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Enhancing Supply Chain Performance by Exploring the Role of Technological Aspects in Supply Chain Management in the Local Automotive Industry in Malaysia

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ABSTRACT

Technology have shed some lights on supply chain management issues. Issues regarding irrational behaviour among supply chain member is one of the topics discussed that can be improved by enhancing technology to the chain. This study looked at the role of technological aspect in supply chain management in mediating the relationship between supply chain orientation and supply chain performance. Questionnaires were used to collect data from manufacturers and suppliers in Malaysia's automotive sector. The Structural Equation Modelling (PLS-SEM) method was used. The findings reveal a concrete prediction model that explains the supply chain management's mediation influence on supply chain performance. As a result, the study goals that focus on the technological aspect in supply chain performance are met. Future study should investigate more on what technology can offer to enhance supply chain performance.

1. Introduction

Supply chain performance (SCP) research have advanced tremendously, benefiting both the business and academic communities [1]. The study of performance measurement is vital since the objectives of different products and services varies. SCP is seen as a strategic component for improving organisational performance and achieving organisational goals such as greater competitiveness, improved customer service, and increased profitability [2-4]. Some researchers concluded that establishing SCP helps businesses endure and compete in the market [5,6]. It is connected to the costs of running a firm; it covers, for example, manufacturing costs, transportation costs, and inventory holding costs [5,6].

Most research on how to stay in business focuses on the relevance, practicability, and how to enhance the performance of one's product or service. As a result, researchers and practitioners must identify a diverse collection of competitive characteristics that correspond to the various objectives for products or services [1]. Despite the fact that the studies have been formally established, there

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are still certain issues that need to be addressed. Why, for example, are there still delays, lead times, inventory levels, and other uncertainties? [7]. Furthermore, the question of market information delay or distortion remains unresolved [8-12]. The delay in market information going upstream will have an impact on supply chain operations. Firms are finding it challenging to deliver superior products and services than their competitors in this environment [1,13].

In order to effectively address the growing challenges, supply chains must develop intelligence [13]. Technology has been described in the literature using a number of distinct terms, such as smart supply chain, digital supply chain, and intelligent supply chain. To enable the autonomy, flexibility, dynamism, and accuracy of production systems, technological aspect in supply chain management integrates a variety of technologies, concepts, and techniques [14]. For example, Cloud computing, 3D printing, advanced analytics, blockchain, augmented reality, RFID, Internet of Things, and cloud technology are some of them. Many aspects of business models, supply chains, products, sales, and services are changing as a result of these technologies, which are altering the face of the industry.

SCM's main elements consist of group efforts to manage supply chains as a whole [14]. Information sharing between supply chain participants is necessary, particularly for planning, integrating, and monitoring processes (e.g., Global Logistics Research Team at Michigan State University 1995). The supply chain's participants must also cooperate, which is defined as "mutual, coordinated activities carried out by firms in a business relationship to produce superior outcomes mutually expected over time" [15-17]. Building, maintaining, and enhancing long-term relationships is a requirement of SCM partners [18]. It can be concluded that technology is very important since it ease up the process involve in the chain. However, technology cannot be optimized if the people involve is not behaving IT literately.

Other than technological aspect, supply chain orientation (SCO) promotes the behavioural factor among the supply chain member. SCO directly affects how well a company performs. Better channel partner relationships result in greater firm commitment and financial performance [18]. The effectiveness of marketing and logistics is positively impacted by firm cooperative norms. Trust has a positive impact on a company's ability to cut costs and increase its market share [19]. Inter-firm cooperation (SCM), on the other hand, mediates the impact of SCO on firm performance. There is a direct correlation between trust, inter-firm cooperation, and performance, and trust fosters inter-firm coordination, which results in higher profit. This also shows that to a good human decision making is vital for supply chain performance. Authors in Ref. [20] take the same stance on the human decision-making issue, and this study addresses an increasing number of recent studies that indicate behavioural and psychological elements have a substantial effect in real-world supply chains.

All factors and relationships in this research will be investigated in the context of Malaysian industry. As a result, the local automobile sector has been chosen as the primary demographic for this research. This study also tends to broaden the link between SCM and SCP while improving the framework proposed by Ref. [21]. The distinction that will be addressed in this study is the technological aspect in SCM between SCO to SCP. The significance of SCM is intended to provide a beneficial conclusion for this research.

2. Methodology

2.1 An Overview of the Automotive Industry in Malaysia

The automobile industry was chosen for this study due to its significance as stated in the Second Industrial Master Plan. Malaysia's car industry comprises not only domestic brands (such as Proton and PERODUA), but also international names such as Toyota, Honda, Nissan, Mercedes-Benz, Volvo, BMW, and Peugeot. With the expansion of Malaysia's automotive sector, there are currently over

690 manufacturers and suppliers supplying over 4000 parts, including body panels, engine parts, braking parts, transmission and rubber parts, steering parts, and electrical and electronic parts. These manufacturers and wholesalers all supply components to both local and foreign consumers.

Since Malaysia develops its own brand, it should offer benefits to local automobile brands such as PROTON and PERODUA in order for them to lead the market. However, global trade liberalisation has resulted in a significant challenge to the country's vehicle sector [22]. To compete in a business market dominated by a few giant enterprises, local producers must strive for excellence. They are unable to compete if the firm is dealing with organisational behaviour challenges and does not have adequate market knowledge.

In this context, previous industry research has highlighted the need of developing strong relationships among supply chain participants rather than relying on government help to capture the market [23,24]. Depending on government aid to generate a profit is not a viable long-term strategy. According to the industrialized economic climate, the economic crisis has encouraged the industry to be more accountable to its clients rather than being just concerned with profit [25,26].

Previous research has showed that there are various difficulties that would have a negative impact on supply chain performance as a result of it. These challenges include buyer-supplier collaboration, chain partnership quality, customer service, supplier network performance, and information flow [27-29]. As a result, knowing the customer and improving the buyer-supplier connection are crucial for attaining high performance.

2.2 Supply Chain Orientation and Supply Chain Performance

The word supply chain orientation (SCO) refers to a company's shared values and belief system, which are converted into behavioural standards that govern how the firm operates its supply chain [30]. SCO provides a solid understanding or strong ties among supply chain stakeholders, resulting in the fulfilment of the customer need. The feature in SCO enables organisations to communicate vital information among supply chain partners [31]. As a result, studies such as from Ref. [2,32-35] thought that the presence of SCO as a behavioural standard improves the quality of service offered to supply chain participants and customers. As a result of this understanding, the possibility to develop a relationship between SCO and SCP exists. However, there is still little debate on this relationship [36,37].

By providing value differentiation to their competitors, SCO has a positive influence on SCP [2, 38]. Authors in Ref. [39] claims that better collaboration, in turn, contributes to greater adaptability and resilience across the supply chain. For example, the SCO element not only supports and improves a firm's operational productivity, but it also assists businesses in improving product delivery [40] and product quality [41]. Neglecting the importance of SCO might result in bad customer service. Embedding SCO results in operational-based behaviours that have an impact on the efficiency and effectiveness with which the company's resources are managed. A similar view on SCO is also shared by Ref. [37,42-44].

Simultaneously, studies on improving SCP emphasise the importance of integration and coordination among supply chain members [45]. According to Ref. [35], supply chain performance is dependent on management's capacity to integrate strategic goals across supply chain participants. Furthermore, supply chain research has looked into a range of factors that influence supply chain performance, such as interaction [46], communication [47], collaboration [48,49], and commitment [50]. Technological aspect in SCM mediate the relationship between SCO and SCP

As a result, the few studies on SCO and SCP reinforce this research, allowing it to dive deep into the direct association between SCO and SCP. This might improve knowledge of SCO as well as deepen

understanding of the positive impact of SCO in various types of markets. Along these lines, this investigation advances the accompanying Hypothesis 1.

Hypothesis 1: There is a relationship between SCO and SCP

2.3 Supply Chain Management

The increased knowledge of what supply chain management (SCM) can provide the manufacturing industry has prompted many researchers and practitioners to do more research into the possible advantages that it can deliver to overall performance [51-53]. This is supported by ongoing research in this field, which constantly propose new ideas and strategy agendas [31,54-58].

In this day, SCM should be considered for more than simply logistics, warehousing, and transportation. With today's tough corporate climate, SCM tasks have extended to include cost control, demand planning and forecasting, procurement, distribution, and effective and efficient resource management. This involves a lot of technological aspect throughout the chain. It is impossible to establish a good relationship when the company is not IT related or expert in utilizing all the systems [59]. Furthermore, SCM includes operations like as value generation, quality, and understanding of supply chain links [18,46,60,61]. As a result, this study shows that SCM is a value-added activity that occurs across a company's supply chain that involve experts in technology. It entails handling goods and overseeing overall processes (logistic, warehousing, transportation, purchasing, marketing, human resource, and finance). These efforts necessitate significant collaboration and integration across all supply chain participants.

The creation of SCM dimensions has been drawn from the strategic character of SCM, which is to increase the performance of a specific business as well as the overall supply chain performance [61,62]. SCM dimensions must also have excellent relationships with internal functions inside the organisation as well as external networking with customers, suppliers, and other chain members [80]. This is to guarantee that the aspects or dimensions in SCM may encourage successful supply chain procedures.

Important studies from various literatures show that information between suppliers, manufacturers, and channels is not always appropriately exchanged across the whole supply chain. This causes issues when partners anticipate market demands based on incomplete or insufficient information [63,64]. Partners, on the other hand, tend to store greater stock in various types of components, materials, and completed items. This is done on purpose to avoid any shortages in their organisation. As a result, they will have to bear high costs together with a bullwhip impact in the supply chain, reducing their profit margin.

Despite the foregoing debates on SCM, there is still a lack of discussion on how successful technological aspect in SCM is at mediating the interaction between SCO, and SCP. This includes how the SCP functions in the relationship with and without effective SCM. Answering such questions assures that practitioners will have a better management strategy on their supply chain process, as well as a lower chance of stock-out and backorder, while enhancing customer satisfaction [65-68].

SCM as a mediator could generate cooperation among the supply chain members. This will result in improved management on costing, material handling, timing and product flexibility [18,22,31,54,65-70].

Thus, this inquiry denotes an attempt to examine the mediating influence of supply chain management between supply chain orientation and supply chain performance, which would suggest Hypothesis 2.

Hypothesis 2: H2: Technological aspect in SCM mediate the relationship between SCO and SCP

Finally, a framework has already been formed based on the above discussion. Figure 1 shows the relationship between variables involved in this study. Based on this figure, supply chain management is seen as an intermediary between supply chain orientation and supply chain performance. This designation is based on past studies. The results of the study will be discussed on the next topic.

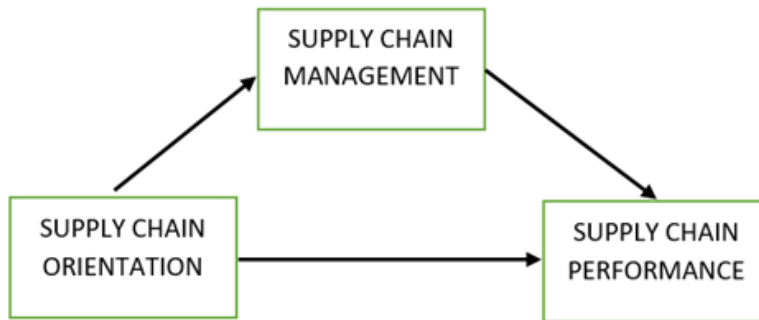


Fig. 1. Research model

3. Data Analysis Technique and Data Collection

The objective for doing this study is to experimentally examine and support the hypotheses that were previously made in this research. Thus, to attain the aforementioned goal, this research makes extensive use of descriptive research and hypothesis testing. This analysis will be conducted inside the Malaysian automotive sector by selecting vehicle vendors from PERODUA and PROTON to assist in giving a detailed knowledge of the link between the variables: SCO, SCM, and SCP. All the constructs and the corresponding measure items were adapted from previous literature to fit the context of this study. Specifically, items measure. All the items were measured with a seven-point disagree-agree Likert scale. The items involved is shown in Table 1.

Table 1

Sources of the research variables

| No | Variable | Total question | Item | Source |
|----|--------------------------|----------------|--|------------|
| 1 | Supply chain orientation | 20 | Credibility, benevolence, commitment, cooperative norm, organization compatibility, management support | [17,38,91] |
| 2 | Supply chain management | 30 | Agreement, information sharing, risk and reward sharing, cooperation, integration, relationship building and agreement | [21] |
| 3 | Supply chain performance | 11 | Quality, timeliness, flexibility and cost | [67] |

The result from the pilot test analysis shows that the Cronbach's Alpha of the variables ranges from 0.8057 to 0.9774. Authors in Ref. [71,72] state that Cronbach's Alpha which is greater than 0.7 is accepted; however, any value that is greater than 0.8 is preferable. This result shows that the values of the Cronbach's Alpha are all greater than 0.8. This indicates a good reliability of the research instrument used. Therefore, none of the items were dropped from this research. The reliability result

of this research has revealed that the variables of this research as listed in Table 2 below are appropriate and suitable to be used in this research.

The total respondent for this study is 690 company. Based on Ref. [73], a minimum sample of 248 is an appropriate sample size for a population of 690-700. An e-mail invitation has been sent to the respondent. The study uses survey method, a highly reliable approach [74]. All the respondents were selected randomly from the automotive sectors in FMM Directory of Malaysian Industries. Out of the 248 questionnaires sent out, 108 (32.72%) respondents replied. The respond rate is in line with Ref. [75,76] in the perspective of the Malaysian automotive Industry.

Table 2
Summary of the pilot test reliability analysis of constructs

| Constructs | Number of items | Cronbach's Alpha |
|--------------------------|-----------------|------------------|
| Supply chain management | 20 | 0.9774 |
| Supply chain orientation | 30 | 0.9519 |
| Supply chain performance | 11 | 0.9662 |

4. Findings

There are two fundamental analyses for scanning data using PLS-SEM, namely as 1) missing value and 2) normality. Missing data were checked using SPSS Missing Data. Out of the 108 questionnaires, 8 were detected with some missing value. 100 questionnaires that were answered contained no missing data. Therefore, 90.7% questionnaires were deemed usable and subsequently coded and analysed.

4.1 Measurement Model

Based on Ref. [71], the author suggested 0.5 as the minimum value for significant loadings. As the measurement items for this research were based on previous studies and had been tested before, with a strong showing of instrument validity value, 0.5 was chosen and used as the minimal cut-off point for factor loadings. For cross-validated items to be included in the finalized data set, the loading must be larger on the intended construct than any other construct. This was also achieved. Using the loadings from the constructs, composite reliabilities (CR) were created for the variables in the model.

Accordingly, the reflecting measurement for this model's validation procedure has been attained and finished. Because this model comprised of a reflective measure, the two procedures employed to assess discriminant validity were Fornell-Larcker [90] criteria and cross-loadings. The discriminant validity result indicated that the square root of AVE for all constructs provided in the diagonal has the highest value (SCP4 – 0.9603) and the lowest value (SCOC1 – 0.7748). For all constructions, the values of the square root of AVE are bigger than the values of the off-diagonal coefficients or the items in the relevant rows and/or columns. As a result, discriminant validity is demonstrated in this study.

4.2 Normality

For the Kolmogorov-Smirnov and the Shapiro-Wilk tests, the data is normally distributed if the tests are insignificant ($p > 0.05$). Hence, the result of the study approved that both tests here are insignificant ($p > 0.05$). Thus, the data are normally distributed. Result is shown in Table 3.

Table 3
 Test of normality

| | Komogorov-Smirnov ^a | | | Shapiro -Wilk | | |
|-----|--------------------------------|----|------|---------------|----|------|
| | Statistic | df | sg | Statistic | df | sg |
| sco | 0.98 | 95 | .425 | .987 | 95 | .109 |
| scm | 0.088 | 95 | .068 | .979 | 95 | .141 |
| scp | 0.107 | 95 | .169 | .969 | 95 | .063 |

4.3 Structural Model

Based on structural model shown in Figure 2, results for the relationship between SCO > SCP is showed in Table 4 below.

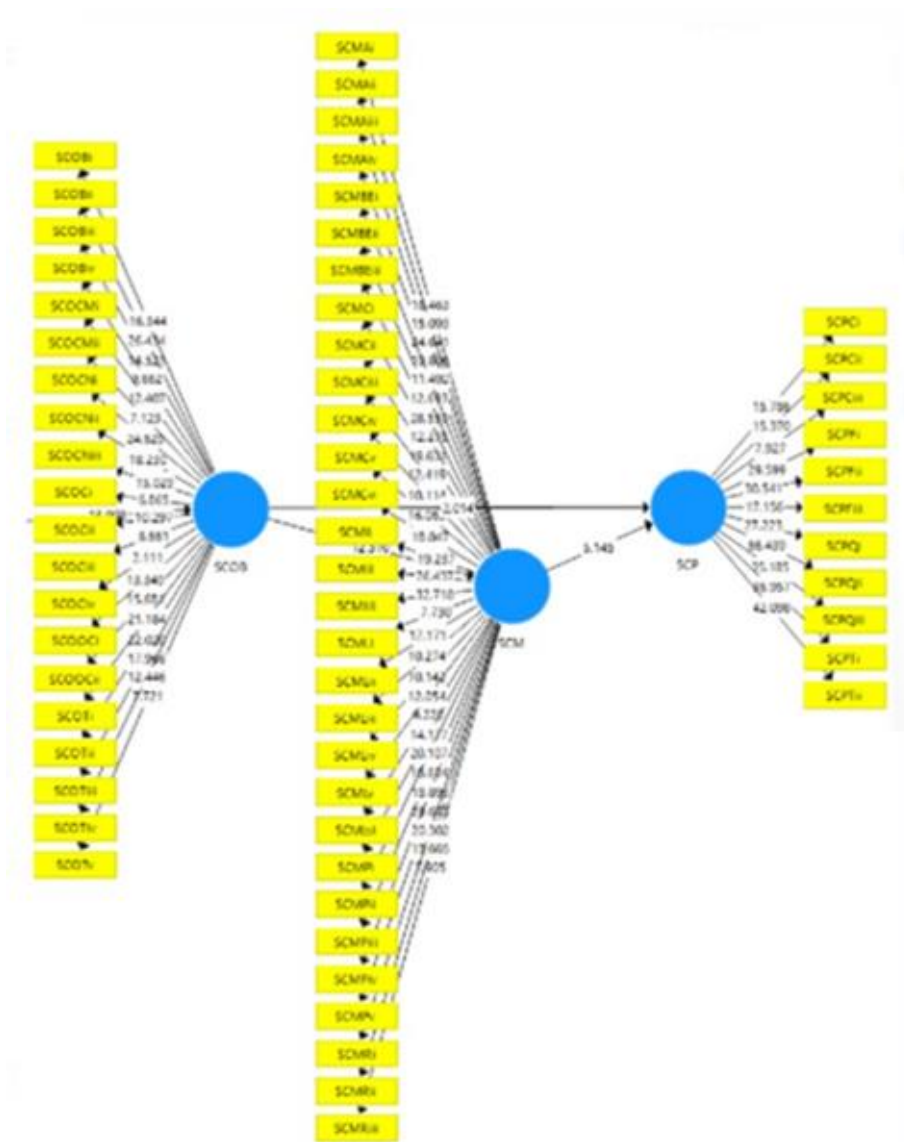


Fig. 2. Assessment of structural model

Table 4
 Relationship between SCO > SCP

| Item | Path | Original sample | Sample Mean | STDEV | T value | P value | Decision |
|------|---------|-----------------|-------------|-------|---------|---------|----------|
| H1 | SCO>SCP | 0.253 | 0.238 | 0.126 | 2.014 | 0.022 | Accepted |

Results shows a significant relationship between SCO & SCP. This result explains that SCO is one of the important variables to SCP.

4.4 The Mediation Effect

Bootstrapping can create an empirical depiction of the individual effect's sample distribution. Bootstrapping is the preferred approach since the sample size of the research is modest (100) compared to the [14] method, which requires a higher sample size. After that, the indirect impact is calculated and utilised to construct the confidence interval (CI). According to simulation research, bootstrapping is one of the more valid and powerful strategies for investigating the mediation effect [77-79]. As a result, for the purposes of this study, the bootstrapping approach with J = 500 and n=100 was used.

The mediators studied were SCO and SCM, as shown in Table 5 below. This conclusion is consistent with earlier researches that discovered the importance of SCO and SCM deployment in organisations.

Table 5
Mediation result

| Item | Path | Original sample | Sample mean | STDEV | T value | P value | Decision |
|------|-------------|-----------------|-------------|-------|---------|---------|----------|
| H2 | SCO>SCM>SCP | 0.335 | 0.352 | 0.089 | 3.776 | 0.000 | Accepted |

4.5 Assessment of Coefficient of Determination (R² Value)

The R² value (refer to Table 6) is one of the approaches for predicting model performance, with a greater R² value indicating a better level of prediction accuracy. The rule of thumb for acceptable R² varies by discipline; nonetheless, R² values of 0.75, 0.5, and 0.25 can be defined as considerable, moderate, and weak, respectively [71].

Table 6
R² Values

| | R | R adjusted | Justification |
|-----|-------|------------|---------------|
| SCP | 0.583 | 0.574 | moderate |

The R² value is strongly related to the number of predictors to a certain variable; consequently, the greater the R² value, the more forecasters a variable has. It is usually preferable to have additional information about the variance presented. However, the goal of this study was not to develop a prediction model, but rather to analyse the influence of strategic orientation (SCO) and the mediation impact of SCM and SCP. Further study was performed to evaluate the effect size of the mediator on SCP in order to quantify the strength of this association.

4.6 Effect Size

The effect size (f²) is the complementary test to R², whereby changes to R² was perceived with the omission of any selected exogenous variable from the model. The change was calculated by estimating the model twice (with and without the latent variable inclusion. The f² result for the model is as shows in Table 7.

Table 7 indicates the values of the effect size and their respective ratings. As could be seen, SCM gives medium effect to SCP. This strengthens the important of SCM as it has been hypothesised. On

the other hand, SCO contributed small effect to SCP. However, this does not mean that those relationships with small f^2 are not statistically important. Authors like Ref. [80] stressed that even the smallest strength of f^2 should be considered because they can influence the dependent variable in their own ways. This results also proof that SCM plays an important role as the mediating effect between SCO and SCP.

Table 7
 Values of the effect size

| | SCM | SCP |
|-----|--------------|---------------|
| SCM | | 0.301(medium) |
| SCO | 1.421(large) | 0.063(small) |

4.7 Predictive Relevance of Model

One would use the cross-validated redundancy measure to examine the predictive relevance of one’s theoretical/structural model [81]. For this model, omission distance of 7 and the following formula are used

$$Q^2 = 1 - \frac{\sum_D E_D}{\sum_D O_D} \tag{1}$$

Table 8 shows the result for predictive relevance of model. The results for the first model yielded a Q^2 (cross validated redundancy) for SCP value of 0.28. The rule of thumb indicates that a cross validated redundancy $Q^2 > 0.0$ is regarded as a predictive model [81]. All the results for Q^2 obtained from this research suggest that this is a predictive model [82].

Table 8
 Predictive relevance

| Item | Q^2 |
|------|-------|
| SCP | 0.28 |

The findings revealed that SCO has both a direct and indirect influence on SCP. This study also suggests that SCO and SCM are crucial elements to implement in a company. The availability of SCO and SCM might assist organisations in reducing uncertainty and minimising the bullwhipped effect on the supply chain.

5. Discussion and Contribution

This section will focus on the findings for this research. The overall result for this research is shown in Table 9.

Table 9
 Summary of the hypothesis result

| No | Hypothesis | Result |
|----|--|-----------|
| 1 | H1: There is a relationship between SCO and SCP | Supported |
| 2 | H2: Technological aspect in SCM mediate the relationship between SCO and SCP | Supported |

5.1 The Relationship Between SCO And SCP (H1)

The first hypothesis (H1) demonstrates that SCO is important to SCP. This is consistent with past findings [83,84]. However, the effect size of SCO to SCP is moderate compared to SCM. SCO is defined as "a company's realization of the systemic, strategic consequences of the activities and procedures associated with managing the different movements in a supply chain"[18]. For example, the SCO aspect not only supports and improves a company's operational productivity, but it also assists enterprises in improving product delivery [40] and product quality [41]. Neglecting the significance of SCO may lead to bad customer service. Based on the result, SCO shows the connection to SCP but being moderated by SCM.

The impact of this discovery further stressed that SCO creates a solid understanding or strong ties among supply chain partners, which results in meeting the customer's requirements. According to [21,34,35,37,65], the elements of SCO are capable of exposing important customer information across supply chain partners. This finding supports most of the previous and present studies [34,35].

5.2 The Effect of SCM As the Mediator Between SCO And SCP (H2)

Result shows that SCM mediates the relationship between SCO and SCP. The purpose of establishing supply chain management (SCM) is to practice a total systems approach to manage the entire flow of information, materials and services [84]. This understanding has brought to the important changes to the area of business management. Traditionally, in order to improve the overall profit, managers used to focus only on the management of their internal operations. However, SCM calls for the integration of their operational activities with decisions and activities of their external business partners. Numerous studies have demonstrated that substantial benefits can be obtained from SCM. However, SCM provides tremendous challenges to managers. A key issue in SCM is then to develop mechanisms that can align the objectives of independent supply chain members and coordinate their decisions and activities so as to optimize performance.

Relating to this research, objective number two of this research aimed at investigating the effect of SCM as the mediator between SCO and SCP. With the effect of SCO, the elements in SCM could generate cooperation among the supply chain members. This will result in improved management on costing, material handling, timing and product flexibility [85-87].

5.3 Contribution of The Research

The findings of this research have provided important contribution to the area of supply chain performance and strategic orientation, academics and practitioners. These findings have also contributed to the body of knowledge. The research contribution in this research is discussed in the following sections in the form of theory and practical.

5.3.1 Theoretical

Among the various strategic orientation, SCO have been chosen for this research and proven that it does give impact to supply chain performance. This is based on the t-value that have been done in chapter four. There are theoretically very few literatures that discuss these two relationships. This research manages to introduce this variable in the automotive industry perspective. Therefore, this research enriches the area of strategic orientation by establishing other approaches suggested by Ref. [88,89].

5.3.2 Practical

This research has revealed the current situation of the embedded behaviours in automotive industries practices in Malaysia. Hence, it has improved the understanding of the situation and current level of implementation of the strategic orientation in this industry to be considered as strategic resources that can enhance the achievement of competitive advantages and better performance. The study therefore suggested that manufacturing practitioners should not only perceive strategic orientation as common behavioural practices but also as strategic resources in achieving competitive advantage and better firm performance.

The research is also beneficial to the management and decision makers and the concerned authorities on supply chain management by suggesting comprehensive understanding and activities that could strengthen the relationship between all the players in supply chain and all the players in the industry. Hence, management should take a step further in providing a supportive environment to the employee and to the supply chain members. Embedding the right and practical strategic orientation will enhance a better supply chain performance for the automotive industry in Malaysian. The next section presents the limitation of the study.

5.4 Limitation of The Study

The main limitation found in this research is the small number of respondents. Even though 100 respondents are deemed adequate in terms of processing using the structural equation modelling tool, it would be better to have more. Initially, a total of 108 questionnaires were received, however, after the data screening process, 10 answered questionnaires had to be discarded, leaving only 98 questionnaires FIT for analyses.

5.5 Direction for Future Studies

The inexistence of the environmental uncertainties as the moderator. Current studies show a very competitive business environment especially for automotive industry. Automotive industries are usually highly affected the government policy, by the technology turbulence and market turbulence. Hence by investigating the existence of the moderator, practitioners could gain valuable information for their company.

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