Economic Implications of Disasters on Cooperative Sector in CALABARZON, Philippines

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ABSTRACT

Cooperatives serve as an important tool for improving the living conditions of members and their community. However, like any other business enterprise, cooperatives are also exposed to disasters that may affect their operations. This study analyzed the economic effects of disasters on cooperatives in CALABARZON, Philippines. Results of the Pearson's chi-square test showed that cooperatives are exposed to various types of natural, biological, and human-induced disasters. It was found out that disasters lead to increased operational costs and reduced net surplus. Using emergency-use-only cell phones and generators, changing production patterns, limiting high risk-customers, buying insurance, and establishing online and offline data backup systems were all found to mitigate the effects of disasters significantly. This study underscores that having business continuity plan (BCP) helps ensure continuous business operations following disaster events. This study recommends developing strategies that would equip cooperatives with necessary technical knowledge and skills in crafting and implementing BCP.

Keywords: *disasters, cooperatives, business continuity, chi-square test*

Introduction

The Philippines is among the riskiest and disaster-prone countries in the world. The country lies along the so-called "Pacific Ring of Fire" and weather pathway near the equator known as the "Typhoon Belt" (Ballesteros and Domingo 2015). This geographic position makes it highly vulnerable to natural disasters such as tropical cyclones, earthquakes, tsunamis, droughts, floods, landslides, and volcanic eruptions (Dilley *et al.* 2015). The country has also experienced some biological disasters such as the COVID-19 pandemic and African Swine Fever (ASF) outbreak, and human-induced disasters, including terrorist attacks, fires, transportation accidents, and structure failures (Ballesteros and Domingo 2015).

Faced with such a diverse hazard, the country's population and businesses are exposed to financial shocks that undermine its economic growth. The inherently destructive nature of disasters has caused significant negative impacts on all types of businesses, particularly those agricultural enterprises, which are heavily reliant on the natural resource base and climate conditions (Israel and Briones 2012, Organisation for Economic Co-operation and Development [OECD] n.d.). The occurrence of disasters disrupted the day-to-day business operations, damaged facilities, products and services, and professional reputations, and threatened the lives of workers, customers, suppliers, and other stakeholders (Wingard and Brandlin 2013). According to Wachsberg (2018), major natural disasters such as earthquakes, typhoons, and floods are so damaging for small businesses that 40% of those that get hit by one of these shut down permanently.

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Recent data from the World Bank (2020) also shows that the COVID-19 community quarantine measures had a significant negative impact (either temporary or permanent) on businesses' operations. In July 2020, about 15% of firms reported having closed permanently. Meanwhile, around 40% of enterprises reported the temporary suspension of their business activities. The negative impact on employment is also evident as 50% reported having reduced payments to employees while 48% reported that they reduced the number of their employees.

Like other business structures, cooperatives are engaged in various activities (e.g., production, marketing, processing, and transport) that were adversely affected by the different types of disasters (Israel and Briones 2012). For instance, in 2013, over 350,000 cooperative members were affected by super typhoon Haiyan (ICA 2013). In the survey conducted by Cooperative Development Authority (CDA) in 2020, 91.7% of the cooperatives also reported that their business operations were halted by COVID-19 community quarantine measures (CDA 2020). However, unlike other businesses and firms, which operate mainly to maximize profits of business owner/s, cooperatives are also social enterprises, providing services with a social cause that benefits its members while making profits to support their development programs continuously (Dacanay 2012). These people-centered organizations also strive to improve the welfare (e.g., income and expenditures) of members and their community (Jimenez *et al.* 2018, Jimenez, Mina, and Catelo 2020). Hence, the members will also bear any costs and lost revenues due to disasters, while suspension or scale-down operations will affect the workers and customers.

Numerous studies assessed the economic consequences of disasters in micro, small, and medium enterprise (MSMEs) (Sharma and Pandey 2020, Ballesteros and Domingo 2015, Villaroel 2013) and individual households (Zhang 2004). However, the impact of disasters on cooperatives is one of the least explored areas. Further, no empirical studies were conducted yet on the economic effects of these disasters on cooperatives in the Philippines. Hence, questions on how different types of disasters affect the economic performance of cooperatives and how cooperatives mitigate the negative impacts of these disasters on their business operations still need to be addressed.

This study aims to assess the economic effects of disasters in the cooperative sector in CALABARZON, Philippines. Specifically, the study seeks to a) identify and analyze the effects of disasters on different types of cooperatives (i.e., micro-small & medium-large size cooperatives and single-purpose & multi-purpose cooperatives), b) determine the mitigation practices adopted by these cooperatives, and c) analyze how these practices help in ensuring continuous operation following disaster events.

Conceptual Framework

Figure 1 presents the framework of the analysis for this study. The ability of cooperatives to continue with their business operation amidst a disaster depends on how their pre- and post-disaster constraints are addressed. The pre-disaster mitigation and preparation entail a good mix of policy and physical infrastructure, contingency and mitigation planning, and institutional support. Policy and institutional support determine the business environment where cooperatives operate. A business continuity plan (BCP) represents how each cooperative hurdle its vulnerabilities or weaknesses in the event of disasters. It is a prevention and recovery system that ensures that personnel and assets are protected and can function quickly in the event of a disaster. A mitigation plan refers to the activities performed by each cooperative to prevent risk before it happens (Ballesteros and Domingo 2015).

Adapted from Ballesteros and Domingo (2015) and Samantha (2018)

Figure 1. Conceptual framework used to assess the economic effects of disasters in the cooperative sector in CALABARZON, Philippines, 2020

Disasters can be natural (e.g., typhoons and earthquakes), biological (e.g., pandemic), or human-induced (e.g., theft, fraud, and cyber-attacks), resulting in massive damage of properties and injury and/or loss of life (Dilley *et al.* 2015). On the other hand, operational challenges refer to the issues in sustaining operations in the aftermath of a disaster event. In particular, enterprises are challenged on four fronts: capital, labor, logistics, and market (Israel and Briones 2012, Ballesteros and Domingo 2015). Capital refers to the cooperatives' physical and financial assets; labor covers the employees; logistics includes all the nodes for delivery of supplies and raw materials and finished products, and; market refers to patrons who are the cooperative members or buyers of finished products and/or services. The occurrence of disasters can also lead to increased operational costs and reduced sales and net surplus.

Consistent with the main principles of disaster risk reduction management (DRRM), pre-disaster planning is key for eventual cooperatives' resilience and business continuity during disaster events. Business continuity is concerned with cooperatives' capability to operate their critical business functions in the immediate aftermath of disaster events. In the DRRM stream of policy and intervention, business continuity is covered under disaster response. As defined in the United Nations International Strategy for Disaster Reduction (UN-ISDR 2009), resilience is the ability to absorb, resist, and recover from the impacts of a hazard in a timely and efficient manner. Business resiliency must be viewed in the broader picture of supply chain resilience since the occurrence of disaster impacts the entire supply chain and not just the business itself. In this study, business resilience is viewed as the ability of businesses to prepare for unexpected events, respond and recover quickly to potential disruptions (e.g., disasters), to return to its original operation, or grow by moving to a new, more desirable state to increase customer service, market share and economic performance (Tucker 2020).

Although important, policy framework, institutional support, and business resilience are not covered in the analysis. This study focused mainly on the economic implications of disasters on cooperatives' business operations (e.g., sales, operational costs, net surplus) and how their existing mitigation practices help ensure continuous operation following disaster events. Other implications of disasters, such as cultural and political effects, were also not covered in this analysis.

Methodology

Study Area

This study was conducted in CALABARZON, Philippines. The region is situated in the southern part of Luzon and is in the south-eastern part of Metro Manila. For years, it has been recorded to have experienced natural and human-induced disasters such as typhoons, fires, earthquakes, and loss of manpower (Hernandez and Ingco 2021). The CALABARZON provinces are mostly coastal provinces and are classified as high-level hazard in terms of tsunami, coastal flood, and urban flood. This means that damaging and life-threatening disasters like tsunami and floods can potentially occur in the area (Global Facility for Disaster Reduction and Recovery [GFDRR] 2021).

Based on the most recent data of CDA (2020), the study area also ranked 1st in the Philippines in terms of the number of operating (11.8% of 18,065) and reporting (15.1% of 11,138) cooperatives.

Type of Data and Method of Data Collection

Simple random sampling was used in selecting the sample from the most recent list of operating cooperatives obtained from the CDA-CALABARZON. The random sampling method is best employed to enable the generalization of findings to the population.

The data collection was carried out through face-to-face, phone interviews, and an online survey form. The selected cooperatives were represented by their respective Board of Directors (BODs), general managers, or other representatives (e.g., bookkeepers and secretaries). Prior to interviews, the researchers ensured that the respondents have sufficient knowledge of the cooperatives' business structure and activities. A semi-structured questionnaire was used to gather primary data from the selected respondents. The questionnaire was designed to collect all necessary information for this study. The survey questionnaire included several questions on cooperative profile (e.g., size, type), types of disasters that they experienced, operational issues experienced (e.g., capital, labor, logistics, marketing), impact of disasters on cooperatives' business operations (e.g., sales, operational cost, net surplus), and mitigating practices adopted to minimize the impacts of the disasters. The sample consisted of 77 cooperatives from the provinces of Cavite, Laguna, Batangas, Rizal, and Quezon.

In all instances, the sample respondents were informed about the goal of the study. They were made aware that they could withdraw anytime and that their confidentiality and anonymity will be protected.

Analytical Procedure

The data from the survey were analyzed using both descriptive and inferential statistics. Descriptive statistics such as frequency distribution and percentages were employed to characterize the profile of cooperatives. Meanwhile, the chi-square test of independence was used to analyze the associations among the categorical variables (for the description of variables, see Appendix Table 1).

To compute for the chi-square statistics, this study used the formula (StatsDirect 2020):

$$\chi^2 = \sum_{i=1}^{r} \sum_{j=1}^{c} \frac{(O_{ij} - E_{ij})^2}{E_{ij}} \quad (1)$$

where χ^2 = chi-square value

r = rows of n observations
c = columns of n observations
O_i = observed (actual) frequency
E_i = expected frequency

The hypotheses for a Chi-square test of independence are as follows:

Null Hypothesis (Ho): There is no relationship between the two categorical variables, they are independent of each other

Alternative Hypothesis (Ha): The two categorical variables are related, they are not independent of each other

Decision Rule: Reject Ho if $\chi^2_c > \chi^2_\alpha$

Furthermore, Cramer's V, also known as Cramer's Phi (coefficient), was used to check the strength of relationships among the variables. Cramer's V is generally used to test the association among two or more unique values in each of the categorical variables. It can be defined as (van der Berg 2021a, van der Berg 2021b):

$$\Phi_c = \sqrt{\frac{\chi^2}{N(k-1)}} \quad (2)$$

where Φ_c =Cramer's V
χ^2 =Pearson chi-square statistic from the aforementioned test
N =sample size involved in the test
k =lesser number of categories of either variable

Since in this study, there are only two unique values (k=2), meaning all variables are binary or dichotomous, then equation 2 can further be simplified to:

$$\Phi_c = \Phi = \sqrt{\frac{\chi^2}{N}} \quad (3)$$

where Φ =Cramer's V/ Phi coefficient
χ^2 =Pearson chi-square statistic from the aforementioned test
N =number of observations

Equation 3 suggests that when analyzing the association among dichotomous variables, using Cramer's V is the same as using the Phi coefficient (StatsTest.com, van der Berg 2021b).

The Phi coefficient is a special type of Cramer's V that is used if both variables are dichotomous (resulting in a 2x2 contingency table) (van der Berg 2021b, Howell 2002). It is simply the Pearson correlation coefficient (r) computed on binary variables (van der Berg 2021b, Glen 2016). Hence, it can also measure the strength and direction of the relationship among categorical variables. Phi coefficient ranges from -1 to +1, where 0 means no relationship, +1 means perfect positive relationship, and -1 means perfect negative relationship (for detailed interpretation of Phi coefficient, see Appendix Table 2).

Results and Discussion

The analysis is presented in two parts, namely: 1) the descriptive statistics to characterize the cooperatives in the CALABARZON, and 2) the results of the Chi-square test of independence to show the relationships among various types of disaster and cooperatives' business operations and mitigation strategies.

Profile of Respondents

Table 1 summarizes the profile of the cooperatives interviewed in this study. Most of the cooperatives were from Laguna (38%). This is followed by Batangas (19%), Cavite (18%), Quezon (13%), and Rizal (12%). Around 86% of the respondents are either board of directors or general managers as they know the ins and outs of the cooperatives. Among the cooperatives, the majority (62%) had at most 10 employees, whereas 34% had 11-50 employees. The remaining 4% reported that they employed at least 300 employees.

Table 1. Profile of selected cooperatives in CALABARZON, Philippines, 2020

Item	Frequency	Percentage Distribution
Place of Operation		
Cavite	14	18.18
Laguna	29	37.66
Batangas	15	19.48
Rizal	9	11.69
Quezon	10	12.99
Total	77	100.00
Respondents		
BOD	66	85.71
Non-BOD	11	14.29
Total	77	100.00
No. of Employees		
≤ 10	48	62.33
11-50	26	33.77
50-299	0	0.00
≥ 300	3	3.90
Total	77	100.00

As shown in Figure 2, cooperatives interviewed were engaged in various sectors. Almost half of them are multi-purpose cooperatives (49%) offering credit and consumers goods and other services, followed by credit cooperatives (16%), service cooperatives (8%), producer cooperatives (8%), marketing cooperatives (6%), transport cooperatives (5%), and consumer cooperatives (4%). Meanwhile, Figure 3 shows that more than 60% of the cooperatives interviewed were micro and small cooperatives (with assets less than PHP 15 million). Around 23% were categorized as medium (with assets of PHP 15-100 million), and 9% were large (with assets more than PHP 100 million) cooperatives.

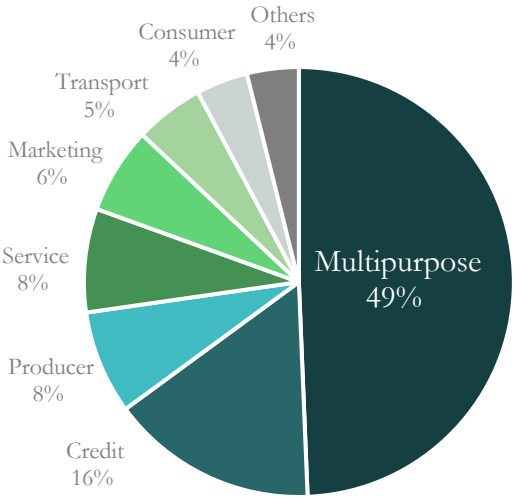

Figure 2. Percentage distribution of cooperatives, by type, CALABARZON, Philippines, 2020

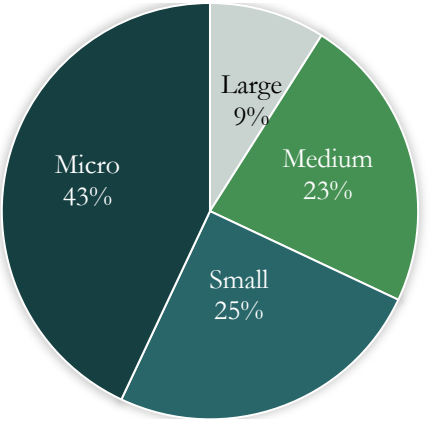

Figure 3. Percentage distribution of cooperatives, by size, CALABARZON, Philippines, 2020

Disasters Experienced by Cooperatives

The cooperatives in the CALABARZON region have been affected by several disasters in 2020. Table 2 shows that 77% of the respondents have experienced both natural and human-induced disasters. Natural disasters such as typhoons, floods, volcanic activities, and earthquakes affected cooperatives' business activities. Cooperatives also reported human-induced and technological disasters such as theft and fraud, problems with a stable supply of water and electricity, and cyber-attacks. Sixty-nine percent of the respondents identified biological disasters (e.g., COVID-19 pandemic, ASF outbreak) to significantly affect their business operations.

Aside from the usual disasters, the cooperatives were also affected by the COVID-19 pandemic. The imposition of community quarantine due to the pandemic forced most (91%) interviewed cooperatives to temporarily close their businesses, while some (16%) laid off their employees. This is expected as the imposition of community quarantine temporarily limits the movement and transportation and restricted operations of all enterprises in the country. The community quarantine restricted the movement of people (e.g., staff, members, clients, etc.) and completely shut business operations.

Table 2. Relationships among disasters and size and types of cooperatives, 77 cooperatives, CALABARZON, Philippines, 2020

Disaster	Size of Cooperative		χ^2	Φ	Type of Cooperative		χ^2	Φ
	Medium -Large	Micro-Small			Single-Purpose	Multi-Purpose		
Natural								
Not affected (%)	21	3	34.106***	0.666	3	21	14.692***	-0.437
Affected (%)	12	65			48	29		
Biological								
Not affected (%)	19	12	14.343***	0.432	10	21	4.182**	-0.233
Affected (%)	13	56			40	29		
Human-induced								
Not affected (%)	16	8	12.531***	0.403	8	16	2.818*	-0.191
Affected (%)	17	60			43	34		
All								
Not affected (%)	6	0	11.122***	0.380	0	6	5.488**	-0.267
Affected (%)	26	68			51	43		

Notes: ***, **, * statistically significant at 1%, 5% and 10%, respectively

Table 2 also shows that there exists a significant (χ^2=11.122, p<0.01) and positive association (Φ=0.380) between disaster and cooperative size. This finding suggests that cooperatives with relatively smaller asset values (less than PHP 15 million) are more exposed to all types of disasters. Furthermore, with χ^2=34.106 and Φ=0.666 that is significant at a 1% probability level, it can also be inferred that natural disaster has a significant and strong positive relationship with micro-small cooperatives. This result suggests that among the disasters identified, micro-small cooperatives are more susceptible to natural disasters. This finding is consistent with the findings of UNDP (2013), saying that micro and small enterprises suffer the most during the occurrence of disasters compared to medium and large businesses.

In contrast, the test of association between disaster and cooperative type showed that multi-purpose cooperatives are significantly (χ^2=5.488, p<0.05) and negatively (Φ=-0.267) related to disasters. This implies that multi-purpose cooperatives are less exposed to all forms of disasters than single-purpose cooperatives (e.g., credit, consumer, and marketing). Moreover, the interview results revealed that product/service diversification helped these cooperatives continue their business operations in the event of a disaster. For instance, some multi-purpose cooperatives noted that whenever a typhoon hit and caused severe damage to their production (e.g., crops/livestock production), operation continues as they still have other products/services such as credit and insurance to offer their members and other clients.

Economic Implications of Disaster Events

Disaster events resulted in the loss of business records, inventory, machinery and equipment, and the costs of repairing damaged infrastructure halted the day-to-day activities of cooperative-respondents. Interviews with respondents revealed that the operational challenges faced in the event of a disaster could be grouped into four categories: labor, capital, market, and logistics. As shown in Table 3, capital issues (83%) are commonly experienced in the incidence of a natural disaster. This is consistent with the results of the chi-square test showing a significant (χ2=26.325, p<0.01) and strong positive (Φ=0.585) association between disasters and capital issues. Among the capital issues identified include damages of equipment and facilities, loss of business records, inventory, machinery, and equipment. The majority (91%) of the cooperatives also reported a reduction in financial assets (e.g., cash and bank deposits) due to disasters. Respondents noted disasters, particularly natural disasters, caused severe damage to cooperatives' physical (e.g., buildings, machinery, and equipment) and financial assets (e.g., cash and bank deposits). For instance, the Taal volcano phreatic eruption caused ashfall over Batangas province and nearby provinces. Transportation disruptions and power interruptions were brought about by ashfall, lava mud, and rocks thus affecting

Table 3. Economic implications of disasters on cooperatives' business operations, 77 cooperatives, CALABARZON, Philippines, 2020

Variable	Natural				Biologic				Human-induced				All			
	Not Affected (%)	Affected (%)	χ^2	Φ	Not Affected (%)	Affected (%)	χ^2	Φ	Not Affected (%)	Affected (%)	χ^2	Φ	Not Affected (%)	Affected (%)	χ^2	Φ
Operational Challenges																
Labor Issues																
No (%)	13	12	12.052***	0.4	18	6	21.252***	0.525	9	16	2.5534	0.182	4	21	3.590*	0.216
Yes (%)	10	65			13	62			14	61			3	73		
Capital issues																
No (%)	10	6	12.717***	0.407	13	4	15.262***	0.445	10	6	12.717***	0.406	6	10	26.325***	0.585
Yes (%)	13	70			18	65			13	70			0	83		
Market issues																
No (%)	16	25	6.811***	0.3	18	22	4.736**	0.248	13	27	2.285	0.172	6	34	7.935***	0.321
Yes (%)	8	52			13	47			10	49			0	60		
Logistic Issues																
No (%)	13	5	22.058***	0.535	13	5	12.928***	0.41	9	9	6.771***	0.297	6	12	24.063***	0.559
Yes (%)	10	72			18	64			14	68			0	82		
Economic Implications																
Net Surplus																
Not Affected (%)	6	3	9.926***	0.359	8	1	10.678***	0.3724	6	3	9.926***	0.359	6	3	53.472***	0.833
Reduced (%)	17	74			23	68			17	74			0	91		
Operational Cost																
Not Affected (%)	5	1	9.571***	0.352	5	1	5.943**	0.278	4	3	4.004**	0.228	4	3	25.213***	0.572
Increased (%)	18	75		6	26	68			19	74			3	91		
Sales																
Not Affected (%)	17	30	6.121**	0.282	17	30	0.77	0.1	13	34	0.731	0.097	5	42	2.374	0.176
Reduced (%)	6	47			14	39			10	43			1	52		

Notes: ***, **, * statistically significant at 1%, 5% and 10%, respectively

transmission and distribution lines. Many cooperatives in Batangas and Cavite lost their facilities, resulting in the temporary cancellation of operations and business closure while conducting structural repairs and restoration. Damaged business facilities caused delays in the production and disposal of cooperative products such as feeds, rice, vegetables, and handicrafts. Among the 22 typhoons that visited the country in 2020 (DOST-PAGASA 2021), typhoons Ambo, Rolly and Ulysses have been identified by the cooperatives to have caused severe damage and disruptions to their business activities. Many (60%) cooperatives remained closed in Quezon province for two weeks due to infrastructure and property damages and transportation disruptions brought about by these typhoons.

The chi-square test results also show that there is a significant (χ^2=24.063, p<0.01) and strong positive (Φ=0.559) relationship between logistics issues and disasters. This implies that natural, biological, and human-induced disasters caused disruptions in cooperatives' business operations. Based on the interview with cooperatives, 82% had difficulty fulfilling and delivering products to the customers due to damages in roads, transmissions, and distribution and communication lines. Also, due to enhanced community quarantine (ECQ) implementation, transport vehicles became limited, resulting in delayed disposal of goods.

The identified disasters disrupt the cooperatives' operation and threaten the continuity of the business enterprise. Cooperatives experienced reductions in sales (53%) and net surpluses (91%) and an increase in operational costs (94%) (see Table 3). The chi-square test of independence showed that natural disaster is significantly and negatively associated with reduced cooperative sales. According to the respondents, whenever there are natural disasters, such as typhoons, floods, and volcanic eruptions, the mobility of goods (and people) is restricted, and the distribution of products is halted, resulting in reduced sales. Table 3 also shows that disaster is strongly and positively related to increased operational cost and reduced net surplus with Phi coefficient estimates of 0.572 and 0.883, respectively. It can also be observed from Table 3 that among the types of disasters, natural disaster has the strongest relationship with increased operational cost. For example, typhoons Ambo, Rolly and Ulysses, and Taal phreatic eruption caused logistics issues. Due to the extreme pressure of rising transportation, input, and other related expenses after a disaster, adjustments should be made to ensure business continuity. However, interviews with respondents revealed that adjustments usually entail additional expenses, significantly contributing to increased operational costs and reduced net surplus of cooperatives.

Meanwhile, biological disaster has the highest association with a reduction in net surplus. Some of the affected cooperatives reported that they incurred sales losses due to businesses' inaccessibility and lower demands for their products. For instance, community quarantine restrictions implemented for the COVID-19 pandemic resulted in the limited mobility of clients and the temporary closure of most cooperatives interviewed. In addition, because CALABARZON is one of the regions hardly hit by ASF, many farmers were discouraged from raising hogs, resulting in reduced sales of feeds produced and/or marketed by some cooperative-respondents.

Mitigation Practices and Business Continuity Plans (BCP)

Table 4 also shows that the mitigation strategies of cooperatives before, during, and after a disaster event include: purchasing insurance (45%), limiting high-risk customers (44%), having emergency-use only cell phones (27%), establishing online and offline data back-up systems (47%), use of generators (18%), and changing production patterns (40%). The chi-square test results revealed that all the mitigation practices have significant and moderate negative associations with disasters. This finding suggests that cooperatives could use all these mitigation practices to minimize the negative impacts of disasters. Among the mitigation practices, use of emergency-use-only cell phones (χ^2=14.259, Φ=-0.430), use of generators (χ^2=13.736, Φ=-0.422), and changing production patterns (χ^2=7.935, Φ=-0.321) have the highest degree of association with disaster. Emergency use communication lines allow

Table 4. Mitigation practices and business continuity plan of 77 cooperative-respondents, CALABARZON, Philippines, 2020

Variable	Natural				Biologic				Human-induced				All			
	Not Affected (%)	Affected (%)	χ^2	Φ	Not Affected (%)	Affected (%)	χ^2	Φ	Not Affected (%)	Affected (%)	χ^2	Φ	Not Affected (%)	Affected (%)	χ^2	Φ
Mitigation Practices																
Buy Insurance																
No (%)	3	45	12.842***	-	10	38	3.0261*	-0.198	5	43	6.279**	-	0	55	6.417**	-
Yes (%)	21	31		0.408	21	31			18	34		0.2856	6	39		0.289
Limit High Risk Customers																
No (%)	13	48	0.297	-	21	40	0.464	0.778	10	51	2.72	-	0	56	6.763***	-
Yes (%)	10	29		0.062	10	29			13	26		0.188	6	38		0.296
With Emergency-use-Only Cellphones																
No (%)	14	62	3.156*	-	22	55	0.653	-0.092	17	60	0.254	-	0	73	14.259***	-0.43
Yes (%)	9	14		0.202	9	14			6	17		0.057	6	21		
With Online and Offline Databank																
No (%)	4	47	10.853***	-	9	42	6.438	-0.289	9	42	1.3	-0.13	0	53	6.090**	-
Yes (%)	19	30		0.375	22	27			14	35			6	40		0.281
Use Generators																
No (%)	4	47	10.853***	-	9	42	6.438	-0.289	9	42	1.3	-0.13	0	53	6.090**	-
Yes (%)	19	30		0.375	22	27			14	35			6	40		0.281
Change Production Pattern																
No (%)	9	53	5.502**	-	13	49	6.346**	-0.287	9	53	5.502**	-	0	60	7.935***	-
Yes (%)	14	23		0.267	18	19			14	23		0.267	6	34		0.321
Business Continuity Plan																
With BCP																
No (%)	0	49	22.889***	-	3	47	23.469***	-0.552	0	49	22.889***	-	0	49	15.240***	-
Yes (%)	23	27		0.545	29	22			23	27		0.545	17	34		0.445

Notes: ***, **, * statistically significant at 1%, 5% and 10%, respectively

cooperatives to inform employees, suppliers, and customers of the disruptions due to disasters. The use of generators keeps important operations continuing in the event of loss of electricity due to disasters. It can also be observed that buying insurance (χ^2=12.842, Φ=-0.408) and establishing online and offline backup systems (χ^2=10.853, Φ=-0.375) have the highest association with natural disaster mitigation. Based on the interview, life insurance (for employees/staff and members), fire insurance (for offices/establishments), and agricultural insurance (for crops and livestock) are the commonly availed insurance of the cooperative. Meanwhile, the use of generators has shown the highest association with both biological (χ2=8.747, Φ=-0.337) and human-induced (χ^2=10.892, Φ=-0.376) disaster mitigation strategies.

About half (49%) of the respondents reported that neither they have any BCP nor are well-prepared to handle disaster risk. This finding highlight that many cooperatives were still ill-prepared in handling different disasters that can harm and disrupt their operations. This is despite the requirement of CDA for cooperatives to have BCP. Through the enactment of RA 11364, CDA has been mandated to require all cooperatives to develop business continuity plans to address all kinds of risks. Interview with respondents revealed that the non-adoption of BCP by some cooperatives was due to limited knowledge and technical know-how on how to establish and prepare a BCP. Non-adoption can also be linked to a lack of interest by some cooperatives due to the organization's size. Most non-adopters of BCP are micro and small cooperatives constrained with resources, both in finance and the number of staff devoted to planning and mitigating the potential risk of disasters.

Fifty-one percent of the cooperatives reported having a concrete BCP in place. Since the Philippines is under constant threat of typhoons and earthquakes, some cooperatives mentioned that they had incorporated the possibility of a seismic event, fire, and typhoon destruction in their BCP and safety training. Results of the chi-square test of independence in Table 4 confirm that BCP is significantly (χ^2=15.240, $p<0.01$) and negatively (Φ=-0.445) related to disaster events. This result also implies that having a BCP allows cooperatives to react to disruptive events and continue their business activities in case of emergencies. This finding further suggests that having BCP could help cooperatives ensure continuous business operations following disaster events. Interviewed cooperatives noted that having a BCP helped them keep the operations running in the event of a disaster.

Summary and Conclusion

This study analyzed the economic effects of disasters on 77 cooperatives from Cavite (18%), Laguna (38%), Batangas (19%), Rizal (12%), and Quezon (13%). Most of the respondents are categorized as single-purpose (51%) and micro and small cooperatives (60%).

Results of the Chi-square test of independence showed that cooperatives are exposed to different types of disasters that can cause massive damage and disruptions in their business activities. In CALABARZON, cooperatives are exposed to natural (i.e., typhoons, floods, volcanic activities, and earthquakes), biological (i.e., COVID-19 pandemic and ASF outbreak), and human-induced disasters (i.e., theft, fraud, problems with a stable supply of water and electricity, cyber-attacks). In terms of cooperative size, micro and small cooperatives were found to be more vulnerable to all types of disasters. On the other hand, multi-purpose cooperatives are less susceptible to all types of these disasters than single-purpose cooperatives (e.g., credit, consumer, and marketing).

Operational challenges faced in the event of a disaster could be grouped into four categories: labor, capital, market, and logistics. Results of the chi-square test of independence revealed significant and positive associations among disasters and operational challenges. Disrupted cash flows and income loss due to damages of equipment and facilities, loss of business records, inventory, machinery, and equipment affected cooperatives' critical business

functions. Disasters also result in difficulty fulfilling and delivering products to the customers because of damages in roads, transmissions, and distribution lines affecting the delivery of products, water and electricity supply, and communication lines. The occurrence of disasters threatens the continuity of cooperatives' business operations. Among others, disaster events resulted in increased operational costs and reduced net surplus of cooperatives. Biological disaster has been found to have the highest association with reducing net surplus and the strongest relationship with increased operational cost.

In terms of mitigating practices, cooperatives implement various activities such as establishing a backup record system, acquiring insurance, limiting high-risk customers, changing operation patterns, providing emergency-use coop cellphones, and using generators. Among these practices, emergency use communication lines and the use of generators were found to have the highest degree of association with disaster mitigation. In addition, the chi-square test revealed that BCP significantly and positively contributes to ensuring cooperatives' business continuity, highlighting the importance of CDA's requirement for cooperatives to develop their business continuity plans.

Recommendations

Based on the above findings, this study recommends the following:

Since it was found out that cooperatives are exposed to a wide range of disasters, insurance cooperatives and other insurance providers may revisit or streamline their products and services to cover these types of risks. Having found that compared to single-purpose cooperatives, multi-purpose cooperatives performed better in terms of the economic indicators during disaster events, policies and programs promoting the institutionalization of multi-purpose cooperatives must be given priority. Moreover, as micro and small-sized cooperatives are more susceptible than medium and large cooperatives, capacity building activities (e.g., training workshops and seminars) among these groups need to be conducted to strengthen their adaptive resilience to disaster events important. Creation of credit lines in the form of "Disaster Loans" and provision of capital supports intended for cooperatives may also be considered to help them address losses in inventory, machinery, and equipment, as well as the costs of repairing damaged infrastructure during disaster events.

The findings of this study also highlight that other than the adoption of mitigating practices, the adoption of BCP is needed to minimize the negative impacts of disasters and reinforce cooperatives' resilience from various disasters. However, even if a BCP has been required for cooperatives under RA 11364, not all cooperatives have BCP in place. The government, private sector, and academe need to step up in providing appropriate training and social and financial support systems for the cooperative sector, particularly those micro and medium-sized cooperatives, to be well-equipped with the necessary technical knowledge and skills in crafting and implementing BCP. Cooperatives must also learn to constantly institute an evaluation and monitoring system for their business continuity plans to ensure that there would be continuous improvement in their disaster-proofing activities. These factors must also be considered in developing BCP for cooperatives.

As the entire country is experiencing various types of disasters, and the types and effects of disasters might vary depending on the location or region, similar studies in other regions could also be conducted to shed more light on how disasters affect the business operations of cooperatives in the Philippines. Furthermore, future studies can also further investigate the impacts of the COVID-19 pandemic as this is a global issue, and cooperatives worldwide are being affected by this disaster event in various ways.

JEMAD's Non-Participation Declaration

Asst. Prof. Liezel Cruz is an associate editor of JEMAD but was not involved during the peer review process of this manuscript.

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Appendices

Appendix 1. Interpretation of the phi coefficients

Value	Interpretation
+1	Perfect positive relationship
+0.70 to +0.99	Very strong positive relationship
+0.40 to +0.69	Strong positive relationship
+0.30 to +0.39	Moderate positive relationship
+0.20 to +0.29	weak positive relationship
+0.01 to +0.19	No or negligible relationship
0	No relationship
-0.01 to -0.19	No or negligible relationship
-0.20 to -0.29	weak negative relationship
-0.30 to -0.39	Moderate negative relationship
-0.40 to -0.69	Strong negative relationship
-0.70 to -0.99	Very strong negative relationship
-1	Perfect negative relationship

Source: Glen (2016)

Appendix 2. Description of variables in the Chi-square test of independence

Variable	Type	Description
		Size and Type of Cooperative
Size of Cooperative	binary	1 if the cooperative is categorized as micro-small, 0 otherwise
Type of cooperative	binary	1 if the cooperative is categorized as a single-purpose, 0 otherwise
		Disasters
Natural	binary	1 if the cooperative is affected by natural disasters, 0 otherwise
Biological	binary	1 if the cooperative is affected by biological disasters, 0 otherwise
Human-induced	binary	1 if the cooperative is affected by human-induced disasters, 0 otherwise
All	binary	1 if the cooperative is affected by all types of disaster, 0 otherwise
		Operational Challenges
Labor Issues	binary	1 if the cooperative experienced labor issues, 0 otherwise
Capital Issues	binary	1 if the cooperative experienced labor issues, 0 otherwise
Market Issues	binary	1 if the cooperative experienced market issues, 0 otherwise
Logistic Issues	binary	1 if the cooperative experienced logistic issues, 0 otherwise
		Economic Implications
Net Surplus	binary	1 if the cooperative experienced reduction in net surplus, 0 otherwise
Operational Cost	binary	1 if the cooperative experienced increase in operational cost, 0 otherwise
Sales	binary	1 if the cooperative experienced reduction in sales, 0 otherwise
		Mitigation Practices
Buy Insurance	binary	1 if the cooperative availed of insurance, 0 otherwise
Limit High Risk Customers	binary	1 if the cooperative restricted high-risk customers, 0 otherwise
With Emergency-use-Only Cellphones	binary	1 if the cooperative has emergency-use-only cellphones, 0 otherwise
With Online and Offline Databank	binary	1 if the cooperative has emergency-use-only cellphones, 0 otherwise
Use Generators	binary	1 if the cooperative uses electric generators, 0 otherwise
Change Production Pattern	binary	1 if the cooperative changed their production pattern, 0 otherwise
		Business Continuity Plan
With BCP	binary	1 if the cooperative has a business continuity plan, 0 otherwise