

# Effect of Driving Force, Knowledge Management, Green Supply Chain Management on Competitiveness and Business Performance of Manufacturing Industries in Thailand

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*Abstract:* - The objectives of this study were to study effects of driving force, knowledge management, and green supply chain management on competitiveness and business performance of manufacturing industries in Thailand; and to verify the goodness of fit of the hypothesis model and the empirical data. The samples consisted of 412 manufacturing industries in Thailand received from stratified random sampling. A questionnaire was employed for data collection. Descriptive statistics were used for data analysis and inferential statistics was applied for a structural equation model analysis through a statistical package. The study found that the overall level of driving force, green supply chain management, competitiveness, and business performance of manufacturing industries in Thailand is at a high level. According to the structural equation model of driving force, knowledge management, and green supply chain management, the study showed that such causal factors have influenced competitiveness and business performance of manufacturing industries in Thailand

*Key-Words:* - Driving Force, Knowledge Management, Green supply chain management

## 1 Introduction

The manufacturing industry is a major cause of global warming and degradation of nature and environment of developing countries. Nowadays, the government, especially the Ministry of Industry, has played a key role in encouraging the industry to turn the organization into a total green industrial system by providing the National Industrial Development Master Plan (2017-2022) to change the organization management system to be environmentally friendly according to the need for industrial change in multidimensions including economy, society, culture, and environment [1]. At the same time, the driving forces of external factors and internal organizational factors stimulate the organization to apply the principles of green supply chain management [2-6] for a balanced and sustainable development of Thai industry. Green

supply chain management is the key to driving Thai businesses to add values to their products and services. Further, one of the factors contributing to the successful operation of the organization is knowledge management [7] which considered as a contributing factor to the green supply chain management process. Several studies reveal that the learning organization influences the performance of the organization by contributing to organizational change, continuous development, and competitive advantages of the organization [8]. The organization's ability to learn is a factor contributed to the organization's development into a learning organization [9] and an ability to adapt to change. Knowledge management contributes to the development of supply chain activities [10] to achieve organizational goals and effective business operations in terms of profits that exceeds

competitors, efficient production, and abilities to use new technologies to develop the product based on the principles of reduce, reuse, and recycle for product design [11]. Business results from the creation of new knowledge and innovations of green supply chain management are intervening variables that contribute to the good performance, successful operation, and sustainable green organization. From the above-mentioned reasons, the researcher interested to study the relationship of causal factors in terms of driving forces, knowledge management, and green supply chain management on competitiveness and business performance of manufacturing industries in Thailand. The results of the research are the organization's awareness on the importance of driving force which considered as the causal factor for the organization to adopt the concepts of knowledge management and green supply chain management. In addition, the findings are also able to use for a causal relationship planning to improve the performance of the business and to use as a reflection of a management ability of the organization that produces goods to serve the customers' needs. The practice that is based on environmental protection in every process of the supply chain system helps to reduce the problem of global warming and leads to long-term sustainability of the business rather than a focus given to a cost reduction and profitability. Importantly, this is to prepare Thailand for the development of manufacturing industry to create a competitive advantage and sustainable business operation.

## 2 Literature Review and Research Hypotheses

### 2.1 The concept of driving force

The driving force has been cited in a widely-literature review including competitor, stakeholder, corporate image, motivation, environmental trend, customer, law and rules enforcement [12-13]. Such driving forces occur both inside and outside the organization [14]. In addition, [15] states that there are an increasing number of stakeholder expectations to reduce the environmental impact; as a result, the manufacturer comes under pressure to apply the green supply chain management. For example, industry in China has increased awareness of green supply chain operations according to the pressure given by stakeholders [3]. Similarly, [16-17] mentioned that customer demand is a key driver in the operation of the company which is very important for a creation of a competitive advantage. Further, [18] found that the driving force generated from the state, the customer, the competitor, and the

society has influenced the green supply chain management and the performance of the manufacturer. The key to green supply chain management is the responsibility and support of the senior management team which will help to reduce the negative impact on the environment and positively affect the corporate image [19]. At the same time, the driving force in a form of transformational leadership of executives will help to develop organizational learning process in the organization. Such the driving force will contribute to creating value for the organization and continuous learning. This is considered as way to create competitive advantage and growth for the organization [20-22]. In addition, [23] also found that a transformational leadership and a transactional leadership have a positive effect on knowledge sharing within the organization. As a result, the research hypotheses are formulated as following:

H<sub>1</sub> Driving force has a direct influence on knowledge management.

H<sub>2</sub> Driving force has direct and indirect influences on competitiveness.

H<sub>3</sub> Driving force has direct and indirect influences on business performance.

H<sub>4</sub> Driving force has a direct influence on green supply chain management.

### 2.2 The concept of knowledge management

Because of the intense business competition and changes in the environment, the organization tries to develop itself into a learning organization to survive in business and for a sustainable development of the organization. [24] states that knowledge is more important to the organization today and in the future than the capital. Knowledge is the property of the organization. Knowing how to work creates efficiency and effectiveness that other organizations cannot imitate [24]. The ability to improve products and services for the benefit of customers and consumers through the organization's knowledge management process in a creative way [25] in terms of quality, rapidity, and innovation leads to a competitive advantage. This should be done under a support and facilitation of executives, environmental protection, value added from recycling and this collaboration will be accomplished through the knowledge building process [26-28]. External factors are considered as the driving force for organizations to initiate the creation of knowledge management within the organization. According to the study of [29], factors in knowledge management are the factors or influences of competitive situations that drive the organization to build its own

knowledge. The starting point for building a learning organization is driven by external factors which help to create a connection among organizations, customers, suppliers, and other stakeholders. The above-mentioned factors are the driving forces for organizations to create and develop their own knowledge to maintain the ability of production, to provide a better and superior delivery of affordable products and services than competitors, and to enhance the growth of the organization. Therefore, the hypotheses concerning knowledge management are formulated as following:

H<sub>5</sub> Knowledge management has a direct influence on competitiveness.

H<sub>6</sub> Knowledge management has direct and indirect influences on business performance.

H<sub>7</sub> Green supply chain management has direct and indirect influences on business performance.

### 2.3 The concept of green supply chain management

Supply chain is dynamic and involves the flow of information, product, and fund from the beginning to the end of product life cycle. [30] mentions that green supply chain is a process that involves both inside and outside the organization since raw material importing, producing, product delivering through delivering organizations, manufacturers, distributors, and customers. The environmental impact must be taken into account at all processes [31],[5]. The study of [32] found that the key factors affecting the green supply chain management of the Thai electrical appliances and electronics industry are government regulations and supporting from the organization's executives. The findings of [32] are in accord with the study of [33] who found that the green manufacturing performance indicator has a significant impact on the ratio of operating expenses to total revenues according to the assessment of green supply chain management performance of the Thai electronics industry. Further, [34] conducted the study about influences of green supply chain management on business performance of the manufacturing industry in Pakistan and found that the factors of green purchasing, green manufacturing, and green designing have a positive impact on business performance. Green manufacturing reflects the ability to use resources at each step by planning to reduce the use of resources through the principles of reduce, reuse, and recycle. The reverse logistics cost is about 4-9% of the total logistics cost [35]. Green supply chain management is a process that starts from procurement to

distribution where all process must take into account the environmental impact. Green supply chain management is a strategy that can create a competitive advantage. As a result, the hypotheses concerning green supply chain management are proposed as following:

H<sub>8</sub> Green supply chain management has a direct influence on competitiveness.

H<sub>9</sub> Knowledge management has direct influences on green supply chain management

H<sub>10</sub> Competitiveness has a direct influence on business performance.

Based on the above literature review, a causal relationship model related to driving force, knowledge management, green supply chain management, competitiveness, and business performance of the manufacturing industries in Thailand has developed as shown in Figure 1.

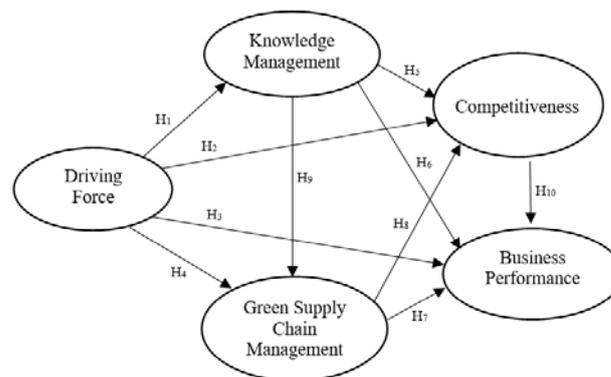


Figure 1. A Conceptual Framework

## 3 Research Methodology

### 3.1 Population and sample

The population used in this study were registered manufacturing industry and members of the Federation of Thai Industries (856 companies). Organizations from 7 groups in manufacturing industry were selected since the 7 manufacturing industrial groups are linked in a supply chain system according to their basic raw materials. The sample determination was based on the concept of [36] who states that a structural equation analysis is a technique that requires a large number of samples. The sample size should be 200 or more, or 10-20 times of observed variables [37]. The sample design of this study was designed to prevent data collection errors; therefore, the sample size was set to 2 times or about 400 samples or more. A stratified random sampling was employed in this study. The sample size of each industrial group is shown in Table 1.

Table 1. Allocation of sample size of each stratum based on a proportion of each industrial group.

Stratum	Number of population	Number of samples
Auto Parts Industry	257	120
Electricals, Electronics, and Telecommunication Industry	200	94
Plastic Industry	178	84
Steel Industry	107	50
Rubber Products Industry	92	43
Foundry Industry	41	20
Aluminium Industry	22	10
Total	856	421

#### 4 Research Tools

A questionnaire was used for data collection. A questionnaire is divided into 7 parts: 1) Part 1 is asking general information of the respondent and information about the organization; 2) Part 2 is asking information about driving force; 3) Part 3 is asking information about knowledge management; 4) Part 4 is asking information about green supply chain management; 5) Part 5 is asking information about competitiveness; 6) Part 6 is asking information about business performance of manufacturing industry; and 7) Part 7 is open-ended questions that ask the respondents for suggestions or recommendations.

The IOC (Index of Item Objective Congruence) technique was applied to verify a content validity of research instrument by 5 experts. All questioned-items had the IOC value  $\geq 0.60$  which meant the content validity of research instrument was accepted. The Cronbach's Coefficient Alpha was employed to verify a reliability of research instrument and the total reliability of research instrument was equal to 0.93. 421 sets of questionnaires were distributed to respondents via e-mail and mail. There were 412 of returned-questionnaires (97.86%). The respondents were the organization's executives and supervisors.

#### 5 Data Analysis

Descriptive statistics (e.g. mean, standard deviation, skewness, and kurtosis) was applied in data analysis to determine the level of variables and the

distribution of data. Inferential statistics including a confirmatory factor analysis (CFA) and a structural equation model (SEM) were employed to verify the goodness of fit of the hypothesis model and the empirical data by using standard statistics to test for models' acceptance. For examples, a verification of the goodness of fit of the hypothesis model and the empirical data through an analysis of covariance of estimation, a study of fit indices or indices developed based on a Chi-square test including indices such as Chi-square, df, GFI, AGFI, CFI, SRMR and RMSEA [37-39]

#### 6 Conclusion

Results of basic statistics analysis of observed variables and latent variables, and results of level analysis of driving force, knowledge management, green supply chain management, competitiveness, and business performance of the manufacturing industry in Thailand.

Table 2: Results of level analysis of latent variables

Latent Variable	$\bar{X}$	S.D.	Meaning
Driving force (DRI)	4.00	0.64	High
Knowledge management (KMA)	4.02	0.61	High
Green supply chain management (GSC)	3.90	0.74	High
Competitiveness (COM)	4.05	0.54	High
Business Performance (PER)	4.05	0.65	High

Form tables 2 shows that the latent variables including driving force, knowledge management, green supply chain management, competitiveness, and business performance have the average mean score at a high level. When analyze the level of each dimension of observed variables, the study showed that most observed variables have the average mean score at a high level (3.77-4.301). According to the driving force variable, rules and regulations has the highest mean score (4.30). For the knowledge management factor, knowledge application has the highest mean score (4.06). Owing to the green supply chain management factor, green designing has the highest mean score (3.94). In term of competitiveness factor, product quality has the

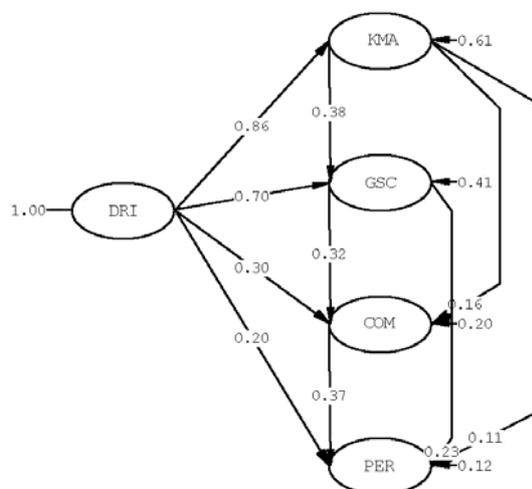
highest mean score (4.11). Finally, the environmental has the highest mean score (4.13) for the business performance factor. The standard deviation is during 0.60-0.88. Data has distributed near the average mean. The skewness value ranges during -0.35 to -1.02 with a left skewed distribution and the kurtosis value ranges during -0.09 to -0.71. However, the skewness and kurtosis values are

slightly different from zero. Therefore, it is considered that the observed variables are distributed normally, so it is appropriate to use for an analysis of structural equation model as shown in Table 3.

Table 3. Results of basic statistics analysis of observed variables

Observed Variable	$\bar{X}$	S.D.	SK	KU	meaning
1. Rules and regulations (dri1)	4.30	0.61	-0.91	0.40	High
2. Customers and consumers (dri2)	4.07	0.74	-0.63	-0.55	High
3. Competitors (dri3)	3.77	0.81	-0.60	0.16	High
4. Raw material suppliers (dri4)	3.81	0.88	-0.42	-0.69	High
5. Society (dri5)	4.25	0.69	-0.69	0.34	High
6. Supporting of executives (dri6)	4.11	0.70	-0.44	-0.72	High
7. Organization's strategies (dri7)	3.97	0.80	-1.02	0.57	High
8. Image/motivation (dri8)	3.98	0.87	-0.75	-0.18	High
9. Knowledge creation and Acquisition (kma1)	4.00	0.67	-0.42	-0.34	High
10. Knowledge sharing (kma2)	4.02	0.66	-0.84	1.24	High
11. Knowledge application (kma3)	4.06	0.63	-0.82	1.21	High
12. Knowledge storage (kma4)	4.03	0.73	-0.92	0.70	High
13. Green purchasing (gsc1)	3.81	0.86	-0.44	-0.68	High
14. Green designing (gsc2)	3.94	0.75	-0.83	0.69	High
15 Green manufacturing (gsc3)	3.97	0.84	-1.00	0.74	High
16. Green delivery (gsc4)	3.88	0.78	-0.64	-0.54	High
17. Credibility of delivery (com1)	4.10	0.60	-0.44	-0.36	High
18. Cost reduction (com2)	3.93	0.68	-0.41	-0.47	High
19. Product quality (com3)	4.11	0.68	-0.63	-0.09	High
20. Economy (per1)	4.01	0.66	-0.35	-0.50	High
21. Environment (per2)	4.13	0.75	-0.87	0.04	High
22. Organization's operation (per3)	4.01	0.76	-0.65	0.08	High

According to results of a verification of the goodness of fit of the hypothesis model and the empirical data, the study found that the causal relationship model of driving force, knowledge management, and green supply chain management on competitiveness and business performance of the manufacturing industry in Thailand, constructed by the researcher, is fitted with the empirical data (Chi-square = 52.10, degree of freedom = 59, CMIN/df = 0.88, CFI = 1.00, GFI = 0.99, and RMSEA = 0.000). The effect values are presented in Figure 2.



Chi-square = 52.10, df = 59, P-value=0.72527, RMSEA = 0.000

Figure 2. A causal relationship structural equation model

Table 4. Analysis of the effects of variables on a causal relationship model of key factors in terms of driving force, knowledge management, and green supply chain management that influence competitiveness and business performance of the manufacturing industry in Thailand.

Effect	Cause variable												R <sup>2</sup>	Effect variable	
	DRI			KMA			GSC			COM					
	$\beta$	SE	t	$\beta$	SE	t	$\beta$	SE	t	$\beta$	SE	t			
DE	0.86	0.05	15.79	-	-	-	-	-	-	-	-	-	-	0.55	KMA
IE	-	-	-	-	-	-	-	-	-	-	-	-	-		
TE	0.86	0.05	15.79	-	-	-	-	-	-	-	-	-	-		
DE	0.70	0.05	14.22	0.38	0.04	9.42	-	-	-	-	-	-	-	0.74	GSC
IE	0.30	0.04	9.32	-	-	-	-	-	-	-	-	-	-		
TE	1.00	0.05	21.17	0.38	0.04	9.42	-	-	-	-	-	-	-		
DE	0.30	0.05	5.51	0.16	0.04	3.81	0.32	0.05	6.06	-	-	-	-	0.77	COM
IE	0.47	0.06	8.40	0.12	0.02	5.26	-	-	-	-	-	-	-		
TE	0.77	0.05	13.95	0.28	0.04	6.48	0.32	0.05	6.06	-	-	-	-		
DE	0.20	0.06	3.42	0.11	0.07	1.49	0.23	0.05	4.42	0.37	0.08	4.38	-	0.86	PER
IE	0.60	0.06	9.69	0.19	0.03	5.67	0.12	0.03	3.41	-	-	-	-		
TE	0.80	0.06	14.51	0.30	0.06	4.82	0.35	0.06	6.09	0.37	0.08	4.38	-		

## Correlation Matrix

Latent variable	DRI	KMA	GSC	COM	PER
DRI	1.00				
KMA	0.74	1.00			
GSC	0.82	0.77	1.00		
COM	0.82	0.76	0.84	1.00	
PER	0.85	0.79	0.88	0.89	1.00

p &lt; 0.01

Form table 4 shows that driving force (DRI) has a direct influence on knowledge management (KMA), green supply chain management (GSC), competitiveness (COM), and business performance (PER) with the effects of 0.86, 0.70, 0.3, 0.20, respectively. At the same time, driving force (DRI) also has an indirect influence on knowledge management (KMA), green supply chain management (GSC), competitiveness (COM), and business performance (PER) with the effects of 0.3, 0.47, 0.6, respectively. These effects are statistically significant at .01. Further, the study also revealed that knowledge management (KMA) has a direct influence on green supply chain management (GSC), competitiveness (COM), and business performance (PER) with the effects of 0.38, 0.16, 0.11, respectively. In addition, knowledge management (KMA) also has an indirect influence on competitiveness (COM) and green supply chain management (GSC) with the effects of 0.12, 0.19, respectively. These effects are statistically significant at .01. Moreover, the study also found that green supply chain management (GSC) has a

direct influence on competitiveness (COM) and business performance (PER) with the effects of 0.32, 0.23, respectively. At the same time, green supply chain management (GSC) has an indirect influence on competitiveness with the effect of 0.12 at .01 statistically significant level. Finally, the study also showed that competitiveness (COM) has a direct influence on business performance (PER) with the effect of 0.37 at .01 statistically significant level.

## 7 Discussion

In general, the factors, namely “driving force”, “knowledge management”, “green supply chain management”, “competitiveness”, and “business performance”, are at a high level. This finding shows that driving force for the organization’s operation, knowledge management, and green supply chain management activities have a positive influence on business operation. This is similar to [13],[16],[40] that the beginning of a learning organization is driven by external factors and the pressure to drive the green supply chain is from

business operations and stakeholders. As a result, the business operation is improvement and gains more competitive advantages and acceptance from customers. Further, the findings of this present study are also in accord with [2],[18],[22],[37] that both internal and external driving force, such as executives, employees, laws, customers, and competitors, can develop the organization to the process of knowledge management to develop into a learning organization. It will also contribute to the added value of green supply chain management activities in the production of goods and services that resulted as competitiveness and business performance that lead to a sustainable development.

The factors, namely “driving force”, “knowledge management”, “green supply chain management” have an influence on competitiveness and business performance of the manufacturing factory in Thailand. Every mentioned factor has both direct and indirect influences on competitiveness and business performance. All mentioned factors are interrelated. This is similar to studies conducted by [10],[18],[24],[34],[41] that driving forces generated from stakeholders and business operations are important for businesses to take into account whether government regulations, consumers, competitors, societies, executives, and employees. As a result, businesses are focusing on a balance creation and knowledge management within the organization by setting the operation guidelines of the organization that given attention and importance of a good performance and environmental impact. When considering each factor separately, the findings could be discussed as following.

The driving forces generated from stakeholders and business operations consist of rules and regulations, customers and consumers, competitors, raw materials suppliers, societies, supporting of executives, organizational strategies, and image/motivation. All mentioned factors have an influence on competitiveness and business performance. They are considered as a cause variable that leads to competitiveness and satisfied business performance. However, competitiveness and satisfied business performance also require mediator variables including knowledge management and green supply chain management.

According to the study of [42], laws and policies of Japan are the driving force behind green supply chain operations. This finding is supported by [12],[13],[15],[21],[32] who found that external and internal driving forces, such as government regulations, customers, competitors, and supporting from executive, are key factors for the development of knowledge management of the organization to become a learning organization and for green supply chain activities management that has a positive influence on business operations. This leads to the network between organizations, customers, raw materials suppliers, other stakeholders and it is considered as the driving force for organizations to create and develop their knowledge to maintain the ability of production, and to provide a better and superior delivery of affordable products and services than competitors.

The knowledge management factors consist of knowledge creation and knowledge inquiry, knowledge sharing, knowledge application, and knowledge storage. It is the factor that has a direct influence on competitiveness and an indirect influence on business performance. However, it also requires a mediator factor - competitiveness. When businesses are managing their knowledge, it will make their businesses more profitable. This is because of organizations need to plan their own knowledge management strategies through the effective integration of appropriate knowledge management process and green supply chain management activities within organizations. [26] found that organizations with service activities that focus on knowledge management will be able to compete and have a better economic performance. This is similar to [29],[40] that knowledge management techniques will lead to achievement of operational efficiency and it has an influence on organizations' ability, adaptation, and performance. In addition, [43] also found that the knowledge management process ability helps to create the empirical evidence of operational efficiency of the organization.

The green supply chain management factors consist of green purchasing, green designing, green manufacturing, and green transportation. These are factors that have a direct influence on competitiveness and an indirect effect on business

performance. At the same time, it also requires a mediator factor competitiveness. According to green supply chain management, if all the processes are managed effectively, it can reduce the environmental impacts, operational cost, and raw materials and energy consumption. As a result, businesses can gain competitive advantage and achieve better business performance. This is supported by the study of [44],[45] who found that businesses that are eco-friendly have increased their competitive advantage. According to [34], the green purchasing factor and the green manufacturing factor have influenced competitiveness and positive business performance. The green designing reflects the ability to use resources at each step by planning to reduce the consumption of resources through the principles of reduce, reuse, and recycle. It is a business that should be promoted to employees in the organization to implement since this helps to enhance the environmental friendliness of the organization and is resulted in better business performance.

The competitiveness factors consist of credibility of delivery, cost reduction, and product quality. These factors have a direct influence on business performance. This is because the factor of success of every organization focuses to increase a continuous growth of the organization. Businesses that operates under the implementation of knowledge management and green supply chain activities management can reduce costs of production. Further, this also influences the development of quality product and operational efficiency from the on-time delivery of goods to serve customers' needs. This finding is in accord with [46] who found that, according to competitiveness, the economic indicators are efficiency in a reduction of production costs, profits, and an increasing rate of sales. Similarly, [47],[48] found that the ability to deliver on time will create confidence and satisfaction for customers which is a factor that determines competitive advantage of the organization. This empirically demonstrates that competitiveness leads to better business performance.

## 8 Recommendation

This research studied only the manufacturing industry in Thailand; therefore, further studies may be conducted with the population of other industries. It should be an in-depth study for additional information. Further, it a study about how to operate green supply chain activities and green supply chain performance indicators of each type of industries should be conducted.

The key problem related to green supply chain management of businesses in the manufacturing industry is industrial entrepreneurs lack of knowledge on environmentally friendly operation. As a result, the environmentally friendly operation should be promoted systematically for the development and reduction of costs. Finally, a study about costs of green supply chain management throughout the process should be conducted.

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