Competitive Priorities and Export Success of Semiconductor Equipment Manufacturing Firms in Singapore

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Abstract— **The semiconductor manufacturing sector in Singapore as a knowledge-based and innovation-driven sector has grown as one of the most important world suppliers for wafers in a way that today up to 11% of the world's wafer output is produced in this country. Outstanding export success of firms engaged in semiconductor industry as a key manufacturing sector in Singapore necessitates studying export success of these companies from a new strategic and manufacturing view point. From such perspective, investigating factors influencing the export success of companies working in this sector is of a great significance. Using data from 36 semiconductor manufacturing units, this study intends to investigate the contribution of the firm's four competitive priorities to export success of Singaporean semiconductor equipment manufacturing firms. The four competitive priorities namely, quality, low cost, flexibility and delivery were regressed against export success through multiple regression analysis performed by SPSS 17 software using the stepwise method. The findings from this study depicted that among the four competitive priorities quality and low cost have a positive and significant relationship with export success of Singaporean semiconductor manufacturing firms while there is no significant relationship between delivery and flexibility and export success. Moreover, the study findings also illustrated that the most important competitive priority that contributed in predicting export success was quality. This study can be considered as a platform for Singaporean semiconductor manufacturing firms' managers in order to take more advantages of quality and low cost aspects of their productions especially when competing on a global scale and also planning to enter in to new international markets.**

Keywords: competitive priorities, export success, semiconductor industry, Singapore

I. INTRODUCTION

Manufacturing sector in Singapore is a significant contributor to this country's growth, creating around a third of Singapore's annual GDP. The semiconductor industry in Singapore dates back to early 1960.Traversing a lengthy root from an early era of assembling and testing, now the industry is developed into the largest segment of Singapore's electronics sector which itself is one of the pillars of manufacturing sector in this country. This astonishing growth turned the country in to a leading semiconductor hub in the world, and positioned Singapore as the second world supplier of wafers. Considering the export success's significant role in providing economic growth and wealth of nations, studying the determinants of export success has become a remarkable field of study during the last decades. The considerable success of Singapore in export of wafers incited the authors to investigate the factors influencing export success of Singapore's semiconductor industry from a new strategic perspective. In this regards, the impact of competitive priorities consisting of quality, low cost, flexibility and delivery on export success of semiconductor manufacturing firms in Singapore is investigated through this study.

Competitive priorities have been long studied in the literature of operation and manufacturing strategy. In one manufacturing firm, those organizational goals which are strategically determined and set are referred to as competitive priorities [16] .In other words, firm's strategic approaches in confronting rivals in competitive markets is called competitive priorities[9]. Basically there are a number of four generally accepted competitive priorities: quality, low cost, flexibility and delivery[9].However, innovativeness was also suggested as another competitive priority by [19] which is now widely accepted as the fifth competitive priority in the literature. In this study we have only investigated the link between the four basic competitive priorities including low cost, flexibility, delivery and quality and the export success of semiconductor manufacturing firms in Singapore. Moreover, the competitive priorities are measured based on the level of emphasis a manufacturing firm places on each one of the four competitive priorities in order to maintain its competitive edge [32] .This method was utilized by most authors e.g. [1] , [19].

To the best of our knowledge, there are no studies in the literature that address the relationship between firm's competitive priorities and its export success.

II. COMPETITIVE PRIORITIES

Within the context of manufacturing strategy literature, the dimensions of manufacturing strategy are identified as firm's competitive priorities [8].As manufacturers' choice of manufacturing tasks [1] competitive priorities are specifically taken into consideration as strategic capabilities which are considered as "the dimensions that a firm's production system must possess to support the demands of the markets that the firm wishes to compete in" [17 p. 47] which are also interpreted as production competence within the literature and play a key role in business success of the

firm in competitive markets[6].Indeed, from manufacturing perspective, the strategy literature has long advocated the significance of competitive priorities in achieving business success for the firm. In this study also, the link between competitive priorities of semiconductor manufacturing companies in Singapore and their success in export is investigated.

Within the mass body of manufacturing and operation strategy competitive priorities are extensively identified as: quality, low cost, flexibility, delivery, and innovativeness [4, 32, 29, 9 and 19].In this study the four basic competitive priorities are identified as independent variables which are elaborated as follows :

Quality is linked with the conformance of products to design specifications and high product performance [30, 12 and 32].From manufacturing perspective, manufacturing managers are accountable for conformance to specifications by monitoring different progresses and assessing the level of conformance of employees to conventional specifications [25 , 2].

Flexibility is associated with how capable the firm is in changing its production volume and /or capacity [24, 27 and 32] firm's capability in production of wide range of products [3] firm's ability in changing products features based on customer needs in short time period [9, 32]; firm's ability in handling customer delivery requirements [14] and the ability of the firm in customizing products based on customer specifications [13].

Delivery is defined as reliability of firm's promises about product delivery along with providing customers with more rapid and on time deliveries in comparison to competitors [26, 20].Indeed delivery can be categorized as delivery reliability and delivery speed [11].Firm's ability in fulfilling its commitments to delivery is referred to as delivery reliability and firm's ability in rapidly delivering products to customers with a higher speed than rivals is called delivery speed. According to [10], the issue about delivery reliability and delivery speed arises only when the required time for backlog of the order in addition to time required for processing of the order completion exceeds the time of delivery which is needed by the customer. In this study delivery is associated with Diminishing manufacturing lead time [10], controlling lead time of order [30], providing speedy deliveries [10] and meeting delivery dates [20].

Low Cost is defined as high level of labor productivity [5]; low level of inventory cost [5]; controlling production cost at low level [20]; and utilization of capacity in a high level [28]. Through standardizing processes and reducing errors, companies can implement low cost competitive priority and implementing intensive cost controls [9,15 &23].

III. EXPORT SUCCESS

Measuring export success is possible by measuring a single variable only; however, creating a construct of a group of variables can provide a more reliable measurement regarding export success intricacy [21]. In this study we operationalized export success as the dependant variable of the study in terms of profitability, export volume and export intensity based on a previous study by [7]. Accordingly,

profitability is measured based on a three point Likert scale ranging from raised profit margin, unchanged profit margin and reduced profit margin in duration of last twelve months, export volume is assessed as an explicator for firm's export operations scale in duration of last twelve months, export intensity is assessed as sales percentage achieved through exports in duration of last twelve months and eventually, export success is measured as the summation of the standardized scales of the three aforementioned measures.

IV. METHODOLOGY

In this study primary data was collected via a questionnaire which was developed based on a study by [18] and another study conducted by [7].The data was collected through simple random sampling procedure from exporting firms, engaged in Singapore's semiconductor manufacturing industry. Furthermore, to examine the relationship between the four competitive priorities and export success of Singaporean semiconductor manufacturing firms, the multiple regression analysis was used.

V. SAMPLE SIZE

For the purpose of this study the sample size of 54 Singaporean semiconductor manufacturing firms was selected among which 14 companies produce wafer fabrication, and about 40 companies produce Integrated Circuit (IC). The questionnaire was emailed to each one of the companies in order to collect primary data. Moreover, to provide respondents with more clarifications a brief description of the study was enclosed to the questionnaires. In order to improve the response rate, after five days we started calling companies to remind them to answer to the questionnaires and provide them with additional explanations and clarifications. Finally, a number of 41 questionnaires were collected after six weeks among which 36 questionnaires were complete. The collected data was then analyzed by SPSS software, through multiple regression analysis. The results of the analysis are presented in data analysis section.

VI. RESEARCH MODEL

To determine the relationship between the four competitive priorities consisting of quality, low cost, flexibility and delivery as independent variables and export success as dependant variable of this study, the following model is presented and empirically tested.

VII. DATA ANALYSIS

To examine the relationship between the firm's four competitive priorities and export success, the multiple regression analysis was used. The relationship was tested by using Stepwise method. As the measurement unit for dependant and independent variables differs, we first standardized the data. However, it is imperative to mention that for Multiple Regression Analysis the normality assumption must be examined. In order to examine the normality assumption the Shapiro-Wilk test was performed ($3 < n \leq 2000$). The Shapiro-Wilk statistics reported the p-value of 0.314, which is more than 0.05. Thus, the data was normally distributed. Hence, the quality, low cost, flexibility and delivery were regressed against Export success using Stepwise Multiple Regression Analysis.

The summaries of regression analysis were portrayed in Table 1, Table 2, and Table 3. As shown in Table 1, SPSS produced two models. The model 2 was selected as final model to investigate the relationship between competitive priorities and companies export success. From the Table 2, the ANOVA procedure provided F-value (F=8.144) which was significant at $\alpha = 0.05$ (Sig=.002<0.05). This means the regression model is significance and at least one of the four predictors can be utilized to predict companies export success. The Durbin-Watson of 2.030 dropped between 1.5 and 2.5 that represented no autocorrelation among the error terms. Therefore, it verified that all error terms were independent. In Addition, the regression provided the R-Square of 0.212.

TABLE I.   TABLE OF MODEL SUMMARY FOR "STEPWISE" METHOD

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.384(a)	.141	.134	. 59231	
2	.512(b)	.212	.225	.57534	2.030

TABLE II.   TABLE OF ANOVA FOR "STEPWISE" METHOD

Model	Sum of Squares	Mean Square	F	Sig.
1 Regression	3.430	3.430	9.841	.003(a)
Residual	18.041	.364		
Total	21.471			
2 Regression	5.341	2.991	8.144	.002(b)
Residual	15.991	.351		
Total	21.332			

For model 2, the collinearity statistics clarified that tolerance statistics for Quality and Low Cost were all greater than 0.1, and VIF (Variation Inflation Factors) were all lesser than 10. Therefore, the results represent no multicollinearity problem. Hence, the basic assumptions are met and regression modeling is supported strongly. Table 3 verified that there were two competitive priorities including Quality and Low Cost that were positively associated with Export success. As shown in Table 3, the two predictors namely Quality (p=.003<0.05), Low Cost (p=.030<0.05) were all directly contributed in predicting export success. Furthermore, the results also indicated that the most important dimension that contributed in predicting export success was quality (B=.512).

TABLE III.   TABLE OF COEFFICIENTS FOR "STEPWISE" METHOD

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
	B	Std. Error	Beta			Tolerance	VIF
1 Constant	1.014	.721		1.403	.112		
Quality	.548	.164	.384	3.011	.003	1.000	1.000
2 Constant	-.162	.813		-.179	.801		
Quality	.512	.169	.311	3.012	.003	.992	1.009
Low Cost	.341	.147	.302	2.212	.030	.992	1.009

VIII. CONCLUSION

In this study the relationship between competitive priorities and export success of Singaporean semiconductor manufacturing firms is investigated. The four basic competitive priorities consisting of quality, low cost, flexibility and delivery were regressed against export success. The results from data analysis showed a positive and significant relationship between quality and low cost and export success of semiconductor manufacturing firms in Singapore. However, the study findings illustrated that the most significant competitive priority that contributed in predicting export success was quality. The findings also depicted that there is no significant relationship between flexibility and delivery as firm's competitive priorities and export success. Hence, the regression equation was estimated as ES= -.162 + 0.512Q + 0.341LC, where ES = Export

Success, Q= Quality and LC=Low Cost. Therefore in this only two competitive priorities were positively associated with export success. Indeed, semiconductor manufacturing firms in Singapore highly emphasized on quality and low cost competitive priorities. As mentioned, in this study quality was the most important predictor for export success. The importance of quality illustrated by this study is in line with the study by [1] which identifies quality as the most important dimension of competitive priorities in manufacturing firms. Low cost also was identified as another predictor of export success in Singaporean semiconductor manufacturing firms. According to [31], cost reduction is considered as a prime task by managers in manufacturing companies and is the basis of decision makings and actions. The results from this study elaborated the significance of manufacturing strategies for achieving success in exports. However, some limitations confine the generalizability of the results which necessitates further studies bout other industries and regions. These limitations are discussed as follows.

IX. LIMITATIONS AND FURTHER RESEARCH

This study is conducted based on the data collected from semiconductor manufacturing companies in Singapore. Differences in term of geographic distinctions and industry dissimilarities must be considered in generalizing the results. Indeed, the generalizability issue unavoidably results from conducting the survey based on a limited number of participants and extrapolation of the samples to populations. Lack of sufficient literature in context of the linkage between competitive priorities and export can be also mentioned as a further constraint. In this study the contribution of the four basic competitive priorities including quality, low cost, delivery and flexibility to export success is investigated through multiple regression analysis. Further study is intended to examine the link between innovativeness as another widely accepted competitive priority and success of the firm in export. Another further research suggestion could be examining the longitudinal influence of export success in terms of investigating the short-term and long-term impacts of previous export success on the explanation of manufacturing strategies. The association of firm's competitive priorities to export performance can be also considered as another future study.

X. CONTRIBUTION

This paper expands the current body of studies associated with export success through investigating the link between firm's competitive priorities and export success and therefore contributes to strategic capabilities of the firm which can influence its success in export. Above all, the results from this study illustrated that building a connection between the most emphasized competitive priorities and firm's export success is a critical factor for a manufacturing firm to endure in today's highly competitive foreign markets. The current study has also some contributions to the top executives and manufacturing managers involving in semiconductor industry especially in Singapore advising that this study identified 2 out of 4 competitive priorities significantly contributed to export success. As this survey is conducted based on Singapore's business environment, it can provide Singaporean Semiconductor Manufacturing firms with new strategic insights in order to develop their products and services and improve their export activities within foreign markets and eventually achieve a higher level of export success through formulating proper competitive manufacturing strategies.

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