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Establishing Merger Feasibility Simulation Model Based on Multiple-Criteria Decision-Making Method: Case Study of Taiwan's Property Management Industry

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Abstract: The purpose of this study is to propose a feasible operational evaluation model for property mergers. It is expected that through the merger of enterprises, the comprehensive improvement of business management and the promotion of logistics supply resources will be effectively promoted, so that enterprises can effectively reduce operating costs and achieve maximum profits. This study uses the modified Delphi method and analytic hierarchy process method to find out the key factors of the common dilemmas in Taiwan's property management companies, and the weight of their impact on the operation. Finally, we use the expected utility theory to develop a valuation model for whether the property is suitable for integration, and to evaluate this, the result is used as a reference indicator for merger operations. After 30 years of vigorous development in Taiwan's property management companies, due to fierce market competition, most of the companies have reduced their profitability in the face of common dilemmas. The study found that the merger model should be accurately evaluated by the evaluation model. The sharing of logistics resources can indeed bring about the benefits of investment and marketing to the merger, and improve the profitability of the company. At the time of writing, there is no research on such a combined analysis of the property management industry in Taiwan. This research method uses multiple decision analysis theory and utility theory to develop a decision-making model that is suitable for consolidation. It can also be applied to the assessment of mergers in other fields, such as the clean service industry, real estate brokerage and other industry merger assessments. This is also the biggest contribution of this research paper.

Keywords: analytical hierarchy process; business merger; decision-making; organizational change; property management; risk management; sustainable development

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1. Introduction

This study used Taiwan's property management industry as a case study for the evaluation model. Over the decades of practical operation in the property management industry, business operations have become problematic, and companies worldwide are being affected by similar problems. Therefore, in order to endow the company with sustainable operation and innovation, we propose this research paper to solve this problem.

1.1. Background Information

The pursuits of profit, innovation, and stabilized sustainable operations are high priorities in business management. Presently, property management companies generally have low profitability, and are insufficiently large to compete against international property management companies. To find a new solution for sustainable operation among property management companies, this study investigated the feasibility of a merger, through which resources such as corporate funds, and human and material resources, can be pooled together [1]. Considering the characteristics of small and medium-sized enterprises (SMEs), such as their general shortage of funds and their owners wanting to be their own bosses,

this study conducted research and discussion based on merger activities [2], particularly those of property management companies.

1.2. Current Problem Situation

The business predicaments of property management companies can be divided into four major categories. First, regarding rising costs, the revision of the Labor Standards Act 2016 has caused a reduction in working hours, an increase in basic wages, and an increase in the relative burden of labor and health insurance, all of which has resulted in an increase in operating costs. Second, regarding business operations, most property management companies are SMEs; therefore, excessive industry competition and the continual increase in new entrants due to low entry barriers lead to price wars and vicious competition, either when market growth slows down or when some players attempt to increase their market shares [3]. Taiwan's sluggish economy is causing wage stagnation, and thus to reduce management costs, management committees and tenants of subdivisions are asking for reductions in property service charges, thereby further contributing to a vicious cycle in the industry. Third, regarding legal aspects, because of their growing awareness of labor rights, employees are increasingly filing complaints. In addition, property managers are required to bear no-fault liability for damages to community rights and interests [4]. Fourth, regarding risk control, management companies must deal with problems, such as whether they have sufficient working capital, applying for labor and health insurance, whether to apply for full insurance, and not fully utilizing the hedging tools of group insurance and life insurance [5].

For a company, a successful merger and acquisition (M&A) promotes synergy [6], reduces production costs, and generates high profits, while increasing its market share and expanding its territories [7]. To solve their current business predicaments, and also to help deal with legal revisions made by the government, property management companies in the private sector can adopt M&A methods [8]. Acquisitions involve the purchase of other companies' shares to enable direct involvement in those companies' operations, and to obtain the rights to operate the acquired companies [9]. However, sufficient capital is required to obtain such rights. Most property management companies are SMEs; thus, considering the difficulty in obtaining capital, and the behavior model of the majority of local people wanting to be a boss, mergers are more suitable for such companies [10]. Therefore, the present study proposed a practical strategy that is suitable for property management companies [11], namely mergers with multiple other property management companies, and verified its effectiveness through a case study. As such, the acquisition method (100% capital purchase) is not discussed in this paper.

1.3. Objective of This Study and Research Method

The method employed in this study was to establish an assessment model of merger feasibility for property management companies [12]. Improving synergy through mergers with multiple other property management companies shifts a company's original competitive operating method to a group-based, consolidated, and merged operating method; such a method prevents unnecessary price wars, expands the company's scale of operations [13], and reduces costs, thereby increasing competitiveness in the industry and promoting the rationalization of the company's operating interests.

This study considered the rationality, rigor, and validity of a decision-making method [14], and integrated the defining characteristics of decision theories and methods [15], particularly the Delphi method, the analytic hierarchy process (AHP), utility theory, and expected utility theory. A modified version of the Delphi method was adopted to define the assessment constructs and decision-making assessment criteria of merging property management companies [16]. The AHP was adopted to calculate the relative weight of each assessment criterion [17]. Utility theory was employed to define the utility interval and utility function equation of each assessment criterion, and expected utility theory was employed to multiply the relative weights derived from the AHP by the values derived from the utility function equations, and then to

sum the products, thereby converting qualitative data into quantitative data to form a basis for assessing the merger feasibility of multiple property management companies [18]. Finally, three property management companies were used to conduct a simulation for verification, and to reach this study's conclusion.

2. Literature Review

2.1. Modified Delphi Method

The modified Delphi method (MDM) is an expert prediction method [19] with calculation methodologies similar to those of the conventional Delphi method [20]. The only difference between the two methods is that the MDM [21] does not include the administration of open-ended questionnaires during the initial stage. In the MDM, such initial-stage questionnaires are replaced with structured questionnaires developed from a review of relevant study results, alternative methods devised by the researcher, or expert interviews. The MDM reduces the time required for interpreting open-ended questionnaire data by enabling the participating experts to focus on the research topic as well as increasing questionnaire return rates [22].

2.2. AHP (Analytical Hierarchy Process)

The AHP was proposed in 1971 by Thomas Saaty, a professor at the University of Pittsburgh. It is mainly applied to decision-making in uncertain situations or to multicriteria decision-making [23]. The AHP involves simple theories but is practical [24]; therefore, it has been widely used by various research institutions since its inception, particularly for planning, prediction, judgment, resource application and trial investment portfolios. In general, the AHP begins with a description of problems [25], the identification of primary factors, the establishment of hierarchical relationships, and the prioritization of decision attributes at each level, using pairwise comparisons and ratio scale. After priorities are assigned, pairwise matrices are established, eigenvalues and eigenvectors of the matrices are calculated, and the weight values of all attributes are derived. In this study, the online AHP system of Business Performance Management Singapore was used to obtain the results of each assessment criterion evaluation.

2.3. Utility Theory and Valuation

Utility theory is a quantitative theoretical analysis methodology. According to Luce's [26] study, Bernoulli explained the practical application value of utility theory in 1738. The practical application of utility theory can be used to predict and evaluate the consumers' preferences and personal risk attitudes. It can also be used to explore personal profitability analysis. Utility theory is also a set of methodologies that belong to multi-attribute assessment. The utility function of each evaluation factor must be defined in the application. As a qualitative–quantitative conversion mechanism, the utility function of each evaluation factor in the overall evaluation is to explain preferences or to illustrate the perception of the event's pros and cons. Research applications in utility theory include the formation of an economic perspective [27] and the determination of whether access to an insurance market affects investments in safety measures [28]. This study defines utility function equations and utility intervals. Relevant deductions and computational statistics are described in the subsequent sections.

2.4. Best Worst Method (BWM)

Best worst method (BWM) is a multicriteria decision-making (MCDM) method that was proposed by Dr. Jafar Rezaei in 2015. The method is used to evaluate a set of alternatives with respect to a set of decision criteria. The BWM is based on a systematic pairwise comparison of the decision criteria [29]. That is, after identifying the decision criteria by the decision-maker (DM), two criteria are selected by the DM: the best criterion and the worst criterion. The best criterion is the one that has the most important role in making the decision, while the worst criterion has the opposite role. The DM then gives his/her preferences of the best criterion over all the other criteria, and also his/her

preferences of all the criteria over the worst criterion, using a number from a predefined scale. These two sets of pairwise comparisons are used as input for an optimization problem, the optimal results of which are the weights of the criteria. The salient feature of the BWM is that it uses a structured way to generate the pairwise comparisons, which leads to reliable results [30].

2.5. Level Based Weight Assessment (LBWA)

The new level-based weight assessment (LBWA) model enables the involvement of experts from different fields, with the purpose of defining the relations between criteria and providing rational decision-making. The method can be applied in practical cases in specialized decision-making support systems, as well as in alternative dispute resolutions in virtual environments. The LBWA model has several key advantages over other subjective models based on mutual comparison of the criteria [31], which include the following: (1) the LBWA model allows the calculation of weight coefficients with a small number of criteria comparisons, only $n - 1$ comparison; (2) the algorithm of the LBWA model does not become more complex with the increase in the number of criteria, which makes it suitable for use in complex multicriteria (MCDM) models with a large number of criteria; (3) by applying the LBWA model, optimal values of weight coefficients are obtained with a simple mathematical apparatus that eliminates inconsistencies in expert preferences, which are tolerated in certain subjective models (best worst method (BWM) and analytic hierarchy process (AHP)); (4) the elasticity coefficient of the LBWA model enables, after comparing the criteria, additional corrections of the values of the weight coefficients depending on the preferences of the decision-makers. This feature of the LBWA model enables sensitivity analysis of the MCDM model by analyzing the effects of variations in the values of the weights of criteria on the final decision.

2.6. The Full Consistency Method (FUCOM)

The full consistency method (FUCOM) is a new technique used to weigh criteria in the literature. This technique is a semi-objective/objective evaluation method, which reduces the comparison of criteria within each other, and optimizes the criteria weights with the optimization algorithm with few comparisons [32].

3. Materials and Methods

3.1. Construction of the Utility-Based Assessment Model of Merger Feasibilities

Methods derived from multiple decision theories were adopted to construct this study's model [33], which is applicable for assessing the merger feasibilities of all property management companies [34]. In practice, one company can be selected as the main merger participant, whereas other companies can serve as the merged participants [35]. As presented in Figure 1, methods derived from multiple decision theories were adopted to construct the assessment model of property management companies' merger feasibilities.

3.2. Construction Evaluation Model

The construction process was divided into six steps (depicted as steps 1 to 6 in the rightmost column of Figure 2).

Step 1: The MDM was adopted to define the four assessment dimensions and 12 criteria for merging property management companies.

Step 2: The AHP was adopted to calculate the relative weight of each assessment criterion.

Step 3: Utility theory was employed to define the utility interval and utility function of each assessment criterion.

Step 4: The utility function parameters A and B were calculated, and the utility function equation of each assessment criterion was developed.

Step 5: Expected utility theory was adopted to multiply the relative weights derived from the AHP by the values derived from the utility function equations, and then sum

the models to convert qualitative data to quantitative data. Finally, the quantitative data obtained were used to assess the feasibility of the property management company merger.

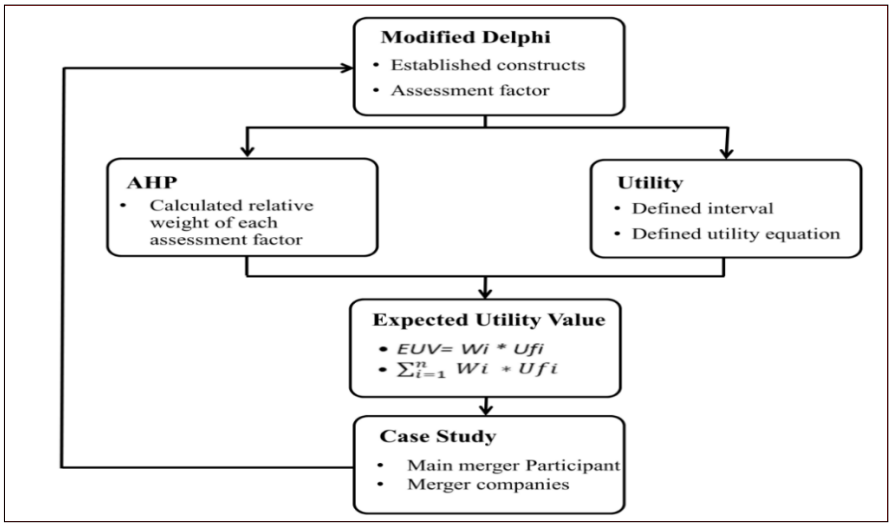

Figure 1. Flow of the application of the four decision theories.

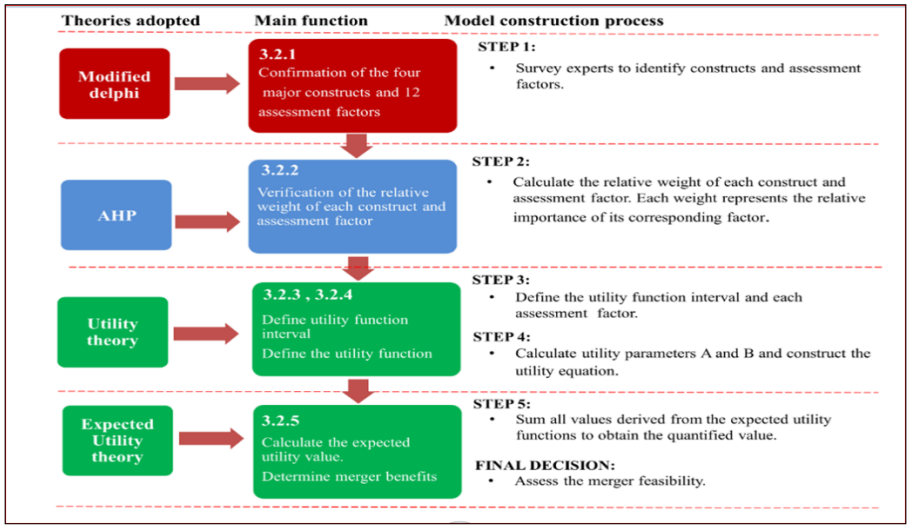

Figure 2. Flow of the six major steps.

3.2.1. Confirmation of the Four Dimensions and 12 Assessment Criteria

The MDM [36] was adopted in this study to define the main dimensions and assessment criteria of property management company mergers. This method is currently considered an expert assessment method [37]. In this study, fifteen experts were interviewed, namely six property management experts, three academic experts, and six chief executive officers (CEOs). After the modification of the structured questionnaire, four major constructs and 12 influencing factors were obtained, as presented in Table 1.

Table 1. Consensual list of dimensions and influencing criteria.

Dimension (LEVEL-1)	Influencing Criteria (LEVEL-2)	Description
The synergy of human and material resources	Streamlining manpower	Labor cost synergy achieved by reducing accounting, human resources, sales, and senior management personnel
	Sharing legal resources	Cost reduction achieved by sharing legal experience and legal consultants
	Sharing operational equipment and material resources	Cost reduction achieved by not investing in redundant furniture, fixtures, and equipment
Operational synergy	Innovation and market strategy	Receptiveness to new management methods and tools, as well as the planning and implementation of business strategies, to achieve market expansion and effectiveness
	The synergy of general affairs	Streamlining of general affairs personnel and improvement of managerial synergy
	Reducing the likelihood of price wars	Prevention of excessive competition and vicious price wars within the industry
Financial synergy	Tax-saving effect	Tax-saving effect resulting from the merger, including accounting fees, business taxes, gift taxes, and property taxes
	Concept of cost	Whether the directors (e.g., CEOs) of a property management company conduct actuarial calculations of costs every month for effective control
	Annual turnover	The annual turnover of each property management company
The synergy of risk management	Aging CEO	The optimal age for the CEO of a property management company is 40 to 55 years. If a CEO is aged over 65 years, succession and decentralization of power to professional managers should be implemented.
	Sufficient working capital	A company's operating working capital should be at least USD 0.975 million and ideally USD 3.25 million. The margin of safety is twice the monthly sales total.
	Insurance and risk management	Hedging to reduce risks, including investment in corporate hedging programs, labor insurance, national health insurance, and group accident insurance

3.2.2. Verification of Relative Weight for Each Dimension and Assessment Criteria

The AHP was adopted in this study to conduct expert interviews and to calculate the relative weights for each dimension and each assessment criterion. A hierarchical structure for each assessment criterion was established after the completion of the Delphi survey procedure. Subsequently, AHP determined the relative weights for 35 valid questionnaires out of 50 questionnaires. The relative weights of all assessment criteria conformed to the consistency ratio (CR $\leq$ 0.1), indicating that they could facilitate a decision-maker's understanding of the key factors affecting the overall assessment [38]. After 50 property management companies, CEOs, and experts had been interviewed, data on the assessment of property management company mergers were summarized. The online AHP system of Business Performance Management Singapore was used to obtain the results of evaluating the four dimensions and 12 assessment criteria. The results are presented in Figure 3. The assessment criteria with the five highest relative weights were (1) insurance and risk

management, 22.3%; (2) streamlining of manpower, 14.4%; (3) operation of working capital, 14.0%; (4) aging CEO, 8.8%; and (5) synergy of general affairs, 8.3%. These results denoted that "insurance and risk management" was the most crucial criterion [39]. Companies are therefore recommended to learn how to hedge [40].

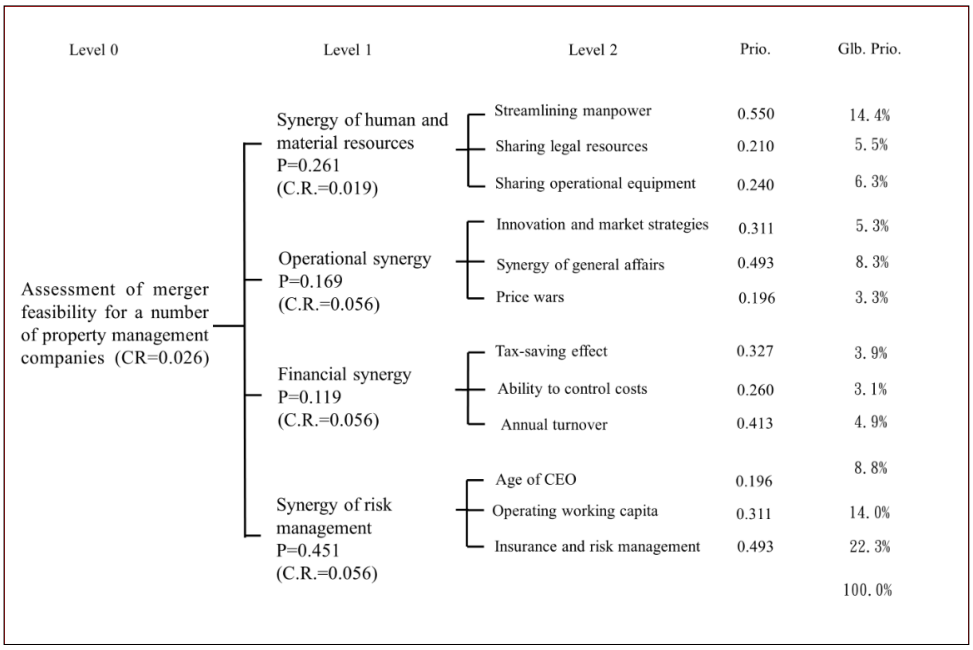

Figure 3. Weighting value overall and for each criterion.

3.2.3. Definition of the Utility Function Interval and Each Assessment Criterion

This step defined the function intervals and parameter calculations for the utility function equations of the assessment criteria. The three types of risk attitudes in utility theory are conservative, neutral, and risky; an individual's risk attitude illustrates his or her preferences concerning various risks and investments. Following the research of Dozzi, AbouRizk, and Schroeder [41], the present study adopted a neutral risk attitude to establish an assessment model, thereby eliminating the problems of complicated thinking methods and calculations inherent in risky and conservative risk attitudes [42]. Two utility equations, namely, linear and parabolic equations, were adopted in the research design of the utility theory, described as follows.

1. The linear utility equation was $U(yi) = Ayi + B$ (items 1 to 12 in Table 2, except for item 10).
2. The parabolic utility equation was $U(yi) = Ax^2 + Bx + C$ (item 10 in Table 2).

Definition of the upper limit (yU) and lower limit (yL) values of the utility interval in the utility function of each assessment criterion for merging property management companies. Of the 12 assessment criteria of property management company mergers listed in Table 3, items 1 to 7 were the main merger company's assessments of the other merged companies, whereas items 8 to 12 represented the assessments of the main merger company CEO's personality traits and the company's business status. The yU and yL of the quantified interval of each assessment criterion were defined through a statistical summary of discussions among numerous CEO experts and researchers. Item 1 describes the method for defining the yU and yL values of the first of the 12 assessment criteria, namely, "streamlining manpower." The yU and yL values of the utility interval for each of the other 11 assessment criteria were defined using this method.

Table 2. Worst, threshold, and optimal expected utility values (EUVs).

Item	wi × 100%	Assessment Criteria	Worst	Threshold (U = 0)	Optimal (U = 1)
1	13.8	Streamlining manpower	−2.80	0.00	14.40
2	5.3	Synergy of legal resources	−1.27	0.00	5.50
3	6.0	Sharing of operational equipment	−3.89	0.00	6.30
4	4.1	Innovation and market strategy	−1.55	0.00	5.30
5	8.6	Synergy of general affairs	−7.35	0.00	8.30
6	3.0	Price wars	−3.54	0.00	3.30
7	3.2	Tax-saving effect	−0.44	0.00	3.90
8	2.0	Ability to control costs	−4.65	0.00	3.10
9	5.1	Annual turnover	−3.68	0.00	4.90
10	9.6	Age of CEO	0.00	0.00	8.80
11	15.2	Operating working capital	−5.60	0.00	14.00
12	24.1	Insurance and risk management	−12.39	0.00	22.30
	100.0	EUV	−47.16	0.00	100.0

EUV calculation results, the reasonable EUV ranges from −47.16 to 100%.

Table 3. Quantified interval definitions of assessment criteria.

Item	Assessment Criteria	Description	Quantitative Unit of Measurement	Quantified Interval		Remarks
				Lower Limit	Higher Limit	
1	Streamlining manpower	Reduction of labor costs through the merger	Percentage	28.4%	68.9%	Substantial savings in labor costs achieved by reducing accounting, human resources, sales, and senior management personnel
2	Sharing legal resources	Reduction of costs through the merger	Percentage	31.9%	75.0%	Financial savings achieved by sharing experiences of legal consultants from multiple companies
3	Sharing operational equipment	Cost synergy of merging material resource and equipment costs	Percentage	35.5%	60.4%	Financial savings from not needing to invest in redundant furniture, fixtures, and equipment
4	Innovation and market strategy	Expanded market share and market power achieved through the merger	Percentage	36.2%	75.0%	Receptiveness to new management methods and tools, and planning and implementation of business strategies
5	The synergy of general affairs	Assessment of synergy of merging general affairs departments	Percentage	34.9%	56.4%	Overall synergistic improvement in a property management company's general affairs department achieved by assessing manpower synergy
6	Price wars	Reduction of competitive pressure resulting from fewer competitors because of the merger	Percentage	12.5%	56.3%	Reduction in price wars because of merger and the resultant reduction in the number of companies operating within the same industry
7	Tax-saving effect	The tax-saving effect generated by the merger	Percentage	35.5%	80.0%	Tax-saving effect resulting from the merger, including accounting fees, business taxes, gift taxes, and property taxes
8	The concept of cost control	Whether the CEO has the ability to precisely calculate costs	Percentage	15%	90%	Whether the CEO of a property management company precisely calculates and effectively controls costs every month: CEOs that perform precise monthly calculations were allotted 100%. CEOs that look at financial reports but do not control costs were allotted 50%. CEOs that do not look at or understand financial reports were allotted 0%.
9	Annual turnover	Assessment of annual turnover	Annual turnover	USD 0.975 million	USD 3.25 million	The annual turnover of property management companies, where the range was USD 0.975 to USD 3.25 million (1 USD = 30.76 TWD)

Table 3. *Cont.*

Item	Assessment Criteria	Description	Quantitative Unit of Measurement	Quantified Interval		Remarks
				Lower Limit	Higher Limit	
10	Age of CEO	Risk assessment of CEO's age (25 > 55 > 65)	Age	25	65	The optimal age for the CEO of a property management company is 40 to 55 years. If a CEO is aged over 65, succession and decentralization of power to professional managers should be implemented.
11	Operating working capital	Fund flows from business operations	Funds/month	USD 0.0975 million	USD 0.325 million	The operating working capital of a property management company should be at least USD 97,500, preferably at least USD 162,500, and ideally USD 325,000. The margin of safety is twice the total monthly sales.
12	Insurance and risk management	Corporate hedging program	Percentage	25%	95%	Hedging to reduce risks, including whether the company truly invests in a corporate hedging program, labor insurance, national health insurance, or group accident insurance (i.e., whether employees are insured or have no insurance coverage): All employees are insured (100%). Not all employees are insured (0%). Others (50%) such as possession of agricultural insurance or veterans insurance, or employees who are labor union members.

3.2.4. Calculation of Utility Parameters A and B and Construction of the Utility Equation

Threshold point (yT) and optimal point (yM) of each assessment criterion for property m. The management companies' mergers were defined, and the parameters and utility function equations were derived.

1. The threshold point (yT) and optimal (yM) of each assessment factor were defined.

Professional managers and CEOs discussed and defined yT as the threshold point and yM as the optimal point for each assessment criterion. The threshold point represented the minimum threshold the assessment criterion should attain, namely, the point where the expected utility value equaled zero. Merging below the threshold point was unfavorable because the marginal utility equaled zero. By contrast, yM represented the optimal point for each assessment criterion. This parameter was generally directly substituted by the yU value because yU was the maximum value in the interval of assessment criteria, and this was the optimal value that was expected.

2. Parameters A and B of the utility function of merging property management companies were derived, and the utility function equations were constructed.

The derivation of parameters A and B of the utility function equations can be separately explained using the linear utility equation and parabolic utility equation.

(a) Derivation of parameters A and B based on the linear utility equation (utility function: $U(yi) = A\ yi + B$)

The following equation was established via ui (yT) = 0, ui (yM) = 1:

$$ui(yT) = A \times yT + B = 0,\ B = -A \times yT \text{ ---------- Parameter B was derived}$$

$$ui(yM) = A \times yM + B = 1,\ A \times yM + (-A \times yT) = 1$$

$$A = 1/(yM - yT) \text{ ---------- Parameter A was derived}$$

The following results were obtained by inputting the aforementioned parameters A and B into U(yi) = A yi + B

$$U(yi) = 1/(yM - yT) \times yi + -(1/(yM - yT) \times yT) \text{ ---------- The results of the linear equation were obtained.}$$

3.2.5. Description of the Final Model and Calculation Method

The description of the final model and calculation method was based on expected utility theory [43], and each assessment criterion was defined using the Delphi theory. Subsequently [44], the relative weight of each assessment criterion was calculated using the AHP. However, the relative weight could indicate only the significance of the assessment criteria; qualitative indicators could not be developed. Therefore, utility theory and expected utility theory were adopted to define the yL, yH, yT, and yM of the utility interval in the utility function of each assessment criterion, and to calculate the utility values [45]. The relative weight of each assessment criterion was multiplied by the calculated utility value derived from Wi × U(yi), and the resulting products were added together to obtain the EUV. Therefore, this study's expected utility equation model was as follows:

$$EUV = \sum_{i=1}^{n} Wi * U(yi)$$

To assess the merger feasibility of property management companies [21], the worst, threshold, and optimal EUVs were calculated as references for assessment. The calculated results, namely −47.16 (worst EUV), 0 (threshold EUV), and 100.0 (optimal EUV), are presented in the rightmost three columns of Table 2. All EUVs for assessing the merger feasibility of property management companies fell between −47.16 and 100.0, and a company with an EUV greater than 0 (threshold point) was deemed suitable for merging

4. Discussion and Suggestion

4.1. Utility-Based Assessment of Merger Feasibility for Property Management Companies

Section 3 describes the construction of the research method and the assessment model for the feasibility of a property management company's mergers. In the case study, we selected the main merger company and three merged companies for simulation analysis of the merger. The process flow is illustrated in Figure 4. First, the main merger company and the merged companies were selected. Subsequently, the CEOs of these companies consolidated all company resources based on the 12 assessment criteria (Table 4) to obtain a merger synergy value (yi). The yi was input into the utility equation U(yi) = A yi + B or U(yi) = Ax^2 + Bx + C to calculate the utility equation value U(yi) for each assessment criterion. The EUV of each assessment criterion was then calculated through multiplication U(yi) by the relative weight Wi (i.e., EUV = Wi × U(yi)). Finally, the 12 EUVs were added together to obtain the quantitative EUV of the assessment model.

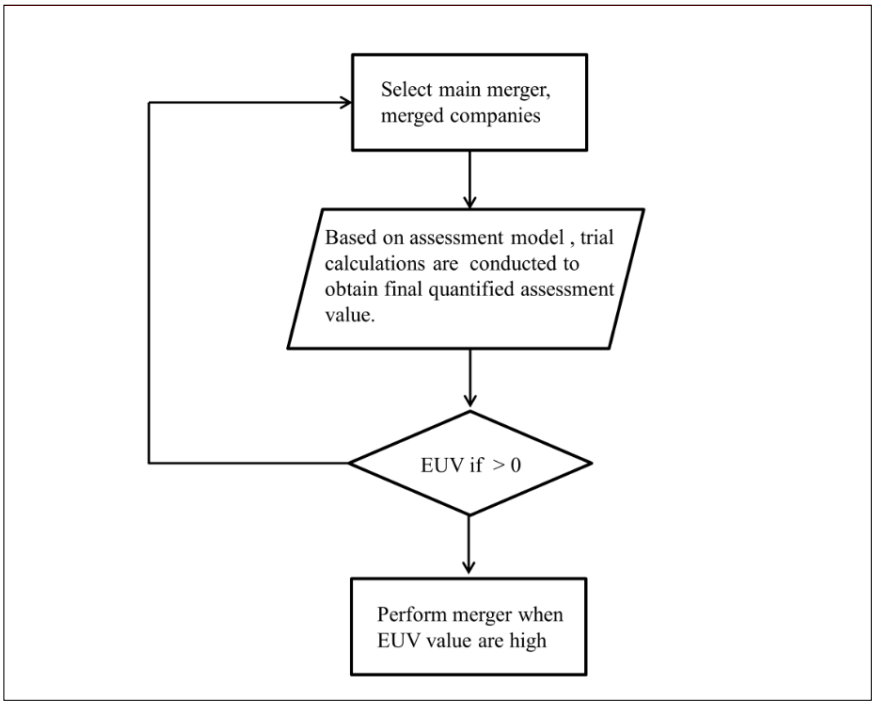

Figure 4. Assessment process of merger feasibility for multiple property management companies.

Table 4. Definitions of yL, yU, yT, yM, parameters, and utility functions.

Item	wi × 100%	Assessment Criteria	yL	yU	yT	yM	A	B	Utility Function
1	14.4	Streamlining manpower	28.4%	68.9%	35%	68.9%	2.950	−1.032	U(y1) = 2.950y1 − 1.032
2	5.5	Sharing legal resources	31.9%	75.0%	40%	75.0%	2.8571	−1.1429	U(y2) = 2.8571y2 − 1.1429
3	6.3	Sharing of operational equipment	35.5%	60.4%	45%	60.4%	6.494	−2.922	U(y3) = 6.494y3 − 2.922
4	5.3	Innovation and market strategy	36.2%	75.0%	45%	75.0%	3.333	−1.500	U(y4) = 3.333y4 − 1.50
5	8.3	Synergy of general affairs	34.9%	56.4%	45%	56.4%	8.772	−3.947	U(y5) = 8.772y5 − 3.947
6	3.3	Price wars	12.5%	56.3%	35%	56.3%	4.762	−1.667	U(y6) = 4.762y6 − 1.667
7	3.9	Tax-saving effect	35.5%	80.0%	40%	80.0%	2.500	−1.000	U(y7) = 2.500y7 − 1.0
8	3.1	Ability to control costs	15%	90%	60%	90.0%	3.333	−2.000	U(y8) = 3.333y8 − 2.0
9	4.9	Annual turnover	3000	10,000	6000	10,000	0.00025	−1.500	U(y9) = 0.00025y9 − 1.50
10	8.8	Age of CEO	25	65	25	45	−0.0025	0.225	* $U(y10) = -0.0025y10^2 + 0.225y10 - 4.0625$
11	14	Operating working capital	300	1000	500	1000	0.002	−1.000	U(y11) = 0.002y11 − 1.0
12	22.3	Insurance and risk management	25%	95.0%	50%	95.0%	2.222	−1.111	U(y12) = 2.222y12 − 1.111

* The parabolic utility equation $U(yi) = Ax^2 + Bx + C$ was used for item 10, and the linear utility equation U(yi) = Ayi + B was used for all other items. yL, lower limit; yU, upper limit; yT, threshold point; yM, optimal point; A, parameter A; B, parameter B; utility function is U(yi) = Ayi + B

4.2. Overview of Main Merger and Merged Property Management Companies

In this case study, the main merger company found three companies with which to merge (all three had a minimum legal capital of USD 1.6 million), and an assessment analysis was conducted. Table 5 provides an overview of the main merger company and the three merged companies; all the companies are real companies, and the data are not simulated.

Table 5. Overview of the main merger company and three merged companies.

Company	Type	Nature of Business	Manpower	Yearly Turnover	Years of Experience	Age and Educational Level of CEO	Background of CEO
Main merger company	Main merger	Security, property management, and cleaning	150	USD 1.935 million	10	58, bachelor's degree	Engineering and business management
Case 1 K company	Merged	Security, property management, and cleaning	110	USD 1.548 million	10	68, bachelor's degree	Engineering and business
Case 2 T company	Merged	Security and cleaning	80	USD 0.967 million	15	58, high school graduate	General business
Case 3 G company	Merged	Security, property management, and legal affairs	280	USD 3.87 million	20	56, bachelor's degree	Law and management

All companies and data (mainly, K, T, G) are real companies, and data are not simulated.

According to the six construction steps (presented in Figure 2) of the model developed based on multiple decision theories (illustrated in Figure 1), the U(yi) value of each utility equation was calculated in step 4. The U(yi) is then inputted into the calculation and analysis in step 5 to obtain the relative weight of each assessment criterion, as well as the quantified interval and utility equation defined by the utility theory. The utility value was subsequently multiplied by the relative weight to obtain the sum of the EUVs for each assessment criterion. In this case study, the main merger company's CEO visited the CEOs of the merged companies (CASE 1–CASE 3 companies) to individually discuss and identify each assessment point (Yi) for each assessment criterion in all companies, according to the 12 assessment criteria for property management company mergers identified in this study. The results are presented in Table 6.

Table 6. Case study results: EUVs of CASE 1–CASE 3.

Item	wi × 100%	Assessment Criteria	CASE1 K Company		CASE2 T Company		CASE3 G Company	
			Yi	EUV	Yi	EUV	Yi	EUV
1	14.4	Streamlining manpower	43.78%	3.73	43.24%	3.50	46.62%	4.94
2	5.5	Sharing legal resources	40.10%	0.02	40.10%	0.02	53.86%	2.18
3	6.3	Sharing operational equipment	42.46%	−1.04	45.30%	0.12	44.86%	−0.06
4	5.3	Innovation and market strategy	47.10%	0.37	50.00%	0.88	47.10%	0.37
5	8.3	Synergy of general affairs	40.00%	−3.64	46.98%	1.44	43.49%	−1.10
6	3.3	Price wars	31.25%	−0.59	31.25%	−0.59	31.25%	−0.59
7	3.9	Tax-saving effect	50.00%	0.98	54.67%	1.43	59.35%	1.89
8	3.1	Ability to control costs	70.00%	1.03	45.00%	−1.55	91.00%	3.20
9	4.9	Annual turnover	USD 1.548 million	2.45	USD 0.967 million	−3.68	USD 3.87 million	4.90
10	8.8	Age of CEO	57.00	5.63	68.00	−2.84	57.00	5.63
11	14.0	Operating working capital	650	4.20	200	−8.40	1000	14.00
12	22.3	Insurance and risk management	80.0%	14.87	55.0%	2.48	90.0%	19.82
%	100.0			28.01		−7.18		55.19

All companies and data (mainly, K, T, and G) are real companies, and data are not simulated. The EUVs obtained were 28.01%, −7.18%, and 55.19%, within a reasonable range of −47.16% to 100% (see Table 2).

This case study's calculation method is described as follows. Taking the first assessment criterion in Table 6 as an example, after the assessment of the main merger company and merged companies' CEOs, the synergy value obtained based on "streamlining manpower" was Yi = 43.78%, which was input into the single assessment model equation EU = Wi × U(yi), where U(yi) = 2.950y1 − 1.032 and the relative weight (Wi) was 14.4%, and thus EU = Wi × U(yi) = 0.144 × (2.950 × 0.4378 − 1.032) = 0.0373 = 3.73%. All other calculation values were successively obtained using this method.

4.3. Description of Assessment Results of Merger Feasibility for All Companies

Based on the assessment model, the calculated EUV of CASE 1 (K company) was 28.01%, whereas that of CASE 3 (G company) was 55.19%. Therefore, both of these companies could have been suitable for merger and a high EUV could have yielded a high success rate for the merger. However, the EUV of CASE 2 (T company) was −7.18%, which was below the threshold (when uT = 0 and the utility value was 0), and thus this company was unsuitable for merging. These results are illustrated in Figure 5.

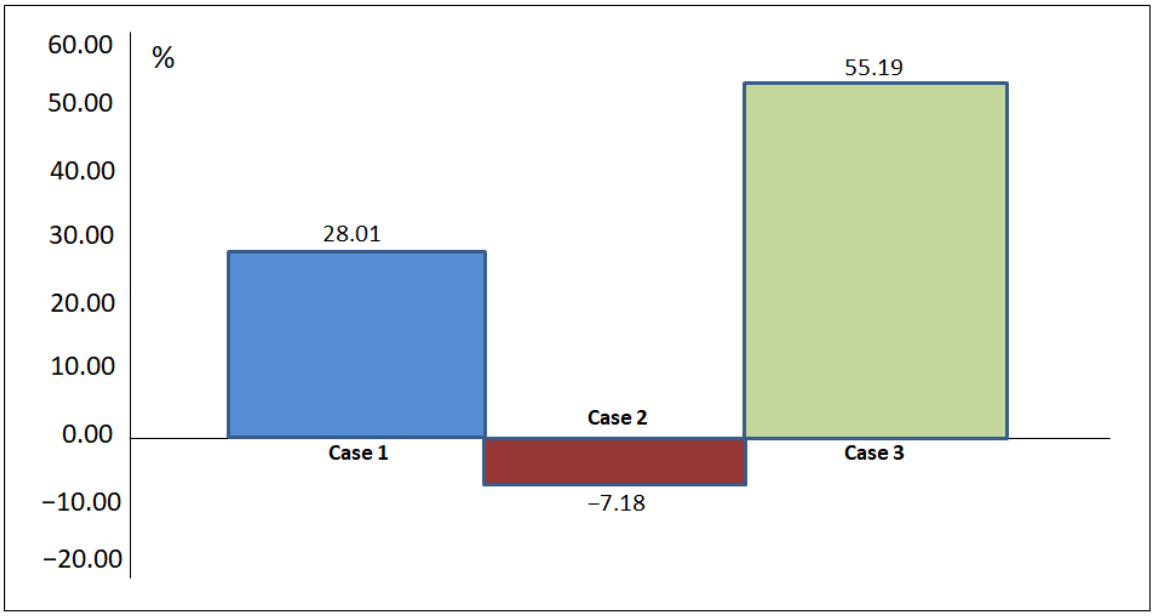

Figure 5. EUVs calculated for CASES 1–3.

4.4. Suggestions

1. In this study, we strongly recommend that the Property Management Association establishes minimum fees to prevent strong competition from reducing profits in the property management industry.
2. This study discusses the use of Singapore AHP computing software to obtain the top four relative weights: (1) insurance and risk management (relative weight = 24.1%), (2) operating working capital (relative weight = 15.2%) (3) synergy of human resources (relative weight = 13.8%), and (4) age of CEO (relative weight = 9.6%). The first three relative weighting factors can be controlled and managed internally by the company, whereas the CEO's age represents a risk of sudden death that cannot be determined or controlled. Accidental deaths of CEOs aged more than 65 years often lead to crises. Therefore, if a CEO is in poor health, the board should attend to the handing over of the company to the succeeding CEO as soon as possible.
3. For many companies, adopting a merger operation for competitive survival is arduous. The improper implementation of the initial merger assessment work could ultimately cause the destruction of the company. This research paper is based on years of practical experience and comprehensive academic theory. The paper contributes to the revelation of key factors and an evaluation model for M&A decisions to provide a reference for M&A evaluation.
4. The reasons for this paper's use of a company to implement a company merger instead of a direct merger (capital purchase) are as follows: (i) Given the Taiwanese "like to be the boss" personality, the merger mode allows the boss to stay the same (retaining shares). (ii) Currently, a property management company requires legal capital of USD 1.643 million (NTD 50 million), but the actual capital investment is less than half, so competition with international enterprises is difficult. The source of

direct M&A funds poses major problems for these companies. (iii) Tax reduction and tax avoidance effects—Many positive synergies and tax cuts result from the merger. For older business owners, in the case of sudden accidental death, tens of millions of dollars' worth of estate tax expenses can be avoided.

5. Conclusions

The assessment model established based on the expected utility theory can be used to quantitatively assess the main merger company and merged companies. If a property management company's result is greater than 0 (EUV > 0), a high quantified value is obtained, and the said company is suitable for the merger. In this case study, the EUV of CASE 1 was 28.01%, and that of CASE 3 was 55.19%; thus, they were both suitable for merging. By contrast, the EUV of CASE 2 was −7.18%, thereby rendering it unsuitable for merging (EUV < 0).

Because of strong competition, most property management companies have reduced their profitability while navigating common obstacles. The study found that the merger model could be accurately evaluated using the evaluation model. The sharing of logistics resources can indeed bring the benefits of investment and marketing to the merger, and improve the company's profitability. At the time of writing, no research has conducted such a comprehensive analysis of the property management industry in Taiwan.

The greatest contribution of this study was the development of an objective and rigorous assessment model for quantitatively assessing a merger among property management companies. This research provides the operators and CEOs of main merger companies with an explicit decision-making tool for mergers, thereby equipping property management companies with a solution for pursuing profitability and sustainable management. The method developed in this study can be applied to research in other fields, such as when conducting a feasibility assessment of a business merger in the cleaning industry, real estate brokerage industry, or real estate industry.

Research Limitations and Future Study

At the time of writing, Taiwan has not conducted a merger assessment study on the property management industry. Therefore, this article aims to fill this gap in research and provide a reference for whether to merge. Although the provided model has been proven to be effective and worthy of reference, there are still other influencing factors, such as legal changes or sudden man-made external factors, so there is no guarantee that the model will succeed. We suggest that future research directions can use our modeling methods and research contributions to promote SMEs in Asia and other countries in the world, to help them solve business problems. Future research methods can also consider using the best worst method (BWM), the level-based weight assessment (LBWA) method, FUCOM, and other methods as evaluation tools.

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