



PERFORMANCE EVALUATION OF
FOOD AND BEVERAGES INDUSTRY
IN MALAYSIA USING GRA MODELS

**FACTORS AFFECTING THE
DIAGNOSIS OF ISCHEMIC
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OPTIMAL VITAMINS INTAKE TO
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A COMPREHENSIVE PERFORMANCE EVALUATION OF FOOD AND BEVERAGES INDUSTRY IN MALAYSIA USING GRA MODELS

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1. Introduction

The current population of Malaysia is 33,481,580 has significantly influenced the demand of its local food and beverage (Department of Statistics Malaysia, 2023). Recently, the F&B industry has generated RM220.33 billion in revenue and is anticipated to expand by 7.95% yearly until 2027 (Statista, 2023). Therefore, the F&B industry is one of the key sectors that contribute to the rise of the nation's economy comprising Gross Domestic Product (GDP), revenue, employment and foreign exchange earnings (Hoe et al., 2020).

This situation has indirectly increased competition between companies especially in the F&B sector. Thus, the company is searching for a comprehensive performance evaluation method that is not only easy to apply but can also accurately analyze the overall company's performance as a whole. Performance evaluation is critical in today's environment since companies must defend their market position against their competitors (Zandi et al., 2014). An effective evaluation methodology can benefit the company itself in maximizing their resources and implementing more appropriate business strategies. The evaluation system can also assist companies in the same industry for benchmarking as an effort to improve performance periodically which finally leads to long-term success (Nguyen et al., 2020).

Hence, the motivation of this study is to employ the modelling mechanism of two GRA models such as Deng's GRA model and Absolute GRA model to comprehensively evaluate the overall performance of F&B industry in Malaysia from 2017 until 2021. The main objective is to utilize Deng's model to rank the selected F&B companies based on their financial ratios. Next, this study will further identify the most influential criteria that effect the company performance in the Food and Beverages industry using Absolute GRA model. The advantages of both methodologies are it can be applied to large or small samples and does not have conventional distribution requirements.

2. Methodology

Since Professor Deng proposed Grey System Theory (GST) in 1989, various Grey models have been introduced such as the Grey incidence analysis model, the Grey cluster model, the Grey prediction model GM (1,1) and the Grey target decision model (Liu & Forrest, 2007). Each model has a distinct mathematical concept and process in achieving its objectives. As one of the most active branches of GST, Grey incidence analysis also known as Grey Relational Analysis (GRA) holds the basic idea of measuring the degree of similarity between sequences depending on the geometrical shape of their curves (Liu et al., 2017).

2.1 Deng's GRA Model

Deng's GRA model is using the average distance between points of sequences to reflect the magnitude of factors and the closeness of development process. That is, the closer geometrical distance of curves, the greater Deng's degree of grey incidence between sequences, and vice versa. Deng's GRA model employ in this study following the methodologies outlined by Suvvari et al. (2019). In general, Deng's GRA model consist of two parts:

Step 1: Calculation of Grey Relational Coefficient:

The calculation of the Grey Relational Coefficient, $\gamma_{0i}(j)$ is obtained using Equation (1):

$$\gamma_{0i}(j) = \frac{\Delta_{\min} + \varepsilon \Delta_{\max}}{\Delta_{0i}(j) + \varepsilon \Delta_{\max}}, \tag{1}$$

where $\varepsilon \in [0,1]$ known as distinguishing coefficient and $\Delta_{0i}(j) = |x_0^*(j) - x_i^*(j)|$.

Step 2: Calculation of Grey Relational Grades

The following Equation (2) is used to obtain the Grey Relational Grade (GRG):

$$\Gamma_{0i} = \frac{1}{m} \sum_{j=1}^m [\gamma_{0i}(j)], \quad i = 1,2,3, \dots, n \tag{2}$$

where Γ_{0i} is the Grey relational grade and $\gamma_{0i}(j)$ is the Grey Relational Coefficient that has been calculated in Step 1.

2.2 Absolute GRA Model

Absolute GRA model is actually based on the similarity between the zigzagged lines of the sequences measured by the area between the zigzagged lines. Hence, the Absolute GRA model is constructed from an integral perspective. The Absolute GRA model following the methodologies and calculation outlined by Li et al. (2019). Let

$$\varepsilon_{ij} = \frac{1 + |S_i| + |S_j|}{1 + |S_i| + |S_j| + |S_i - S_j|} \tag{3}$$

where

$$|S_i| = \left| \sum_{k=2}^{n-1} x_i^0(k) + \frac{1}{2} x_i^0(n) \right| \tag{4}$$

$$|S_j| = \left| \sum_{k=2}^{n-1} x_j^0(k) + \frac{1}{2}x_j^0(n) \right| \tag{5}$$

$$|S_i - S_j| = \left| \sum_{k=2}^{n-1} (x_i^0(k) - x_j^0(k)) + \frac{1}{2}(x_i^0(n) - x_j^0(n)) \right| \tag{6}$$

Finally, the flowchart summarizes the research process involved in Figure 1 below:

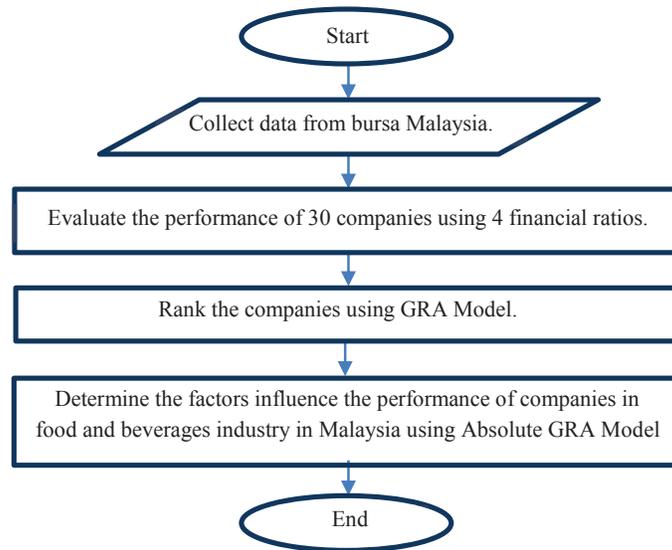


Figure 1: Flowchart of process involved

3. Result and Discussions

Table 1 below show the average financial ratios of 30 companies within five years (2017-2021) calculated from the financial statements from each company.

Table 1: Average financial ratios of 30 F&B companies in Malaysia

Company	Debt Ratio	Current Ratio	Profit Margin	Asset Turnover
3A Resources	0.154	5.674	0.079	0.206
Able Global Berhad	0.265	2.747	0.073	0.382
Ajinomoto	0.166	7.463	0.187	0.407
Apollo Food	0.082	15.390	0.082	0.164
Bioalpha	0.137	7.210	-0.149	0.099
Carlsberg	0.681	0.866	0.124	0.799
CCK	0.307	1.791	0.046	0.304
China Ouhua	0.014	67.129	0.146	-0.014
CI Holdings	0.618	1.458	0.020	0.184
Cocoaland	0.140	5.245	0.117	0.228
Dutch lady	0.654	1.103	0.123	0.716
Fraser & Neave	0.278	2.228	0.096	0.366
Green Ocean	0.476	11.655	0.091	0.080
Guan Chong	0.613	1.410	0.060	0.144
Harrisons	0.640	1.707	0.016	0.251

Cont.				
HB Global	0.449	1.163	0.104	0.079
Heineken	0.627	1.081	0.125	0.640
Hup Seng	0.346	2.055	0.144	0.439
Hwa Tai	0.607	1.196	-0.019	0.418
Kawan Food	0.156	3.281	0.111	0.220
Lotus KFM	1.293	3.136	-0.308	-0.015
MALAYAN Flour	0.548	0.998	0.019	0.111
Nestle	0.777	0.552	0.113	0.734
OCB	0.330	1.564	-0.052	0.162
Oriental Food	0.240	2.143	0.052	0.212
Power Root	0.324	1.961	0.090	1.055
PPB Group	0.048	9.974	0.285	0.023
REX	0.344	1.594	-0.047	0.765
SAUDEE	0.427	2.521	-0.092	0.075
Spritzer	0.168	3.173	0.085	0.699

Table 2 display the ranking for 30 companies of Food and Beverages in Malaysia according to their Grey Relational Grades (GRG). Observed that, a higher GRG indicates that the company is well performed as compared to their competitors in the same industry.

Table 2: Ranking of 30 F&B companies from Deng’s GRA model

Company	Ranking
China Ouhua (5858)	1
PPB Group (4065)	2
Power Root (7237)	3
Ajinomoto (2658)	4
Spritzer (7103)	5
Apollo Food (6432)	6
Cocoaland (7205)	7
Kawan Food (7216)	8
3A Resources (0012)	9
Carlsberg (2836)	10
Hup Seng (5024)	11
REX (9946)	12
Fraser & Neave (3689)	13
Dutch lady (3026)	14
Able Global Berhad (7167)	15
Heineken (3255)	16
Nestle (4707)	17
Oriental Food (7107)	18
CCK (7035)	19
Bioalpha (0179)	20
Green Ocean (0074)	21
HB Global (5187)	22
OCB (5533)	23
Hwa Tai (8478)	24
Guan Chong (5102)	25
MALAYAN Flour (3662)	26
Harrisons (5008)	27
CI Holdings (2828)	28
SAUDEE (5157)	29
Lotus KFM (8303)	30

Table 3 indicate the average values of Absolute Degree of Grey Incidence for each factors considered in this study. The result shows that the key factors that influenced the performance of companies in Malaysia’s F&B industry are Profit Margin Ratio (PMR) followed by Debt Ratio (DR), Asset Turnover Ratio (ATR) and finally Current Ratio (CR). Indirectly, the result could serve as reference for the company’s in planning their future strategies and resources.

Table 3: Average values of each criterion from Absolute GRA model

Factors	Average	Rank
Profit Margin Ratio (PMR)	0.8845	1
Debt Ratio (DR)	0.8770	2
Asset Turnover Ratio (ATR)	0.8332	3
Current Ratio (CR)	0.5266	4

4. Conclusion

As a conclusion, this study has successfully demonstrated the applicability of GRA methodologies to provide a comprehensive evaluation of F&B companies in Malaysia. Hence, the result of this study has twofold: able to rank the companies based on their financial performance in the industry as well as to identify the most influential criteria using Deng's and Absolute GRA respectively. Initially, Deng's GRA model show that China Ouhua is the best-performing companies followed by PPB Group and Power Root. While, the lowest performing companies are CI Holdings, SAUDEE and Lotus KFM. Furthermore, Absolute GRA model also indicated that Profit Margin Ratio (PMR) as the most influential factors that affecting the companies' performance particularly in local F&B industry. Finally, the current result can be a guideline for the management of companies to conduct effective benchmarking evaluation and gain a better understanding on how to improve their performance in the future.

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