

DEVELOPING DISASTER-RESILIENT SUPPLY CHAINS FOR HOUSEHOLD FOOD SECURITY IN CALABARZON, PHILIPPINES

Julieta A. Delos Reyes* and Jennifer C. Padrid
Department of Agricultural and Applied Economics
College of Economics and Management
University of the Philippines Los Baños
*Corresponding author: jadelosreyes@up.edu.ph

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ABSTRACT

The pandemic induced structural and functional changes in agri-food supply chains, necessitating an analysis of responses in promoting household food security resilience to disasters with magnitude as the COVID-19. This study examined how 273 household-respondents secured their food needs amidst the said immobilizing pandemic. Data were collected through face-to-face and online interviews over two months beginning April until May 2022, recalling circumstances before and during the pandemic. Key informant interviews with two food providers were also conducted. Laguna in CALABARZON, Philippines was chosen as it represents a microcosm of vibrant community impacted by lockdowns. Descriptive analysis, t-tests of means, and ANOVA were performed. Findings indicate that the shortened food supply chain during the pandemic bolstered consumer resilience, with increased involvement from various entities including local government units (LGUs), family, friends, and private organizations, leveraging social capital and networks. However, consumer diets worsened during the crisis, with severe deficiencies in vegetables and fruits (12% vs. 50% recommended), and excessive consumption of meat (40% vs. 17% recommended) and cereals (38% vs 33% recommended). Moreover, there was a decrease in average daily food budgets and household savings. While the proliferation of makeshift and mobile market promoted food security, stability was still reduced. Key drivers for resilience included innovativeness, diligence, social capital, and networks, supported by stable internet connectivity and government aid. Recommendations for promoting a shorter supply chain include creating a regional task force for food planning, establishing regional food hubs with built-in trading centers, and strengthening mechanisms for food system governance.

Key words: agri-food, regional food hubs, trading centers; mobile markets

INTRODUCTION

In times of crisis, ensuring adequate food supplies is paramount. The food industry is a crucial sector that must remain functional during a pandemic (Kumar et al 2022). During the COVID-19 pandemic, food security became a major concern as structural and functional changes occurred in agri-food supply chains. Analyzing the effects on food security of these changes is essential. The pandemic necessitated a new approach, as pre-pandemic food supply chains may no longer be effective, requiring modifications for both short-term household food security and long-term food and nutrition security. Food security, according to the FAO, exists when all people have access to sufficient, safe, and nutritious food for a healthy life. Food supply chains are dynamic and are affected by shocks, such as

the COVID-19 with its accompanying lockdowns. According to Ali et al (2022), in simple supply chains these shocks can be grouped into supplier shocks, production shocks and customer shocks. They also claimed that in supply chain resilience during disasters responsiveness, readiness, and recovery are elements that require utmost attention. Recently, more often, global food value chains (GFVCs) have been the ones operational in many countries and therefore the most studied, but local food supply chains are equally important because domestic border closures have become crippling as well, hence the need for this study.

In the Philippines, the COVID-19 pandemic has taken a heavy toll on livelihoods mainly because of loss of job opportunities and reduction in income for those who managed to retain their work. Laguna Province, which is dubbed as the “Philippines’ Silicon Valley” as it houses a number of electronic and semiconductor industries (Crown Asia, n.d.), has not been spared. Job lay-offs were experienced along with work hour reductions. With income decline comes the challenge of securing the food supply of the households and eventually nutrition security of the family members. This study aimed to analyze how households secured their food during immobilizing disasters like the COVID-19. It examined changes in food buying behavior, attitudes and perceptions toward food availability, accessibility, utilization, and stability before and during the pandemic. Additionally, it analyzed structural and functional changes in agri-food supply chains to aid disaster adaptation and recovery, and suggested measures to make these supply chains more responsive to promote household food security during disaster damage recovery.

Theoretical Framework

The study is based on theories of Supply Chain Management (SCM), collaborative SCM, and collaborative initiatives. SCM involves integrated activities ensuring the flow of goods, services, and information from sources to end-users for sustainability and efficiency. Collaborative SCM focuses on cooperation among chain participants for better performance through communication, transparency, flexibility, leadership, synchronized decision-making, and compatibility. During the pandemic, collaborations among farmers, processors, and logistics providers is essential. Collaborative initiatives, like quick response strategies and information systems, are crucial for reducing lead times and improving food supply flexibility during disasters.

By applying these theoretical foundations, the study aims to identify changes in the food supply chain in Laguna during the COVID-19 pandemic and their effects on household food security. As ways forward, to promote resilience, best practices in SCM can be institutionalized to ensure seamless food supply chains, which are vital for food security during disasters. Quick responses to changing food demands are necessary to maintain food security and adherence to safety protocols during disasters. In some instances, timing can be a matter of life and death and efficient food supply chains could shorten delivery time.

MATERIALS AND METHODS

A survey of 273 household food decision-makers in Laguna was conducted to analyze how they secure food for their households during the COVID-19 pandemic. Data were collected through face-to-face and online interviews over two months beginning April until May 2022, recalling circumstances before and during the pandemic. Key informant interviews with two food providers were also conducted. Laguna was chosen as it represents a microcosm of a vibrant community impacted by lockdowns.

The study used an explanatory sequential research design of mixed method which entailed gathering and analyzing quantitative data first, then collecting and analyzing qualitative data to better understand the implications/meanings of those numbers. The respondents’ food security was determined using four dimensions: availability, accessibility, utilization, and stability, using a five-

point Likert scale on agreement (1=strongly disagree and 5=strongly agree). They rated statements before and during the pandemic (beginning March 2020 when lockdowns were first declared). Mean scores per indicator and overall dimensions were computed, t-test of means, and ANOVA were performed for income and savings.

RESULTS AND DISCUSSION

Respondents’ profile. A total of 273 household-respondents from various municipalities in Laguna were surveyed, with Los Baños contributing the highest share (58%) while Calauan and Nagcarlan (9%) had the least. Respondents were primarily female household food decision-makers (69%), averaging 43 years old, with high educational attainment. Most families had an average size of 4, with a few (3%) being beneficiaries of the Pantawid Pamilyang Pilipino Program (4Ps) (Table 1). These households have income level that is below the poverty threshold of the Laguna province, who have pregnant woman and children 0-18 years old (officialgazette.gov.ph, n.d.).

Lot and house ownership was at 45 percent, with an average residential lot of 206 square meters. Mobile phones were widely owned (96%), followed by laptops (35%). These gadgets have become necessities during the pandemic not only for online communications but also for work from home arrangements. Aside from being necessities, mobile phones were also the cheapest. Common toilet facilities included latrines without flushing mechanisms (51%) and those with flush (47%). For drinking water, 84 percent purchased containerized water, while 12 percent used piped-in water and 4 percent used deep wells (Table 1).

Table 1. Highlights of the respondent characteristics, 273 household food decisionmaker-respondents, selected municipalities in Laguna, 2022.

Dominant Characteristic	Value
Females (%)	69
Average age (years)	43
Senior high school and college graduates (%)	63
Average household size (number)	4
Member of 4 Ps (%)	3
Has household members with health conditions (%)	21
Average number of children per family (number)	2
Average number of senior citizen per family (number)	1
Land and house ownership (%)	45
Size of land owned (square meters)	206
With backyard (%)	23
Size of backyard (square meters)	95
Mobile phone ownership (%)	96
Laptop ownership (%)	35
Latrine toilet without mechanism for flushing (%)	51
Drinking water bought (%)	84

Credit source and amount borrowed. Before and during the pandemic, about 50 percent of the respondents borrowed money. The average amount borrowed increased significantly from PhP31,437 to PhP60,177 during the pandemic. The t-test of means performed revealed that this difference was significant at 5 percent level of probability. The most common source of credit before the pandemic was family/relatives (26%), which became more popular (30%) during the pandemic. Borrowing from friends decreased from 21 to 19 percent (Table 2). This might have been due to the fact that “friends” are similarly situated, that is, short of money as well.

Table 2. Distribution by credit source and average amount borrowed, 273 household food decisionmaker-respondents, selected municipalities in Laguna, 2022.

Credit Source	Before pandemic			During pandemic		
	Freq.	%	Ave. Amount (PhP)	Freq.	%	Ave. Amount PhP)
Bank	18	13	123,779	20	14	128,219
Cooperative	6	4	10,125	5	4	11,584
Microlending	33	24	19,825	33	23	15,614
Friends	30	21	7,326	27	19	8,994
Family/Relatives	36	26	11,592	43	30	14,356
Bombay	15	11	42,410	13	9	42,475
Credit card	2	1	5,000	1	1	200,000
Total	140	50*	31,437	142	50*	60,177

*Percent of total (273)

Sources and amount of income. The number of people with no income more than doubled from 6 (2%) before to 14 (5%) during the pandemic. There was also a decrease in private company workers, self-employed individuals, and those supported by family member abroad. In contrast, government and farming jobs remained stable during the pandemic but business owners shifted to selling high-demand items like face masks and food deliveries. Many of them ventured into home deliveries particularly of food items. Government employees retained job security due to tenure protection, unlike private employees who faced layoffs (Figure 1). As employment opportunities declined, average household income dropped from PhP17,060 to PhP15,853, or a 7 percent decrease. However, income increased for those in farming, government service, and some private employment sectors. This was because farmers could charge more for essential food items, and private employees, such as call center agents, worked longer hours due to restricted mobility or remote work. Government employees received special assistance like internet allowances and social support.

Despite an increase in the number of people starting businesses, monthly income fell by nearly 12 percent from PhP25,930 to PhP22,857 due to higher transportation costs imposed by the IATF-MEID restrictions. While 59 percent of respondents found their income sufficient during the pandemic, 41 percent did not. Government and private employees typically had stable incomes, leading to a rise in average savings from PhP60,147 to PhP67,206. Respondents prioritized essential spending over non-essentials, driven by fears of a prolonged pandemic (Table 3).

However, the reduction in income and increase in savings likely led to decreased food quantity and quality, negatively impacting nutrition. In a related study, Reyes (2021) found that before the pandemic, 52.4 percent of households in Pili, Camarines Sur were food secure, with more urban households (55.3%) being secure compared with rural households (44.7.5%). According to the author, this food insecurity in rural areas was due to low wages and limited job opportunities during the pandemic (Reyes 2021).



Figure 1. Sources of income before and during the COVID-19 pandemic

Table 3. Average monthly income by source, 273 household food decisionmaker-respondents, selected municipalities in Laguna, 2022.

Income Source	Before Pandemic (PhP)	During Pandemic (PhP)	T-Stat	P	D.F.
Farming	11,864	12,192	1.84*	0.08	29
Government Employment	17,587	18,308	1.89*	0.07	35
Private Employment	28,969	31,068	-0.31	0.76	35
Business	25,930	22,857	1.15	-0.26	24
Self-Employment	16,926	15,961	1.21	0.24	24
Remittance from abroad	27,172	19,435	2.13**	0.04	40
Retailing	8,029	7,003			
Average	17,060	15,853			
HH Savings (PhP)	61,363	52,384	1.09	0.28	272

Household food supply chain. The household food supply chain (Figure 2) starts with input suppliers to farmers, but this paper focuses on food outputs. Farmers often face limited options, with many relying on middlemen rather than selling directly to consumers or market centers. This was supported by Delos Reyes (2023) who found that farmers usually rely on middlemen, with 92 percent of vegetables in CALABARZON passing through assembler-wholesalers. However, during the pandemic, farmers sold directly to makeshift markets, wet markets, mobile markets, consumers, LGUs, and NGOs, enhancing convenience and reducing transportation risks.

Direct consumer sales were most common which was eventually replaced by the LGUs. Shorter supply chains, while lacking economies of scale (Thilmany et al., 2021 as cited by Hobbs, 2021), offer greater resilience and flexibility by fostering strong interpersonal relationships and networks. Also, Hobbs (2021) contends that transportation and distribution can pose vulnerabilities in long food supply chains. Additionally, some households grew vegetables in backyards or vertical gardens (Figure 2).

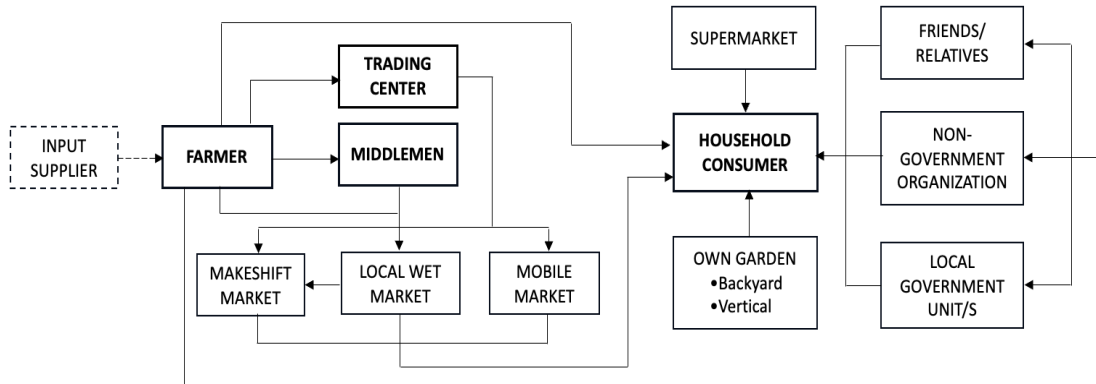


Figure 2. Household food supply chain during the COVID-19 pandemic

Food sources before and during pandemic. The household food supply chain (Figure 3) remained functional before and during the pandemic, despite structural changes due to IATF-MEID mobility restrictions. Ranking was determined by the number of times they were mentioned in the multiple responses of the respondents with Rank 1 having the most number of mentions.

Wet markets and supermarkets retained their top ranks as food sources. However, purchases from wet markets slightly decreased (55% to 54%), while those from ma markets (24% to 27%) and mobile markets (18% to 22%) increased (Figure 4). These shifts were driven by improved accessibility, with makeshift and mobile markets becoming more popular during the pandemic. Mobile markets, in particular, served housing communities, following the model introduced by Pasig City Mayor to reduce crowds in traditional markets. During the pandemic, supermarkets remained the second most popular food source (44%), mainly for bulk buying by higher-income households. Donors, including LGUs, became the third most important food suppliers, rising from 6 pre-pandemic to 39 percent during the pandemic. LGUs initially provided rice, canned goods, and noodles but later procured fresh produce directly from farmers, facilitated by the *Kadiwa ni Ani* and *Kita* Program.

Relatives' contribution as a food source increased from 7 to 13 percent, and friends from 6 to 12 percent, highlighting the importance of social ties during crises. Private and international NGOs and church groups also became significant, increasing from 3 to 11 percent, often through community pantries. Backyard gardening decreased slightly from 12 to 11 percent due to a lack of seeds, while online sellers dropped in rank due to delivery restrictions and the rise of makeshift and mobile market, which served local communities effectively during lockdowns (Fig.3).

Consumption patterns before and during pandemic. Respondents were requested to indicate the percentage share of the given food groups to the daily food expenditure of their households before the COVID-19 pandemic. Due to limitations on recall, they were only asked on whether the share of each food group became higher, lower, or remained the same during the pandemic. Worthy of note is the fact that not all food groups are being consumed by a single household hence the wide variability in the indicated number of samples per food type.

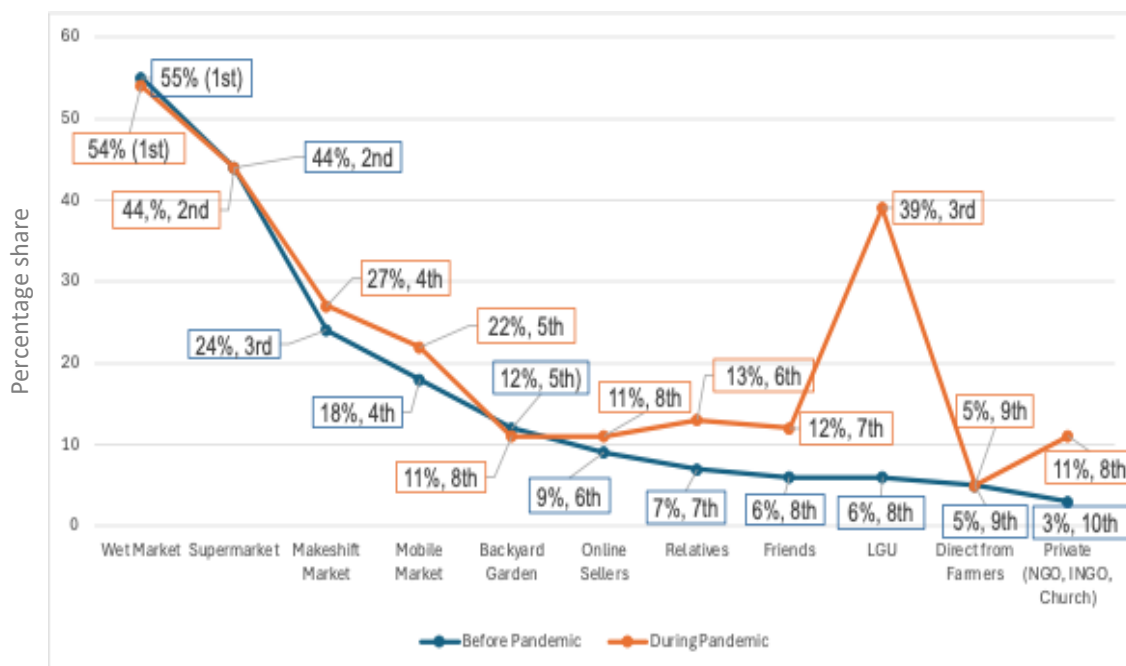


Figure 3. Rank of food sources before and during the pandemic
 Note: Numbers are corresponding share in responses and rank per period

Before pandemic. The Food and Nutrition Research Institute (FNRI) of the Department of Science and Technology (DOST) launched the *Pingang Pinoy*, a visual tool promoting healthy eating among Filipinos. It recommends meals consisting of 33 percent Go foods, 17 percent Grow foods, and 50 percent Glow foods (33% vegetables and 17% fruits) (BIDANI Network Program, 2020). Results revealed that the sample respondents did not follow these guidelines as they consume only 12 percent Glow foods but 40 percent Grow and 38 percent Go foods, with 5 percent each for canned goods and others (e.g., fish crackers, fish balls) (Figure 5).

Rice was the highest consumed item (29%), with all respondents citing it as their staple. Corn, noodles, and root crops had the lowest expenditures (3% each) since corn is seasonally produced and root crops are moderately expensive. Noodles were most commonly consumed (73%) due to affordability and availability. Vegetables (7%) and fruits (5%) had a combined share of 12 percent, with vegetables being more commonly consumed (90%) compared with fruits (50%), because vegetables are seen as viands while fruits are considered desserts or luxuries (Fig. 4).

Aggregate meat consumption accounted for 20 percent of the food budget, with pork and chicken at 8 percent each, and beef at 4 percent. Beef, the most expensive, was consumed by only 9 percent of respondents, while chicken was consumed by 87 percent. Seafoods other than fish had an 8 percent share, higher than fish at 7 percent, but were mentioned by only 19 percent of respondents. Eggs, despite having a low expenditure share (5%), were consumed by 70 percent of respondents, due to their affordability and availability (Table 4).

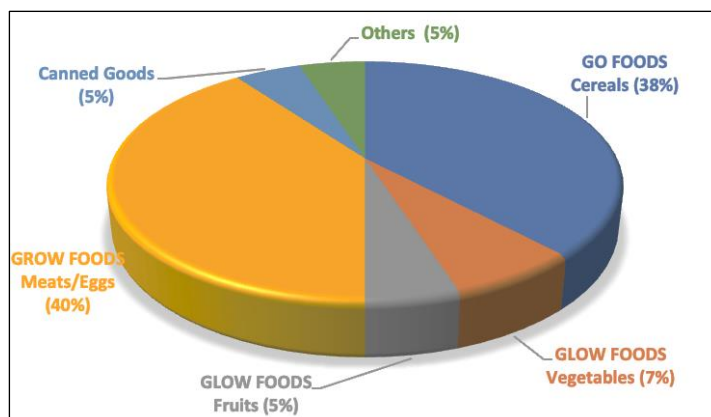


Figure 4. Average expenditure shares in Pinggang Pinoy food groups, before the COVID-19 pandemic

During pandemic. During the pandemic, the average daily food budget decreased by 8 percent, from PhP441 to PhP407, although the difference was found not significant. Aside from some difficulties in accessibility, the respondents opted to reduce their daily expenses in anticipation of the need to manage their savings for the expected long struggle with the pandemic. Even then, their savings dropped by 15 percent, from PhP61,363 to PhP52,384. Over 25 percent of the respondents reported to have reduced food consumption, while 52 percent maintained original levels and 22 percent elected to increase consumption by using savings to boost immunity. The result of the t-test however, found the difference in mean daily budgets before and during the pandemic as not significant (Table 4).

Table 4. Average share in daily food expenditure by food group, before and during pandemic, 273 household food decisionmaker-respondents, selected municipalities, Laguna, 2022.

Food Group	Average share	Change During Pandemic		
		Higher	Lower	Same
In Percent				
Go Foods	38	19.22	42.32	38.42
Rice (n=273)	29	31.5	30.5	37.9
Corn (n=8)	3	0	40.0	60.0
Noodles (n=199)	3	33.1	35.8	31.1
Tubers/Root Crops (n=98)	3	12.3	63.0	24.7
Glow Foods	12	33.90	22.45	43.65
Vegetables (n=246)	7	36.1	25.1	38.8
Fruits (n=136)	5	31.7	19.8	48.5
Grow Foods	30	20.06	41.75	38.18
Pork (n=192)	8	16.1	39.9	44.1
Chicken (n=237)	8	23.3	38.6	38.1
Beef (n=26)	4	10.5	52.6	36.8
Eggs (n=216)	5	43.5	17.4	39.1
Fish (n=204)	7	27.0	28.3	44.7
Seafoods (other than fish)(n=51)	8	0	73.7	26.3
Canned Goods (n=86)	5	37.5	15.6	46.9
Others (n=35)	5	3.8	3.8	92.3
Total/Average	100	22.89	25.18	51.89
HH Average Daily Budget (PhP)				
Before Pandemic	441	t-stat=1.24 ^{ns}	P=0.22	D.F.= 272
During Pandemic	407			

Budget increases were highest for noodles, fruits, vegetables, rice, and eggs, with 31 to 44 percent of respondents reporting higher spending. Noodles were popular due to their low cost and ease of preparation. Fruits, vegetables, and eggs were valued for their immune-boosting properties and affordability (for eggs). The biggest reduction in budget allocation was for seafood (74%), while canned goods saw the least reduction (15%) because they can be stocked for a longer period. By food group, Glow foods saw the highest increase in consumption due to their perceived immunity benefits, while Go foods had the highest reduction (42.32%). Corn had the highest retained expenditure (60%), but only 2 percent of respondents consumed it as a staple. Over a third of households maintained their expenditure on meat, eggs, fish, fruits, and vegetables, though the volume consumed likely declined due to rising prices (Table 4).

Food security assessment. The Food Insecurity Experience Scale (FIES) of the Food and Agriculture Organization of the United Nations (FAO) was utilized to assess the food security status of the households. The FIES comprises eight questions, where a YES response indicates a certain degree of food insecurity. If respondents answered affirmatively to multiple questions, the highest numbered affirmative response determined their level of food insecurity. Conversely, respondents who answered NO to all questions were classified as having food secure households. In addition, food security assessment was also through individual evaluation of the four elements of food security. A five-point Likert agreement scale was used for the assessment.

ANOVA was performed to test for the significance of the difference in the indicators per element. Results show that there was a general reduction in the number and proportion of food secure households from 26 to only 17 percent during the pandemic. Within the spectrum of food insecurity, worsening of the situation was also noted during the pandemic. The proportion of those mildly food insecure rose from 47 percent before to 59 percent during the pandemic. Interestingly, the moderately food insecure which accounted for only 18 percent during the pandemic used to be 21 percent before. The same pattern was observed for severely food insecure with 6 and 5 percent before and during the pandemic, respectively. These differences were found significant using ANOVA with F-value of 25.74 and p-value of 0.00017 (Table 5). One of the reasons for this is the targeting of the most vulnerable by the government in the provision of assistance. The LGUs were fully functional as government assistance were downloaded from the national government through the different LGU levels until the smallest unit which is the barangay. During this time checkpoints were present in designated places in every municipality to operationalize the mandatory quarantine.

Table 5. Level of household food insecurity before and during the COVID-19 pandemic, 273 respondents, selected municipalities, Laguna, 2022.

Level of Food Insecurity	Before Pandemic	During Pandemic
Food Secure	70 (26)	47 (17)
Mildly food insecure	129 (47)	162 (59)
Moderately food insecure	57(21)	50 (18)
Severely food insecure	17 (6)	14(5)
$F(1,7) = 25.74; p=0.00017$		

Note: Numbers in parentheses are percentages

Food availability. Food availability ratings before (3.18) and during (3.13) the pandemic were almost similar, but specific indicators showed significant differences. The highest mean rating for food availability in markets decreased from 4.34 to 4.07, despite mobile markets mitigating the impact by reaching communities, although at higher prices. These changes were statistically significant at one percent level of probability (Table 6). The lowest mean rating was for "Your household did not have to reduce the amount of purchased food even if prices increased," dropping from 2.37 to 2.18. Respondents noted that fixed incomes forced them to reduce purchases as food prices rose. The mean differences in ratings were found to be statistically significant at one percent level of probability,

underscoring the impact of these changes. Vegetable gardening, already low before the pandemic, did not compensate for the lack of vegetable supplies due to a shortage of seeds/seedlings (Table 6).

Table 6. Mean rating on food availability and t-test results, 273 household food decisionmaker-respondents, selected municipalities, Laguna, before and during the pandemic, 2022.

Availability Indicators	Before	During	T-Test Results		
	Mean Rating ^a	Mean Rating ^a	T-Stat	P	D.F.
Food items are available for purchase in markets (e.g., “ <i>talipapa</i> ” and mobile “ <i>palengke</i> ”) in the barangay.	4.34	4.07	4.36 ^{***}	0.000	272
Your household engaged/continue to engage in vegetable production (e.g., backyard gardening) to augment food supply.	2.65	2.71	-1.7 ^{ns}	0.029	272
Your household was able to purchase good quality food.	4.02	3.82	4.01 ^{***}	0.000	272
Your household did not have to reduce the amount of purchased food even if their prices have increased.	2.37	2.18	2.62 ^{**}	0.009	272
Your household was able to purchase food from mobile “ <i>palengke</i> ”.	2.50	2.84	-5.14 ^{***}	0.000	272
Availability	3.18	3.13			

^aRating scale: 1=strongly disagree; 2=disagree; 3=neutral; 4=agree; 5=strongly agree

Food accessibility. Food accessibility ratings remained neutral before and during the pandemic. Makeshift markets and mobile markets significantly improved food accessibility, with high ratings for “*Your household was able to purchase food because there were available sellers (e.g., makeshift and mobile markets) in the barangay,*” scoring 4.28 and 4.19, respectively, both statistically significant at one percent level of probability. This decline was the result of limited ability of these additional providers to source food (particularly fruits and vegetables) from distant suppliers. Further, income sufficiency as a measure of food accessibility remained consistently low and unchanged between periods. This was aggravated by rising food prices as complained by the respondents. Despite challenges, households reported being able to afford complete meals without assistance, viewing assistance items as supplements rather than substitutes. Meanwhile, the LGU's provision of food and healthcare assistance received a neutral rating overall, but agreement with “*There is institutionalized (from LGU) food and healthcare assistance in your area*” increased from 3.15 to 3.26, which was significant at 5 percent level of probability (Table 7). During lockdowns, LGUs were frontline assistance providers, assisting community members in need.

Table 7. Mean rating on food accessibility and t-test results, 273 household food decisionmaker-respondents, selected municipalities in Laguna, before and during the pandemic, 2022.

Accessibility Indicators	Before	During	T-Test Results		
	Mean Score ^a	Mean Score ^a	T-Stat	P	D.F.
Your household has high income relative to your family needs.	2.57	2.50	1.28 ^{ns}	0.199	272

Accessibility Indicators	Before	During	T-Test Results		
	Mean Score ^a	Mean Score ^a	T-Stat	P	D.F.
Even if there is no assistance your household did not have to skip meals.	3.00	3.28	-8.40***	0.000	272
Your household was able to purchase food because there were available sellers (e.g., makeshift and mobile market) in the barangay.	4.28	4.19	-4.29***	0.000	272
There is an institutionalized (from LGU) food and healthcare assistance in your area.	3.15	3.26	-2.30**	0.022	272
Accessibility	3.25	3.31			

^aRating scale: 1=strongly disagree; 2=disagree; 3=neutral; 4=agree; 5=strongly agree

Food utilization. The highest mean rating was given to the utilization indicator statement "Your household was able to obtain food and clean water," both before (4.58) and during the pandemic (4.57). However, while initially, the rating for "Your household was able to eat diverse types of food" was high at 4.35, it declined significantly to 4.05 during the pandemic. This decline was highly significant at the one percent level of probability, highlighting the importance of ensuring that a variety of foods are consumed for adequate nutrition. The lowest rating was for "Your household was able to afford nutrition and healthcare services" (Table 8). This is a vital condition as healthcare products and services can serve as substitutes in the absence of natural food sources.

Table 8. Mean rating on food utilization and t-test results, 273 household food decisionmaker-respondents, selected municipalities in Laguna, before and during the pandemic, 2022.

Utilization Indicators	Before	During	T-Test Results		
	Mean rating ^a	Mean rating ^a	T-Stat	P	D.F.
You or household members have knowledge on the preparation (cooking) of different types of food.	4.32	4.38	-1.73 ^{ns}	0.843	271
Your household was able to eat diverse types of food (e.g., a combination of vegetables, eggs, fish, or meat).	4.30	4.05	5.85***	0.000	271
Your household was able to obtain food and clean water.	4.58	4.57	0.47 ^{ns}	0.638	271
Your household was able to afford nutrition and healthcare services.	3.41	3.28	3.186**	0.002	271
Utilization	4.16	4.07			

^aRating scale: 1=strongly disagree; 2=disagree; 3=neutral; 4=agree; 5=strongly agree

Food stability. Food stability was largely affected by the pandemic. The reduction in frequencies, particularly for the availability of food for purchase, food and clean water acquisition, diverse food consumption, sanitation and hygiene maintenance, and affordability of nutrition and healthcare services, illustrates the negative significant impact of the pandemic. While the situation of respondents may not be as dire as that of the very poor, they were still negatively affected (Table 9). This suggests that the very poor would certainly have been more severely affected.

Table 9. Distribution by rating on food stability per week, 273 household food decisionmaker-respondents, selected municipalities. Laguna, before and during the pandemic, 2022.

Stability Indicators	Before Pandemic					During Pandemic				
	1-2	3-4	5	6	7	1-2	3-4	5	6	7
Percent										
There was available food to purchase for your household.	14	8	7	7	64	17	11	4	13	54
Your household was able to obtain food and clean water.	2	5	3	5	84	4	4	7	6	78
Your household was able to eat diverse types of food.	3	16	13	15	53	8	16	25	7	43
Your household was able to maintain proper sanitation and a clean environment.	3	4	4	9	79	1	7	5	9	77
Your household was able to afford nutrition and healthcare services.	64	6	6	4	20	64	5	9	7	14
Average (%)	17.2	7.8	6.6	8	60	18.2	8.6	5.0	8.4	53.2

Case studies. The following two case studies are presented as examples of how diligence, family cohesiveness, and social capital promoted resilience amidst the COVID-19 pandemic and even showcased how they still emerged as winners. These are included to inject the idea that despite immobilizing disasters, there are still ways and means to overcome hardships and become resilient.

Case 1: Family-owned food business adaptation during the pandemic

A family-run food business, known for affordable fried chicken and sautéed mongo, was popular among students at the University of the Philippines Los Baños. Before the pandemic, they earned PhP10,000-PhP12,000 daily. Lockdowns significantly reduced their customer base. To adapt, they began offering delivery services and advertised online. Their innovation and online presence attracted university employees working from home. Deliveries continued even after lockdowns and the resumption of face-to-face classes.

The business thrived, allowing for expansions such as additional tables, repairs, and a larger cooking area. The team grew to over 10 employees, and riders received free lunches. The absence of the Bombay (informal money lender) and a resilient business model contributed to their success. Key drivers of their success included the eldest son's technical training in hotel and restaurant management, active social media presence, stable internet connectivity, and strong customer and supplier relationships.

Case 2: Adaptation of the "Super Store" during the pandemic

"Super Store" is a family-run business managed by the parents and their eldest son, supporting a family of eight. Initially a small retail store, it expanded to include various goods and services, such as renting customized karaoke machines. Despite initial challenges, including living in a flood-prone area, they quickly adapted during the pandemic by shifting sales online and serving a nearby subdivision under lockdown.

Their online presence, via a dedicated chat group, became essential. The mother shared real-time pictures of goods available in the marketplace, allowing residents to place orders directly. Their offerings ranged from fruits and vegetables, groceries to cooked meals, with the eldest son handling deliveries using a tricycle. Their success is attributed to a strong social network built through genuine customer service and active church involvement. They transitioned from a physical store to using their home as a temporary storage and distribution center. Stable internet connectivity and close community ties were crucial for their operations, which are primarily conducted through Facebook Messenger.

CONCLUSIONS AND RECOMMENDATIONS

A shortened food supply chain, during the pandemic, enhanced consumer resilience, with increased support from LGUs, family, friends, and private organizations leveraged by social capital. However, diet diversity worsened, with severe deficiencies in vegetables and fruits and excessive consumption of meat and cereals. Average daily food budgets and household savings decreased. Despite the proliferation of makeshift and mobile markets, food stability was reduced. Resilience can be driven by innovativeness, diligence, social capital, and stable internet connectivity, along with government aid. Recommendations for promoting a shorter supply chain include prioritizing food planning; establishing a regional task force for food planning and food hubs, enhancing food governance mechanisms. LGUs should play pivotal role in this. This recommendation is consistent with the findings of Dube and co-workers (2016) as cited by Das et al. (2021, that government support plays a crucial role in strengthening supply chain resilience against catastrophic events. The adoption and announcement of business-friendly policies, considering organizations of various types, sizes, and ownerships during times of disruption, can foster industrial growth and help stabilize the economy.

Prioritizing food planning is essential for disaster resilience, as food is crucial for survival. Without adequate food, chaos ensues, making recovery more difficult. Institutionalizing food planning by creating a Regional Task Force for Food Planning is recommended. Being regional is essential because the major production areas for diverse food item needed to fulfill the *Pinggang Pinoy* meal model are geographically separated and go beyond provincial boundaries. The task force should integrate the food system into development planning to ensure adequate resources (land, facilities, funds, and expertise) are consistently provided for an effective and efficient disaster response. This can only be done if there is a single body that will keep the ball rolling in the right direction.

Once a regional task force is established, a regional food hub should be created to facilitate the seamless movement of food commodities across provincial boundaries, especially during crises. In support of this, a model similar to the Food Lane Program of the Department of Agriculture (DA) way back in 2004 in the northern Philippines, could be looked at but with improved implementation scheme. This program which is managed by a technical working group (TWG), issues Food Lane Conduct Passes to accredited trucks, expediting their passage through checkpoints and preventing delays in transporting perishable goods (Cayanan 2020; Cruz 2022; Liao 2011).

The effects of the Food Lane Program on the marketing of selected vegetables from Benguet to Metro Manila were assessed and the number of checkpoints encountered during accreditation to the Program was reduced to only two from six before accreditation; amount of bribe paid was reduced and travel time was also reduced from 7 to 6 hours (Liao 2011). Likewise, the volume of vegetables traded increased from 14,646 kg before to 20,924 kg per week during the program. Similar to the recommended creation of the TWG for the present study, the Food Lane Program was managed by a TWG due mainly to the checkpoints in municipal boundaries that could impede and delay the movement of goods. Since, there were still problems encountered with the program, it is recommended that an improvement in implementation be made.

In addition, the task force should also consider the following strategic actions and programs: identification of diverse sources of food prioritizing those that are major producers; establishing vegetable trading centers in strategic areas where they are accessible to both suppliers and buyers; development/provision of infrastructure links such as farm-to-market roads; and enhancing internet connectivity in production areas, especially in the hinterlands to facilitate online marketing and sales.

Food system governance involves interactions among various actors, influencing food production, distribution, and consumption (van Bers et al., 2016, as cited by Vignola et al., 2020). This study's food supply chain includes input suppliers, farmers, middlemen, market facilities, and consumers. The pandemic highlighted the crucial roles of government, LGUs, civil society/private sector, and small producers. Enhancing the short supply chain's efficiency requires synergy and collaboration among these actors and procedural consistency. The recommended regional task force should promote this synergy aiming for good governance for food system.

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