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Financial Distress Levels of Selected Big Corporations in Cebu, Philippines: An Economic Perspective Modelling using Fuzzy Cognitive Map

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Abstract

The financial health of major corporations is essential for local and national economic stability. This study investigates financial distress among selected large corporations in Cebu City, Philippines, from both microeconomic and macroeconomic perspectives. It examines internal issues like operational inefficiencies and governance problems, alongside external economic influences, to identify key drivers of financial instability. Using financial metrics from the Philippine Stock Exchange (2022), Altman Z-scores were calculated to assess financial health, categorizing firms into "distress" and "grey" zones. Expert interviews helped establish causal relationships between economic factors and financial distress, analyzed using Fuzzy Cognitive Mapping (FCM) to quantify each factor's impact. The findings reveal that companies with poor operational efficiency are at significant risk. Improving Operational Efficiency and Cost Structure had the highest potential to reduce distress, with a change level of 25%. Industry-Specific and Global Economic Factors were also crucial, affecting distress reduction by 19%. The study recommends enhancing operational processes, adopting lean practices, and strengthening governance to build financial resilience. These strategies are vital for the long-term stability of Cebu's economic ecosystem.

Keywords
Financial Distress, Altman Z-score, Operational Efficiency, Fuzzy Cognitive Map, SDG9

1. Introduction

The financial health and stability of corporations, especially large and influential ones, is a matter of significant importance not just for the companies, but also for the broader economic ecosystem in which they operate. When major corporations face financial distress, it can have ripple effects on various stakeholders, including employees, suppliers, customers, and even the local and national economies.

This study aims to examine the financial distress experienced by selected big corporations in Cebu City, a major economic hub in the Philippines. The study takes a comprehensive approach by analyzing the issue from both micro- and macroeconomic perspectives, recognizing that the financial performance of individual corporations is influenced by a multitude of factors, ranging from internal management practices to external economic conditions.

On the microeconomic front, the study delves into the specific circumstances, strategies, and decisions that may have contributed to or exacerbated the financial distress of the selected corporations. This includes an in-depth analysis of factors such as operational inefficiencies, mismanagement, competitive pressures, and industry-specific challenges. By examining the microeconomic factors, the study seeks to identify potential areas for improvement and provide insights that could help other corporations avoid or mitigate similar financial challenges. Complementing the microeconomic analysis, the macroeconomic perspective explores the broader economic landscape and its impact on the financial performance of the selected corporations. This encompasses an examination of factors such as economic growth, inflation, interest rates, exchange rates, and government policies. By understanding the macroeconomic forces at play, the study aims to shed light on the external factors that may have contributed to or exacerbated the financial distress, as well as the potential implications for the local and national economies.

The scope of this case study encompasses a comprehensive analysis of the financial distress experienced by selected big corporations in Cebu City, with a focus on both internal and external factors. The findings and recommendations derived from this study are intended to inform corporate decision-making, policy formulation, and broader economic strategies, ultimately contributing to the overall financial stability and resilience of the business ecosystem in Cebu City and beyond.

1.1 Objectives

The purpose of this study is to model the dynamics of financial distress levels of the selected organizations based on different micro- and macro-economic factors. Specifically, this study aims to answer the following questions:

1. What is the existing financial distress level of the selected big businesses in Cebu?
2. What is the causal relationship between microeconomic and macroeconomic factors to financial distress?
3. How should big businesses prioritize economic strategies to retain financial stability and resilience?

2. Literature Review

The financial distress of corporations is a widely studied phenomenon in both microeconomic and macroeconomic literature. Researchers have explored various internal (corporate governance, operational efficiency, capital structure) and external (economic growth, fiscal policies, financial markets) factors that contribute to financial distress. This section reviews key theoretical frameworks and empirical studies that inform this research.

Microeconomic Theories

Microeconomic theories focus on firm-level factors such as corporate governance, operational efficiency, financial management, and innovation.

Corporate Governance and Financial Stability

Corporate governance plays a crucial role in financial distress mitigation. Agency theory (Jensen & Meckling, 1976) explains the conflicts of interest between managers (agents) and shareholders (principals), which can lead to excessive risk-taking and financial instability. Stakeholder theory (Freeman, 1984) expands this perspective by emphasizing the importance of balancing the interests of multiple stakeholders, including employees, suppliers, and investors. Upper echelons theory (Hambrick & Mason, 1984) highlights the impact of top executives' decisions on financial performance. Studies have shown that strong governance structures improve corporate transparency and risk management, reducing financial distress risks (Drew et al., 2006; Iqbal et al., 2014; Kaen, 2005).

Operational Efficiency and Cost Optimization
Operational inefficiencies contribute significantly to financial distress. Transaction cost economics (Williamson, 1981) explains how firms can reduce operational costs through efficient contracts and supply chain management. The resource-based view (Barney, 1991) highlights the role of unique firm resources in maintaining financial stability. Empirical studies show that implementing lean management practices such as Six Sigma and Kaizen improves cost efficiency and profitability (Cinco, 2014; Zhang & Huang, 2023).

Capital Structure and Financial Management
Financial distress is often linked to poor capital structure decisions. The trade-off theory (Kraus & Litzenberger, 1973) suggests that firms balance debt and equity to optimize financial performance. The pecking order theory (Myers & Majluf, 1984) argues that firms prefer internal financing over external debt to minimize asymmetric information costs. The free cash flow theory (Jensen, 1986) warns that excessive liquidity can lead to inefficient investments. Studies have confirmed that firms with poor financial management practices are more prone to distress (Bui, 2016; Flaminiano & Francisco, 2021; Guinigundo, 2017; Rago et al., 2023).

Market Position and Competitive Dynamics
The Five Forces Model (Porter, 1979) and competitive strategy framework (Porter, 1980) highlight how market competition affects corporate profitability. Firms that fail to differentiate their products or adapt to changing market conditions are more vulnerable to distress. Research on Philippine corporations supports this, showing that firms with weak competitive strategies struggle to maintain financial stability (De La Salle University & Lim, 2022; Aragon, 2016).

Innovation and Adaptation
The dynamic capabilities theory (Teece et al., 1997) suggests that firms that continuously innovate can better withstand economic shocks. The absorptive capacity theory (Cohen & Levinthal, 1990) and organizational learning theory (Argyris & Schön, 1978) emphasize the importance of knowledge acquisition in maintaining financial stability. Empirical studies confirm that firms that invest in R&D and technology adoption perform better during economic downturns (Del Prado & Rosellon, 2017; Velikikh, 2021).

Macroeconomic Theories
Macroeconomic conditions significantly impact corporate financial health. Economic fluctuations, government policies, and global market dynamics all contribute to financial distress risks.

Economic Growth and Business Cycles
The Keynesian economic framework (Kavaliov, 2015) states that government intervention is necessary to stabilize business cycles. The real business cycle theory (Nachane, 2018) argues that economic fluctuations are caused by external shocks rather than internal inefficiencies. Studies confirm that firms in developing economies, like the Philippines, are highly sensitive to GDP growth rates and business cycles (Battaglini & Coate, 2016; Oh et al., 2015).

Monetary and Fiscal Policies
The monetary policy theory (Volejníková & Kuba, 2020) and fiscal policy theory (Battaglini & Coate, 2016) explain how interest rates, inflation, and government spending affect corporate financial performance. Empirical research suggests that high inflation and restrictive monetary policies increase financial distress risks for corporations (Guinigundo, 2017; Georgakopoulos & Georgakopoulos, 2018).

Global Economic Conditions and Trade
International trade theories, such as the Heckscher-Ohlin model (Cavusoglu, 2019) and new trade theory (Ranjan & Raychaudhuri, 2016), highlight the impact of global supply chains and exchange rate fluctuations on corporate profitability. Studies show that Philippine firms with diversified international markets are more resilient to financial distress (San Miguel Corporation, 2024; Del Monte Pacific Limited, 2024).

Industry-Specific Factors
The industrial organization theory (Sandmo, 2014) and product life cycle theory (Nag et al., 2021) explain how sector-specific factors influence financial distress. Companies in declining industries or those facing technological disruption are more likely to experience distress (Talavera, 2017; Thorlakson et al., 2018).

Financial Market Conditions
The efficient market hypothesis (Knell, 2015) and capital asset pricing model (Georgakopoulos & Georgakopoulos, 2018) describe how financial markets affect corporate distress levels. Research confirms that firms with strong investor confidence and access to capital markets are less likely to experience distress (Rago et al., 2023).

Empirical Studies on Financial Distress in the Philippines
Several empirical studies have examined financial distress among Philippine corporations. Flaminiano & Francisco (2021) found that SMEs in the Philippines struggle with credit constraints, leading to higher financial distress risks. Gabriel et al. (2020) examined leadership styles in Philippine companies and their impact on financial resilience. Luningning (2023) explored contemporary trends in Philippine corporate management, identifying key challenges contributing to financial instability.

A recent study by Cruz et al. (2021) highlighted the importance of supply chain resilience in preventing financial distress. Van Holt et al. (2021) emphasized the role of sustainable business practices in long-term financial stability.

3. Methods
The study employs a mixed-methods approach, integrating both **quantitative** and **qualitative** techniques to analyze financial distress among major corporations in Cebu City. This methodology allows for a comprehensive examination of both **internal (microeconomic) and external (macroeconomic) factors** affecting corporate financial health.

3.1 Quantitative Methods
The primary quantitative approach used in this study is the **Altman Z-score Model**, which evaluates financial distress by computing a company's financial health using specific financial ratios. This model helps identify which corporations are at risk of bankruptcy or financial instability. The formula used is:

$$Z = 1.2T_1 + 1.4T_2 + 3.3T_3 + 0.6T_4 + 1.0T_5$$

where:

T_1= Working Capital / Total Assets
T_2= Retained Earnings / Total Assets
T_3 = Earnings Before Interest & Tax / Total Assets
T_4 = Market Value of Equity / Total Liabilities
T_5 = Sales / Total Assets

The computed **Z-scores** categorize corporations into three zones:

- **Distress Zone** (<1.81) → High risk of bankruptcy
- **Grey Zone** (1.81–2.99) → Moderate risk, financial uncertainty
- **Safe Zone** (≥3.00) → Financially stable

Companies were selected for further investigation based on their Z-scores. Those in the **Distress Zone** and **Grey Zone** were analyzed further to determine contributing factors to financial distress.

Additionally, **Fuzzy Cognitive Mapping (FCM)** was used to analyze relationships between economic factors and financial distress. FCM is a **causal mapping technique** that helps visualize the influence of different economic constructs on financial performance. The **FCMExpert** software was used to calculate activation coefficients, measuring the strength of causal relationships.

3.2 Qualitative Methods
To supplement the quantitative findings, the study incorporates expert interviews to gain insights into how different micro- and macroeconomic factors contribute to financial distress. The qualitative method involves:

- Five industry experts were selected based on their expertise in corporate finance, economics, and business management.
- AHP was used to quantify expert opinions and establish causal relationships between economic factors and financial distress.
- A structured questionnaire was used to assess experts' views on key financial and economic factors affecting corporate distress. Responses were scored from 0 (no influence) to 5 (very strong influence) to measure the impact of each factor.

The mixed-methods approach ensures a holistic understanding of financial distress by combining financial data analysis with expert insights and causal modeling.

4. Data Collection

The study utilizes data from **multiple sources**, including financial statements, market reports, and expert interviews.

4.1 Financial Data Sources

Financial data for selected corporations was obtained from the **Philippine Stock Exchange (PSE) 2022 Financial Reports**. The following financial metrics were collected:

- Current Assets
- Current Liabilities
- Working Capital
- Total Assets
- Retained Earnings
- Earnings Before Interest & Tax (EBIT)
- Market Value of Equity
- Total Liabilities
- Sales Revenue

These metrics were used to compute **Altman Z-scores**, which determined the financial distress level of each corporation.

4.2 Selection of Companies for Analysis

The study focuses on five large corporations in Cebu:

- **Company A** – a power generation and distribution company
- **Company B** – Cement manufacturing
- **Company C** – Food and beverage manufacturing
- **Company D** – Liquor and spirits industry
- **Company E** – Food and beverage production

These companies were selected due to their significant role in Cebu's economy and their varying levels of financial distress based on Z-scores:

- Company A, B, and C → Distress Zone
- Company D, E → Grey Zone

4.3 Expert Interviews

To complement the financial data, structured interviews were conducted with five **industry experts** specializing in corporate finance, economic policy, and business strategy. The **interview guide** contained questions assessing the impact of:

- Microeconomic factors **(e.g., corporate governance, operational efficiency, market competition)**
- Macroeconomic factors **(e.g., GDP growth, inflation, fiscal policies)**

5. Results and Discussion

5.1 Numerical Results

The numerical results of the study primarily focus on financial distress assessment using Altman Z-scores, Fuzzy Cognitive Mapping (FCM), and Causal Weight Matrices to quantify the relationships between microeconomic and macroeconomic factors influencing corporate financial stability.

Table 1. Altman Z-scores of Selected Corporations

Company	Altman Z-Score	Financial Distress Level
Company A	1.582	**Distress Zone** (High Risk)
Company B	1.453	**Distress Zone** (High Risk)
Company C	1.400	**Distress Zone** (High Risk)
Company D	2.652	**Grey Zone** (Moderate Risk)
Company E	2.551	**Grey Zone** (Moderate Risk)

The Altman Z-score model was used to assess the financial distress of selected corporations based on financial data from the Philippine Stock Exchange (PSE) 2022 Reports. The Z-scores classify firms into Distress ($Z < 1.81$), Grey ($1.81 – 2.99$), or Safe ($Z \geq 3.00$) Zones. Companies A, B, and C fall in the Distress Zone, meaning they face a high risk of financial distress or bankruptcy. Companies D and E fall in the Grey Zone, meaning their financial stability is uncertain, requiring close monitoring.

Table 2. Competitive Profile Matrix Analysis

Critical Success Factor (CSF)	Weight	Company A (Score)	Company B (Score)	Company C (Score)	Company D (Score)	Company E (Score)
Corporate Governance & Risk Management	0.10	0.60	0.60	0.60	0.70	0.90
Operational Efficiency & Cost Optimization	0.10	0.50	0.70	0.70	0.60	0.60
Innovation and Adaptation	0.10	0.40	0.50	0.90	0.50	0.60
Human Capital Development	0.10	0.70	0.50	1.00	0.80	0.80
Supply Chain Management	0.10	0.70	0.80	0.70	0.50	0.60
Sustainable Business Practices	0.10	0.60	1.00	0.80	0.50	0.80
Diversification & Market Expansion	0.10	0.60	0.50	1.00	0.50	1.00
Capital & Financial Stability	0.10	0.80	0.80	0.50	0.80	1.00
Strategic Partnerships & Collaborations	0.10	0.60	0.70	0.80	0.90	1.00
Effective Leadership & Management	0.10	0.80	0.70	0.70	0.90	0.60
Final Score	-	**6.3**	**6.8**	**7.7**	**6.7**	**7.9**

Company E (7.9) and Company C (7.7) scored highest, suggesting stronger financial stability and strategic positioning. Company A (6.3) had the lowest score, indicating weaknesses in key business areas.

Table 3. Microeconomic Factor Causal Weight

Microeconomic Factor	Causal Weight
Corporate Governance & Management (CGM)	0.44
Operational Efficiency & Cost Structure (OEC)	0.60
Capital Structure & Financial Management (CSF)	0.56
Market Position & Competitive Dynamics (MPC)	0.44
Innovation & Adaptation (IAA)	0.16

Operational Efficiency (0.60) has the strongest impact on reducing financial distress while Innovation & Adaptation (0.16) has the least impact but still significant.

Table 4. Macroeconomic Factor Causal Weight

Macroeconomic Factor	Causal Weight
Economic Growth & Business Cycles (EGB)	0.28
Monetary & Fiscal Policies (MFP)	0.40
Global Economic Conditions (GEC)	0.48
Industry-Specific Factors (ISF)	0.44
Financial Market Conditions (FMC)	0.48

Global Economic Conditions (0.48) and Financial Market Conditions (0.48) have the highest influence on financial distress while Economic Growth (0.28) has a lower but still significant impact.

In FCM, the causal effect or coefficient is measured in units of activation. The activation level concept of i at time $t+1$ is determined by the weighted sum of the activation levels of all concepts j connected to concept i at the time t. Each connection strength w_{ij} represents the degree of influence that concept j has on concept i. These weights are typically specified when constructing FCM based on expert knowledge or empirical data. The activation function $f(x)$ introduces nonlinearity into the model, allowing for complex interactions and feedback loops between concepts in the FCM (Nápoles et al., 2018). The formula is the following:

$$A_i(t+1) = f(\sum_{j=1}^{n} w_{ij} \, . A_j(t))$$

Using the FCMExpert software, the degree of causality is summarized per microeconomic and macroeconomic factor in Table 5 below.

Table 5. FCM Activation Coefficients

Component	Activation Coefficient (Causal Relationship)	Interpretation	Implication
CGM	0.8466	High activation	Corporate Governance and Management is steadily and highly influenced by its causal pathways
OEC	0.8144	High activation	Operational Efficiency and Cost Structure is steadily and highly influenced by its causal pathways
CSF	0.8502	High activation	Capital Structure and Financial Management is steadily and highly influenced by its causal pathways
MPC	0.8382	High activation	Market Position and Competitive Dynamics is steadily and highly influenced by its causal pathways
IAA	0.8689	High activation	Innovation and Adaptation is steadily and highly influenced by its causal pathways
Financial Distress	0.9716	High activation	Financial Distress is steadily and highly influenced by its causal pathways
EGB	0.7602	High activation	Economic Growth and Business Cycles is steadily and highly influenced by its causal pathways
MFP	0.8245	High activation	Monetary and Fiscal Policies is steadily and highly influenced by its causal pathways
GEC	0.8156	High activation	Global Economic Conditions is steadily and highly influenced by its causal pathways
ISF	0.7861	High activation	Industry-Specific Factors is steadily and highly influenced by its causal pathways
FMC	0.8512	High activation	Financial Market Conditions is steadily and highly influenced by its causal pathways

Table 6. Scenario Analysis: Reducing Financial Distress

Factor	Change Level (Δ)
Operational Efficiency & Cost Structure	0.25
Industry-Specific Factors	0.19
Global Economic Conditions	0.19

Mental Modeler is used to analyze scenarios in the FCM. The main objective of the scenario analysis is to decrease financial distress level. Improving operational efficiency and cost optimization ($\Delta = 0.25$) will have the most significant impact on reducing financial distress. Macroeconomic adjustments in industry-specific factors and global market conditions ($\Delta = 0.19$) are also critical.

5.2 Graphical Results

The graphical representation is a **Fuzzy Cognitive Map (FCM)** that captures the relationships and influences among various factors in the system. Each node represents a concept or variable (economic factors), while the directed edges represent the causal influence of one concept on another. The numerical weights on the edges reflect the strength and direction (positive or negative) of these causal relationships (Figure 1).

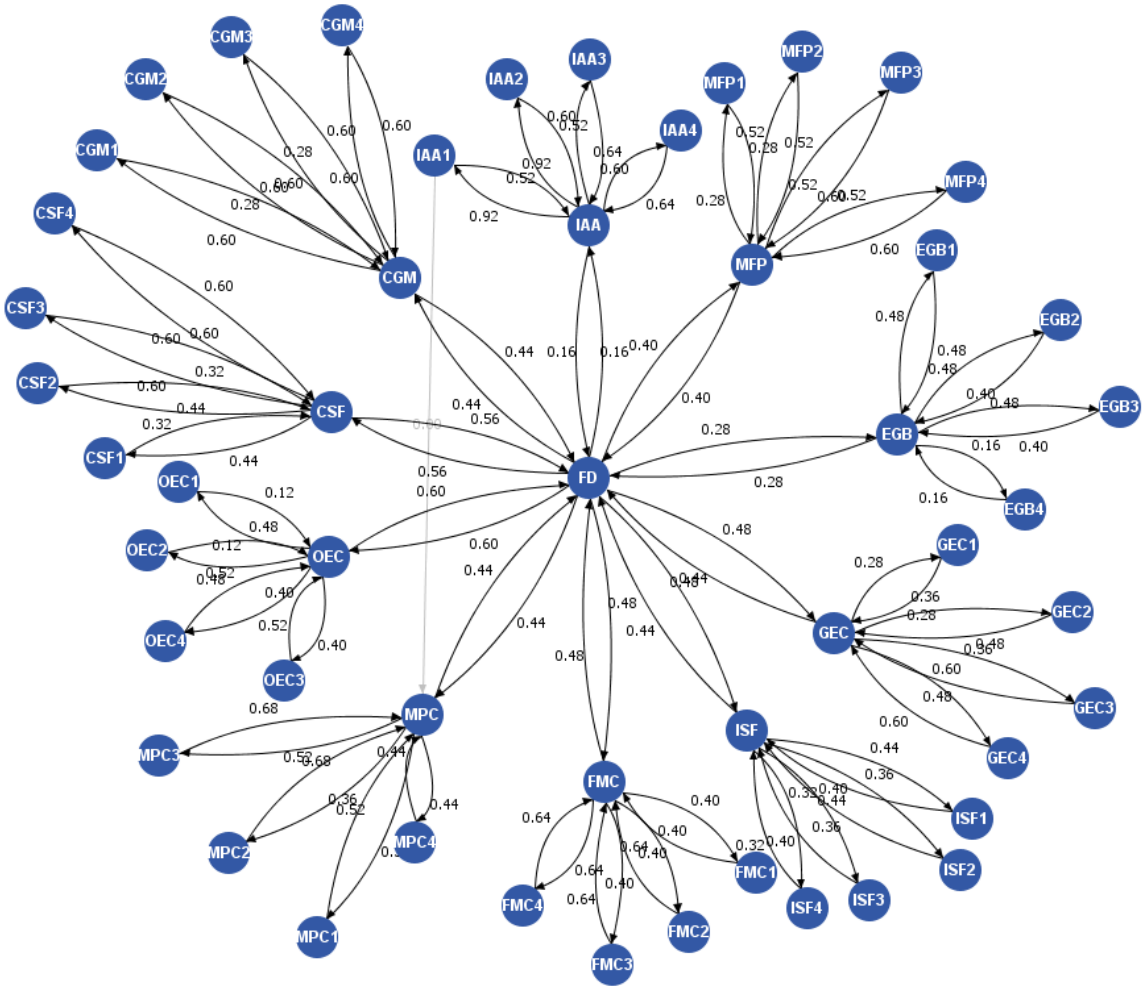

Figure 1. Fuzzy Cognitive Map of Financial Distress and Economic Factors

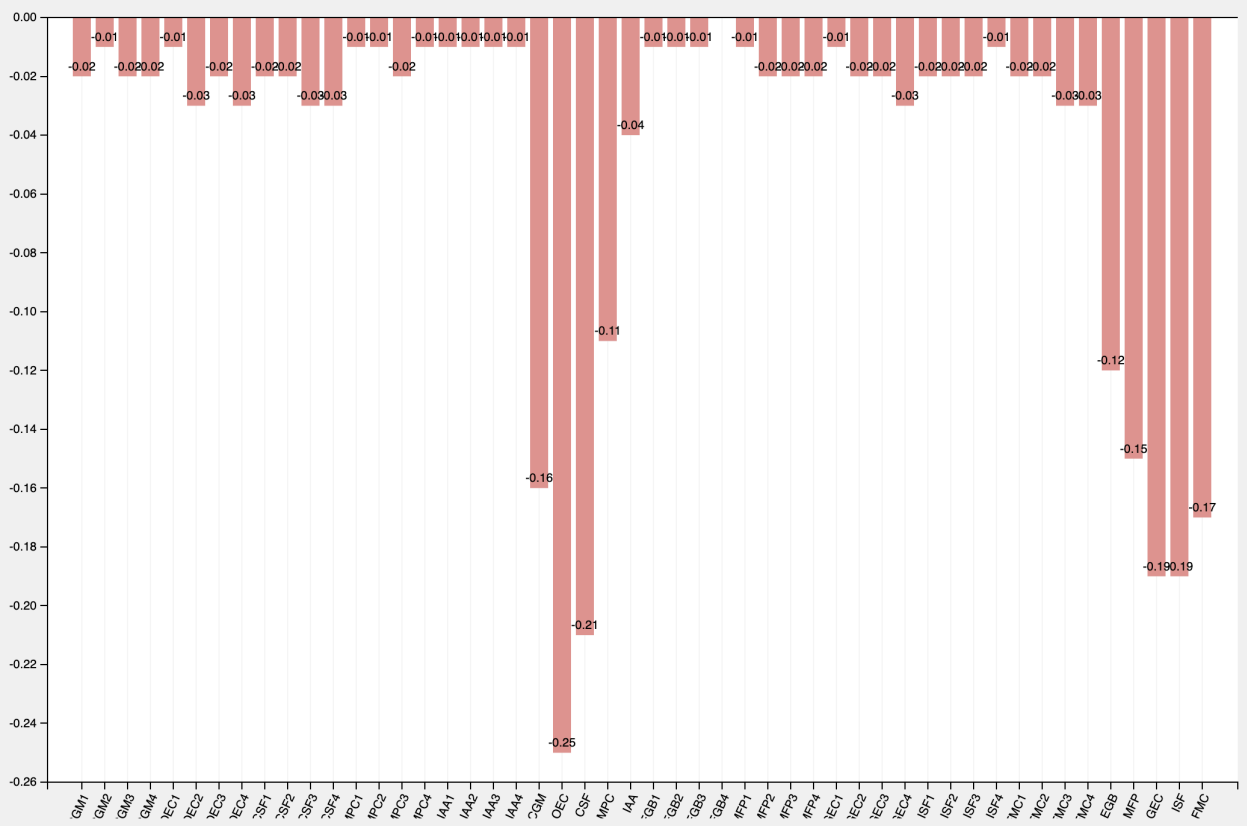

Figure 2. Scenario Analysis of Decreasing Financial Distress Level

Mental Modeler was developed by Dr. Steven Gray with funding from the USDA and NSF. Working with a range of other researchers from different disciplines and institutions, the software is being implemented in several community-based planning and research projects (Gray et al., 2013). Based on the analysis and findings of the study, the following key points can be summarized (Figure 2):

From a microeconomic perspective, improving Operational Efficiency and Cost Structure (OEC) has the most significant impact on decreasing financial distress for AboitizPower. The scenario analysis revealed that a 0.25 level of change in OEC factors would bring about substantial changes in reducing financial distress. From a macroeconomic perspective, Industry-Specific Factors (ISF) and Global Economic Conditions (GEC) play a crucial role in decreasing financial distress. The scenario analysis showed that a change level of 0.19 for both ISF and GEC would contribute significantly to alleviating financial distress. The Fuzzy Cognitive Map (FCM) analysis highlighted the high activation coefficients for various constructs, indicating their steady and strong influence on financial distress through their causal pathways. These constructs include Corporate Governance and Management (CGM), Operational Efficiency and Cost Structure (OEC), Capital Structure and Financial Management (CSF), Market Position and Competitive Dynamics (MPC), Innovation and Adaptation (IAA), and Financial Market Conditions (FMC).

5.3 Proposed Improvements

The study proposes the following improvements and concludes with actionable strategies:

Microeconomic Perspective

- Enhance Operational Efficiency and Cost Structure (OEC). A 0.25 level of change in these factors can significantly decrease financial distress..

Macroeconomic Perspective

- Focus on Industry-Specific Factors (ISF) and Global Economic Conditions (GEC), as a 0.19 change level in these areas can substantially alleviate financial distress.
- Strengthen Corporate Governance and Management (CGM) and implement Capital Structure and Financial Management (CSF) to improve financial stability.

- Encourage Innovation and Adaptation (IAA) to external changes and competitive dynamics for better financial resilience

6. Conclusion

The study provides a detailed analysis of financial distress of selected big corporations in Cebu, Philippines, examining both internal (microeconomic) and external (macroeconomic) factors. It concludes that by, 1) improving operational and cost efficiency, 2) addressing industry-specific challenges, 3) adapting to global economic shifts, large corporations can enhance financial resilience and sustainability. These strategies, coupled with maintaining a prudent capital structure, can help mitigate financial distress and contribute to the financial stability of both the company and the broader economic ecosystem

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