increase in contact with DAs will increase the probability of the livelihood being affected by the COVID-19 pandemic by a factor of 2.6% holding other factors constant. This shows that farmers who were meeting DAs frequently before the outbreak of the pandemic were faced the challenge to sustain the previous contact. During such cases, they may face the challenges of getting updated agricultural information to implement improved farming practices. The result of this study agrees with the findings of [Boef et al. \(2021\)](#) who argued that social distancing prevents stakeholders from meeting to exchange goods, services, and information.

5. Conclusion and policy implications

COVID-19 pandemic is a global phenomenon that has been heavily affecting the lives, livelihoods, and wellbeing of the entire human population. However, its impact varies among different groups and sectors.

In the study area, crop production, livestock rearing, daily work, small business trade, trading of livestock, and remittance are the dominant livelihood activities, among others. The results confirm that although the pandemic affected different dimensions of lives and livelihoods ranging from farming activities to small business and remittance, yet its effects varied depending geo-local settings and pre-pandemic livelihood activities of the target Woredas. The effects not only temporarily paused income sources, but have also ceased livelihood activities on an enduring basis. The binary logistic regression model result reveals that the sex of the household head and frequency of contact with DA had a positive and significant relationship with the effect of the COVID-19 pandemic on their livelihood activities. On the other hand, it was found that land-holding size, use of irrigation, and distance from the market had a negative and statistically significant relationship with the effect of the COVID-19 pandemic on their livelihood activities. It can be concluded that the pandemic significantly affected all dimensions of livelihood diversification strategies. Particularly non-farm and off-farm livelihood activities of smallholder farmers are significantly affected by the pandemic.

Therefore, the government and other donor organizations should focus on immediate and long-term intervention strategies to recover the most affected households through social security programs and revolve funding mechanisms. Creating market linkage for agricultural products can also boost the resilience capacity of rural households.

6. Limitation of the study

This study used a cross-sectional research design which doesn't capture the seasonality of data. The study also fails to analyze the resilience capacity of households after the COVID-19 pandemic. Besides, robust impact assessment techniques like Propensity Score Matching (PSM) models were not applied in this study. Therefore, future research should focus on analyzing the impact of the COVID-19 pandemic by generating data that can capture the seasonality, and resilience capacity of households. Moreover, detailed analysis on the effect of the pandemic across the sex of household heads is needed by generating gender aggregated data.

Declarations

Author contribution statement

Asrat Mulat Asegie, Samuel Tadesse Adisalem: Conceived and designed the experiments; Performed the experiments; Analyzed and interpreted the data; Wrote the paper.

Amogne Asfaw Eshetu: Conceived and designed the experiments; Analyzed and interpreted the data; Wrote the paper.

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Data availability statement

Data will be made available on request.

Declaration of interests statement

The authors declare no conflict of interest.

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