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The future of Mango farmers post COVID-19 pandemic outbreak: The Household Livelihood Resilience Approach

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ABSTRACT

The future and welfare of mango farmers are important and if mango farmers can apply agribusiness behavior, namely perseverance, resilience, hard work, saving, carefulness, discipline, and respecting time, they stand a better chance of survival during a pandemic. How mango farmers' livelihood will be going forward is, yet unknown since many aspects such as economic, physical, financial, and human factors of their way of earning a living are affected hugely by Covid-19. This study was conducted to determine the socio-economic nature of mango farmers in Vhembe district Limpopo province, determine the livelihoods of mango farmers after the Covid-19 pandemic, and identify challenges that mango farmers encountered during the Covid-19 pandemic. Descriptive statistics and household were employed to help analyze the results from the collected data. In the study area, 77% of the farmers were males and pensioners since they were above the age of 60. Currently, mango farmers are highly impacted by the outbreak of Covid-19 in terms of production and marketing their products, thus these changes in their livelihood and their survival in farming are in the line since 54% of the farmers currently have access to loans, which makes it easy for them to cover for their loss of income. The government should ease up other restrictions on farmers to enable them to farm and issue necessary support to those farmers who have lost the least they had due to Covid-19. Concerning access to information about Covid-19, the results of the study posit the significance of the relationship between finance and human capital, which the study recommended that the government should subsidize the farmers.

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1 Introduction

It is advisable to employ the notion of resilience to sustainably manage resources for both ecosystem function and farmers' development and well-being (Berkes et al. 2002). However, Tanner et al. (2015) proposed that the lens of resilience requires greater attention to mango farmers' livelihoods if it is to address the limits of adaptation strategies and the development needs of the planet's poorest and most vulnerable farmers. Most rural area-based mango farmers are oriented to product quality and market demand, and oriented towards the addition of value, able to control and utilize nature, responsive to innovation this value allows mango farmers to survive and have a better future (Gatto and Busato 2020)

Agriculture in rural areas continues to be the main economic activity that sustains the livelihoods of most farmers 'households. Most mango farmers depend on mango farming as their source of income. The covid-19 pandemic forced the country to go on lockdown, where mango farmers marketing channels had to close down. During the pandemic, farmers' households and indeed the district's food security seems threatened (Yamba et al. 2017). The capacity of all farmers to sustain and improve their livelihood opportunities and well-being despite any form of disturbances is a livelihood-resilient approach. This approach expands beyond the technical approaches to minimizing harm and loss by bringing issues of farmers' lives. Importantly livelihood approach acknowledges that farmers' characteristics are different and their perceptions of different situations affect their ability to adapt to changes (Quandt 2018; Rahman et al. 2019).

As illustrated by Lebel (2017), there is a need to expand resilience work to include more analysis of the processes and perceptions that affect people's ability to adapt to the impacts of various changes to their livelihood. Integrating livelihood approaches with resilience thinking can reinforce the understanding of the dynamics of rural household livelihood and of how rural households pursue and improve their livelihood to cope with changes and perturbations (Alexander 2013; Speranza et al. 2014). Livelihood resilience is a coping strategy used by farmers during stressful times. These coping strategies can be spontaneous but often involve planning and preparation shocks. Coping strategies can be specific responses or activities used to adjust to changing conditions of production, both short and long-term (Quandt 2018).

1.1 Household livelihood resilience

The Household Livelihoods Resilience Approach (HLRA) is a method of understanding the lives of people experiencing poverty and disadvantage. A participatory approach is based on the belief that people experiencing poverty have abilities and assets that can be used to help them manage and improve their lives (Altendorf 2017). Some attempts to measure livelihood resilience only provide a theoretical framework instead of practical methods. Most of the efforts to measure resilience only rely on the objective measure of resilience, whereas many interventions to build livelihood resilience focus on the community scale. Many efforts to measure livelihood resilience ignore human agency, the importance of power relationships, and access to assets (Quandt 2018).

A livelihood is sustainable and can cope with and recover from stress and shocks, maintain or enhance its capabilities and assets, and provide sustainable livelihood opportunities for the next generation and which contributes net benefits to other livelihoods at the local and global levels and in the short and long term (Clark and Carney 2008). Tanner et al. (2015) promote the livelihood resilience approach because it highlights human agency and capacity to prepare and cope with different shocks. This is important because it shows that people can take an active role in building resilience. Measuring livelihood resilience through the five livelihood capital assets can highlight how people actively build and accumulate capital to better prepare for shocks.

1.2 Impacts of Covid-19 on mango production, food security, and livelihood of farmers

Coronavirus is a contagious virus that spread continuously, coronavirus disease 2019 (Covid-19) is continuing to spread around the world; it is a hard time for many economic sectors, including agriculture (Andersen et al. 2020). The virus has posed serious challenges to the sustainable functioning of agricultural food markets. As of 1 May 2020, more than 3.2 million cases were confirmed with over 231,000 deaths (FAO 2020a). The WHO is still reporting a continuous rise in the number of cases, with the pandemic now spreading to virtually all countries of the world (Jámbor et al. 2020). The impact of Covid-19 on perishables vegetables, fruits, milk, eggs, and poultry producers has been even more severe than on the producer of cereals, pulses, and oil seeds. Most current assessments generally foresee a contraction in both supply and demand for agricultural products and point to possible disruptions in trade and logistics (Galán Saúco 2004; Scoone 2020).

To avoid a total disaster that is food insecurity and economic instability in the rural sector during the Covid-19 crisis all-available mechanisms enable the drawdown of additional financial resources mustered. It should be possible to identify which previous experiences may be relevant and applicable this time around in the Covid-19 crisis; then target the populations most likely to benefit, and support them in scaling up as necessary once the interventions have been determined and put in place (Scoone 2020). The 2008 financial crisis was primarily a crisis of prices and speculation, linked to the global financial situation including the vast market in sub-prime mortgages in the US. As it happens, global food stocks in 2020 are in good shape (AFD 2020).

1.3 Previous literature on Livelihood Resilience Approaches (LRA)

There are a growing number of approaches to thinking about resilience. Bahadur et al. (2010) review 16 approaches among these and identify many common features. Since the publication of these articles, multiple organizations have also defined their resilience frameworks. Several of these frameworks also come with long lists of resilience characteristics or features. Depending on this, resilience can be defined as a process, an outcome, an overarching objective, or a dimension of sustainability.

Today, livelihoods approaches are most useful as an analytical or heuristic tool (Clark and Carney 2008). They provide a way to order information and understand not only the nature of poverty but also the links between different aspects of people's livelihoods. In this way, they help users to understand complex and changing situations (Ellis and Freeman 2007). They broaden the policy dialogue and assist in identifying the relevance of programs as well as where key constraints and opportunities lie. Furthermore, livelihood approaches are still essential within social and economic research on poverty and food security, both as embedded in research strategies and as a research tool (Speranza et al. 2014).

2 Materials and Methods

Limpopo Province is comprised of five districts. These are Capricorn district, Mopani district, Sekhukhune District, Vhembe district, and Waterberg district. However, the current study was conducted in the Vhembe district of Limpopo province, South Africa. The district comprised four local municipalities namely Makhado, Musina, Collins Chabane, and Thulamela. The area of the district is 25 597 km² with a population of approximately 1.2 million (Stats SA, 2018). Data for the study was collected from the Vhembe district in the Limpopo Province, where the population of registered mango farmers is approximately 400. To determine the sample size of the study, Raosoft sample size calculator was used to determine the sample size from the list of smallholder sunflower farmers in the study area. With the help of the above-mentioned calculator, and a sample size of 111 was selected for this study.

2.1 Household Livelihood Resilience Approach

The household livelihood resilience approach was used to analyze the impact of the Covid-19 pandemic on mango farmers after the Covid-19 pandemic outbreak. According to Thulstrup (2015), this method is based on participatory research applied anthropology and rapid rural appraisal. According to this approach, livelihood should be considered in terms of people's access to capital assets such as financial, physical, natural, human, and social assets (Quandt 2018). HLRA process is applied in steps as follows:

Step 1: Mango farmer's indicators

The HRLA indicators of livelihood resilience are developed using a literature review of the capital assets. This approach to determining indicators of resilience is similar to the stakeholder assessment method proposed by Campbell et al. (2001). The indicators are organized around the five-livelihood capital, financial, physical, natural, human, and social assets as has been done by previous research (Erenstein et al. 2010). While some of these indicators will be contextual-based, it does not mean that the context and responses will be the same for all households within a community. As explained by Twigg (2007) researchers and development practitioners need to move away from thinking of community as 'homogenous', and instead recognize internal variability and differences as shown in table 1.

Step 2: Composite asset index

A composite asset index is created for each household, to create the index the results of each indicator will be converted so that the answer choices for questions will be on a scale of 0 to 1. It is assumed that higher scores should indicate higher levels of livelihood assets and greater livelihood resilience (Quandt 2018). The importance of converting the results of each indicator question into a scale of 0 to 1 is that it allows indicators to be averaged together and generally makes it easier to analyze as shown in figure 1.

2.2 Econometric Model

The probit model is a popular specification for an ordinal or a binary response model that employs a probit link function (Thulstrup 2015). The Binary Probit model was used to analyze the impact of access to general information about the Covid-19 outbreak. General information includes; how to produce mangoes under Covid-19 regulations, how to market mangoes and the labour requirements in the new normal with Covid-19. Access to information can help farmers deal with the Covid-19 outbreak. In the study area, some farmers had access to information while other farmers had no access. Therefore we assume that Y* can be specified as follows:

$$Y^*i = B0 + B1X1 + B2X2 + \ldots\ldots\ldots + BkXk + Ui$$

And that: $Yi = 1$ if $Y^* > 0$;

$Yi = 0$ Otherwise

Where X1, X2… Xk represents the explanatory variables, B represents a vector of unknown parameters and U represents the disturbance term (Nagler 1994).

Table 1 livelihood resilience indicators

Assets	Quantitative indicator
Financial capital	Income (Rand per annum) Access to loan (Yes or No) Household belongings (No of belongings) Size of farmland (No of hector) Ownership of farm equipment (Own, Rent, Borrow, or lease) Non-Agriculture salaried job (Yes or No)
Human capital	Family labour availability (Yes or No) Education level (Level or respondent) Health problems affecting practice (Yes or No) General health of family labour (Scale from Poor to good) Availability of healthy facilities (Yes or No)
Social capital	Access to social information about health (Yes or No) Participation in other Agriculture activities (Yes or No) Strength of relationship with the neighbour farm (Scale from poor to good) Participation in farmers' groups (Yes or No)Access to extension services (Yes or No)
Physical capital	Road conditions (Scale from bad to good) Availability of storage facilities (Yes or No) Access to market (Yes or No) Ownership of farming equipment (No of equipment) Distance to the market (No of KM)
Natural capital	Size of farmland (No of Hectors) Own farm (Yes or No) Diverse farming activities (Yes or No) Diversity of farm crops (Yes or No) Availability of natural resources (Yes or No)

Source: Author computation 2021

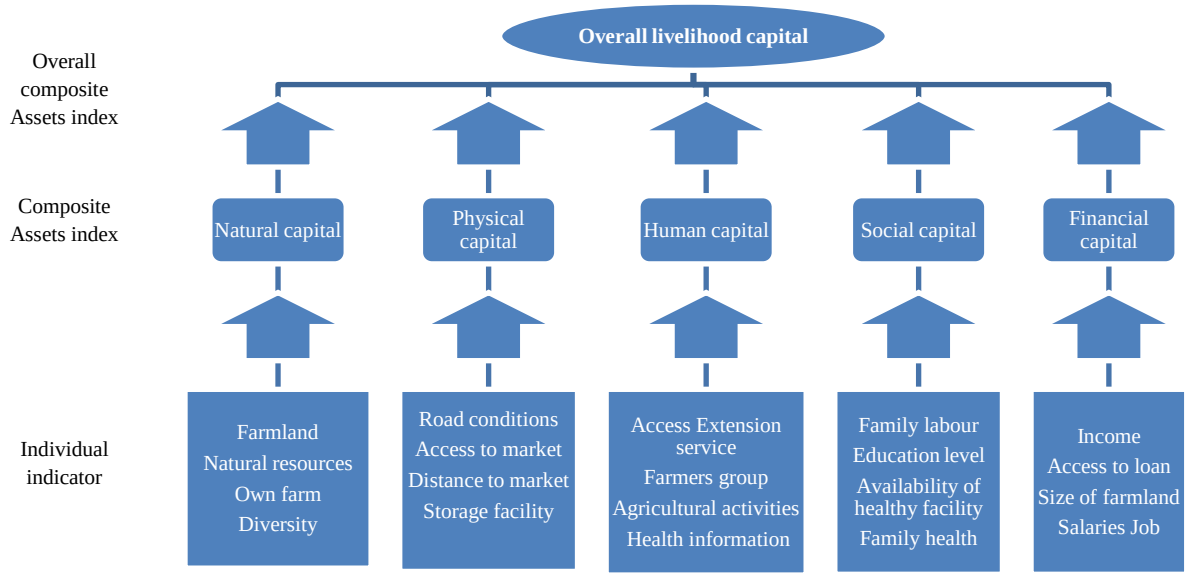

Figure 1 Schematic representation of data types and linkages for sustainable livelihood framework (*Source*: Author computation 2021)

3 Results and Discussion

Results presented in table 2 showed different socio-economic characteristics of mango farmers, the results of the study revealed that about 40% of farm workers had comorbidities while 60% had no comorbidities, this implies that 40% or farm workers are in danger of being attacked by Covid-19 and can be vital to them and it will alter their livelihood. Andersen et al. (2020) stated that Covid-19 is continuing to spread around the world, causing hard times for many economies and sectors, including the future of agriculture and since people with comorbidities are prone to this virus.

Table 2 Socio-economic characters of respondents

Parameters				N=111
Gender			Male	Female
			77 %	23 %
Age	21-40 years	41-60 years	61-80 years	81-100 years
	9%	29%	52%	10%
Employment status	Employed	Unemployed	Pension	Other
	31%	9%	60%	0%
Education level	No schooling	Primary	Matriculated	Tertiary
	9%	9%	64%	18%
Access to loan			Access Granted	No access
			54%	46%
Access to extension service			Have access	No access
			100%	0%
Access to COVID-19 Information			Have access	No access
			87%	13%

Source: Authors computation 2021.

3.1 Access to credit

With Covid-19 affecting different parts of the economy, many of them will require loans to revive their production for the future and be able to produce again, the farmer who had access to short-term and long-term loans from commercial banks made up 54% of the study and 46% of farmers had no access to loans. This can be due to a lack of collateral or any form of property in their name and a lack of information on how to acquire loans and this poses danger to the continuity or revival of their farming projects post Covid-19 and maintaining their livelihood. Lack of access to loans can also be due to high-interest rates, according to Schmidhuber et al. (2020), since the outbreak of Covid-19, interest rates have changed around the world and risen by about 3.5% for low and middle-income countries

3.2 Access to information regarding Covid-19

Importantly most of the farmers had information about the impact of Covid-19 and ways of dealing with it. Farmers with general information regarding Covid-19 constituted 87% of the study and those who lacked info were 13% of the sample population in the study area. Lack of Covid-19 information access can be due to the inability to access the internet and digital media (DFID 2020). The WHO is still reporting a continuous rise in the number of cases, with the pandemic now spreading to virtually all countries of the world. After the first shock, many media platforms have started to post articles on the different effects of the virus related to agriculture. This enabled many farmers to have access to information regarding the Covid-19 outbreak and this will help them in the future to deal with the virus.

The results of the study revealed that males as compared to female farmers dominated the study conducted, 77% of the participants were males and 23% were females as indicated in table 2. Respondents indicated that mango production is dominated by males because it is labour intensive in table 2. Females do land a helping hand but mostly the ownership is dominated by males, According to Campbell et al. (2001), across sub-Saharan Africa, men have been found to produce between 4 to 25% more crops per hectare as compared to women while in case of mangoes this number is higher and men produced above 40% higher than women.

The second category is of farmers who are of the age between 41 to 60 years constitute 29% of the sample population in the study area. This indicates that most of the people consider mango farming after retirement but they start preparing early so that they can gain more experience. The other group is farmers of age between 21, 40, and 81 to 100 who make 9% and 10% respectively. The rest of the respondents between the age of 21 and 40 showed less participation this indicated that they are still engaged in other activities such as schooling and other economic activities and most of them do not see farming as a means of survival that can provide them with enough income to maintain their livelihood.

During the analysis of the results, the value of 1 was assigned to the most desirable response while 0 was to the least desirable response. For the question that had two answers, yes or no, 1 was assigned to the most desirable answer which is yes and 0 was allocated to the least desirable answer which is no. Questions with multiple answer choices were assigned values within the range of 0

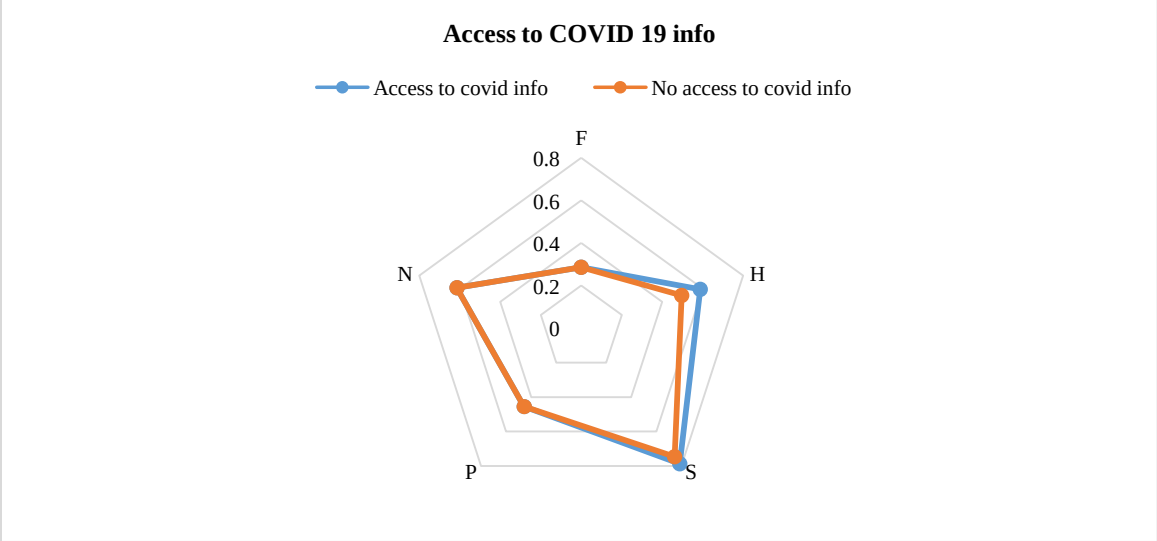

Figure 2 Spider diagram comparing the five livelihood capitals between, the farmers with access to Covid-19 information and farmers without access to Covid-19 information. How farmers with access to information can be resilient to Covid-19 outbreak and survive to continue with livelihood.

to 1. Quandt (2018), assumes that higher scores should indicate higher levels of livelihood assets and greater livelihood resilience. The interrelationship between the five individual composite indexes have been shown in figure 2.

3.2.1 Financial capital

Results presented in table 3 revealed that the average cost of production is 0.10, which indicates that due to the COVID-19 outbreak the cost of production has increased and this affects the livelihood of mango producers. The cost has increased due to certain factors such as the increase in transport. According to Rawal et al. (2020), the sudden imposition of the lockdown caused a massive disruption in the entire agricultural marketing system. No preparations were made to ensure the continuation of agricultural marketing or to ensure the safety of food supply chains before the lockdown was announced. There was a shortage of inputs and farmers had to pay a higher price for the inputs at the beginning of the Covid-19 pandemic. Mango farmers had to pay more to get the input for their products such as spray and fertilizers. Marketing costs since farmers need to deal with locked-down regulations before reaching the preferred market. The entire agricultural sub-sector future of farming for profit rather than subsistence is threatened by any type of transport restriction, or by limits to the scope for selling produce (URD 2020).

The change in livelihood caused by the lockdown has resulted in a considerable additional economic burden on farmers because of higher costs, increased debt burden, inability to sell products at reasonable prices, and crop losses. A large number of farmers, in particular, producers of pulses, oilseeds, vegetables, and fruits, have been forced to sell their produce at low prices to local traders because of disruptions in the functioning of the markets (Folke et al. 2002).

The income average is 0.41, which is below 0.50 and is close to the least desired income, which can help to influence the future livelihood of mango farmers. According to Rawal et al. (2020), the sales of fruits and vegetables have contracted very significantly because of the decline in demand. Mango is harvested in different parts of the country between April and July (DAFF 2019). Producers of all these fruits have incurred massive losses because of a collapse of both export and domestic demand due to lockdown regulations.

The financial sector plays a fundamental role in enabling successful country responses to the food supply and production by farmers and maintaining their livelihood. Other countries such as China are implementing lower percent interest rates for loans to Agri-SMEs in providence through the Agricultural Bank of China to help farmers to gain their lost income (FAO 2020b).

Most mango farmers have lost income due to Covid-19 and some will have to apply for loans in the future so that they can regain their normal livelihood before Covid-19 in their production. Farmers' export average is (0.00) which shows that farmers are also not exporting their products and this influence their income and it plays a huge role when it comes to the survival of outbreaks such as Covid-19. According to Smith (2012), the surge in food prices bans on exports, and loss of revenue because of economic contraction have severe problems for food security. During the pandemic, governments across the world impose lockdowns and shut down their borders. Therefore, the fear that food markets have logistical constraints and shortages in labour puts pressure on the prices.

Table 3 Livelihoods of mango farmers after the covid-19 pandemic outbreak (HLRA)

Indicators	Averages
Financial	
Income (Rand per annum)	0.41
Access to loan (Yes or No)	0.54
Cost of production	0.10
exporting	0.00
Non-Agriculture salaried job (Yes or No)	0.35
Human	
Family labour availability (Yes or No)	0.12
Education level (Level or respondent)	0.63
Farmers with commodities	0.24
Access to info about COVID	0.95
Availability of healthy facilities (Yes or No)	1.00
Social	
Access to irrigation schemes	0.94
Challenges when producing	1.00
Access to info about COVID 19	0.95
Access to general support from NGOs	0.05
Access to extension services (Yes or No)	1.00
Physical	
Market channel available	1.00
Availability of storage facilities (Yes or No)	0.28
Access to market (Yes or No)	1.00
Ownership of farming equipment (No of equipment)	0.00
Access to market information	1.00
Natural	
Size of farmland (No of Hectors)	0.56
Own farm (Yes or No)	1.00
Diverse farming activities (Yes or No)	0.35
Variety produced the most	0.58
Variety that sells the most	0.58

3.2.2 Physical capital

Due to storage of facilities, mango farmers fail to keep on supplying their market, and as such when the Covid-19 outbreak mango farmers suffered a setback when it comes to supplying the market. Mango storage has an average of 0.28, which shows that mango farmers lack storage facilities. A mature crop, if not stored properly, is spoilt because of pests and fungus. The storage capacity at the farm level is limited and often not good enough for prolonged storage. This is particularly a problem for poor and middle peasants and producers of perishable crops. While perishable crops such as potatoes and tomatoes need cold storage, even grain is at risk of spoilt (Rewal et al. 2020).

Since the Covid-19 outbreak, countries are taking advantage of digitally enabled innovation and developing digital ecosystems in the agricultural and rural sectors to provide market information (UNESCAP 2019). Participants had access to the market even after the Covid-19 outbreak. Access to market information and access to the market both have an average of 1.00 respectively. This factor will help farmers to maintain their livelihood and since they will still have access to the market in the future this is mainly because most farmers have various markets available to them.

3.2.3 Human capital

In any year, the need for employment creation in farming peaks in May and June, when the labour demand in agriculture is lowest in most parts of the country (FAO 2020b). The availability of labour average is 0.12 which shows that there is a lack of labour available; this is because most mango farmers use family labour as their workers on the farm. Agriculture is a sector that typically hires a large number of part-time or seasonal workers, and the virus causes a scarcity of farm labour force. As the virus limits the free flow of labour, farmers are also worried that they will not be able to hire enough workers, particularly for planting and harvesting (Jambor et al. 2020).

To create the overall weighted index all indicators were averaged since they are given equal weight. The average was used to show the influence of access to information about Covid-19 on farmers' future livelihoods (Table 4). Each indicator was given equal weight to aid interpretation and reduces ambiguity, as done by Erenstein et al. (2010).

3.2.4 Natural capital

Participants that have enough natural capital (0.614) help them to maintain their livelihood. All participants have their land which they are using for production; they do not have to go for loans to pay the rent for the land. This also helps them to keep their farming projects afloat. The physical capital value is 0.456, due to owning the land farmers are well equipped to build storage facilities in the future on the land so that they can store their mangoes, and support natural capital. If mangoes are well stored in proper facilities, farmers will have sufficient mangoes to supply the market in the future and this will have less impact on their future livelihood.

3.2.5 Social capital

Socially (0.788) farmers are getting all the necessary support to be resilient against the Covid-19 outbreak. All the participants indicated that they have full access to extension services offered by the Department of Agriculture. Farmers also have their support groups where they support each other in terms of difficult situations such as the Covid-19 outbreak. Concerning information about Covid-19, most of the participants are covered because the government made the information available to the public, this includes symptoms and prevention measures.

The decrease in social average from 0.788 to 0.747 showed how important it is for farmers to know more about Covid-19. This is because farmers will be able to produce more at less cost and apply necessary measures such as the use of storage facilities to store the mangoes. Socially mango farmers can also use the help available from NGOs to support their livelihood.

Access to Covid-19 information has a huge impact on human capital causing the change in average from 0.588 to 0.497 when farmers do not have access to Covid-19 information. Many farm workers are individuals with comorbidities and they are prone to the Covid-19 virus, so they need to remain in a safe place. This will affect the farm activities such as harvesting and fertilizing negatively due to the lack of labour availability.

3.3 Mango farmers' access to Covid-19 information

Table 5 summarizes the results of the binary probit regression coefficients of indicators affecting the mango farmer's access to general information about the Covid-19 outbreak. The binary probit model is a type of regression where the dependent variable can only take two values (Albert and Chib 1993). As such, it was used to analyze the data obtained from 111 mango farmers who were interviewed using a structured questionnaire, of the 111 farmers sampled, six (6) farmers had no access to general information on COVID-19, and 105 had access to general information about Covid-19.

A positive sign on an explanatory variable's coefficient indicates that the higher the values of the variable increase and decrease vice versa (Nagler 1994). In the table given above income coefficient is

Table 4 Overall weighted average index

Capitals	Averages with access to information about COVID-19	Averages without access to information about COVID-19
Financial	0.286	0.286
Human	0.588	0.598
Social	0.788	0.747
physical	0.456	0.456
Natural	0.614	0.614

Source: Authors computation 2021

Table 5 Binaryprobit results

Variable	Coefficient	Standard error	ratios	P value
Income (Rand per annum)	-2.79**	1.8531	0.061	0.131
Cost of production	0.999	1.9780	2.716	0.614
Family labour availability (Yes or No)	1.060**	0.9351	2.887	0.257
Education level (Level or respondent)	0.699	1.3441	2.011	0.603
Challenges when producing	3.237	3.3855	25.421	0.339
Access to irrigation schemes	-0.387	0.9165	0.679	0.673
Size of farmland (No of Hectors)	-4.477*	2.3299	0.011	0.055
Variety produced the most	0.838	2.6250	2.311	0.755
log likelihood	22.6			
Observation	Yes=6 (5.4%); No=105 (94.6%)			

**Significance at 10%; *significant at 5%; Source: Authors computation 2021.

-2.79 which is significant at 10%, which implies that when the income increases it enables farmers to get enough information about Covid-19. Income as financial capital indicator implies that a farmer's financial asset can help farmers in the future get information that will enable them to be resilient to the Covid-19 outbreak and this is because financially a farmer will be able to follow Covid-19 protocols and access far-distanced market as such their livelihood will be maintained.

Family labour availability value is 1.060 which is significant at 5%, indicating that if farmers have access to information they will know who to hire since they are well aware of who is at risk and who is safe regarding the Covid-19 virus. This implies that human capital has a huge influence on the future of mango farmers' livelihood because if farmers hire the right labour or have safe labour available they will be able to produce and sell their mangoes in the future.

Conclusion and recommendations

Mango farmers with access to Covid-19 information are more resilient and are more to survive the outbreak and continue to produce their mangoes. Farmers with less information are facing a lot of changes in their livelihood; they are bound to make adapting measures so that they produce again and earn income. Farmers encounter a lot of challenges when producing and marketing their products. Since the outbreak of Covid-19, production and marking has changed and the challenges have increased in numbers as compared to when the situation is normal.

The overall conclusion is that Covid-19 has changed the mango farmer's household livelihood and as such their production and marketing, this is due to the challenges that farmers encounter when producing and marketing their products. Covid-19 has also exposed farmers to a new way of doing things than their normal way.

The study recommends that farmers get work-shopped on how to deal with the pandemic for them to keep on producing. The workshop can offer well need needed education on what strategies to employ when farmers are facing a pandemic such as Covid-19 since it is new to them. Farmers lack support from the NGOs and banks to be resilient enough against the pandemic since the Covid-19 outbreak most farmers have lost income and spent more when producing. The study recommends that farmers should join hands and start their funding programs so that they can be able to help each other when there is a financial need. When mango farmers are a team they can also reduce, the money spent when they are taking their products to the market because they can share a load price.

Most of the mango farmers do not have a store room where they can store their products and their inputs as chemicals used for spraying their mangoes. Since most farmers own, the land that they are producing the study recommends that they build storage rooms for their products and input to avoid having to source every time to avoid price fluctuations. The study also recommends the sharing of storage among farmers who already have storage to avoid the loss of mangoes.

Based on the results of the study it can be recommended that youth needs to engage in mango production and farmers should hire them as workers this will help reduce the dominance of pensioners in the industry and allow for the survival of the farmers. Farmers' lack of access to the market is due to the restriction imposed by the government to curb the spread of Covid-19 and as such, farmers cannot export their products anymore. The study recommends that the government ease up the regulations on farmers and markers where farmers can sell their products so that they can be able to access the market. The study also recommends that farmers should be work-shopped on the importance of exporting their products

because they can earn more than what they are earning by targeting markets around them.

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