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AN ANALYSIS OF THE THAI AUTOMOTIVE PARTS SMALL-MEDIUM ENTERPRISE (SME) PRODUCTIVITY DEVELOPMENT PROCESS

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ABSTRACT

Thailand ranks 12th in the world in vehicle production and first in Southeast Asia. Thailand also hosts over 50% of the world's top OEM automotive parts suppliers, with approximately 1,800 Tier 2 and Tier 3 auto parts manufacturers' which are classified as small-medium enterprises (SMEs). Given Thailand's significant contribution to the global automotive industry, a study was undertaken to determine the effects of the variables' financial factors (FF), supply chain management (SCM), and quality management (QM) on the Thai auto part SME productivity development (PD). Multi-stage cluster sampling was used to select the 402 individuals used in the sample. The research instrument used was a 42 item questionnaire for Part 2's 5-level Likert type agreement scale questionnaire, whose data were analyzed by use of SPSS Version 23 software and the AMOS module. Study results determined that there were negative influences from Thai organizational culture, as well as the role that SCM can play in smaller SMEs that have no relationship with a large partner. However, the variance of factors influencing Thai auto parts SME productivity development (R^2) was determined to be 60.5%. Furthermore, factors influencing a Thai auto part SME PD were FF, SCM, and QM, with values of 0.775, 0.532, and 0.337, respectively.

INTRODUCTION

Thailand has become a significant manufacturing base in Southeast Asia, especially in the production of auto parts, with the automotive sector has become Thailand's third-largest industry. Ever since the early 1960s, Thailand's officials have stated that automotive policy is a critical pillar in

developing the Kingdom's economy and creating new local labor, with the ever-changing governments always recognizing the importance of attracting new investment and expansion within the sector.

Additionally, the Organisation for Economic Co-operation and Development (2018a) has stated that Thailand works to maintain strong supply-chain support for domestic organizations involved in manufacturing and production, especially those companies that have been recognized as small-medium enterprises (SMEs). At the end of 2018, Thai officials stated that there were approximately three million SMEs (Christianty, 2018), 400,000 of which were in the manufacturing sector. Moreover, these SMEs were growing at an annual rate of 6%, which is 2018, represented 42.8% of the Kingdom's total gross-domestic-production (GDP) ("DIP undertakes "Change to SHIFT" mission", 2018).

Furthermore, within the Thai SME sector, Thai automotive manufacturers and parts suppliers represent approximately 1,800 companies, most of which are automotive parts suppliers (Yongpisanphob, 2019). Of these, approximately 1,100 are Thai owned SMEs being classified as either Tier 2 or Tier 3 suppliers.

Also, according to Petcharit et al. (2020), Thailand’s automotive parts exports are destined to over 100 countries and are ranked 13th globally. Moreover, the Thai automotive industry represents 10% of Thailand’s GDP and is the 12th largest automotive producer in the world (Maikaew, 2019), the sixth-largest global commercial vehicle producer, and the second-largest manufacturer of one-ton pickup trucks (Board of Investment, 2016).

However, in 2019 and 2020, the Thai automotive industry has undergone a dramatic upheaval due to a US-China trade war (Maikaew, 2019), and the global COVID-19 pandemic. Results from which have contributed to a dramatic drop in local demand, major supply chain disruptions, and a significant decrease in overall production output. Statistics from 2020 report a 38.76% decline in production in the first nine months of 2020, when compared to the same period in 2019 (Agwan, 2020), with only 963,066 units having been produced. Weak overseas demand from the impact of COVID-19 has been stated as the prime reason, with the cumulative first three-quarters of 2020 production for both domestic sales and exports declining by 40.13% and 37.49%, respectively, from the 2019 production level of 2.01 million units.

However, before the COVID-19 impact on Thai automotive and parts production, the automotive sector employed an estimated 850,000 workers (Maikaew, 2019). By value, the OEM (original equipment manufacturer) vehicle assembly process market represents 30 – 40% of the total auto parts market in Thailand, with automobiles averaging 80% local content, pickups 90%, and motorcycles nearly 100% composed of Thai-produced parts (Yongpisanphob, 2018). Additionally, the replacement equipment manufacturers (REM) market takes the remaining 60% – 70% of the market for auto parts.

To better understand the Thai auto parts markets, one needs to understand its growth has tracked with the growth of Thailand's domestic vehicle sector, which has been significant, rising from 9.74 million accumulative registered automobiles (the REM market) in 2008 to 16.24 million in 2016 (Yongpisanphob, 2018). The numbers for motorcycles were equally as impressive, rising from 16.43 million in 2008 to 20.48 million in 2016. Even more staggering is the fact that Thai drivers registered 1,614,576 vehicles from January to June 2018 ("More than 1.5 million new vehicles registered", 2018).

Entrepreneurial SMEs also play a major part in the production of auto body parts replacement, as well as in the upstream to the downstream process. One reason for their success has been out-of-warranty vehicles within the Kingdom increased to 14 million vehicles in 2020 (with more than 5 million vehicles between 3 – 8 years old). Finally, over half of the Tier 1 suppliers are automotive part companies as well, with 54% producing parts for automobiles, 28% parts for motorcycles, and 18% doing both (Yongpisanphob, 2019). Finally, Thailand hosts 50% of the top 100 auto parts manufacturers in the world.

In 2018, the Kingdom ranked 1st in ASEAN (Association of Southeast Asian Nations) for the export of all types of auto parts and 14th globally for auto parts, and seventh for motorcycle parts (Yongpisanphob, 2019). During the first three months of 2020, Thai produced auto parts exported to ASEAN nations reached a value of approximately $1.49 billion, while in the same quarter, total auto parts exported globally reached around $6.27 billion (Statista Research Department, 2020).

Another element critical to this sector is the financial factors (FF) involved in Thai auto parts SME PD. This includes easy access to credit and equity finance, as finance is a necessity in any SME's development. However, numerous SMEs in developing economies with limited credit sharing capabilities encounter considerable difficulty in obtaining lines of credit, especially when compared to larger, international firms (Harvie et al., 2013).

Additionally, in an analysis of total quality management (TQM) practices within ASEAN automotive industries, it was stated that the motivation for TQM comes from a highly competitive automotive market and customer pressure (Punnakitikashem et al., 2010). However, Tier 3 suppliers are far less likely to implement TQM unless their suppliers get involved. Also, according to Petcharit et al. (2020), often time the terms Kaizen (used by Japanese firms) and TQM are used interchangeably, but in reality, they are different concepts. This is important to understand, as a large number of Thai auto parts firms are either owned or substantially influenced by Japanese companies. Moreover, in the highly competitive, ever-expanding, global marketplace, consumer quality demand is emerging as one of the most crucial elements in a firm's success and eventual survival (Curkovic et al., 2000; Garvin, 1988; Zakuan et al., 2009).

It has also been observed that supply chain management (SCM) is also a crucial element in enhancing a manufacturing plant's financial results, with Barrak et al. (2017) contending that as inventory increases relative to sales,

manufacturing efficiency decreases. Therefore, efficiency is calculated as an allocation fill rate (AFR), with the SCM process striving for an AFR of 95.5%, while also maintaining minimal stock levels. Therefore, the automotive parts supply chain efficiency operates using the concepts of just-in-time (JIT) delivery of lean manufacturing to maintain access to a wide variety of parts without having to keep them in inventory (Botha et al., 2017). Additionally, according to Krugman (1997, p. 11), "Productivity isn't everything, but in the long run, it is almost everything." (Krugman, 1997, p.11), as a nation's ability to increase its living standard is significantly dependent on the nation's ability to increase its output per worker.

In Singapore, productivity (P) development has been a key theme across all sectors of the economy and its top-ranked educational system, with P being defined as the relationship between output (O) and input (I) (Woon & Loo, 2018). Output relates to the type of products which are the goods produced or services delivered. Input is composed of the resources (R) used in producing the products, with the primary resources being labor and capital (e.g. machinery and equipment). P is, therefore, an indication of how well the resources are used to produce the products, with a higher ratio indicating higher productivity.

Productivity output is also expressed in monetary terms, with a common measure being a value-added (VA), where VA = revenue (Re) minus the bought-in materials and services required for production (MSP). This measure is applicable at the enterprise, sector, and economic levels, whereas at the economic level, it is known as the gross domestic product (GDP) (Woon & Loo, 2018). The growth of GDP over time is referred to as economic growth.

When labor is used as the input in the output-input ratio, the productivity measure is known as labor productivity (LP) (Woon & Loo, 2018). The elements used to access LP are VA, L, and the total work hours (TWH). According to the use of this formula by the Singapore government, the number of workers is used as obtaining the data for the number of hours worked comes at great expense and difficulty. At the economic level, the labor productivity measure is GDP per worker or GDP per hour worked. This increased productivity from year to year is known as labor productivity growth, which is the most common measure of productivity.

Total Factor Productivity (TFP) is a combination of labor and capital (Woon & Loo, 2018, p.5), which has three elements including VA, workers (W), and capital (C). TFP is thereby equal to VA divided by W plus C, with TFP measuring how efficient labor and capital are used to produce products. Once again, according to Krugman (1997, p.12), increasing productivity is the only method in which long-term, sustainable; living standard growth can be achieved. If the reader would like to view the formulas for P, VA, LP, and TFP, as well as an expanded explanation, please visit this link at https://tinyurl.com/y4kwzplw.

Research objectives

To obtain the study's sample from the population of 1,800 automotive industry organizations, multi-stage random sampling was used to select 402 supervisors/managers who were working within Thai automotive car manufacturers, specialized car dealerships, and specialized car parts manufacturers in Bangkok's metropolitan area, and the three surrounding provinces of Samutprakan, Rayong, and Chonburi (Table 1).

Furthermore, the study set out to investigate the interrelationships between each firm's FF, their QM processes, and the SCM's effects on their business performance. Hence, the study generated the following research questions:

To what extent do a firm's financial factors affect the SME's QM and SCM processes?
Other key questions were how do each SME's FF, QM, and SCM programs affect PD?
By use of both a confirmatory factor analysis (CFA) and structural equation model (SEM), the interrelationships of FF, QM, and SCM on Thai automotive parts SME PD, will be investigated.

Research hypothesis

Therefore, we determined that there was significant support from the literature review for FF, as well as the inclusion of the manifest variables foreign corporate investment (FCI) and owner capital (OwnC). It was also determined that the latent variable QM, along with its manifest variables Intrapreneurship (INTRA), organizational culture (OC), and human resource management (HRM) were a good fit for the study. Additionally, SCM was selected as well as its related manifest variables lean manufacturing (LEAN), logistics management (LOGM), and outsourcing (OUT). Concerning PD, we selected employee value-added (VA), labor productivity (LP), and total factor productivity (TFP) as PD's manifest variables for analysis. Finally, we conceptualized the following five hypotheses for the model's analysis:

H1: FF influences QM both directly and positively.
H2: FF influences SCM both directly and positively.
H3: FF influences PD both directly and positively.
H4: QM influences PD both directly and positively.
H5: SCM influences PD both directly and positively.

METHODOLOGY

Development of the research instrument

From our review of the literature and related theory, four latent variables were identified. From this, a five-part draft questionnaire was developed, consisting of Part 1's personal and job-related information. Part 2 was concerned with 13 items about FF, Part 3 with 12 items about QM, Part 4 with 9 items about SCM, and finally, Part 5's 8 items concerning PD. Furthermore, three experts

from the private sector and two from my university were asked to assist with the draft questionnaire's reliability assessment. From the Saturday afternoon question and answer session, scaled assessment questionnaires were used to evaluate each expert's opinions on each item's appropriateness, importance, and phrasing. From the experts' feedback, the Index of Item-Objective Congruence (IOC) was used to find the content validity (Turner & Carlson, 2003) on the questionnaire's 42 five-level agreement scale items (Parts 2 – 5). By accepted definition, IOC scores ≥ of 0.50 are considered acceptable, with items below this threshold normally revised or rejected. The units of scale measurement were; strongly agree (4.21 – 5.00), agree (3.41 – 4.20), undecided (2.61 – 3.40), disagree (1.81 – 2.60), and finally, strongly disagree (1.00 – 1.80). The questionnaire content validity assessment made use of Cronbach α values (Table 1), which were collected from the initial pilot-test of 30 individuals who did not participate in the final survey (Table 2).

Sample and data collection

Sample size determination made use of research from multiple studies in which it was reported that in the results from Monte Carlo simulation studies and other CFA models, that a researcher's sample is better if it includes a minimum of at least 200 individuals, but larger sample sizes of 400 assure better CFA results (Bartholomew et al., 2008; Tabachnick & Fidell, 2013).

Therefore, from the population of 1,800 Thai automotive industry organizations, multi-stage random sampling was used to select 402 individuals who were working within Thai automotive car manufacturers, specialized car dealerships, and specialized car parts manufacturers in Bangkok's metropolitan area, and the three provinces of Samutprakan, Rayong, and Chonburi (Yongpisanphob, 2018).

Moreover, Table 1 shows the final results from the sampling process as broken out by specialized automotive dealerships, automotive manufacturers, and specialized auto parts manufacturer.

Table 1: Final sampling process results

Auto Parts Industry Management	Total		Specialized automotive dealerships	Automotive manufacturers		Specialized auto parts manufacturer		
	No.	%	No.	%	No.	%	No.	%
SMEs ≤ 50 employees	334	83.1	40	63.5	17	65.4	277	88.5
SMEs ≥ 51 - 200 employees	68	16.9	23	36.5	9	34.6	36	11.5
Totals	402	100.0	63	100.0	26	100.0	313	100.0

Confirmatory factor analysis (CFA)

CFA analysis was undertaken with the use of IBM's® SPSS® (Statistical Package for the Social Sciences) Version 23 software and the AMOS module. From this, the □2 value theory suggests that it should not be statistically significant ($p \geq 0.05$), with a □2 / df (degrees of freedom) value ≤ of 2.00. Convergence validity should also be used to measure factor loadings of the observed variables and latent variables. Additionally, all factor loadings should show values ≥ 0.5, with the reliability of each construct examined through the CFA by use of composite reliability (CR ≥ 0.6). Furthermore, model fit validity is also tested by using the average variance extracted (AVE), and the comparative fit index (CFI) which have suggested values ≥ .95. The standardized root mean square residual (SRMR) ≤ 0.05 and the root mean square error of approximation (RMSEA) should also be used as a measure of the models' goodness-of-fit (GOF) (Hu & Bentler, 1999).

RESULTS

Respondents' characteristics (n=402)

The majority of respondents were male (322 or 80.1%), between the ages of 31 - 40 (272 or 67.66%), and held supervisory roles (288 or 71.64%), as compared to higher-level manager roles (114 or 28.36%).

Goodness-Of-Fit (GOF) analysis results

The GOF appraisal used accepted criteria provided in the SPSS 23/AMOS module software. As such, the CMIN (Chi-square) (49.75) was determined as not being statistically significant ($p \geq 0.05$), with the CMIN/df = 1.42 (≤ 2.00). Also, both the RMSEA and SRMR values of 0.03 were under the accepted criteria of ≤ 0.05. The goodness-of-fit index (GFI) was also determined as 0.98, which shows a good fit as it is ≥ 0.90. Also, the value for the adjusted goodness-of-fit index (AGFI) was 0.96, which also indicates a well-fitting model as its value was ≥ 0.90.

Table 2: Results from CFA analysis for the study's latent and manifest variables.

Constructs	mean	CR	AVE	Manifest Variables	Loading	R^2
FF (13 survey items)	0.75	0.15	0.08	Foreign Corporate Investment (FCI)	0.413	0.171
				Owner Capital (OwnC)	0.402	0.162
QM (12 survey items)	0.91	0.87	0.69	Intrapreneurship (INTRA)	0.841	0.707
				Organizational Culture (OC)	0.911	0.829
				Human Resource Management (HRM)	0.908	0.825
SCM (9	0.78	0.64	0.38	Lean Manufacturing	0.793	0.629

survey items)				(LEAN)		
				Logistics Management (LOGM)	0.628	0.394
				Outsourcing (OUT)	0.809	0.655
PD (8 survey items)	0.81	0.72	0.47	Employee Value Added (VA)	0.924	0.854
				Labor Productivity (LP)	0.718	0.515
				Total Factor Productivity (TFP)	0.611	0.374

SEM results

The SEM results from the model's analysis showed consistency with the data in Table 3 and Table 4. The variance of constructs influencing the increase of PD (R^2) was determined to be 60.5%. Factors influencing PD were FF, SCM, and QM, with total effect values of 0.775, 0.532, and 0.337, respectively (Table 3). Finally, we note the significant interrelationship DE strength between SCM and FF (1.050).

Table 3 Decomposition of the correlation matrix for PD

Dependent variables	Effect	Independent variables		
		FF	QM	SCM
PD	DE	-0.067	0.337	0.532
	IE	0.842	-	-
	TE	0.775	0.337	0.532
SCM	DE	1.050	-	-
	IE	-	-	-
	TE	1.050	-	-
QM	DE	0.841	-	-
	IE	-	-	-
	TE	0.841	-	-

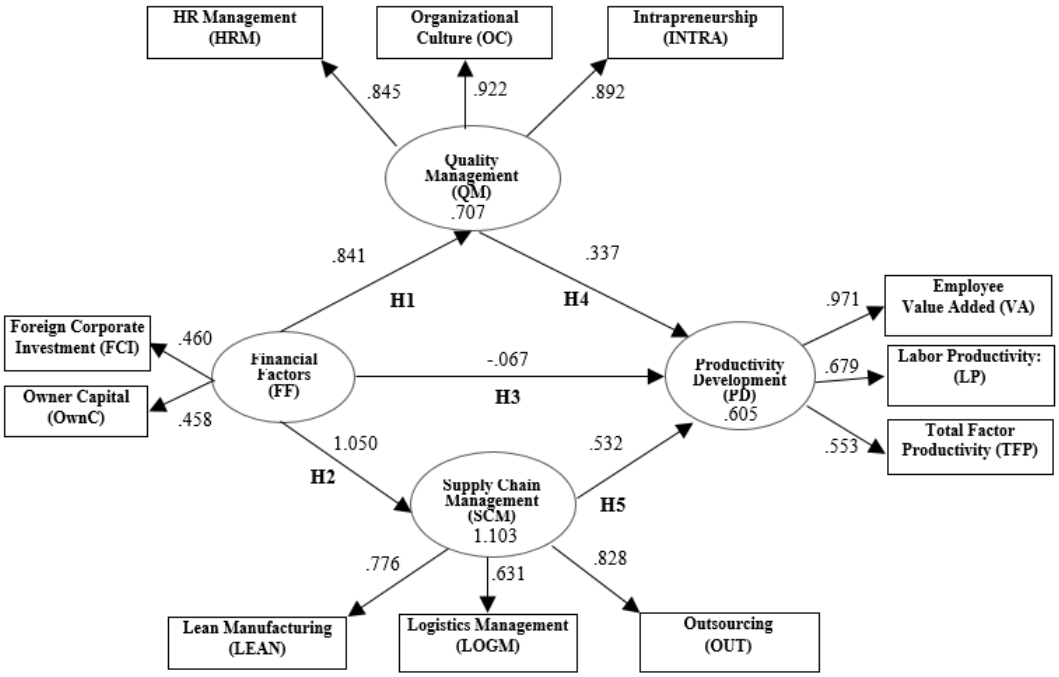
Note. DE = direct effect, IE = indirect effect, TE = total effect

Table 4: Latent variable r (Under the bold diagonal)

Variables	FF	QM	SCM	PD
FF	1			
QM	0.95	1		
SCM	0.98	0.89	1	
PD	0.90	0.81	0.79	1
AVE	0.21	0.78	0.56	0.57
Construct Reliability	0.35	092	0.79	0.79
$\sqrt{AVE}$	0.46	0.88	0.75	0.75

Note. The statistical significance level for the variables is at the 0.01 level.

Figure 1 The final model for Thai auto parts industry PD.



H1: Results from the study supported H1 and showed that FF had a direct (r = 0.841, t-value = 9.106) positive affect ($p \leq 0.01$) on Thai auto parts SME QM.

H2: Results from the study supported H2 and showed that FF had a direct (r = 1.050, t-value = 8.902) positive ($p \leq 0.01$) effect on Thai auto parts SME SCM.

H3: However, the linkage between FF and PD was rejected.

H4: Results from the study supported H4 and showed that QM had a direct (r = 0.337, t-value = 2.169) positive ($p \leq 0.05$) effect on the Thai auto part SME PD.

H5: Results also determined that the relationship between SCM and PD was rejected.

DISCUSSION

Financial factors (FF)

Nagai (2007) has noted that SME financial support resources include both private banks and public financial institutions. Examples include the SME Development Bank of Thailand, which functions under the Ministry of Industry. Another Thai government-owned group available for financial support is the Small Business Credit Guarantee Corporation (SBCG). Finally, Thai SMEs are given preferential tax treatments, inheritance tax breaks, corporate income tax cuts, and an 'extraordinary depreciation system' (Nagai, 2007).

From another study concerning 2,676 Nigeria SMEs, 33.1% indicated that lack of access to finance was the greatest hindrance to their firm's success (Igwe et

al., 2018), with a lack of access to electricity second (27.2%), and corruption third (12.7%). This is consistent with an Organisation for Economic Co-operation and Development (2018b) detailing how micro firms and female-owned businesses had great difficulty in obtaining appropriate finance. The reports also mentioned that young and innovative SMEs had the same problem. Moreover, in South Korea, it was reported by Choi et al. (2018) that SME growth was dependent on global markets. The importance of global markets is also recognized in Thailand, with the Thai government has created an export promotion framework that has one of the largest SME support budgets per capita in the world. Furthermore, SMEs' financial instruments frequently operate in thin, illiquid markets, which drive down demand from SMEs, and discourage potential finance suppliers (Nassr & Wehinger, 2016; Organisation for Economic Co-operation and Development, 2017). This is consistent with Edosomwan (1995), who additionally reported that SMEs need to broaden their range of financial instruments while developing comprehensive approaches at addressing both demand and supply-side barriers.

Finally, although FF was theorized to impact PD, the study's participants rejected the hypothesis. We, therefore, conclude this is due to the line manager's having no input in an organization's financial decisions. This is supported by other studies (Barney, 1986; Gordon, 1985; Holmes & Tangtongtav, 1995; Hult et al., 2002; Michalisin et al., 1997; Pimpa, 2012; Thanasankit & Corbitt, 2002).

Quality management (QM)

Supporting research has indicated that due to limited resources, technological change, and a highly competitive environment, only those organizations that manage both quality and productivity as an ongoing activity will be able to deal with QM issues (Chahal, 2015; Edosomwan, 1995). This is consistent with Feigenbaum (1991), who estimated that poor quality can represent 15% – 40% of a manufacturing plant's productive capacity. Finally, according to Chaichinarat et al. (2018), automotive quality is dependent on a product's longevity and strength. It also relies on a customer's satisfaction in the after-sales service process and word-of-mouth advertisement.

Supply chain management (SCM)

Significant support for the rejection of the study's final hypothesis (H5) comes from multiple studies in which it was determined that SMEs have difficulties in adopting SCM practices and operating in an SCM environment. These problems, however, have the potential to be overcome if SCM is implemented with large customers or key partners (Arend & Wisner, 2005; Quayle, 2003; Thakkar et al., 2012).

CONCLUSION

The study's purpose was to investigate how Thai auto parts SME's productivity development is affected by various factors including financial factors, quality management, and supply chain management. Since GDP growth is determined by labor growth and labor productivity growth, and since Thailand's population

expansion has dramatically slowed, product development will be a critical aspect for the nation's future growth and economic sustainability.

Access to capital is also a great concern for SMEs globally. However, when accessed from the commercial sector, it is delivered at a high rate of return. This, therefore, requires government agencies to step in. Fortunately, Thailand has acknowledged these issues and has instituted agencies and programs for SMEs to access startup and working capital. However, in Thailand, due to cultural norms, input, and control of an SME's financial and capital access process take place at a very high level within a firm. Even many publicly traded Thai corporations are run as family businesses.

However, Thailand's auto parts strength has come from the fact that, by value, over 80% of all parts used in the manufacture of vehicles are now sourced domestically. This requires everyone involved in productivity and quality management processes to have the determination to improve the work organization effectively and efficiently. Thai SME's must retain their customer focus, staff involvement, and continually make efforts to improve their QM processes. There must be active engagement between management and workers, with communications channels between them open.

Also, SCM is today tied to information technology. However, technology alone cannot make a firm profitable or competitive. Future SME SCM processes must, therefore, rely on platforms and technologies outside the normal business environment and utilize tools and software that are easily accessible and easy to use.

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