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A SYSTEMATIC APPROACH TO STRATEGY FORMULATION FOR MEDIUM-SIZED SHIPYARDS

Buana Ma'ruf
Research Staff of BPPT, Indonesia

Abstract

A more comprehensive strategy formulation has an important role for sustainable competitive advantage of the shipbuilding companies in the global market. The nature of shipbuilding industry differs from general industry, therefore a strategy formulation model should be developed based on its own characteristics and business environment. This paper presents a proposed strategy formulation model for medium-sized shipyards both in business and corporate levels. A new approach was developed based on comprehensive business environment analysis, using questionnaires to the industry's stakeholders and multivariate analysis "Factor Analysis." From the analysis, two business environmental models are made, and combined into corporate model called "Ten-boundary environment model." These models are used to develop Shipyard Matrix, then integrated into a shipyard strategy formulation model, called "YARDSTRAT," using the David's strategy formulation framework. Real case application and discussion have been carried out in two national shipyards. The proposed model and the results were compared to their existing formulation model for model evaluation and validation, using 12 evaluation criteria. The results show that, the average value of each criteria of the proposed model is much higher than the average value of the existing model (SWOT analysis).

Key words: shipyard, environment model, strategy formulation, strategic management

Introduction

The establishment of INPRES No.5/2005, so called "cabotage policy," is intended to promote the national shipping and shipbuilding companies. This policy will increase the national market demand both new building and ship repair services. Since this domestic market is a part of the global market, however, must be capable to promote their competiveness. As classified by Schlott (1985), among the national shipyards, less than ten companies are categorized as medium-sized shipyards with the capacity above 5,000 DWT. Their market share in new building of Indonesian shipyards is accounted only 0.35% to 0.50% of the world market in the last ten years. Low competitiveness of the national shipyards is mainly caused by the limitation in strategic planning (Ma'ruf, et al, 2004a).

Competitiveness can be defined as the ability to win and execute shipbuilding orders in open competition and stay in business. In the global competition, the role of strategic management becomes very important for any business entity, including shipbuilding industry. As stated by Michael Kami (Thomson and Strickland, 2001), "Without a strategy the organization is like a ship without a rudder." SWOT analysis that currently used in strategy formulation of major National shipyards, however, is considered very general (Pearce and Robinson, 2000), and this is the historical deficiency of SWOT analysis (Ruocco and Proctor, 1994). Their environment analysis is carried out by using intuitive subjective judgment with limited information (Ma'ruf and Widjaja, 2004b), of which academics are critical (Suriasumantri, 1998). The Indonesian engineers also tend to make unrealistic judgment in evaluating their competitive positions (Hamada, et al, 2003).

Because of the shipyards compete globally and have complex and specific characteristics (Bruce and Garrard, 1999), its strategy formulation shall be made in a more comprehensive environment analysis to maintain its long-term growth. The best way to formulate strategy always depends on the nature and needs of the business in the company's portfolio (HBS, 1991). Betz (2001:286) also states that, the problem in strategy formulation is, how to evaluate a strategic intuition with strategic analysis. This specific approach would give greater legitimacy than any other" (McGrahan, 2004:93).

Our previous study shows that, the dominant environment factors affecting competition are relatively different between new building business and ship repair business (Ma'ruf, et al, 2005b). It is therefore, this particular study is then aimed at proposing an alternative strategy formulation model for middle-sized national shipyards based on their business characteristics. Based on their business environment (Ma'ruf, et al, 2005a), the strategy formulation model is developed and applied in a real case of the national shipyards.

Literature Review

Strategic planning is a part of strategic management. As defined by David (2003), strategic management is the art and science of formulating, implementing and evaluating cross functional decisions that enable an organization to achieve its objectives. Strategic management is seeking to manage all resources to develop competitive advantage and to help create the future (Wheelen and Hunger, 1994). Strategy itself, is an important tool to achieve competitive advantages (Porter, 1985).
In hierarchical, strategy consists of corporate level, business level, and functional level. Corporate level

focuses on overal company's direction, business level emphasizes on competitive position of a product or service, and functional level emphasizes on functional departmental performance (Wheelen and Hunger, 1994). For middle-sized firm that characterized as functional structure (Wheelen and Hunger, 1994), its products are not in a separate business unit. Since the functional structure is mostly used in the middle-sized shipyards, this particular research will combine both corporate and business strategies, as a practical requirement of the strategy process (Betz, 2001).

Many of the concepts and techniques dealing with long-range planning and strategic management have been developed and used successfully by business corporations (Wheelen and Hunger, 1994). Numbers of widely used strategic management models have been reviewed, including: David's model (2003), Thompson and Strickland's model (2001), Wheelen and Hunger's model (1994), Pearce and Robinson's model (2000), Mintzberg's model (1998), and Porter's model (1985). Some of them are applicable in corporate level and some others in business level. However, these models are generic models that applicable in general industry, and most of them rely on qualitative and conceptual framework.

Among the models, the David's model is the only quantitative and application-oriented model that emphasizes the formulation into a methodological procedural framework (Betz, 2001). Its best strategies are selected sistematically through three integrated stages. In the other models, its environment analysis (internal and external factors evaluations) is based on subjective intuitive judgment (David, 2003). However, a case study of the David's model in a shipyard (Ma'ruf, et al, 2004a) show that, judgment approach could lead to unproper strategy selection.

As an opened system, some models of environmental analysis and competitive advantages were reviewed to explore the enviromental factors (variables) of the shipyads, including: Grant (1995), Amit and Schoemaker (1993), Petreraf (1993), Harvard Business Review (1991), dan Wheelen and Hunger (1994). These variables will be used as the input of the strategy formulation.

Research Methodology

This research work was initiated by reviewing existing strategy formulation model used in major Indonesian shipyards, existing strategic management models particularly David's model, and application of David's model through case study in a shipyard. From the case study, it is found that some potential improvements shall be made for a specific application in ship building company, including its approach to environment scanning and formulation process.

Based on literature review, questionnaires to top-management of some shipyards in Asia Pasific countries, and intensive discussion to related experts, all relevant variables (internal and external factors) for sustainable competitive advantages were identified. These include 20 internal variables and 20 external variables. In this study, the relative importance of these variables were identified by using questionnaires to the industry's stakeholders, including: shipyards, shipping companies/customers, suppliers and subcontractors, academician and researchers, and expert, government, association. Composition of the target respondents was determined based on the research objective and expert discussion. The questionnaires were designed using semantic differential scale 1 to 5 (less important to

very important). Data was collected from 112 selected respondents during July-August 2004. This exceeds the minimum respondents required, at least five times number of variables (Hair, et al, 1998).

The average of sample adequacy exceeds 0.80, and the average reliability (alpha) also exceed the recommended level of 0.70 (Hair, et al., 1998), and data validity is accepted (r calculation r table). The collecting data was analyzed using a multivariate statistical technique "Factor Analysis." It is an interdependence technique in which all variables are simultaneously considered, each related to all others (Hair, et al, 1998). For the sample size is 100 or larger, the factor loadings exceeded 0.70 are taken as dominant factors. The loadings are the correlation of each variable and the factor, and indicate the degree of correspondence between the variable and the factor (Hair, et al, 1998). In the factor analysis, all factors are independent each other (Johnson and Wichern 1999).

The environment models are created based on the number of internal and external factors both in ship building and ship repair (Ma'ruf, et al, 2005a). The portfolio matrix which so called "Shipyard Matrix," is developed in line with attractiveness score of strategy and classification of company's rating. All of the models are then used to develop a strategy formulation model for the shipyards, by integrating them into the formulation stages as adopted from the David's framework. Validation of the proposed models are carried out by expert discussion and evaluation, as well as applying it in a real case in two national shipyards. The formulation process and the results are then discussed with the management of the companies, using 12 evaluation criteria. The criteria consists of suitability, feasibility, acceptability, and some additional criteria given by experts.

Results and Discussion

1. Development of environmental model

From the factor analysis, varimax of the factor analysis results factor loadings and unrotated factor solutions extract factors in order of their importance (Hair, et al, 1998). Table 1 and 2 show the results of factor analysis of the internal factors and the external factors, both ship building and ship repair (Ma'ruf, et al, 2005a). According to the research objective, names of the factors are given based on summated scales, which can be related to the conceptual definition (Hair et al 1998). Groups of factor consist of three to four factors, each consisting variables with factor loading above 0.70. Since the total weighting of variables is equal to 1.00, the individual weighting is then given based on the percentage of variance and the factor loading of variables.

Table 1. Internal Factors

Ship Building			Ship Repair		
Factors and Variables	**Loading**	**Weight**	**Factors and Variables**	**Loading**	**Weight**
Factor 1: Shipyard Management			Factor 1: Price Quotation		
Company culture	0.812	0.19	Price level	0.776	0.24
Organization and management	0.736	0.18	Employee know-how	0.739	0.22
Business network	0.702	0.17			
Factor 2: Process Technology	0.737	0.10	Factor 2: Shipyard management		
Engineering and database	0.707	0.09	Company culture	0.812	0.11
Facilities and equipments			Business network	0.721	0.10
Factor 3: Product Performance			Factor 3: Product performance		
Delivery time	0.811	0.08	Delivery time	0.815	0.09
Quality assurance	0.713	0.07	Quality of product	0.743	0.09
Factor 4: Price Quotation			Factor 4: Yard Location		
Price level	0.884	0.12	Shipyard location	0.911	0.15

Table 2. External Factors

Ship Building			Ship Repair		
Factors and Variables	**Loading**	**Weight**	**Factors and Variables**	**Loading**	**Weight**
Factor 1: Interim Supply			Factor 1: Interim Supply		
Quality of material	0.791	0.19	Price of material	0.777	0.22
Price of material	0.774	0.18	Quality of material	0.723	0.21
Supplier knowhow	0.734	0.17	Quality of sub-contractor	0.718	0.20
Factor 2: Shipbuilding Order			Factor 2: Maritime Policies		
Domestic market	0.856	0.10	Bank support	0.823	0.07
International market	0.812	0.10	Government support to shipyard	0.778	0.07
			Government support to shipping	0.729	0.07
Factor 3: Global restrictions			Factor 2: Repair Order		
Entry barriers in global market	0.760	0.07	Domestic market	0.894	0.16
Industry infrastructure	0.746	0.07			
Factor 4: Maritime Policies					
Government support to shipyard	0.778	0.04			
Government support to shipping	0.711	0.04			
Bank support	0.707	0.04			

The results of the above factor analysis may be given in the form of a generic environment model for the national medium-sized shipyards. The model is then called "Ten-boundary environment model," as given in Figure 1. The variables included in the factors are then developed into two business submodels, environment model in shipbuilding, and environment model in ship repair.

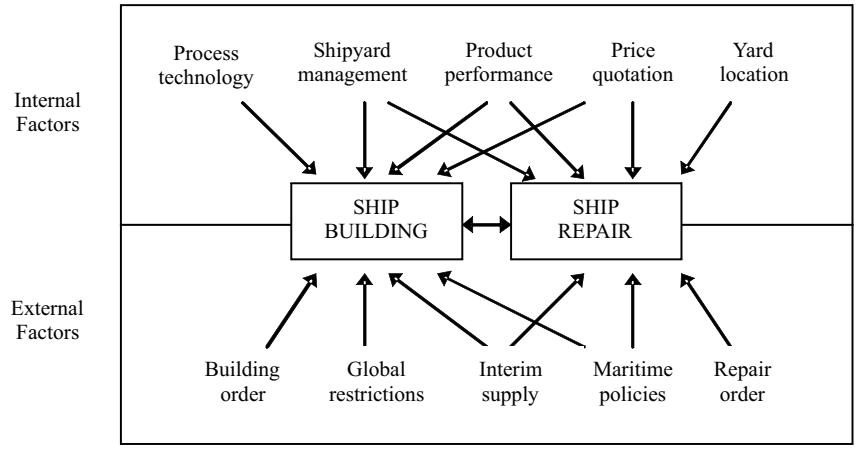

Figure 1. Ten-boundary environment model

The factors and variables in both models are relatively the same. Their differences are related to the nature and the market orientation. However, most of the dominant variables are intangible resources, as also concluded by Hall in general industry (Hall, 1992). As found, "process technology" and "global restrictions" are only significant in shipbuilding. In the other hand, "yard location" is only relevant in ship repair. Based on weighting contribution, factor "shipyard management" in shipbuilding and "price quotation" in ship repair are the most dominant factors for sustainable competitive advantage, which account for 54 percent and 46 percent. For the external, factor "interim supply" is the most dominant factor for both businesses which account for more than 50 percent of the total weighting.

Since the environment analysis is the starting point in any strategy formulation models, the above results may be applied in the case of formulating strategy of middle-sized shipyards in Indonesia and other

similar countries. The business environment models may be used to create a quick overview for a company, by simply plotting the score of each internal and external factor (1 to 4) onto the models. In this purpose, the boundary lines are moved to the model's corners, and the score 1 is put in the middle to score 4 in each corner. The company's factor scores are then put along the lines and linked all together to overview the company's competitive position compared to the maximum score of 4.

2. Development of shipyard matrix

The factors and weighting of variables included as shown in Table 2 and Table 3 are also used to design possible strategy alternatives in two matrices, called "Shipbuilding Matrix," and "Ship Repair Matrix." Both matrices are simply called "Shipyard Matrix," as shown in Figure 2. The matrix consists of nine quadrants as adopted from the Internal and External Matrix and Grand Strategy Matrix (David, 2003). Design of strategy alternatives is made based on attractiveness score of strategy according to the company's rating. The rating is determined by using scale of 1 to 4 as adopted from the David's model (David, 2003), where the values are guided by criterias indicating the internal conditions of the company and the company's response for the external factors. Total score of a strategy is determined according to its average attractiveness score of each company's rating for all internal and external factors. Strategies with the value of 2.00 to 4.00 are taken as strategy alternatives in each quadrant. The total score is classified into three categories of IFE value and EFE value (low, medium, and high).

In the matrix, there are 15 strategy alternatives are included (David, 2003). They are: market penetration (MP), market development (MD), product development (PD), backward integration (BI), forward integration (FI), horizontal integration (HI), joint venture (JV), concentric diversification (CD), horizontal diversification (HD), conglomerate diversification (CtD), merger (M), retrenchment (R), divestiture (D), and liquidation (L). The Shipbuilding Matrix is given in Figure 4. In the Ship Repair Matrix, there are only five strategy alternatives in Quadrant II (without JV), and two alternatives in Quadrant III and IV (without PD).

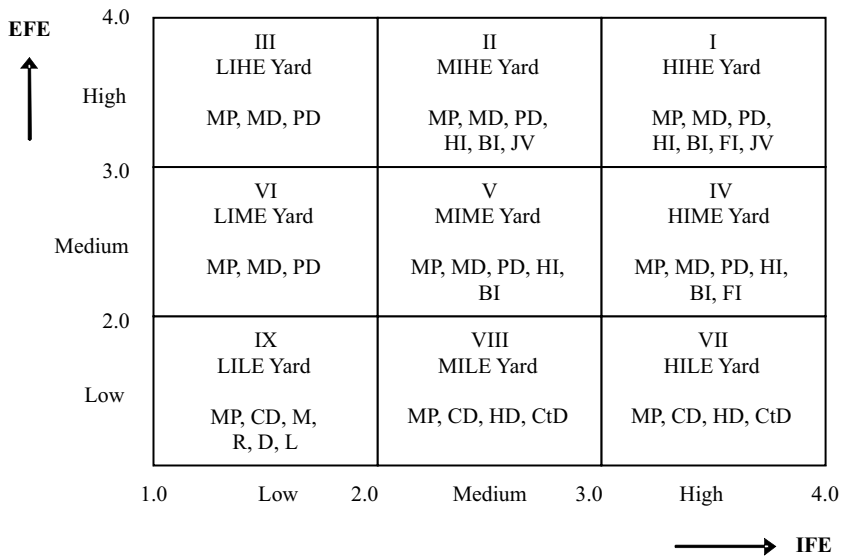

Figure 2. The Shipbuilding Matrix

By using the matrix, a company could simply determine its possible strategy alternatives by plotting the total IFE and EFE scores on the matrix, either ship building business and ship repair business. Eventhough the numbers of strategy alternative have been reduced, this matrix still suggests strategies within a broad range of the total score of IFE and EFE. Two or more shipyards with different IFE and EFE scores could have the same quadrant (the same possible strategies). Therefore, a more comprehensive formulation may be still needed to determine more specific strategies.

3. The proposed strategy formulation model

As the main objective of this particular research, a shipyard strategy formulation model is developed, called "YARDSTRAT," as shown in Figure 3. This proposed model is developed based on the framework of the David's formulation model that consists of three stages as mentioned at the beginning. The David's conceptual framework and application limitations found through a case study in shipbuilding industry have been considered for improvement. Its modifications are mainly related to the needs and the specific characteristics of the shipbuilding company, including: environment analysis is carried out with a comprehensive business analysis, determining company's rating and strategy attractiveness scores are guided with a given list, and strategy selection may be made both in corporate and business levels.

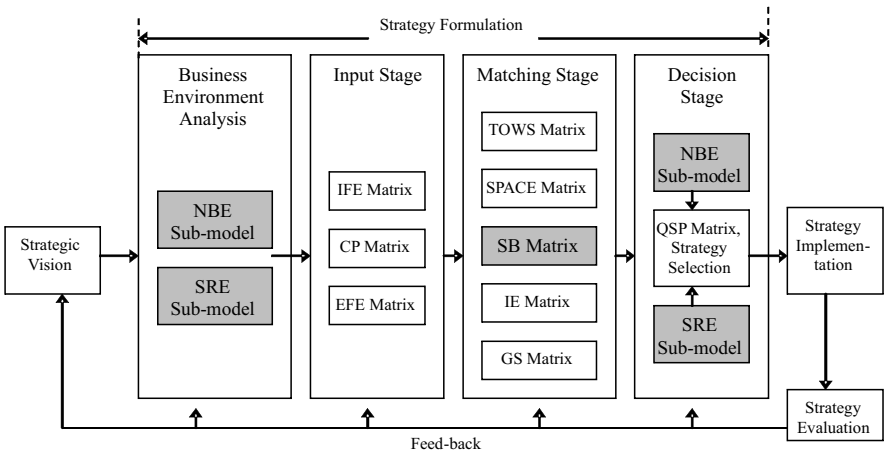

Figure 3. YARDSTRAT (Shipyard Strategy Formulation Model)

In the input stage, three matrices are applied including Internal Factor Evaluation (IFE) Matrix, External Factor Evaluation (EFE) Matrix, and Competitive Profile Matrix (CPM). At the matching stage, five matrices are used, including: TOWS Matrix, IE Matrix, Ship Building/Ship Repair Matrix, and Grand Strategy Matrix. The results of the environment analysis (NBE submodel and SRE submodel) are used in the input stage through the decision stage. The shipyard business matrix (NB Matrix and SR Matrix) is used in the matching stage, in which the matrix was developed from the results of the factor analysis.

Other formulation methods (matrices) at the matching stage remain the same as those used in the David's model except the BCG Matrix. This matrix is difficult to apply in medium-size shipyard since its future market share cannot be predicted, and its business lines are not operated in separate business

units (Ma'ruf and Widjaja, 2004b). Furthermore, the matrix is similar to the IE Matrix as business portfolio matrix (David, 2003). However, the input of those matrices is made based on the results of the factor analysis. By using quantitative strategic planning matrix (QSPM) at the decision stage, best strategies are determined based on total attractiveness score (TAS) of selected strategies at the matching stage.

4. Model validation

The application of the YARDSTRAT may be carried out manually. However, a computer-based application program would be more effective for easy application and accurate results, such as by using Borland Delphi. In this study, model validation was carried out through expert discussion and evaluation, and real case application in five national shipyards and two foreign shipyards. The company's ratings for all internal and external variables included in the models, were collected using questionnaires to the top-management and managers of the shipyards. The average rating value (integer) was taken as input to the software. The model and the case study's results were discussed and compared to their existing formulation model and strategies using 12 evaluation criteria, through management meeting in two shipyards in May 2005. The evaluation was given by their own-judgment using scores 1 (very low) to 5 (very high), and the average values are given in Table 3. The results show, the average value of each criteria of the existing model (SWOT analysis) is 3, and the proposed models (PM) is 4. With significant level 5%, the collected data is valid ($r_{calc} > r_{table}$) and reliable (alpha= 0.7035 > r_{table}= 0.468). The T-test of paired samples test shows $t_{calc} - t\alpha,_{19}$ (t_{table}: $t_{0.05;19}$ = 2.093).

Table 3 The average value of the SWOT analysis and the proposed models (PM)

No.	Evaluation Criteria	Company 1			Company 2	
		SWOT	PM		SWOT	PM
1	Model application	2.36	4.09		2.67	4.33
2	Level of strategy	2.36	4.09		3.11	4.56
3	Formulation model	2.45	4.45		2.44	4.67
4	Environmental analysis	2.18	4.09		2.56	4.22
5	Factors/variables' weighting	1.91	4.00		2.11	4.44
6	Guidance of company rating	2.73	4.27		2.22	4.56
7	Strategy selection process	2.36	4.36		2.89	4.33
8	Types of strategy	2.00	4.27		2.22	4.56
9	Selection and rank of strategies	2.36	4.18		2.78	4.44
10	Suitability	2.00	4.09		2.67	4.33
11	Feasibility	2.45	4.09		2.22	4.33
12	Acceptability	2.27	4.27		2.89	4.78

Company 1: DPS (11 respondents), Company 2: IKI (9 respondents); PM= proposed models;
SWOT= strengths, weaknesses, opportunities, threats

Based on the research objective, the proposed model can be considered as a generic model for the middle-sized shipyards particularly in Indonesia, and any other countries with relatively similar business environment characteristics. The proposed models may be valid for a long time since there is no significant change(s) in their business environment characteristics. As a capital goods industry, the strategic factors and the variables in the models are relatively steady. If there is a significant change occurred, however, the environment models may be modified accordingly. Further research may be needed to cover the big and the small-sized shipyards. For big shipyards with relatively the same core businesses and characteristics, however, the framework is still applicable but the weighting of variables may be different.

Conclusion

Since the existing strategy formulation models are mainly in general industry or consumer goods industry, a specific strategy formulation model for the shipyard is obviously needed. Based on the results of its environment analysis, a strategy formulation model was developed using the basic framework of the David's model. The proposed model, which called "YARDSTRAT," consists of three integrated stages. The input stage consists of Internal Factor Evaluation (IFE) Matrix, External Factor Evaluation (EFE) Matrix, and Competitive Planning Matrix. All factors used in these matrices including their weighting scores are given as the results of the environment analysis. The results are made in the form of an environment model called "Ten-boundary environment model."

The model consists of five internal factors (product performance, price quotation, shipyard management, process technology, and yard location), and five external factors (interim supply, maritime policies, global restrictions, building order, and repair order). As shown in the model, the dominant internal and external business environment factors affecting sustainability of competitive advantage between ship building business and ship repair business are relatively different. The results of the environment analysis were also used to develop Shipyard Matrix (Shipbuilding Matrix and Ship Repair Matrix), which then included at the matching stage. The matrix was developed in more specific based on the IE Matrix and GS Matrix as applied in the David Model. Possible strategy alternatives on the matrix were determined based on strategy attractiveness that subject to the given factors. Some of the most frequent strategies proposed at the matching stage are selected using the Quantitative Strategic Planning Matrix (QSPM). The best strategies are then determined based on their total attractiveness scores, both in business and corporate levels.

The proposed environment models and the Shipyard Strategy Formulation Model may be considered as generic model for middle-sized shipyards in Indonesian in particular, and similar shipyards in other countries with relatively the same environmental characteristics. Case study result and discussion in two national shipyards show that, the model is valid and much better than SWOT Analysis as currently applied in the state-owned shipyards (average value 4 compared to 3, for the range of 1 to 5). The proposed model may be valid for long time since there is no significant change(s) in its business environments. Since the research observation was limited to the middle-sized shipyards, another research work may be needed to cover the big and small-sized shipyards. The YARDSTRAT framework is still applicable for them, but the weighting of variables may be different.

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