THE MANUFACTURING STRATEGIES AND FIRM'S PERFORMANCE IN THE AUTO PART INDUSTRY

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งานวิจัยนี้มีวัตถุประสงค์ในการหาองค์ประกอบกลยุทธ์ในการผลิตส าหรับผู้ผลิตชิ้นส่วนยานยนต์ที่ให้ผลตอบแทนต่อผู้ถือหุ้นสูงขึ้น โดยทำการเก็บข้อมูลเชิงสำรวจจากผู้ผลิตชิ้นส่วนยานยนต์จำนวน 109 บริษัท กลุ่มตัวอย่างได้ตอบแบบสอบถามโดยการจัดลำดับความสำคัญของกลยุทธ์การผลิต 25 ข้อใน 3 ด้าน คือ (1) ด้านคุณภาพที่มีความสำคัญที่จะช่วยสนับสนุนกลยุทธ์ในการดำเนินธุรกิจ (2) ด้านกิจกรรมที่จะทำให้บริษัทบรรลุเป้าหมายและวัตถุประสงค์ (3) ด้านปัจจัยที่ควรมีมากกว่าคู่แข่งและจะทำให้บริษัทสามารถประสบความสำเร็จในการแข่งขันได้ ผลการวิเคราะห์ทางสถิติโดยวิธีการวิเคราะห์หาปัจจัย (Factor Analysis) สามารถลดปัจจัยกลยุทธ์ลงได้ 11 ข้อจาก 25 ข้อ และใช้วิธีการวิเคราะห์แยกองค์ประกอบ (Principal Component Analysis) จัดหมวดหมู่ปัจจัยที่เหลือ 14 ข้อออกเป็น 6 ด้าน และเมื่อใช้การวิเคราะห์การถดถอยพหุคูณ (Multiple Regression) พบว่าองค์ประกอบของกลยุทธ์ในการผลิตที่สำคัญมีปัจจัย 4 ด้านจาก 6 ด้านที่สามารถทำให้ผลผลตอบแทนต่อผู้ถือหุ้นเปลี่ยนแปลงไปได้แก่ ปัจจัยด้านที่ 1 คือการจัดส่งสินค้า ปัจจัยด้านที่ 2 คือการสร้างความได้เปรียบในการแข่งขันด้านคุณภาพ และความหลากหลายของชนิดของสินค้า ซึ่งปัจจัยทั้งสองด้านนี้ทำให้ผลตอบแทนต่อผู้ถือหุ้นลดลง ปัจจัยด้านที่ 3 คือราคาต้นทุน และปัจจัยด้านที่ 4 คือความสม่ำเสมอของคุณภาพ ปัจจัยทั้งสองด้านหลังนี้ท าให้ผลตอบแทนต่อผู้ถือหุ้นสูงขึ้น

Abstract

The purpose of this research is to find the proper manufacturing strategies affecting return on equity for auto parts manufacturing. Data were collected from 109 companies through conducting a survey. The respondents were asked to evaluate their judgments on the 25 manufacturing strategies in 3 areas namely: 1) Competitive priority on quality issues; 2) Improvement Activities to achieve firms' goals and objectives; and 3) Order-winning for its product to be preferred as compared with a competitor. A Factor Analysis Technique was applied to search for joint variations and to lower the number of variables by 11 out of 25. Then the Principal Component Analysis was used to extract 14 factors classified into 6 areas. The

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results from Multiple Regression Analysis show that Return on Equity could be ex-plained by the 4 out of 6 important factors of manufacturing strategies. First, the competitive priorities in delivering merchandise, and criteria of order winning in quality competition and product variety and versatility, have an inverse relationship with return on equity. But the competitive priority in cost and quality conformance has a direct relationship with return on equity.

INTRODUCTION

The automotive industry in Thailand contributes approximately 10 percent of manufacturing production index, generates 12 percent of the nation GDP, and employs more than 300,000 people (Board of Investment; Automotive Summary). The automotive manufacturing could be classified into three levels: passenger and commercial vehicle assemblers, component manufacturers, and supporting/equipment manufacturers (Board of Investment 1995). All of the world's major automakers, assemblers, and parts and components manufacturers have been attracted to the industry in Thailand including U.S. Big three namely Ford, General Motors, BMW, DaimlerChrysler, and Japanese Big Five namely Mitsubishi, Mazda, Toyota, Isuzu, Honda and Nissan. There were 1.4 million vehicles produced in 2008. There are approximately 850 part manufacturers consists of 358 first-tier suppliers, 272 second-tier suppliers, and 220 third-tier suppliers. Thailand is developing a major offshore base for Japanese and American automotive manufacturers. In 2007, the American economy began to slow significantly, mostly because of a real-estate slump and related financial problems. The vehicle produced was reduced down to 0.94 million vehicles in 2009. In the current situation, Thai automotive manufacturers are trying to improve quality, lower cost, and are more competitive than before.

With increasing competition in automobile global market, selecting appropriate manufacturing strategies has become very important to keep an automotive part firm sustaining in the business. In such a competitive environment, companies have to keep their quality at acceptable level, perform many activities to achieve goals and objectives, and produce product to be as good as their competitors. There are holistic sets of strategies to choose from such as "what are competitive priorities strategies should be taken?", "what improvement activities are more important than others?", "how do the companies win orders?".

This paper presents findings of an empirical survey on the implementing of manufacturing strategies from 1st Tier Automotive Part companies in Thailand.

LITERATURE REVIEW

Pual and Laosirihongthong 1998; Laosirihongthong, Paul, and Speece 2003; Laosirihongthong and Paul 2004 showed that most companies in the sector have implemented certain order-qualifier criteria and structural and infrastructural issues in manufacturing strategy. They concluded that automotive manufacturers in Thailand were in low competitiveness and less integration of various functions such as marketing, sales,

and finance. In this study, the main question was "Which manufacturing strategies is affected firm's performance?".

Manufacturing Strategy

Manufacturing strategy should describe the contribution that manufacturing could achieve lower cost, acceptable quality, and provide availabilities. Moreover, the appropriate strategies must fit among manufacturing, marketing function, and providing high return on equity. Previous studies (T. Laosirihongthong and G.S. Dangayach, 2005) conducted survey research collect data from Thailand and India. They reviewed and identified strategies for automotive manufacturing companies into three main areas including 12 dimensions on competitive priority, 26 activities of improvement, and 10 criteria of order-winning. The results concluded the following important strategies in 3 areas.

Five dimensions on Competitive Priority

1. Dependable Delivery: make on time delivery or meet delivery schedules
2. Delivery Speed: provide fast deliveries
3. Low Cost: ability to profit in price competitive markets
4. Conformance Quality: improve conformance to design specification
5. Volume Change: make rapid volume changes

Ten Improvement Activities

1. Just in time: produce and deliver finished goods just-in-time to be sold
2. Computer Numerical Control: numerically controlled machine tools
3. Office Automation: computerization of office systems
4. Workforce Involvement: giving worker more planning responsibility
5. Customer Relations: improve customer satisfaction, customer-supplier relationship
6. Material Requirement Planning: computer-assisted material planning system
7. Bar Coding: bar identification system
8. Statistical Process Control: the use of statistical methods to control quality
9. Computer aided design: computer-supported design and drafting system
10. Total Quality Management: approach to improving the competitiveness of an organization through kaizen, total participation and continuous improvement

Ten criteria of Order Winning

1. Attractive Packaging: Outside appearance of a product
2. After Sales Service: Service rendered after sale
3. Competitive Price: Price according to competition in the market
4. Conformance Quality: improve conformance to design specifications
5. Efficiency: Error free working of product
6. Speed of New Product Development: How quickly new product is launched
7. Product Durability: Useful life of product
8. Product Range: variety of products
9. Variety in Design: Versions or variations of a product
10. Versatility of Product: Robustness or multiple use of a product

Firm's performance

Financial Statements represent information exhibiting firms' performance. Balance sheet shows financial position of firm at one point in time while income statement shows profit and loose for the previous year. Financial ratios, especially profitability ratios, provide information on firm profit such as profit margin, return on asset (ROA), return on equity (ROE), and return on investment (ROI). Profit margin is equal to net income divided by sales. Return on asset is equal to net income divided by total asset. Return on equity is equal to net income divided by common equity. Prajogo (2007) showed that product quality was predicted differentiation strategy, but not cost leadership strategy. Thus, product quality would not lead to cost concern strategy or increasing firm performance. However, Curkovic et al., (2000), and Forker et al., (1996) showed that product quality and service quality have direct relationship with Pre-tax ROA, After-Tax ROA, Growth in ROI, Market share, and Growth in market share, but not ROI.

RESEARCH METHODOLOGY

Sampling method

The sample consisted of first tier automotive part manufacturing which could be classified in to four groups of companies' namely Engine/Drive-trains/Steering, Suspension/Brake/Wheel/Tire, Bodyworks/Interior, and Electrical system. Questionnaires were sent to all automotive part manufacturing of 384 firms in the Thailand. The total number of response was 109 questionnaires at 28.4% response rate.

Survey Instruments

The respondents were asked to indicate the degree of importance given by their firms on a five-point Likert scale. In the measurement, scale 1 indicates least importance and scale 5 indicates most importance. The items employed to measure manufacturing strategy were developed by Laosirihongthong and Dangayach (2005). The reliability test was performed and reliability was at 0.70.

DATA ANALYSIS AND INTERPRETATION

Data Analysis

In this study, the researchers applied both factor analysis and regression analysis.

Factor analysis

The first step is to test whether factor analysis is appropriate. The Kaiser-Meyer-Olkin and Bartlett's test were applied. The Kaiser-Meyer-Olkin measure of sampling adequacy is an index for comparing the magnitudes of the observed correlation coefficients to the magnitudes of the partial correlation coefficients. Large values for the KMO measure indicate that a factor analysis of the variables is appropriate. The KMO measures the sampling adequacy which should be greater than 0.5 for a satisfactory level to proceed with factor analy-

sis. Bartlett's test of Sphericity tests whether the correlation matrix is an identity matrix, which would indicate that the factor model is inappropriate. Bartlett's test of Sphericity is used to test the null hypothesis that the variables in the population correlation matrix are uncorrelated. The observed significance level should be less than 0.05 to reject the null hypothesis and application of factor analysis is appropriate. The results from table1 show the data is appropriate to be analysis with factor analysis method.

The Factor Analysis procedure has several extraction methods for constructing a solution. The second step of factor analysis was applied for data reduction (Principal Components). The principal components method of extraction begins by finding a linear combination of variables (a component) that accounts for as much variation in the original variables as possible. Then, it finds another component that accounts for as much of the remaining variation as possible and is uncorrelated with the previous component, continuing in this way until there are as many components as original variables. Components with eigenvalues greater than 1 are saved to the working file. From table 2, Initial communalities are estimates of the variance in each variable accounted for by all components or factors. For principal components extraction, this is always equal to 1.0 for correlation analyses. Extraction communalities

Table 1: KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		0.557
Bartlett's Test of Sphericity	Approx. Chi-Square	241.808
	Df	105.000
	Sig.	0.000

Table 2: Initial Communalities and Extraction Communalities

Extraction Method: Principal Component Analysis.	**Initial**	**Exaction**
1 Dependable Delivery: make on time delivery or meet delivery schedules	1.000	0.525
2 Delivery Speed: provide fast deliveries	1.000	0.567
3 Low Cost: ability to profit in price competitive markets	1.000	0.642
4 Conformance Quality: improve conformance to design specification	1.000	0.719
5 Volume Change: make rapid volume changes	1.000	0.652
6 Computer Numerical Control: numerically controlled machine tools	1.000	0.591
7 Workforce Involvement: giving worker more planning responsibility	1.000	0.695
8 Computer aided design: computer-supported design and drafting system	1.000	0.619
9 Material Requirement Planning: computer-assisted material planning system	1.000	0.671
10 Total Quality Management: approach to improving the competitiveness of An organization through kaizen, total participation and continuous improvement	1.000	0.701
11 Conformance Quality: improve conformance to design specifications	1.000	0.685
12 Product Durability: Useful life of product	1.000	0.549
13 Variety in Design: Versions or variations of a product	1.000	0.546
14 Versatility of Product: Robustness or multiple use of a product	1.000	0.623

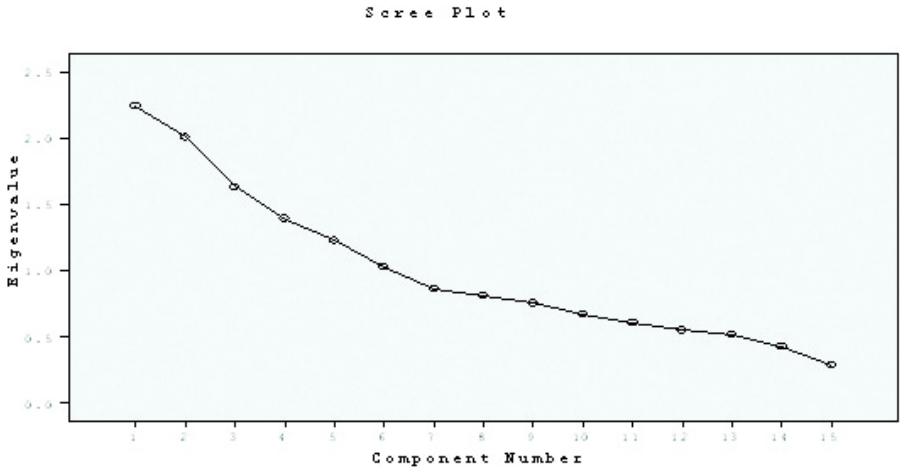
are estimates of the variance in each variable accounted for by the components. The communalities in this table are above 0.5, which indicates that the extracted components represent the variables fairly well. The lowest extraction communality is at 0.525 which is acceptable.

Table 3 showed Total Variance Explained. For the initial solution, there are six components having eigenvalues greater than 1 form the extracted solution. The second section of the table shows the extracted components. They explain 63.52% of the variability in the original fourteen variables, so you can considerably reduce the complexity of the data set by using these components, with only a 36.48% loss of information. The scree plot graphically displays the eigenvalues for each factor and suggests that there are six acceptable factors.

After factors have been selected, the next step is to rotate them. Rotation is

Table 3: Total Variance Explained

Component	Initial Eigen values			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	2.239	14.924	14.924	2.239	14.924	14.924
2	2.007	13.380	28.304	2.007	13.380	28.304
3	1.633	10.887	39.191	1.633	10.887	39.191
4	1.391	9.272	48.463	1.391	9.272	48.463
5	1.229	8.193	56.656	1.229	8.193	56.656
6	1.030	6.868	63.524	1.030	6.868	63.524



needed to achieve simple structure. The simple structure of 6 six factors from 14 variables as follow. From table 4, Factor 1 comprises three items with factor loading ranging from 0.512 to 0.776. Factor 2 comprises two items with factor loading ranging from 0.709 to 0.729. Factor 3 comprises three items with factor loading ranging from 0.782 to 0.820. Factor 4 comprises two items with factor loading ranging from 0.790 to 0.813. Factor 5 comprises two items with factor loading ranging from 0.678 to 0.810. Factor 6 comprises two items with factor loading ranging from 0.672 to 0.786.

Factor 1 is comprised of variables that measure competitive priority related to delivery merchandise:

1.1 Dependable Delivery

Table 4: Rotated Component Matrix

Factors	**Component**					
F1: Competitive Priority	1	2	3	4	5	6
1 Dependable Delivery						0.786
2 Delivery Speed						0.672
3 Low Cost			0.820			
4 Conformance Quality			0.782			
5 Volume Change			0.787			
F2: Improvement Activities						
6 Computer Numerical Control	0.636					
7 Workforce Involvement	0.776					
8 Computer aided design	0.512					
9 Material Requirement Planning					0.790	
10 Total Quality Management				0.813		
F3: Criteria of Order Winning						
11 Conformance Quality					0.810	
12 Product Durability					0.678	
13 Variety in Design		0.709				
14 Versatility of Product		0.729				
Eigenvalues	2.257	2.025	1.688	1.451	1.305	1.077
% of Variance)	14.106	12.655	10.055	9.070	8.155	6.732
Cumulative % of Variance)	14.106					
Bartlett's Test of Sphericity = 241.808 df = 105 Sig.= 0.00 Kaiser-Meyer-Olkin Measure of Sampling Adequacy = 0.557						

2.2 Delivery Speed

Factor 2 is comprised of variables that measure competitive priority related to cost and conformance quality issue:

2.1 Low Cost

2.2 Conformance Quality

2.3 Volume Change

Factor 3 is comprised of variables that measure improvement activities related to workforce participation and used of computer:

3.1 Computer Numerical Control

3.2 Workforce Involvement

3.3 Computer aided design

Factor 4 is comprised of variables that measure improvement activities related to quality improvement and management issue:

4.1 Material Requirement Planning

4.2 Total Quality Management

Factor 5 is comprised of variables that measure criteria of order winning related to quality competition issue:

5.1 Conformance Quality

5.2 Product Durability

Factor 6 is comprised of variables that measure criteria of order winning related to product variety and versatility issue:

6.1 Variety in Design

6.2 Versatility of Product

Multiple Regression analysis

Regression was conducted to assess the relationship between dependent and independent variables. The dependent variables representing firm's performance are gross profit, return on asset, return on investment, and return on equity. The independent variables are the six factors from the factor analysis results above. In SPSS, there are five options method of entering variables. "Enter" method is a useful procedure in testing all independent variables regardless of significant levels in explaining the behavior of the dependent variable. The results show that strategic variables could explain the return on equity but not for all other dependent variables. The six predictor variables together explained 16% of the variance in return on equity. Factor 1 delivery merchandise, factor 5 quality competition issue and factor 6 product variety and versatility issue have inverse relationship with return on equity. Factor 2 cost and conformance quality issue have a direct relationship with return on equity.

Discussion

Manufacturing strategy selection is a complicate and difficult decision especially in a market situation with high competition. Furthermore, there are too many strategies to choose from. The adoption of a strategy is costly. The factor analysis method applied here helps reduce a number of strategies to a group of non-duplicated and effective strategy. From the 25 strategies identified from previous research, we have reduced and combined strategy down to six groups of strategies.

Up to this point, the analysis achieved combining and reducing of strategies. The multiple regression analysis is applied for modeling and analyzing several variables, focusing on the relationship between firm's performance (dependent variable) and the total of six groups of strategies (independent variables). The regression result showed that if we adopted one of the four groups of strategies, the firm's performance

would change. From regression result and strategy model, the return on equity would be reduced in response to the change by emphasis more on:

1. The competitive priorities in delivering merchandise.
2. Criteria of order winning in quality competition.
3. Criteria of order winning in product variety and versatility.

On the other hand the return on equity would be increased in response to the change by emphasis more on Competitive Priority on cost.

CONCLUSION

The outcome of the study provides support that the choice of strategies has an influence on firm's performance. Some manufacturing strategies are identified here but there might have some other factors affecting firm's performance. The four key factors are strategies on delivering merchandise, quality competition, product variety and versatility, and cost and quality conformance issue. In the *competitive priorities* in delivering merchandise and criteria *of order winning* in quality competition and product variety and versatility have an inverse relationship with return on equity. It is very simple and straight forward. If you want to achieve dependable delivery and delivery speed, your cost must be increase. To achieve conformance quality, product durability, variety in design, and versatility of product are increasing cost activities and decreasing the return on equity. However, reducing cost strategies such as low cost, quality conformance, and volume change could increase return on equity.

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Regression Result

Model Summary

Model	R	R Square	Adjusted R square	Std. Error of the Estimate
ROE	.401(a)	.161	.112	18.37807

ANOVA

Model		Sum of Squares	Df	Mean Square	F	Sig.
ROE	Regression	6619.737	6	1103.289	3.267	.006(a)
	Residual	34450.863	102	337.754		
	Total	41070.600	108			

Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta	B	Std. Error
ROE	(Constant)	101.543	30.610	3.317	.001	
	Factor 1	-24.835	7.426	-.374	-3.344	.001
	Factor 2	13.784	6.099	.250	2.260	.026
	Factor 3	-1.199	5.088	-.022	-.236	.814
	Factor 4	3.209	3.949	.075	.813	.418
	Factor 5	-9.980	4.744	-.197	-2.104	.038
	Factor 6	-8.012	3.684	-.202	-2.175	.032

a Dependent Variable: ROE50

Strategy Model