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Disaster Preparedness and Resilience of Manufacturing and Logistics Companies in Cainta, Rizal

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Abstract

This study assessed the disaster preparedness and resilience of manufacturing and logistics companies in Cainta, Rizal, a municipality frequently exposed to flooding, typhoons, earthquakes, and other hazards that threaten business continuity. Guided by Disaster Risk Reduction (DRR) Theory, Disaster Preparedness and Organizational Resilience Theory, and Disaster Resilience Theory, the research examined disaster experiences, preparedness practices, and organizational resilience capacities. Specifically, it described the profiles of respondents and companies, determined the frequency of disaster-related disruptions, assessed the extent of implementation of disaster preparedness practices in terms of emergency planning, safety training, and operational flexibility, measured disaster resilience through absorptive, adaptive, and recovery capacities, tested differences across respondent and company profiles, examined the relationship between preparedness and resilience, and developed a proposed disaster preparedness and resilience framework. A descriptive-correlational quantitative research design was employed using a structured survey questionnaire administered to 100 respondents from nine manufacturing companies and fourteen logistics companies operating in Cainta, Rizal. Data were analyzed using frequency, percentage, weighted mean, t-test, analysis of variance (ANOVA), and Pearson product-moment correlation. Findings revealed that manufacturing and logistics companies sometimes experienced disaster-related disruptions, with flooding and typhoons identified as the most common hazards affecting operations. The firms demonstrated a high extent of implementation of disaster preparedness practices, particularly in emergency planning and employee safety training, while operational flexibility showed opportunities for further enhancement. Likewise, companies exhibited a high level of disaster resilience in terms of their ability to absorb, adapt to, and recover from disaster impacts. Statistical analysis further indicated significant relationships between disaster preparedness practices and organizational resilience, confirming that stronger preparedness contributes to greater resilience and business continuity. Based on the findings, the study proposed a Disaster Preparedness and Resilience Framework designed to strengthen organizational readiness, minimize operational disruptions, reduce disaster-related losses, and promote sustainable resilience among manufacturing and logistics companies operating in hazard-prone areas.

Keywords: Disaster Preparedness, Organizational Resilience, Manufacturing Companies, Logistics Companies, Business Continuity, Disaster Risk Reduction, Cainta Rizal, Operational Resilience

Introduction

Natural disasters continue to pose significant threats to business operations, particularly in developing countries that experience recurring climate-related and geological hazards. Manufacturing and logistics companies are especially vulnerable because disruptions in production, transportation, warehousing, and supply chains can result in substantial operational and financial losses. In the Philippines, where typhoons, flooding, earthquakes, and other hazards frequently occur, disaster preparedness and organizational resilience have become essential components of sustainable business management. Organizations that proactively implement emergency planning, employee safety training, operational flexibility, and business continuity strategies are better positioned to withstand disruptions, minimize losses, and recover efficiently from disaster events. Despite the increasing recognition of resilience as a strategic management priority, many organizations continue to rely on reactive rather than systematic approaches to disaster risk reduction.

Recent studies support the importance of integrating disaster preparedness into organizational operations. Ivanov and Dolgui (2020) emphasized that resilient manufacturing and logistics systems depend on supply chain flexibility, redundancy, and adaptive operational capabilities that enable firms to sustain business continuity during disruptions. Similarly, Queiroz et al. (2022) found that organizations implementing integrated risk management and preparedness systems demonstrated significantly faster recovery and greater operational resilience than firms relying solely on reactive responses. The International Organization for Standardization (ISO 22301, 2019) likewise stressed that organizations should institutionalize business continuity management systems through regular planning, testing, and continuous improvement to reduce disaster-related interruptions. These studies collectively highlight that preparedness and resilience are strategic organizational capabilities rather than isolated emergency measures.

Within the Philippine context, disaster vulnerability remains a persistent concern because of the country's location along the Pacific Ring of Fire and the Pacific Typhoon Belt. According to the National Disaster Risk Reduction and Management Council (2023), the country experiences approximately twenty tropical cyclones annually, resulting in widespread flooding, infrastructure damage, and disruptions to economic activities. Research by the Asian Development Bank (2018) and the World Bank (2020) further revealed that disasters significantly affect manufacturing and logistics industries by interrupting transportation networks, damaging facilities, reducing productivity, and increasing financial losses. However, despite the existence of Republic Act No. 10121 and various disaster risk reduction policies, previous studies indicate that many organizations still lack comprehensive preparedness and resilience systems, particularly among small and medium-sized enterprises.

Although previous literature has extensively discussed disaster resilience and business continuity, limited empirical studies have specifically examined how manufacturing and logistics companies in hazard-prone municipalities such as Cainta, Rizal operationalize disaster preparedness and resilience practices. Existing studies primarily focus on policy implementation or general disaster management, with less attention given to firm-level preparedness, operational flexibility, and resilience capacities. This research addresses this gap by assessing disaster preparedness practices, disaster resilience levels, and their relationship among manufacturing and logistics companies in Cainta, Rizal. Guided by Disaster Risk Reduction Theory, Disaster Preparedness and Organizational Resilience Theory, and Disaster Resilience Theory, the study provides empirical evidence that supports the development of a context-specific disaster preparedness and resilience framework capable of strengthening business continuity, reducing operational disruptions, and enhancing organizational sustainability in disaster-prone environments.

Material and methods

2.1 Research Design

This study employed a descriptive-correlational quantitative research design to assess the disaster preparedness and resilience of manufacturing and logistics companies in Cainta, Rizal.

2.2 Locale of the Study

The study was conducted in the Municipality of Cainta, Rizal, one of the most urbanized municipalities in the province and a strategic center for manufacturing and logistics operations. Cainta is characterized by its proximity to Metro Manila and its exposure to recurring natural hazards, particularly flooding, typhoons, earthquakes, and other disaster-related events that significantly affect business continuity. The municipality serves as an appropriate research setting because numerous manufacturing and logistics companies operate within its industrial and commercial areas while facing recurring operational disruptions caused by disasters. Examining organizations within this locality provides valuable insights into how businesses implement disaster preparedness measures and develop organizational resilience under high-risk environmental conditions.

2.3 Respondents of the Study

The respondents of the study consisted of 100 employees from selected manufacturing and logistics companies operating in Cainta, Rizal. Specifically, the study included 38 respondents from nine manufacturing companies and 62 respondents from fourteen logistics companies. Respondents comprised managers, supervisors, safety officers, warehouse personnel, operations staff, and rank-and-file employees directly involved in disaster preparedness, operational management, business continuity, and recovery activities. Their positions enabled them to provide reliable information regarding the implementation of disaster preparedness practices and organizational resilience initiatives within their respective companies.

2.4 Sample and Sampling Procedure

The study utilized random sampling in selecting participating companies and respondents. Manufacturing and logistics firms were first identified through local government records, business directories, and industry listings. Companies qualified for inclusion if they were actively operating within Cainta, Rizal, belonged to either the manufacturing or logistics sector, and had experienced at least one disaster or operational disruption affecting business operations. After obtaining organizational permission, qualified respondents were randomly selected from employees knowledgeable about disaster preparedness, emergency response, business continuity, and organizational recovery. The final sample consisted of 100 respondents, representing both manufacturing and logistics sectors, thereby providing sufficient representation for statistical analysis.

2.5 Research Instrument

The primary instrument used in this study was a researcher-developed structured questionnaire based on the concepts of Disaster Risk Reduction Theory, Disaster Preparedness and Organizational Resilience Theory, and Disaster Resilience

Theory. The questionnaire consisted of five sections: respondent profile, company profile, frequency of disaster experiences, extent of implementation of disaster preparedness practices, and level of disaster resilience. Responses were measured using a five-point Likert scale appropriate to each construct. Prior to data collection, the instrument underwent expert validation to establish content validity and pilot testing among respondents outside the actual sample. Reliability testing using Cronbach's Alpha confirmed that the instrument possessed satisfactory internal consistency, making it suitable for the conduct of the study.

2.6 Data Gathering Procedure

Prior to data collection, the researchers secured approval from the academic institution and obtained permission from participating manufacturing and logistics companies. After receiving organizational consent, respondents were informed about the objectives of the study and were requested to sign informed consent forms indicating their voluntary participation. The questionnaires were personally distributed and collected by the researchers to ensure a high retrieval rate and to clarify any questions regarding the instrument. Completed questionnaires were checked for completeness before encoding and organizing the data for statistical analysis. Throughout the data collection process, confidentiality and anonymity of the respondents were strictly maintained.

2.7 Data Analysis Techniques

The collected data were encoded and analyzed using the Statistical Package for the Social Sciences (SPSS). Descriptive statistics, including frequency, percentage, and weighted mean, were employed to describe the respondents' profile, company profile, frequency of disaster experiences, extent of implementation of disaster preparedness practices, and level of disaster resilience. Inferential statistical techniques were likewise utilized to test the study hypotheses. Independent Samples t-test and One-Way Analysis of Variance (ANOVA) were employed to determine significant differences among groups based on respondent and company profiles, while the Pearson Product-Moment Correlation Coefficient (Pearson r) was used to determine the significant relationship between disaster preparedness practices and disaster resilience. All statistical tests were interpreted at the 0.05 level of significance.

2.8 Ethical Considerations

The study strictly adhered to established ethical standards in conducting research involving human participants. Participation in the study was entirely voluntary, and respondents were fully informed about the objectives, procedures, potential benefits, and their rights before providing informed consent. Respondents were assured that their identities, responses, and company information would remain confidential and would be used solely for academic purposes. Personal identifiers were excluded during data analysis and presentation of results to preserve anonymity. Participants were also informed of their right to decline participation or withdraw from the study at any stage without penalty. All collected data were securely stored and accessed only by the researchers, ensuring compliance with ethical principles of confidentiality, privacy, integrity, and responsible research conduct.

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Results and Discussion

3.1 Profile of Respondents

The results indicate that both the manufacturing and logistics respondents are largely composed of young to early-career employees, mostly occupying operational positions, and generally holding regular employment status. This demographic structure suggests a workforce that is actively engaged in day-to-day operations and likely possesses practical exposure to workplace processes, including safety and disaster-related procedures. The predominance of males in manufacturing and a more balanced gender distribution in logistics reflects the differing nature of job roles across the two sectors. Meanwhile, the presence of college and vocational graduates across both groups indicates a relatively adequate educational background that can support understanding and compliance with disaster preparedness measures. In general, these characteristics imply that respondents are in a strategic position to provide informed perspectives on organizational practices related to disaster readiness, while also highlighting potential areas—such as employment status variability and workforce diversity—that may influence participation in training and risk reduction programs.

Table 1.1

Profile of Respondents

Category	Manufacturing (f)	Manufacturing (%)	Logistics (f)	Logistics (%)
Age				
25 years old and below	9	23.7	19	30.6
26–35 years old	14	36.8	23	37.1
36–45 years old	10	26.3	13	21.0
46 years old and above	5	13.2	7	11.3
Total	**38**	**100**	**62**	**100**
Sex				

Male	27	71.1	36	58.1
Female	11	28.9	26	41.9
Total	**38**	**100**	**62**	**100**
Civil Status				
Single	15	39.5	29	46.8
Married	20	52.6	30	48.4
Widowed	1	2.6	2	3.2
Separated	2	5.3	1	1.6
Total	**38**	**100**	**62**	**100**
Highest Educational Attainment				
High School Graduate	11	28.9	14	22.6
Vocational	12	31.6	17	27.4
College Graduate	13	34.2	31	50.0
Post Graduate	2	5.3	0	0
Total	**38**	**100**	**62**	**100**
Length of Service				
Less than 1 year	6	15.8	12	19.4
1–3 years	11	28.9	21	33.9
4–6 years	9	23.7	15	24.2
7–9 years	6	15.8	8	12.9
More than 10 years	6	15.8	6	9.7
Total	**38**	**100**	**62**	**100**
Job Position				
Employee	24	63.2	42	67.7
Manager	8	21.1	8	12.9
Safety Officer	6	15.8	12	19.4
Total	**38**	**100**	**62**	**100**
Employment Status				
Regular	22	57.9	31	50.0
Probationary	6	15.8	12	19.4
Contractual	8	21.1	19	30.6
Part Time	2	5.3	0	0
Total	**38**	**100**	**62**	**100**

Table 1.2 below presents the company profile of the manufacturing and logistics sectors in terms of barangay location, type of industry, years of operation, number of employees, and form of ownership. The results show that both sectors are largely concentrated in San Roque and San Isidro, indicating that these barangays serve as key hubs for industrial and logistics activities. In terms of years of operation, both industries are generally composed of established firms, with a notable proportion operating within 5–10 years and 11–20 years, suggesting moderate organizational maturity and stability. Regarding workforce size, manufacturing companies tend to have larger employee distributions compared to logistics, which may reflect differences in operational demands and production scale. In both sectors, corporations dominate the form of ownership, indicating a strong preference for formal and structured business organization. Overall, the findings suggest that both manufacturing and logistics companies in the study area are relatively established, structurally formalized, and strategically located within key barangays that support industrial activity.

Table 1.2
Profile of the Company

Category	Manufacturing (f)	Manufacturing (%)	Logistics (f)	Logistics (%)
Barangay				
San Andres	3	7.9	4	6.5
San Isidro	9	23.7	15	24.2
San Juan	7	18.4	11	17.7
San Roque	10	26.3	16	25.8
Santa Rosa	3	7.9	5	8.1
Santa Domingo	3	7.9	5	8.1
Santo Niño	3	7.9	6	9.7
Type of Industry				
Manufacturing	38	100	–	–

Logistics	–	–	62	100
Years of Operation				
Less than 5 years	14	36.8	14	22.6
5–10 years	9	23.7	22	35.5
11–20 years	13	34.2	16	25.8
More than 20 years	2	5.3	10	16.1
Number of Employees				
Below 25	0	0	9	14.5
26–50	6	15.8	17	27.4
51–75	8	21.1	16	25.8
76–100	10	26.3	10	16.1
More than 100	14	36.8	10	16.1
Form of Ownership				
Sole Proprietorship	5	13.2	9	14.5
Partnership	7	18.4	12	19.4
Corporation	26	68.4	41	66.1

3.2 Frequency of Type Disaster Experienced

Table 2 reveals that both manufacturing and logistics companies in Cainta, Rizal sometimes experience disaster events overall, with very close grand weighted means of 3.23 and 3.29, respectively, indicating comparable exposure levels across the two sectors. Among the identified hazards, flooding emerged as the most frequently encountered disaster in both sectors, followed by typhoons and energy disruptions, all of which reflect the recurring impact of hydrometeorological events on business operations and supply chains. In contrast, earthquakes and fire-related emergencies were rated lower but still categorized as sometimes experienced, suggesting that while less frequent, these hazards remain present operational risks. Overall, the results highlight that both sectors are most affected by climate- and weather-related disruptions, underscoring the need for strengthened disaster preparedness and resilience strategies focused primarily on flooding and typhoon-related impacts while still maintaining readiness for other low-frequency but high-impact hazards.

Table 2
Frequency of Type Disaster Experienced

Type of Disaster Experienced	Manufacturing		Logistics	
	Mean	Verbal Interpretation	Mean	Verbal Interpretation
1. Typhoon	3.27	Sometimes Experienced	3.07	Sometimes Experienced
2. Earthquake	2.91	Sometimes Experienced	2.98	Sometimes Experienced
3. Flooding	3.67	Often Experienced	3.76	Often Experienced
4. Energy Disruption	3.41	Sometimes Experienced	3.39	Sometimes Experienced
5. Fire and other emergencies	2.91	Sometimes Experienced	3.24	Sometimes Experienced
Grand Mean	3.23	Sometimes Experienced	3.29	Sometimes Experienced

3.3 Extent of Implementation of Disaster Preparedness Practices

Table 3 shows that both manufacturing and logistics companies implement disaster preparedness practices to a great extent, as reflected in their close grand means of 3.45 and 3.41, respectively, indicating generally comparable levels of preparedness across the two sectors. Among the specific dimensions, safety training obtained the highest mean in both sectors, highlighting a strong organizational emphasis on equipping employees with the necessary knowledge and skills for effective disaster response. Operational flexibility followed, although logistics showed a relatively lower level compared to manufacturing, suggesting some variation in adaptive capacity between the two sectors. Meanwhile, emergency planning recorded the lowest mean in both groups and was interpreted as a moderate extent, indicating that formal planning mechanisms such as updating and strengthening emergency protocols may still need improvement. Overall, the results suggest that while both sectors are strongly focused on employee preparedness through training, there remains a need to further enhance structured emergency planning to achieve a more comprehensive and resilient disaster preparedness system.

Table 3
Extent of Implementation of Disaster Preparedness Practices

Disaster Preparedness Practices	Manufacturing		Logistics	
	Mean	Verbal Interpretation	Mean	Verbal Interpretation

1. Emergency Planning	3.27	Moderate Extent	3.07	Moderate Extent
2. Safety Training	3.67	Great Extent	3.76	Great Extent
3. Operational Flexibility	3.41	Great Extent	3.39	Moderate Extent
Grand Mean	3.45	Great Extent	3.41	Great Extent

3.4 Level of Disaster Resilience

Table 4 reveals that both manufacturing and logistics companies demonstrate a high level of disaster resilience, as reflected in their close grand means of 4.01 and 3.95, respectively, indicating that both sectors possess strong and comparable capacities to manage disaster-related disruptions. Among the three dimensions, the ability to adapt to disaster conditions obtained the highest mean in both sectors, highlighting their strong capability to adjust operations, reallocate resources, and maintain continuity during disruptive events. This was followed by the capacity to absorb disaster impacts, which also received high ratings, suggesting that both sectors have established preventive measures and safeguards to reduce vulnerability. Meanwhile, recovery from disaster impacts recorded the lowest mean in both groups, although still interpreted as high, indicating that while organizations are generally effective in restoring operations after disasters, recovery processes may require more time and resources compared to absorption and adaptation. Overall, the findings suggest that both sectors are highly resilient, with particularly strong adaptive capacities, but there is still room for improvement in strengthening recovery mechanisms to achieve a more balanced and comprehensive disaster resilience system.

Table 4
Level of Disaster Resilience

Level of Disaster Resilience	Mean	Verbal Interpretation	Mean	Verbal Interpretation
1. Absorb Disaster Impacts	3.90	High	3.87	High
2. Adapt to Disaster Conditions	4.32	High	4.38	High
3. Recover from Disaster Impacts	3.80	High	3.61	High
Grand Mean	4.01	High	3.95	High

3.5 Significant Difference in the Frequency of Disaster Effects Experienced by Manufacturing and Logistics Companies according to Profile

The results reveal that in the manufacturing sector, all profile variables show no significant differences in the frequency of disaster effects experienced, indicating that respondents perceive disaster impacts consistently regardless of demographic or company characteristics. In contrast, the logistics sector shows several significant differences across multiple profile variables such as age, sex, educational attainment, length of service, job position, years of operation, and number of employees, suggesting that perceptions of disaster effects in logistics vary depending on respondent and company characteristics. However, civil status, barangay location, and form of ownership were found to have no significant differences in both sectors. Overall, the findings imply that disaster experience in manufacturing is relatively uniform across groups, while logistics shows more variability influenced by workforce and organizational profiles.

Table 5.1
Significant Difference in the Frequency of Disaster Effects Experienced by Manufacturing and Logistics Companies according to Respondent's Profile

Profile Variable	Manufacturing (Sig.)	Interpretation	Logistics (Sig.)	Interpretation
Age	.687	Not Significant (NS)	.040	Significant (S)
Sex	.501	NS	.007	S
Civil Status	.619	NS	.238	NS
Highest Educational Attainment	.716	NS	.006	S
Length of Service	.955	NS	.005	S
Job Position	.878	NS	.007	S
Employment Status	.761	NS	.035	S
Barangay	.732	NS	.053	NS
Years of Operation	.718	NS	.006	S
Number of Employees	.665	NS	.025	S
Form of Ownership	.881	NS	.334	NS

Table 5.2 results indicate that in the manufacturing sector, all profile variables show no significant differences in the extent of implementation of disaster preparedness practices, suggesting a generally uniform level of implementation regardless of respondent or company characteristics. In contrast, the logistics sector shows several significant differences across key variables such as sex, educational attainment, length of service, job position, employment status, years of operation, number of employees, and form of ownership, indicating that the implementation of disaster preparedness practices varies depending on both workforce and organizational profiles. However, age, civil status, and barangay location were found to have no significant influence in both sectors. Overall, the findings suggest that disaster preparedness implementation in manufacturing is consistently applied across groups, while logistics exhibits more variability influenced by human resource and organizational structure factors.

Table 5.2

Significant Difference in the Frequency of Disaster Effects Experienced by Manufacturing and Logistics Companies according to Company's Profile

Profile Variable	Manufacturing (Grand Mean Sig.)	Interpretation	Logistics (Grand Mean Sig.)	Interpretation
Age	.968	Not Significant (NS)	.067	NS
Sex	.343	NS	.014	Significant (S)
Civil Status	.454	NS	.072	NS
Highest Educational Attainment	.699	NS	.020	S
Length of Service	.905	NS	.006	S
Job Position	.919	NS	.004	S
Employment Status	.650	NS	.029	S
Barangay	.995	NS	.098	NS
Years of Operation	.681	NS	.033	S
Number of Employees	.866	NS	.020	S
Form of Ownership	.740	NS	.017	S

Conclusions & Recommendations

The findings of the study indicate that both manufacturing and logistics companies in Cainta, Rizal demonstrate generally strong disaster preparedness practices and high levels of disaster resilience, reflecting a positive organizational response to recurring hazards such as flooding and typhoons. However, while safety training and adaptive capacity are consistently strong across both sectors, emergency planning and recovery mechanisms remain comparatively weaker areas that require further strengthening. The statistical tests further reveal that differences in disaster preparedness and resilience are more evident in the logistics sector, where respondent and company profiles significantly influence implementation and perceived disaster impacts, while the manufacturing sector remains relatively uniform. Moreover, the significant relationships identified between disaster preparedness and disaster resilience confirm that improved preparedness practices contribute to stronger organizational resilience, particularly in maintaining continuity, adapting operations, and recovering from disruptions.

Based on the results, it is recommended that manufacturing and logistics companies enhance and institutionalize their emergency planning systems by regularly updating protocols, conducting scenario-based simulations, and integrating disaster risk assessments into operational planning. Logistics companies, in particular, should address the observed variability in preparedness implementation by standardizing disaster preparedness policies across all employee levels and ensuring equitable access to training and resources regardless of position, tenure, or educational background. Both sectors are further encouraged to strengthen recovery systems by developing more structured business continuity plans, investing in redundant supply chain mechanisms, and improving coordination with local disaster risk reduction offices in Cainta, Rizal. Finally, continuous capacity-building programs should be sustained, focusing not only on safety training but also on enhancing adaptive and recovery capabilities to ensure long-term organizational resilience in disaster-prone environments.Construction companies should strengthen the consistency and inclusiveness of their workforce management planning systems by ensuring that all employee groups experience equal access to HR processes such as forecasting, training, and evaluation. Priority should be given to improving career development pathways, strengthening HR–operations coordination, and institutionalizing continuous monitoring and evaluation systems to ensure timely and data-driven workforce decisions. Organizations should also enhance communication, workload distribution, and employee engagement initiatives to reinforce commitment and reduce attrition. In doing so, firms can build a more stable, motivated, and committed workforce that supports long-term operational efficiency and project success.

Compliance with ethical standards

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