FRUIT AND VEGETABLE FARMERS' PERCEPTION OF THE IMPACT OF COVID-19 PANDEMIC AND ADOPTION OF SURVIVAL STRATEGIES

G. G. C. J. Gunawardhana[1,*], G. G. C. J. Anjalee[2], and H. M. L. V. Herath[3]

[1,2,3]Department of Agribusiness Management, Faculty of Agriculture and Plantation Management,Wayamba University of Sri Lanka, Makandura, Gonawila,, Sri Lanka

*Corresponding author (email: chathurikagunawardhana7@gmail.com)

INTRODUCTION

The extent of the novel Coronavirus caused adverse influences on all food markets, including fruits and vegetables. Farmers, retailers, and consumers are being faced with shocks in the supply and demand of food commodities (Richards & Rickard, 2020). This shortage of food products has caused a severe panic among individuals worldwide and made the pandemic even worst than expected (Kaushik *et al*., 2021). Most countries went into lockdowns, travel and trade restrictions, separation of infected individuals, social distancing, and quarantine, while only the crucial economic sectors remained open. The rapid spread of COVID-19 has seriously impacted the developing economies due to their vulnerability and lack of resources to combat such a pandemic (Middendorf *et al*., 2021). Like many other developing countries, agriculture is the primary source of income in Sri Lanka. The agricultural sector in the country was already fragile and vulnerable to shocks and stresses, such as climate change, market failure, and pest and disease occurrences. As such, the agricultural sector in Sri Lanka is argued to be more exposed to the pandemic.

Therefore, this study explored the perceptions of fruit and vegetable farmers on how the COVID-19 pandemic has impacted the different aspects of farming (i.e., production, market, human resources, farmer livelihood, and agricultural policy). Moreover, the study investigated the different mitigation strategies the fruit and vegetable farmers adopted to overcome the COVID-19-related issues they faced. The results of this study can help to understand the impacts of COVID-19 on fruit and vegetable farmers and explore mitigating strategies taken to minimize the impact on farming and rebuild the system.

METHODOLOGY

This study was conducted with a randomly selected sample of 100 fruit and vegetable farmers in the Galle district. A pilot survey was conducted (n=10) to validate the questionnaire. The main survey was conducted from February to March 2022. Data were collected via face-to-face administering of the questionnaire and telephonic conversations. The questionnaire consisted of four main categories; 1) Farmers' personal information, 2) Farming details, 3) Impact of COVID-19, and 4) impact mitigation strategies. COVID-19 impact statements (n=25) and mitigation strategies (n=15) were measured on a five-point Likert-Scale. Data were also gathered on four farm outcome variables (i.e., the number of employees, the extent of cultivation, income per season, and yield per season) to examine whether there is any significant difference between before (i.e. in the year 2018) and after COVID-19 (i.e. in the year 2021) situations.

The data were analyzed using descriptive and inferential statistics via the software IBM SPSS version 25. A Paired sample T-test was performed to investigate whether the farm outcomes were significantly different between "before" and "after" COVID-19 situations. Reliability analysis was also carried out to ensure the internal consistency of the Likert Scale data, COVID-19 impact, and mitigation strategies. Cronbach's alpha which ranges from 0 to 1, was used as the measure of reliability (Hair *et al.,* 2014). The alpha values of Likert-scale items used in this study were within this suitability range and deemed acceptable. The study identified five main areas of farming affected by the COVID-19 pandemic, including; production (PR), marketing (MR), human resources (HR), farmer livelihood (FL), and policy and regulatory changes (PL). The mean values of the scores provided by the respondents were calculated to examine the degree to which farming is affected by the pandemic in these five areas. Lastly, a Principal Component Analysis (PCA) was employed to analyze the data on impact mitigation strategies. The outcome of PCA also helps to explore relationships among variables and see if a smaller number of underlying constructs can explain the pattern of results. According to the guidelines given by Hair *et al.* (2014), for a sample of 100 respondents, component loadings of 0.5 and above are considered significant.

RESULTS AND DISCUSSION

Most respondents were male (69%), and the most significant proportion (60%) were in the 46-65 age group. Considering the level of education, the highest percentage (42%) of farmers were educated up to G.C.E. Ordinary Level. Only 6% of the farmers were educated to a degree or diploma level. 51% of the sample involved part-time farming. The majority of the farmers (63%) only had 1 to 5 years of farming experience. In the sample, the majority of farmers cultivated vegetables only (52%). Among the farmers, 19% farmers only cultivated fruits while 29% cultivated both fruits and vegetables.

Table 1 Results of paired t-test

Farm outcome	Mean	Probability
No. of employees	0.440	0.000*
Extent of cultivation	0.190	0.000*
Income per season	11105.0	0.000*
Yield per season	8.030	0.000*

*Note:*significant at 0.05 confidence level*

According to the paired T-test results, all four outcome variables resulted in a probability value of 0.000, which is less than the 0.05 significance level. This indicates that the mean differences between these four outcome variables are statistically significant. It can be explained that compared to the "before" COVID-19 period, the number of people employed in these farms, the extent cultivated, income, and yield per season have significantly changed in the "after" COVID-19 period. During the analysis, the scores were averaged to calculate the mean values for each factor. Accordingly, political and agricultural policy changes recorded the highest overall mean value (3.866) out of the five main impact areas, while human resources recorded the lowest overall mean (3.278). Out of all 25 factors, the closure of local food markets (4.47) and imposing lockdown periods (4.46) recorded the highest mean scores.

Table 2 Mean values of COVID-19 impact areas

Area of impact	Mean
Production	3.778
Availability to inputs	3.970
Changing cultivating land area	3.060
Changing the quantity of yield in the harvest season	4.310
Changing prices of inputs	4.230
Changes in planting patterns	3.320
Market	3.720
Customer availability	3.790
Changes in buying power	3.290
Difficulties to reach the customers	4.000
Postharvest losses	3.510
Changing output prices	4.010
Human resources	3.278
On-time wage payment	2.970
Workers infected with COVID-19	2.530
Labour shortage	3.760
Changes in working labour hours	3.900
Going to new jobs instead of farming	3.230
Farmer livelihood	3.468
The health of family members	3.090
Changes household income	4.070
Impact of quarantine periods	3.440
Use of social services during the COVID-19 period	3.430
Subsidies/ financial support given by the government	3.310
Policy and regulatory changes	3.866
Travel restrictions	3.980
Implementation of lockdown period	4.460
Import and trade restrictions	3.370
Closure of local food markets	4.470
Changes in inflation rate	3.050

Farmers were affected by the breakdown of the food supply chain due to imposing lockdowns and movement restrictions. Apart from the policy and regulatory changes, farm production is highly affected by the pandemic. Farmers were severely affected by the rising prices of raw materials, including inorganic fertilizer, pesticides, weedicides, and high-yielding seeds and planting materials. As the COVID-19 pandemic created an economic crisis, the government implemented several import restrictions, including inorganic fertilizer and agrochemicals. As a result of these import restrictions, the price of the raw material increased uncontrollably. Hence, they scored lower for the import and trade restrictions (3.37) but highly on changes in the prices of inputs (4.23). Under the market-related areas affected by the pandemic, farmers reported difficulties changing output prices (4.01) and reaching customers (4.00).

Farmer livelihood is another central area affected by the COVID-19 pandemic. Changes in household income (4.07) are one of these fruit and vegetable farmers' main concerns during the pandemic. The health of family members is critical for these farm families as most provide

free labour for their cultivation. If they have hired any labourers before the COVID-19 period, the number of them has drastically reduced after the COVID-19 period. Therefore, human resources are the least affected area of farming by the COVID-19 crisis. The varimax rotated principal component analysis was performed to adopt impact mitigation strategies, and five components were extracted. These five principal components were generated with an eigenvalue more significant than one. The five components cumulatively explained 50% of the variance in the data. PC1 identified positive loadings of four strategies; integrated farming management, getting support from family members, improving the number of planting cycles, and applying for bank loans have identified production-related strategies for mitigation. Moving to direct marketing and diversifying to other businesses for extra income have identified adaptations for the agricultural policy changes for the PC2. The PC3 identified positive loadings of two strategies; allocating separate days for workers instead of working every day and changing the type of vegetable/fruit cultivated, identified for the adaptations for operational changes. Taking measures to ensure the health and safety of workers and improving the recruitment of workers are identified as impact mitigation strategies for human resource-related issues for PC4. The PC5 identified favourable loading for modern marketing channels. It is an impact mitigation strategy identified to mitigate related to traditional marketing approaches.

Table 3 Rotated component matrix for impact mitigation strategies

Statement	PC1	PC2	PC3	PC4	PC5
Integrated farming management	0.70				
Get support from family members	0.63				
Improved number of planting cycles	0.58				
Apply for bank loans	0.41				
Moving to direct marketing		0.52			
Diversifying to other businesses for earning extra income		0.67			
Allocating separate days for workers instead of working every day			0.67		
Changing the type of vegetable/fruit cultivated			0.66		
Take measures to ensure the health and safety of workers				0.83	
				0.55	
Improve the recruitment of workers					0.69
Using modern marketing channels					
Cumulative variance	12.0	23.0	33.0	41.7	49.9
Eigenvalues	1.791	1.658	1.493	1.306	1.23

CONCLUSIONS AND IMPLICATIONS

This study explored the impacts of the COVID-19 pandemic on the farming and livelihood of fruit and vegetable farmers. Policy and regulatory changes were identified as the most affected farming area, while human resources were identified as the least affected area. The paired t-test considered four factors; the number of employees, land extent of cultivation, income, and yield per season. All four outcome variables recorded significant differences after the COVID-19 period from the before COVID-19 period. This indicates the considerable impact of

COVID-19 on fruit and vegetable farmers. Most of the farmers reported issues related to inputs' prices, decreasing consumers' availability, closure of food markets, transportation problems during the COVID-19 period, etc. The principal component analysis extracted five principal components and summarized the impact mitigation strategies for the COVID-19 pandemic. PC1 identified strategies for production-related, PC2 extracted responses for agricultural policy changes, PC3 identified operational changes, PC4 extracted strategies for human resources, and PC5 identified strategies for new marketing methods to mitigate the impacts of COVID-19. Results of the study discovered that most of the farmers in the Galle district had faced challenges and difficulties during the past COVID-19 outbreak. Therefore relevant authorities should encourage by giving them special attention and incentives to rebuild a better marketplace for fruit and vegetable farmers.

Keywords: COVID-19 pandemic, fruit and vegetable farmers, impact mitigation

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