DEVELOPMENT OF CONTINGENCY-BASED ENTERPRISE EXCELLENCE INDEX CRITERIA USING ANALYTIC NETWORK PROCESS

B. Sulistyo[1], M. Mohammad[2*], E.E.M. Safian[3]

[1]Faculty of Industrial and System Engineering,
Telkom University, Bandung, Jawa Barat 40257, Indonesia

[2]Faculty of Mechanical and Manufacturing Engineering,
Universiti Tun Hussein Onn Malaysia,
86400, Parit Raja, Batu Pahat, Johor, Malaysia

[3]Faculty of Technology Management and Business,
Universiti Tun Hussein Onn Malaysia,
86400, Parit Raja, Batu Pahat, Johor, Malaysia

*Corresponding Author's Email: mmusli@uthm.edu.my

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ABSTRACT: Business Excellence Models (BEMs), such as the Baldrige Excellence Framework (BEF), provide comprehensive frameworks for assessment and guidance towards achieving organisational excellence. However, generic and cultural misalignment of BEF can limit its effectiveness in addressing the distinctive circumstances of the enterprises. This study addresses this gap by developing the Enterprise Excellence Index (EEI) criteria tailored for Indonesian State-Owned Enterprises (SOEs), adapting from the BEF. Moreover, the existing calculation method used has the limitation of not taking into consideration the interdependence of the criteria. Instead, in this study, the Analytic Network Process (ANP) is applied since it allows for more complicated interrelationships and could prioritise groupings or clusters of elements in a nonlinear and non-hierarchical structure. The final result of the EEI shows a different composition compared to the BEF in Categories 3, 4, 5, and 7. While the scores for each category and the total score of both frameworks remain the same, there is no different score composition in Categories 1, 2, and 6. Meanwhile, the difference between the EEI and Category 7 is in composition and the total score for each item. The EEI is also compared to the Malaysia

Business Excellence Framework (MBEF), which shows a total difference in all categories and item scores.

KEYWORDS: *Baldrige Excellence Framework, Enterprise Excellence Index, Analytic Network Process, Malaysia Business Excellence Framework*

1.0 INTRODUCTION

The pursuit of excellence within an enterprise is motivated by both internal and external influences. Enterprise performance is a clear indicator of the organisation's health, the efficiency and effectiveness of processes, the longevity and sustainability of the enterprise, and the effective delivery of goods and services [1]. The business excellence model (BEM) is a phrase used to help communicate the importance of the word "excellence" in all aspects of the business, not just product quality and process [2]. This model provides guidelines and criteria for evaluation and is used by enterprises worldwide as groundwork for continuous improvement [3]. It is also identified as a comprehensive practice in managing organisations and achieving results based on fundamental concepts or values of high-performing organisations. These practices were developed into a framework called a business excellence model for how excellent organisations must operate [4].

The Baldrige Excellence Framework (BEF) and the European Foundation for Quality Management (EFQM) model are the most widely used BEMs. The success of the BEF and the EFQM models in developing the performance and competitiveness of companies in their respective countries has drawn considerable global attention [5]. Many ASEAN countries developed excellence frameworks mainly based on the BEF to evaluate and recognise organisational performance, including selecting high-performing organisations for national awards and providing feedback on their applicants [6] and this framework symbolises the best practices of total quality management [2], [7], [8]. For example, Malaysia Business Excellence Framework (MBEF) developed business excellence models tailored to the country's needs and characteristics [9], [10]. The model is a reference frame for assessing organisational performance and providing national awards based on a

business excellence model collected with various criteria and sub-criteria assessment [11].

The relevance of developing a business excellence framework for the enterprise and the nation has been emphasised in many publications. However, no previous study has been found looking at the establishing excellence index criterion specific to the context of the enterprise [6]. Therefore, to ensure a successful and sustainable transformation towards excellence in the enterprise, the enterprise excellence index (EEI) criteria are introduced, which is adapted from the BEF [12]. Several techniques were used to identify the factors that determined the excellence model. The multi-criteria decision-making method, such as the analytic hierarchy process (AHP), was proposed as a decision-making technique for rating the business excellence index. However, it did not consider interdependence among the excellence criteria, which is its limitation [13]. The analytic network process (ANP) was then introduced to derive relative priority scales of absolute numbers from individual judgments of a fundamental scale of a non-hierarchical process [14]. The ANP is better since it can prioritise group or cluster elements in a non-hierarchical structure [15]. Therefore, this research focuses on developing the appropriate criteria for the enterprise excellence index (EEI) criteria based on the Baldrige excellence framework by using the ANP method.

2. METHODOLOGY

This research is one of the first studies to assess the suitability of enterprise excellence categories and items according to the Indonesian SOE situation by applying the ANP method. Constructing the ANP model is a mixed-method approach to build a schematic that outlines the overall flow of the ANP framework used in this study. The three ANP construction phases are shown in Figure 1. The first phase is constructing the ANP model, which involves designing the ANP network structure and structure validation. The second phase is to conduct the pairwise comparisons survey involving experts in the process of data-gathering. The last phase is to analyse and synthesise the result to the EEI composition score.

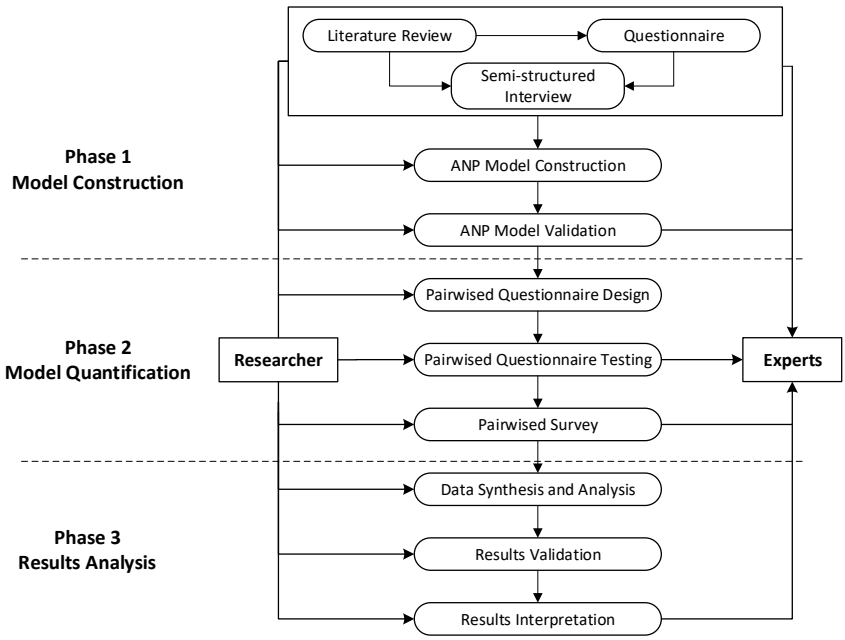

Figure 1: ANP construction phases

2.1 ANP Model Construction

Constructing the ANP model is a mixed-method approach to building a schematic that outlines the overall flow used in this study. The EEI criteria network is derived from reviewing documents and literature, and by conducting a semi-structured interview. Establishing an EEI network model is based on determining control hierarchies and the corresponding specifications for comparison of system components (clusters) and component sub-criteria and the deduction for each control and sub-criteria of the clusters with their elements. The EEI criteria are divided into three hierarchy levels, the first level is the goal of the ANP model, level two is the clusters of the network which contains seven criteria and level three is the nodes for the sub-criteria which contains 17 items. The EEI level for weighting the excellence index with clusters, nodes, and the network relationship among the criteria or sub-criteria is arranged as shown in Figure 2.

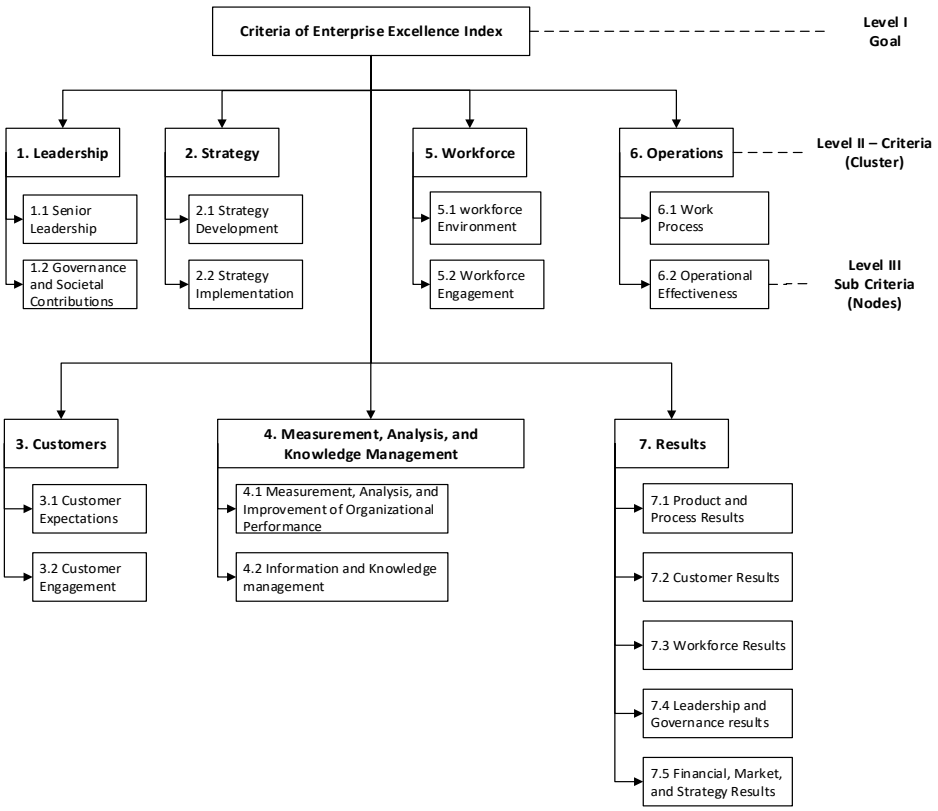

Figure 2: Structure of EEI level

2.2 Expert Respondents

The ANP pairwise comparison survey was collected from the expert's opinions for decision weighting factors. These experts offer a structured framework for discussion, including the critical intangibles of every significant decision and the tangibles, and a way to resolve conflicts and agree on decision-making. Twenty-one respondents participated in the pairwise comparison judgment. 57% were managers from Indonesian SOEs, 33% were business excellence assessors, and 10% were researchers in higher education institutions.

2.3 EEI-ANP model construction

The linkages among the EEI clusters and nodes are significantly interrelated and interconnected [16], just like the BEF. Jayamaha et al.

[17] found a high integration and alignment between the various items and categories of BEF. As a result of Phase 1 (semi-structured interview) for building ANP constructions, a model visual and the connections of the EEI network diagram are constructed in a Super Decisions model, with clusters, nodes, and arches among the characteristics, as shown in Figure 3.

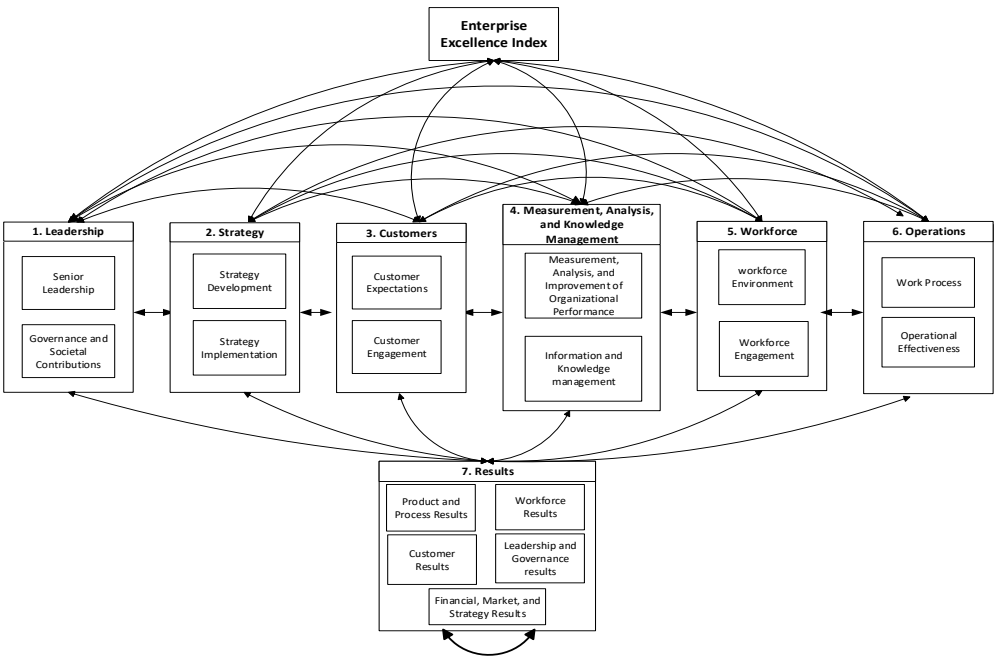

Figure 3: EEI categories and items network diagram

All clusters in each network are compared when all connections have been established. Nodes are compared to one another, and clusters are compared to one another. For each network's nodes, judgments/assessments are made. A comparison group's nodes must be in the same cluster. These nodes, known as children nodes, are linked to the same parent node and evaluated based on their influence. The parent's influences on the child, or vice versa, must be treated consistently. Conversely, the flow direction over the entire network and throughout the model should be maintained.

3. RESULTS AND DISCUSSION

The fundamental of the ANP is the analysis of dependence among the characteristics and sub-characteristics of the model in a network structure. Therefore, associated with the network diagram in Figure 3, the EEI is constructed in a Super Decisions model, with clusters, nodes, and arches being among the characteristics, as shown in Figure 4. The questionnaire used in this research started by judging a pairwise comparison on the cluster level and pairwise comparisons on the node level. For making judgments in pairwise comparisons, the scale of absolute number is Saaty's fundamental scale. The scale has nine different intensities of importance: One means activity of the same importance as the objective, and nine means extremely important.

Twenty-one experts were involved in the pairwise comparison judgment process. Twelve experts were managers from SOEs in the industrial clusters, seven experts were business excellence assessors and the remaining two experts were researchers from higher education institutions. The total number of pairwise comparisons generated by SuperDecisions software comprises 49 clusters and 260 node comparisons. To measure the reliability and validity of the questionnaire model, several statistical tests were conducted, which involved: 1) Cronbach's Alpha test for testing data reliability, 2) KMO–Barlett's test for validity test results, 3) Consistency test for knowing how the most inconsistent decisions, and 4) Rater agreement test for assessing the agreement level between experts. All the results were passed for the statistical test.

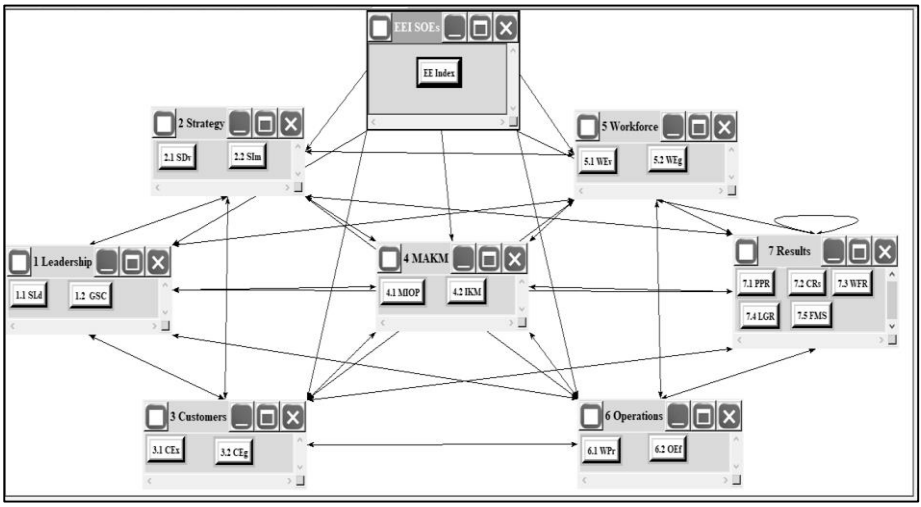

Figure 4: EEI network in SuperDecision model

3.1 ANP Priority Results

The node's weight determines each of the existing node's priority, where the node with the highest weight gets the priority, while the node with the lowest weight will not be the priority or the last consideration. Twenty-one experts (12 managers, 7 business excellence assessors, and 2 researchers) were involved in the pairwise comparison of the EEI determination. The experts' questionnaires were analysed using the SuperDecisions software, resulting 21 priority matrices from which their geo-mean priorities are derived.

The first step to determine the EEI is to calculate each category and item's scores based on the normalised cluster results from global weight normalisation, which shows the node's weight according to their cluster. The total score for each category is kept the same as the original BEF. As seen in Table 1, the set of the overall normalised cluster priorities results is derived from the Geometric Mean of the expert respondents.

Table 1: The outcome of the normalised-cluster weight

Node	Overall
1.1	0.5876
1.2	0.3919
2.1	0.5004
2.2	0.4987
3.1	0.5171
3.2	0.4800
4.1	0.5205
4.2	0.4712
5.1	0.4985
5.2	0.4990
6.1	0.4985
6.2	0.5004
7.1	0.1931
7.2	0.1891
7.3	0.1861
7.4	0.1999
7.5	0.2228

The normalised cluster, as shown in Table 2, is calculated by multiplying each node's normalised priorities (item) with the maximum score for each cluster (category). The score arrangement for each item of its category is generated in the following steps: for example, Category 1 has a maximum score of 120, and the overall weight of Item 1.1 in Table 1 is 0.5876, so the score for Item 1.1 is 0.5876 x 120 = 70.51.

Table 2: EEI score by normalised cluster priorities

Cluster and Node	Overall
1 Leadership (120)	
1.1 Senior Leadership	70.51
1.2 Governance and Societal Contributions	47.03
2 Strategy (85)	
2.1 Strategy Development	42.54
2.2 Strategy Implementation	42.39
3 Customers (85)	
3.1 Customer Expectations	43.95
3.2 Customer Engagement	40.80
4 Measurement, Analysis, and Knowledge Management (90)	
4.1 Measurement, Analysis, and Improvement of Organisational Performance	46.84
4.2 Information and Knowledge Management	42.41
5 Workforce (85)	
5.1 Workforce Environment	42.37
5.2 Workforce Engagement	42.42
6 Operations (85)	
6.1 Work Processes	42.38
6.2 Operational Effectiveness	42.53
7 Results (450)	
7.1 Product and Process Results	86.88
7.2 Customer Results	85.07
7.3 Workforce Results	83.76
7.4 Leadership and Governance Results	89.95
7.5 Financial, Market, and Strategy Results	100.27
Total Score	**992.1**

Since the result score of 992.1 is less than 1000 points, the EEI category and item score's total score is still incomplete. Subsequently, an expert evaluation of the EEI was conducted to develop a score composition that

meets the requirements. The EEI's maximum score is equalised in 1000 points based on the BEF, and the total score for each EEI category is the same as the BEF categories' score.

3.2 Comparison of the EEI, BEF, and MBEF criteria

As shown in Table 3, the final criteria of the EEI are compared with the BEF [12] and MBEF [18] criteria. The scores for each category and the total score of both BEF and EEI frameworks remain the same, and there is no different score composition in Categories 1, 2, and 6. The main difference with the BEF for Categories 3 and 5 is in the position of each score that switches to one another, while in Category 4, the score of 4.1 is more extensive than 4.2. Meanwhile, the difference between the EEI and the BEF in Category 7 is in composition and the total score for each item. Items 7.2, 7.3, 7.4, and 7.5 increased in their score, but Item 7.1 decreased from its existing value. Compared with the MBEF, the EEI criteria are aligned in the total score and the number of categories and items, but there are differences in the naming and the score of each category and item, and the difference in the position of Category 3 and Category 4.

Table 3: Comparison of EEI, BEF, and MBEF

Enterprise Excellence Index (EEI)	Baldrige Excellence Framework (BEF)	Malaysia Business Excellence Framework (MBEF)
1. **Leadership (120)**	**1. Leadership (120)**	**1. Leadership (150)**
1.1 Senior Leadership (70)	1.1 Senior Leadership (70)	1.1 Visionary & Promote Innovation (90)
1.2 Governance and Societal Contribution (50)	1.2 Governance and Societal Contribution (50)	1.2 Governance and Societal Contribution (60)
2. Strategy (85)	**2. Strategy (85)**	**2. Strategy (90)**
2.1 Strategy Development (45)	2.1 Strategy Development (45)	2.1 Strategy Development (45)
2.2 Strategy Implementation (40)	2.2 Strategy Implementation (40)	2.2 Strategy Deployment, Implementation, and Review (45)

Table 3: Comparison of EEI, BEF, and MBEF (Continued)

Enterprise Excellence Index (EEI)	Baldrige Excellence Framework (BEF)	Malaysia Business Excellence Framework (MBEF)
3. Customers (85)	**3. Customers (85)**	**4. Customers (110)**
3.1 Customers expectations (45)	3.1 Customers expectations (40)	4.1 Customer Needs and Expectation (50)
3.2 Customer Engagement (40)	3.2 Customer Engagement (45)	4.2 Customer Engagement (60)
4. Measurement, Analysis, & Knowledge Management (100)	**4. Measurement, Analysis, & Knowledge Management (100)**	**3. Information (90)**
4.1 Measurement, Analysis, and Improvement of Organizational Performance (50)	4.1 Measurement, Analysis, and Improvement of Organizational Performance (45)	3.1 Information Management (45)
4.2 Information and Knowledge Management (40)	4.2 Information and Knowledge Management (45)	3.2 Knowledge Management (45)
5. Workforce (85)	**5. Workforce (85)**	**5. Workforce (120)**
5.1 Workforce Environment (45)	5.1 Workforce Environment (40)	5.1 Workforce Management (55)
5.2 Workforce Engagement (40)	5.2 Workforce Engagement (45)	5.2 Workforce Engagement (65)
6. Operations (85)	**6. Operations (85)**	**6. Process (90)**
6.1 Work Process (45)	6.1 Work Process (45)	6.1 Process Management (70)
6.2 Operational Effectiveness (40)	6.2 Operational Effectiveness (40)	6.2 Supply Network Management (20)
7. Results (450)	**7. Results (450)**	**7. Results (350)**
7.1 Product and Process Results (90)	7.1 Product and Process Results (120)	7.1 Leadership results (70)
7.2 Customer Results (85)	7.2 Customer Results (80)	7.2 Customer Results (70)
7.3 Workforce Results (85)	7.3 Workforce Results (80)	7.3 Process Results (70)
7.4 Leadership and Governance Results (90)	7.4 Leadership and Governance Results (80)	7.4 Workforce Results (70)

7.5 Financial, Market and Strategy Results (100)	7.5 Financial, Market and Strategy Results (90)	7.5 Financial and Market Result (70)

4.0 CONCLUSION

The objective of the study has been achieved by developing the enterprise excellence index criteria customised for Indonesian SOEs by applying the ANP method. Although the criteria are based on similar principles as the Baldrige excellence framework, the differences are in the score of the criteria and items. The priority weights of categories and items of the EEI were different from the MBEF and the BEF in the categories of Customer, Measurement, Analysis and Knowledge Management, Workforce, and Results.

For future research, it is suggested that the enterprise excellence criteria should include a comprehensive set of sustainability indicators that explicitly address the Sustainable Development Goals (SDGs) as well as the Digitalisation, Environment, Social and Corporate Governance initiatives [19], [20], [21].

AUTHOR CONTRIBUTIONS

B. Sulistyo: Original Draft Preparation, Data Collection, Data Analysis, Software Application, Editing; M. Mohammad: Conceptualization, Methodology, Supervision, Writing-Reviewing, Editing; E.E.M Safian: ANP modelling, Supervision, Writing-Reviewing.

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