Applying MCDM Approach to Investigate the Impact of Supply Chain Capabilities Factors toward Turnaround Performance: A Case Study in Japanese Car Manufacturer in Thailand

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Abstract

This research proposes a multi-criteria decision-making (MCDM) framework to investigate the impact of supply chain capabilities toward turnaround performance. In this study, supply chain capabilities are determined by internal supply chain capabilities, supply chain integration and supply chain collaboration. A Japanese car manufacturer in Thailand used as a case study. Data collection was conducted by in-dept interview with six qualified experts focusing on relevant supply chain activities between Tier-one suppliers and the case company. CRITIC method is deployed to compute the relative importance weights of supplier chain capabilities. Thereafter, CoCoSo approach is used to rank the turnaround performances. The findings in this study helps the scholars and practitioners in logistics field better understand the relationship between supply chain capabilities and turnaround performance.

Keywords

Turnaround, Supply chain capabilities, CRITIC and CoCoSo

1. Introduction

Due to internal and external uncertainty factors such as Coronavirus disease (Covid-19), changes in the environment and technology, if companies do not adapt or improve their performance or service. It may impact to financial and operation performance. There are many applicable strategies to manage with these troubles such as Turnaround, which is considered as one of the remarkable interesting approaches for organization, especially under a crisis. The objective of turnaround is to alleviate firms' deterioration and recover business performance, during recession or lower profits (Chathot et al. 2006). Many researches show the benefit of supply chain capabilities toward firm's performance but there is very rare research to examine supply chain capabilities factors that enable firm to turnaround its business during crisis. Therefore, this research attempts to develop and propose as an integrated conceptual model between supply chain capabilities and turnaround on the operation level.

1.1 Objectives

There are two purposes of this study as follow:

- To investigate weight of supply chain capabilities' criterion.
- To prioritize Automotive industry turnaround that affected from supply chain capabilities.

2. Literature Review

Turnaround

Turnaround is an action that companies take to prevent low performance or financial deterioration in the face of a decline (Chathoth et al. 2006). Organizational decline can be triggered by both internal factors such as weak strategies, human resources, unutilization resources etc. and external factors such as technological advancements, politics, erroneous organizational management, etc. (Panicker and Manimala 2014). In 1994, Barker and Mone defined a shrunk corporate due to a reduction of return on investment (ROI) and return on sales (ROS) (Shahri and Sarvestani 2020). Turnaround can be divided into two levels which are strategic and operation level. When a company faces with a decline, each company uses a different strategy to restore its business. Panicker and Manimala (2014) introduced five turnaround strategies i.e. human resources, finance, marketing, product/ operations, and collaboration planning strategies. Likewise, there are two phases of turnaround i.e. retrenchment and recovery. Retrenchment is an immediate action of organization to halt the decline and increase business performance.

While Recovery strategy is to stabilize organizations (Chathoth et al. 2006). In turnaround process, top management is a key people to take an action to overcome the decline (Suffolk 2006). Moreover, Panicker and Manimala (2014) suggested a five-step successful turnaround i.e. declines & crisis, triggers for change, strategic formulation, retrenchment & stabilization and return to growth. Turnaround enables firms to improve operational performance, financial efficiency, quality services offering and increase higher competition. However, some organizations are unsuccessful on turnaround process because the decline is caused by a number of factors. The successful turnaround organization is an organization who can define the cause of deteriorations and solve timely. Most of large organization are successful in turnaround because they have more resources than small organization. In this paper, researcher attempted to collect turnaround measurement on the operation level which depicted in table 1

Table 1. Operational Turnaround Measurement

Operational turnaround indicators	Description	Source(s)
Stock Management (T1)	Organization have right level of stock which can reduce related cost such as capital, interest and management cost.	Finkin (2019); Hill et al. (2018)
Delivery Dependability (T2)	Organization have on-time delivery and can meet customer's requirement with correct quantity.	Zadeh et al. (2020)
Product Quality (T3)	Organization can provide high-quality product to meet customer's requirement with minimize defect.	Hong et al. (2019); Wu et al. (2014)
Delivery Speed (T4)	Organization can manage short time from order receiving until product delivery.	Song and Liao (2018); Zadeh et al. (2020)
Flexibility (T5)	Organization can quickly adjust the product's volume and schedule to meet customer's change.	Song and Liao (2018); Wu et al. (2014); Hong et al. (2019)
Demand Management (T6)	Organization can provide right product, right time to the right customer and avoid bullwhip effect by accurate demand forecast.	Finkin (2019); Hill et al. (2018)
Productivity (T7)	Organization can minimize input to gain more quantity of output which can reduce capital investment.	Finkin (2019); Hong et al. (2019)

Supply Chain Capabilities and related theories

Supply chain capabilities are very essential for organizations because they can drive organization to be successful. If organizations have good management in supply chain capabilities, organizations will able to see overview of all activities and suddenly solve the problem. Moreover, good management in supply chain capabilities can reduce operating costs and increase profit to organizations. In Thai manufacturing sector, Vanichchinchai (2019) classified supply chain management into transaction-based and relationship-based supply chain. Vanichchinchai (2021)

explored links between supplier relationship, customer relationship and supply performance from two integration levels: coordination and collaboration. In this paper, the researcher collects data of supply chain capabilities based on three theories which are resource base view theory, dynamic capabilities theory and transaction cost theory. Resource base view theory refers to organizations can imitate their resources, which are valuable, inimitable, exploitable and rare, so as to create a competitive advantage, improve organization's performance which can survive in crisis while dynamic capabilities theory describes the abilities of organization to adapt their internal and external capabilities in responding to the rapid change of business environment (Kirci and Seifert 2016). Moreover, transaction cost theory discusses about the co-working of stakeholder in order to reduce cost of operation. After data analyze, the researcher found that supply chain capabilities can be divided into two types; 1) intra supply chain capabilities which is supply chain capabilities; can be in table 2 and 2) inter supply chain capabilities which consist of supply chain integration and supply chain collaboration can be seen in table 3 respectively.

Table 2. Intra Supply Chain Capabilities

Supply chain perspective	Supply chain criterion	Description	Theoretical View	Source(s)
Supply chain capabilities (P1)	information system capability (C1)	Defined as a computer system, software or telecommunication that gather, organize and distribute all-important data to company. IS capabilities can help organization to get competitive advantage because it supports decision making and internal control.	Resource base view theory	Gunasekaran et al. (2017); Yeh et al. (2012); Swanepoel (2004)
	inter-firm relationship skills/relationship management (C2)	Defined as the management of relationship or interaction between company and stakeholder. The aim is long term relationship by planning strategy.	Resource base view theory, Dynamic capabilities	Gunasekaran et al. (2017); Jarratt (2008); Zolkiewski and Turnbull (2002)
	proactive/ risk management (C3)	Defined as a process that help organization to prevent loss or minimize risk from uncertainty. It consists of risk identification, risk analysis, risk assessment and risk control.	Resource base view theory, Dynamic capabilities	Gunasekaran et al. (2017); Mishra et al. (2019); Alexander (1992)
	complexity management capabilities (C4)	Organization can define essential and unnecessary thing. Then, they can response appropriately.	Resource base view theory, Dynamic capabilities	Gunasekaran et al. (2017); McKenna (1999); Aitken et al. (2016)
	supply chain knowledge management (C5)	Defined as ability of organization to manage knowledge. Firm can apply both internal and external sources to generate or create competitive.	Resource base view theory, Dynamic capabilities	Gunasekaran et al. (2017); Doepgen et al. (2020); Lee et al. (2019)

Supply chain perspective	Supply chain criterion	Description	Theoretical View	Source(s)

Supply chain capabilities (P1)	performance measurement (PMS)/ prioritizing supply chain improvements capabilities (C6)	Defined as a process of synthesize and analyze employee's activities to achieve organization's goals that were set. They must perform well by using less input to gain more output.	Resource base view theory	Gunasekaran et al. (2017); Nudurupati et al. (2020)
	skills/ talent management capabilities (C7)	Defined as human resource management system that aims staff development by up skill and knowledge in working.	Resource base view theory	Gunasekaran et al. (2017); Omotunde and Alegbeleye (2021)

Table 3. Inter Supply Chain Capabilities

Supply chain perspective	**Supply chain criterion**	**Description**	**Theoretical View**	**Source(s)**
Supply chain integration (P2)	information technology integration (C8)	The connection of information technology which allow firm and partner get real time information. It can help firm easily to manage supply chain activities.	Resource base view theory, Dynamic capabilities	Dey et al. (2012); Prajogo and Olhager (2012)
	collaborative planning (C9)	It is a process that all supply chain partner work together for planning whole supply chain activity. Members understand the goal clearly which aim to maximize profit to all chain.	Dynamic capabilities, Transaction cost theory	Dey et al. (2012); Hao et al.(2012)
	joint demand forecasts (C10)	Defined as forecast demand between supplier and customer in order to get correct information and avoid bullwhip effect Moreover, it can fullfill customer's need.	Resource base view theory, Transaction cost theory	Dey et al. (2012)
	joint replenishment forecasts (C11)	Defined as working together between supplier and customer in order to fullfill and manage appropriately stock level.	Transaction cost theory	Dey et al. (2012)
	process integration (Joint Product Development/System) (C12)	The linkage of working/activities among supply chain members which can lead to smooth flow and time reducing.	Transaction cost theory	Dey et al. (2012); Robinson and Malhotra (2005)
	reorganization of outsourcing (C13)	Firm uses outsourcing to operate supply chain activity because they are specialized in working.	Transaction cost theory	Dey et al. (2012)

Supply chain perspective	**Supply chain criterion**	**Description**	**Theoretical View**	**Source(s)**

Supply chain Collaboration (P3)	information sharing (C14)	Firm shares accurate information such as ideas or plan to partners. Partner can use the information to make decision or plan their supply chain activities.	Resource base view theory, Transaction cost theory	Cao et al. (2009); Prajogo and Olhager (2012)
	goal congruence (C15)	Supply chain members perceive their objective and commit to overall goals of whole supply chain	Transaction cost theory	Cao et al. (2009)
	decision synchronization (C16)	Defined as joint decision of all supply chain partner in operation and planning	Transaction cost theory	Cao et al. (2009); Simatupang and Sridharan (2004)
	incentive alignment (C17)	Defined as a process of sharing risk, benefit, cost among supply chain members	Transaction cost theory	Cao et al. (2009); Simatupang and Sridharan (2004)
	resource sharing (C18)	Defined as a process which supply chain members share assets or capabilities	Resource base view theory, Transaction cost theory	Cao et al. (2009); Alsaad et al. (2017)
	collaborative communication (C19)	Defined as a message or communication among stakeholder which lead to transparency and reduce risk that may occur during process.	Transaction cost theory	Cao et al. (2009); Vactor (2011)
	joint knowledge creation (C20)	Supply chain members work together to create new knowledge by sharing their own knowledge. It enhances working activity and better to response environment's change.	Resource base view theory, Transaction cost theory	Cao et al. (2009); Alsaad et al. (2017)

This paper aims to fill the gap of research analysis by concentrate on analysis supply chain capabilities that enable the automotive industry to recover its business during crisis. The researcher develops and presents an integrated conceptual model based on literature review and theory as shown on fig 1.

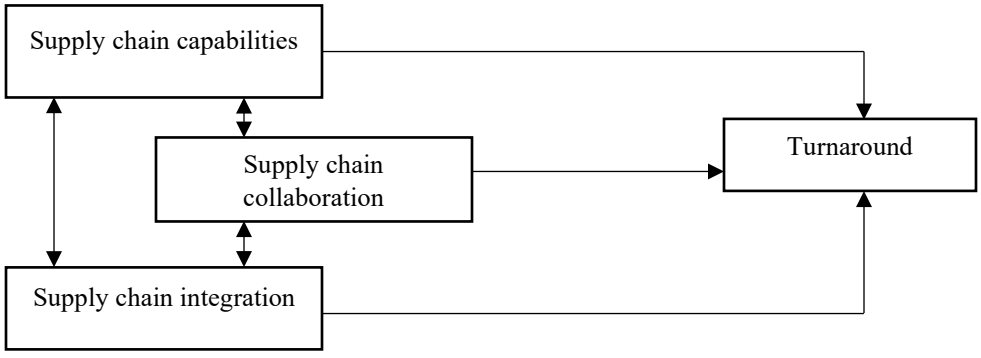

Figure 1. Conceptual Model

CRITIC

Diakoulaki offered the CRITIC approach (Kumari and Acherjee 2022). Numerous studies employ the CRITIC technique because it can properly weight criteria. Conflict and comparative strength are two indications that can be used to classify the weight. The standard deviation displays comparative strength. The volatility is greater and the weight will be greater if the standard deviation is higher. On the contrary, the correlation coefficient illustrates the dispute. The conflict is smaller and the weight is smaller if the correlation coefficient is larger.

CoCoSo (Combined compromise solution)

Yazdani firstly introduced CoCoSo in 2019 (Dwivedi and Sharma 2022). Since this approach is a reasonable algorithm to evaluate several options based on many criteria, it can help to select the best options. This method has been utilized in many studies to solve decision problems.

3. Methods

The research has a sequence developing conceptual model of supply chain capabilities that related to turnaround. The conceptual model was tested by in-depth interview with expert. After that, CRITIC and COCOSO method were applied to shows the result of supply chain capabilities impact on Automotive turnaround outcome. The summarized research process is presented on fig 2.

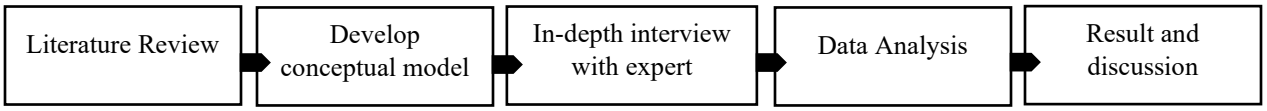

Figure 2. Research Methodology

1) Literature review: The researcher gathers data from many resources about supply chain capabilities, supply chain collaboration, supply chain integration and turnaround.

2) Develop conceptual model: The researcher synthesizes and analyzes all data and develop conceptual model based on three theories; Resource base view theory, Dynamic capabilities and Transaction cost theory.

3) In-depth interview with expert: The researcher in-depth interview with six experts who have experience in automotive supply chain at least ten years of manager or senior level. The experts evaluate the importance of supply chain capabilities affect to turnaround. The criteria of importance can divide into nine levels. Then, the researcher converts the evaluation into fuzzy numbers as shown in table 4.

Table 4. Fuzzy Number

Linguistic Variable	Fuzzy Number
Very low (VL)	(1,1,2)
Very low to low (VLL)	(1,2,3)
Low (L)	(2,3,4)
Medium low (ML)	(3,4,5)
Medium (M)	(4,5,6)
Medium high (MH)	(5,6,7)
High (H)	(6,7,8)
High to very high (HVH)	(7,8,9)
Very high (VH)	(8,9,10)

4) Data analysis: Data were analyzed in below process.

4.1 The importance score of experts were convert into fuzzy number (L, M, U) and find the average of each fuzzy number.

$$\text{Average} = \frac{\Sigma k}{K} \quad (1)$$

$\sum k$ = Total importance score K= Total number of experts

4.2 Find the total relation matrix defuzzy

$$\text{Total relation matrix defuzzy} = (l+4m+u) / \text{Total number of experts} \quad (2)$$

4.3 CRITIC was applied to find the weight of supply chain capabilities as follow:

Step1: Calculate normalize

$$T_{ij} = \frac{Xij - \min_i Xij}{\max_i Xij - \min_i Xij} \quad \text{for i = 1,…,m and j= 1,…,n.} \quad (3)$$

Step2: Calculate the standard deviation (σj) of each criterion and find the linear correlation coefficient between vector X_i and X_j. Matrix R = [rij] when j = 1,2,…,m

Step3: Calculate each criterion measure

$$H_i = \sigma i \sum_{j=1}^{m} (1 - r_{ij}) \quad (4)$$

Step4: Find the weight of each criterion as follow:

$$W_i = \frac{H_i}{\sum_{j=1}^{m} H_i} \quad (5)$$

4.4 CoCoSo was applied to prioritize Automotive industry turnaround that affected from supply chain capabilities as follow:

Step1: S_i (weighted sum value) and P_i (weighted product value) of each criterion can be acquired by

$$S_i = W_i * \text{Total relation matrix defuzzy} \quad (6)$$

$$P_i = (\text{Total relation matrix defuzzy})^{\wedge} W_i \quad (7)$$

Step2: Each alternative's evaluation scoring strategy was calculated by

$$\delta_{ia} = \frac{P_i + S_i}{\sum_{i=l}^{m} (P_i + S_i)} \quad (8)$$

$$\delta_{ib} = \frac{S_i}{\min S_i} + \frac{P_i}{\min P_i} \quad (9)$$

$$\delta_{ic} = \frac{\lambda (S_i) + (1-\lambda)(P_i)}{\lambda \min S_i + (1-\lambda) \max P_i} \quad ; 0 \leq \lambda \leq 1 \quad (10)$$

$\lambda = 0.5$ is assigned

Step3: The evaluation scores are computed by δ_i, values (as more significant as better)

$$\delta_i = (\delta_{ia} * \delta_{ib} * \delta_{ic})^{1/3} + \frac{1}{3} (\delta_{ia} * \delta_{ib} * \delta_{ic}) \quad (11)$$

5) Result and Discussion: The researcher was able to prioritize which turnaround gets the most impactful from supply chain capabilities.

4. Data Collection

In-depth interviews with six specialists served as the data collection method in this qualitative study. In this study, purposive sampling was employed. According to Tongco (2007), purposive sampling is the examination of something that necessitates knowledge or specialist individuals on that subject. Six specialists with at least ten years of manager- or senior-level experience in the automotive supply chain were chosen by the researcher for this study. During the in-depth interviews, the experts are able to talk and offer their opinions. The significance of supply chain capabilities that contributed to the recovery of the automotive sector will then be evaluated by specialists.

5. Results and Discussion

This study examined the weights of supply chain capabilities' importance and their impact on turnaround in Automotive industry. Figure 3 displays supply chain capabilities criterion' weight results which are 0.066 (C7), 0.065 (C6), 0.060 (C5), 0.058 (C13), 0.053 (C8), 0.051 (C9), 0.051 (C20), 0.049 (C3), 0.049 (C10), 0.049 (C12), 0.048 (C17), 0.048 (C18), 0.047 (C19), 0.047 (C11), 0.046 (C1), 0.046 (C4), 0.044 (C2), 0.044 (C14), 0.041 (C16) and 0.039 (C15). The three essential supply chain capabilities are skills/talent management capabilities (C7), performance measurement (PMS)/ prioritizing supply chain improvements capabilities (C6) and supply chain knowledge management (C5) which have scores 0.066, 0.065 and 0.060 respectively. These supply chain capabilities were categorized as intra supply chain capabilities of organization. The result of this study suggested that organization should constantly develop and concentrate on internal resources of organization because it is significance to firm in order to create competitive advantage.

This corresponds to resource base view theory which stated about the benefit of firms' resource. In addition, this study shows that skills/talent management capabilities (C7) have highest weight. The study of Omotunde and Alegbeleye (2021) stated that firm should attempt to develop talent management of employee because it can increase their job performance and reduce error in working. Besides, the comfortable feeling of employee can lead organization successfully because employee frankly talk about problem that result to managers can identify the issue quickly and solve it timely. Organizational resource development also reduces the risk of business interruption due to economic, social and environmental changing. The study of Panicker and Manimala (2014) clarified that human resource strategies is one of turnaround strategies which lead to successful of organization turnaround. In the contrast, goal congruence (C15) has the least weight because all supply chain members must perceive the objective and commit to overall goals for whole chain which is difficult to occur during crisis time. The study of Mazzei and Ravazzani (2011) reported that although firm have good communication but during unfavorable circumstances, messages are often misinterpreted and lead to resistance.

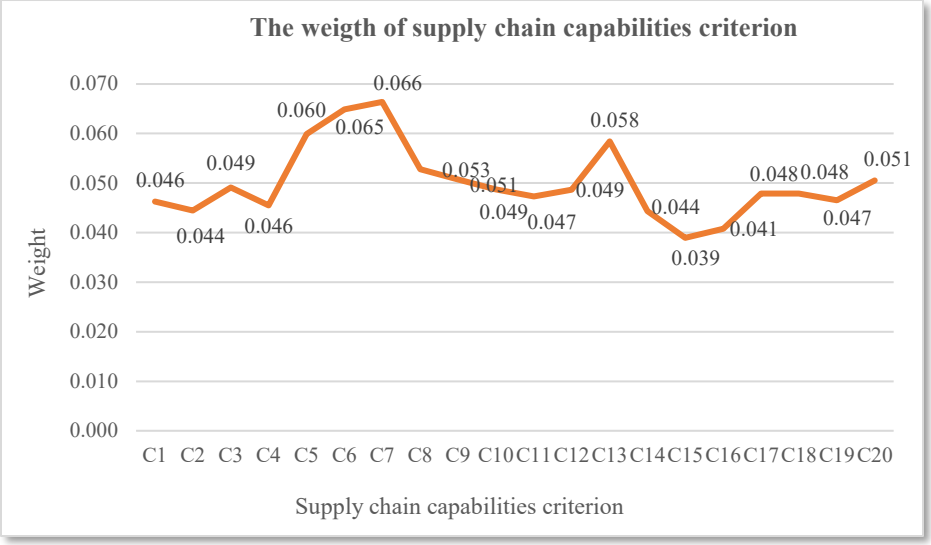

Figure 3. Supply chain capabilities criterion' weight results of CRITIC

Secondly, this paper provides turnaround ranking results which are presented in table 5. Based on scores ($\boldsymbol{\delta_i}$), the ranking of turnaround is T6>T1>T4>T5>T3>T2>T7 which have scores 0.211, 0.206, 0.198, 0.196, 0.195, 0.194, 0.187 respectively. Demand management (T6) is the most business turnaround that was affected from supply chain capabilities. Organization can provide right product, right time to the right customer and avoid bullwhip effect. Demand management can create balance between production and customer's need in order to occurring few mistakes, reducing production loss and waste as well as enhance competitiveness.

All of these things result to business turnaround outcome in term of increasing business operation and financial performance (Tikici et al. 2011). In addition, the study of Scherrer (2003) claimed that the causes of deteriorated business are misunderstanding customer's requirement which company must do turnaround immediately. In contrast, productivity (T7) has the least scores. Productivity is the way that organization can maximize output while minimizing input, hence lowering capital expenditure. The capital of manufacturing consists of equipment, inventory, purchase items and labor (Finkin, 2019) which is difficult to control. Organizations are unable to continuously monitor the most efficient working step while spending minimal labor time. When workers are able to produce nearly enough to meet the demand, workers may take a break during the day or end their shifts early. Moreover, organization may lose time to repair or set up machine due to problem. This is resulted to work interruption. However, Ong et al. (2021) explained that productivity can help organization survive the competition and it is also significant factor that generate revenue to organization which considered as a part of operational turnaround (Tikici et al. 2011).

Table 5. Turnaround ranking results of CoCoSo

Operational turnaround	$\boldsymbol{\delta_{ia}}$	$\boldsymbol{\delta_{ib}}$	$\boldsymbol{\delta_{ic}}$	$\boldsymbol{\delta_i}$	Ranking
T1	0.144	2.105	1.018	0.206	2
T2	0.142	2.042	1.005	0.194	6
T3	0.142	2.049	1.006	0.195	5
T4	0.143	2.058	1.009	0.198	3
T5	0.143	2.052	1.007	0.196	4
T6	0.145	2.131	1.025	0.211	1
T7	0.141	2.000	0.995	0.187	7

6. Conclusion

According to this study, the top three supply chain competency factors with the largest weights respectively are skills/ talent management capabilities, performance measurement (PMS)/ prioritizing supply chain improvements capabilities and supply chain knowledge management. Moreover, supply chain capabilities can impact to business turnaround because it can create operational and financial efficiency. Demand management is considered as the turnaround that is most influenced by supply chain competence. Therefore, knowledge of the supply chain is crucial. Organizations can use this study to be a guideline to improve their operations if they are in a crisis. For, future research should concentrate on other nationalities car manufacturer in Thailand, or in other business contexts since this study only examines Japanese car manufacturer in Thailand.

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Biographies

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