Supplier relationship management and its impacts on purchasing performance in aircraft maintenance, repair, and overhaul in Thailand

Peter Madzik
Technical University in Liberec, Faculty of Economic, Voronezska 13, 460 01 Liberec, Czech Republic, EU,
peter.madzik@tul.cz
Noppadol Suwannasap
Rajamangala University of Technology Thanyaburi, 39 Moo.1, Klonghok, Klong-luang, Pathumthani, 12110, Thailand,
noppadol_s@rmutt.ac.th (corresponding author)

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Abstract: Supplier Relationship Management (SRM) has been recognized to play an important role in improving purchasing performance. However, there is no evidence yet to prove this application in the aircraft maintenance, repair, and overhaul (MRO) industry in Thailand. This paper studied SRM which are arm's-length SRM and cooperative SRM practices, and their impacts on purchasing performance in the aircraft MRO industry of Thailand by using Delphi Technique. Data are collected from in-depth interviews, and by means of a questionnaire. Sample group of this research are 20 specialists who involved with purchasing processes in aircraft MRO. The results show that cooperative SRM improves purchasing performance in all aspects, while arm's-length SRM only improves purchasing performance in reducing sales price.

1 Introduction

The COVID–19 pandemic hampered the economic growth of almost every country and resulted in closure of many airline companies. In 2020, aviation industry revenues totalled $328 billion, around 40 percent of the previous year [1]. With more than half of the global fleet on ground in 2020 and lower utilization of the remaining aircraft, airlines deferred as much maintenance as possible to preserve the company cash flow [2]. According to the Oliver Wyman forecast in 2020, the MRO revenues across the aviation industry declined 41 percent if compared with 2019. However, as per a report, MRO demand is expected to grow 50 percent between 2021 and 2024 and increase of over $30 billion, as fleet size and utilization gradually get back to pre-COVID level [3]. Heath Patrick, Steven Lien and Jim Currier, leaders from Honeywell Aero Space explained that the aviation industry need to focus on cost structure, reliability of aircraft and equipment, support staff and crews to recover post pandemic [4]. To reduce cost and increase the reliability of aircraft, MRO purchasing will be an important tool in this situation as it will support the flow of MRO inventory and aircraft maintenance efficiency.

SRM is a purchasing strategy which has been recognized for reducing purchasing costs, purchasing errors, the process of inventory management, while improving product quality and the accuracy of product delivery [5]. Through research, such recognition has been proven in manufacturing, retail, wholesale, and distribution sectors. However, when employing SRM, there is not much evidence proving improvement to the purchasing performances of other industries, including aircraft MRO industry. When purchasing aircraft spare parts, the aircraft MRO industry in Thailand has some drawbacks in comparison to neighbouring countries, such as Malaysia

and Singapore. Purchasing in the aircraft MRO industry of Thailand still focuses on supporting operations, rather than being a core strategy of the organisation. As a result, it is impossible to optimise purchasing performance [6]. Due to the recovery of aviation industry, the demand in aircraft maintenance and aircraft spare parts requirement increases. Delivery time and inventory management have become main activities in this situation, as well as cost control. Therefore, finding an effective purchasing strategy for aircraft MRO has become essential and consequently SRM in aircraft MRO industry received more attention than in previous.

This research is qualitative research by using Delphi research method, which is suitable to collect expert opinions in a small group and allow experts to re-consider their opinions in the topics that they answer. Data were collected from purchasing managers and senior purchasing officers in the airline MRO division or aircraft MRO companies in Thailand. There were 10 organisations and 2 people from each were interviewed. The objective is to study SRM activities, the implementation of SRM, and its effects on purchasing performance. Results are used to build a conceptual model of SRM types that suitable to the aircraft MRO industry.

2 Literature review

In recent times, the theories, conceptual frameworks, and researches about SRM have received a lot of attention. Most researches focused on the characteristics of different SRM types and the impacts of SRM on organizational performances in terms of costing and production efficiency. However, this research studied the impacts of SRM on purchasing performance. The literature review focuses on SRM factors in selecting SRM types, different

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SRM types, purchasing, purchasing performance and variables used in the conceptual model.

2.1 Supplier Relationship Management (SRM)

SRM is an ongoing process, which aims to build a harmonious purchasing-supplier relationship, through which both parties work together to streamline and make the purchasing and supply chain processes more efficient in long term [7,8]. Different ways to categorize the purchasing-supplier relationship have been presented by academics and researchers, however, they are generally categorized into 4 ideals.

The first one is an *arm's-length relationship*, which occurs only when a purchase occurs. It is a short-term purchasing-supplier relationship which mainly focuses on reducing costs, and there is no collaboration or two-way exchange of information [9-13]. The second is represented by a *participating relationship* between the supplier and purchasing. Both organisations coordinate to solve problems, but on a limited basis. The partnership usually has short-term aims, which mostly targets on cost-reduction and prompt product delivery [9,11,13]. The third purchasing-supplier relationship is a *collaborative relationship* in which purchasing and sales cooperate in strategy planning, operational planning and problem solving. This relationship has long-term aims and focuses on cost-reduction and improvement to the efficiencies of both organizations [9,10,12,13]. The last is *strategic alliances* that are represented by collaborative purchasing-supplier relationships, with no 'end-date'. Both parties are committed to working closely together, in joint: product design, strategy planning, problem solving and ventures. They aim for complete cost reduction and improved performance [10,11,13,14].

2.2 Factors which affect the decisions in choosing SRM types

SRM is categorized into many types, according to the characteristics and activities. Therefore, implementation of the right SRM type to the industry is essential [9]. From the literature review and related researches, factors which affect the decisions for choosing SRM types can be summarized into three main factors.

The first factor is product purchased. *Types of products purchased* has direct impacts on SRM types [15]. Product quality and unique features or product types are important factors to consider too when choosing SRM types [16]. Product price and product value are also important when selecting SRM types to implement [17,18]. *Types of purchasing policies* is the second factor affecting the decisions in choosing SRM types. The main important purchasing policies according to the literature review are purchasing policy according to supplier ability, purchasing policy according to purchasing costs, and purchasing policy according to purchasing contract period [16,19-21]. The different purchasing policies are suitable to the different types of SRM. The last factor affecting the

decisions in choosing SRM type is the *collaboration degree with supplier*. There are two important factors relating to collaboration degree with supplier, which are the degree of collaboration according to the activities that supplier and buyer doing together [15], and the degree of collaboration according to information exchange or information sharing [16].

2.3 Purchasing and purchasing performance

Many companies have turned their attention to purchasing because it greatly influences cost reduction and enhances business competitiveness. Nowadays, purchasing concepts differ from purchasing concepts in the past. Traditional purchasing concepts focused on 'low price and on-time delivery. However, these contained additional hidden operational costs [22]. Purchasers nowadays focus on complete cost reduction, value-added service, the ability to meet customer needs and long-term supplier relationships [23]. No matter which concepts are used, an organization still needs efficient purchasing, and that efficiency must also be measurable. According to literature reviewed, purchasing key performance indicators can be divided into 4 categories, which comprise: cost effectiveness, quality performance, on-time delivery, and quantity accuracy [24].

Cost effectiveness is the most important key performance indicator for measuring purchasing performance. Cost effectiveness focus on unit price reduction, ordering cost, inventory cost and transportation cost. *Quality performance* focus on the quality of product purchased and the quality of supplier. It is measured by the level of product purchased that not meeting the quality requirement, the purchasing satisfaction level of the supplier's performance in responsibility and delivery. *On time delivery* measured by lead time requirement, the number of on time delivery, delay of production process due to late delivery of product or material. The last key performance indicator is *quantity accuracy* which measured by the number of deliveries with the incorrect quantity and defects, and the deficit or surplus of inventory caused by the purchasing and scheduling departments themselves.

2.4 Research gap

According to the relevant literature, there are various study areas for SRM research. Some focus on SRM's type and activities in the different environments, some focus on the impacts of SRM on interested factors, and while some focus on the factors that affect SRM.

In this research, we focus on 3 important areas in SRM, which are types of SRM used in aircraft MRO industry, factors that influence selecting SRM types and the effects of SRM on purchasing performance. Hines [9] explained that different SRM types are suitable for different business situations. To implement the right type of SRM, the company needs to understand their requirements and limitations, including examining the factors that related to

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selecting SRM types in each business situation. SRM has been proved to have significant impact on organization performance in many areas, such as cost reduction, operation and production performance, distribution, inventory control and purchasing performance. The different SRM types will bring different benefits in business performance. The study about different types of SRM and their effects on different purchasing performance indicators will also help organization to design and implement the correct SRM type to suit their requirement and situation, especially in post Covid-19 recovery situation for aircraft MRO industry.

3   Methodology

This research is qualitative research using Delphi research method (Figure 1), which has been proven to be a reliable measurement instrument in developing new concepts and setting direction of future-orientated research [25]. Data were collected from in-depth interviews, and by means of a questionnaire. These were conducted with

purchasing managers and senior purchasing officers in the airline MRO division, or aircraft MRO companies in Thailand. Two specialists were selected from each of 10 organisations. The sample size was 20, which is the quantity required to achieve a reliability success rate of 90-95% [26]. In Delphi exercise, a minimum of 12 respondents is generally considered to be sufficient to enable consensus to be achieved [27]. Each organisation was chosen by using simple random sampling, from a population of 40 organisations [28]. Data collection was divided into two cycles to compare and confirm the opinion of experts for each question. In the first cycle, open-ended questions were used in in-depth interviews, which were also semi-structured interviews. In the second cycle, a rating scale questionnaire and structured interviews were both conducted. Both were pre-planned interviews [29], which covered the topics relating to SRM types: factors which affect the decision-making in choosing SRM types, purchasing performance measurement, and the impacts of SRM on purchasing performance.
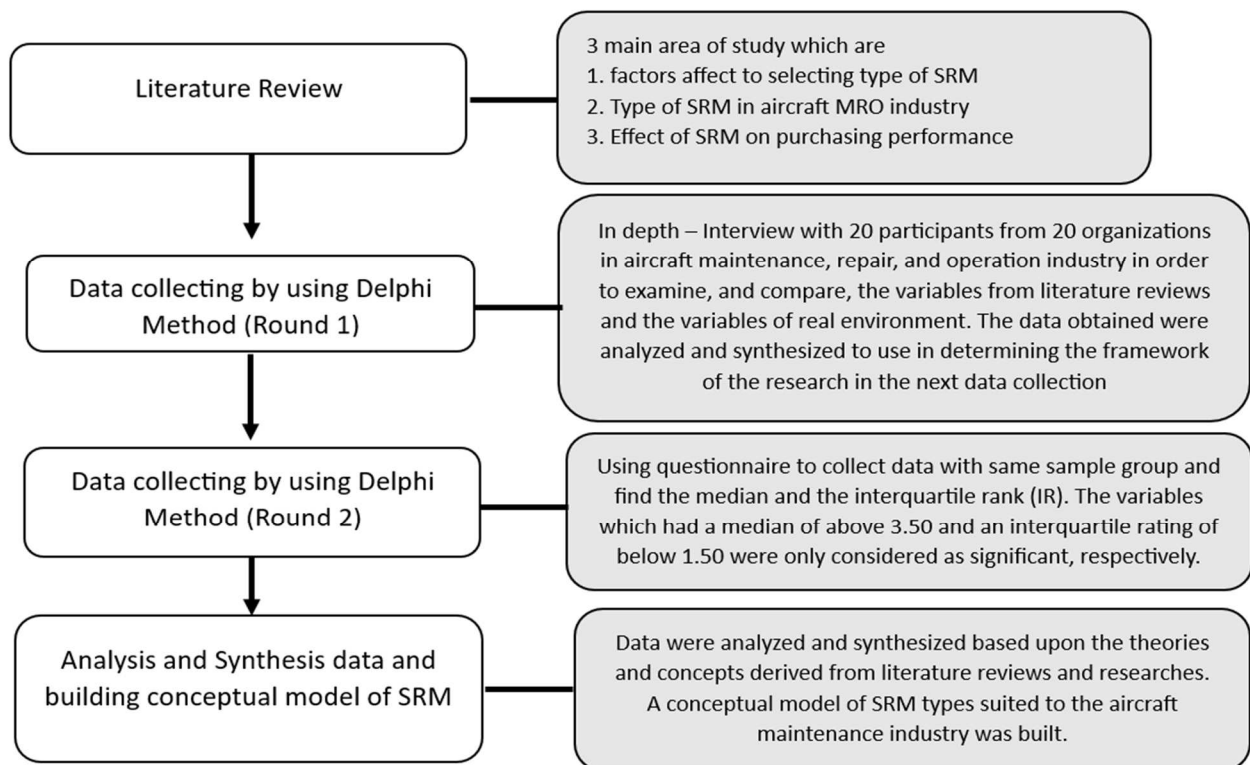

Figure 1 Flow diagram illustrating the method of this research

4   Results

The results will be presented in two parts. The first part showed the results obtained from the first cycle of data collection, and the second part is the results from the second cycle of data collection. Details are as follows:

4.1   Results from the first cycle of data collection

The results obtained from the open-ended questions in the interviews with specialists showed that there are two main types of SRM used in the aircraft MRO divisions of airlines or aircraft MRO companies: arm's-length SRM and cooperative SRM. The factors affecting the decisions for choosing each SRM can be summarised into four types of ideals: (1) types of goods/parts purchased, (2) supplier

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type, (3) purchasing policies, and (4) collaboration degree between suppliers and purchasing. For the variables related to the SRM activities, the data from in-depth interviews showed that there are three main categories: (1) purchasing activities, (2) information-sharing related activities, and (3) other activities in managing product quality, managing inventories, and using supplier technologies and knowledge. For the impacts of SRM on purchasing performance, most interviewees reported that SRM will affect purchasing performance, in four areas: (1) purchasing costs, (2) purchase volumes, (3) delivery lead times, and (4) supplier performance.

4.2 Results from the second cycle of data collection

Data from the in-depth interviews conducted were used to develop a rating scale questionnaire to collect data for forming a structured interviews. The questionnaire was given to the same sample to verify the importance of the variables to be used when developing a SRM conceptual model that suit the aircraft MRO industry in Thailand. The results of the second cycle of data collection can be summed up in the variables used, as shown in figure 2-19. The result of factors which affect decision in choosing SRM types is shown as radar chart for each sub-factors as Figure 2 - Figure 5.
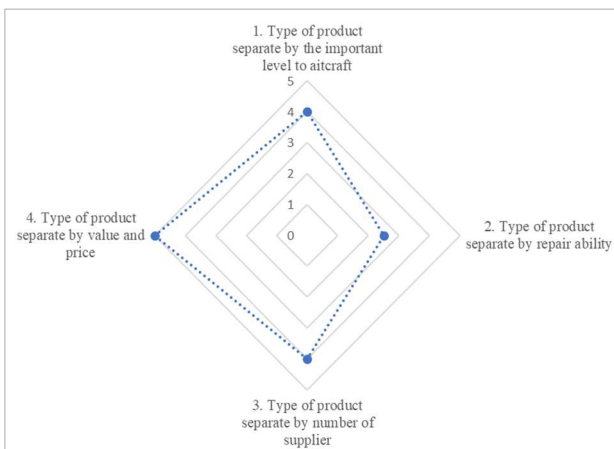

Figure 2 Median score for type of product which effect to selecting SRM type

The results showed that specialists emphasised on almost all factors, excluding product types separated by repairability whose median score is 2.5. Most specialists explained that types of goods can be divided into 'Consumable products' and 'Reparable products' and all SRM types are used for both consumable and reparable products. The results also showed the factors of goods type according to value and price is the most important. Cooperative SRM is suitable to employ for goods which have high value and only provided by a limited number of suppliers. In contrast, arm's-length SRM is suitable to goods which have low value yet provided by multiple

suppliers. For product types that separated by its importance level for aircraft, specialists suggested using cooperative SRM with the more important parts and arm's-length SRM with the lesser important parts.
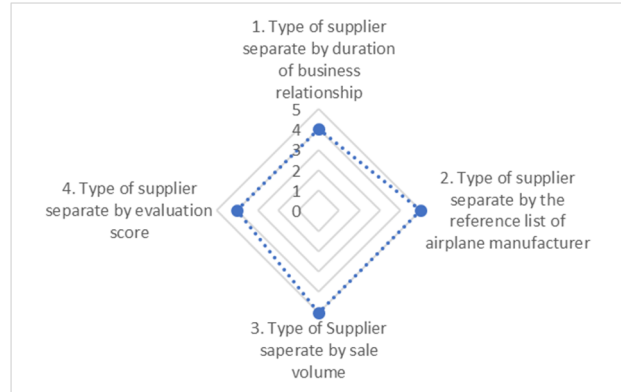

Figure 3 Median score for type of supplier which effect to selecting SRM type

Supplier type directly affect the decision-making in choosing SRM types. Specialists emphasized the median score of all factors under this category are over than 3.5. When studying the details, cooperative SRM is found to be used for suppliers who have had longer business relationships and high trading values, and suppliers who scored high in supplier evaluation. In contrast, arm's-length SRM is used with suppliers who have had a short business relationship and have low trading values, and suppliers who passed the supplier evaluation at standard level. The results also showed that cooperative SRM is used with suppliers who are on the reference list of aircraft manufacturers, while arm's-length SRM is used with suppliers who are not.
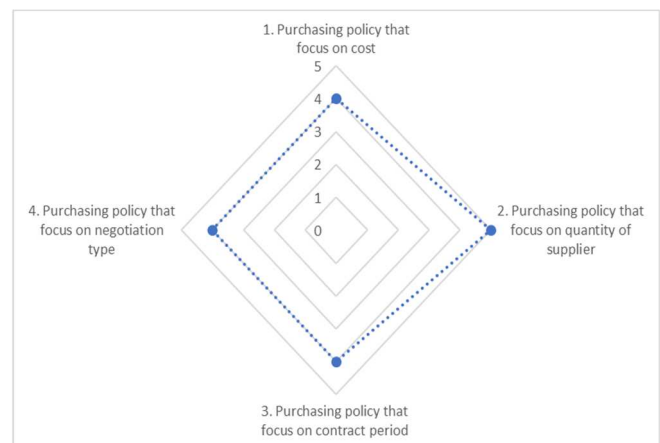

Figure 4 Median score for type of purchasing policies which effect to selecting SRM type

Specialists emphasized all factors related to purchasing policies, the median score of all are over than 3.5. Purchasing policy that focus on quantity of supplier get the highest score from specialists. Cooperative SRM is used

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for a single supplier policy, while arm's-length SRM is used in multiple supplier purchasing policy. Cooperative SRM suits to use in purchasing policies which focus on complete purchasing costs, long-term contracts, and win-win negotiations. On the other hand, arm's-length SRM suits for purchasing policies which focus on price, no contract terms, and win-lose negotiations.
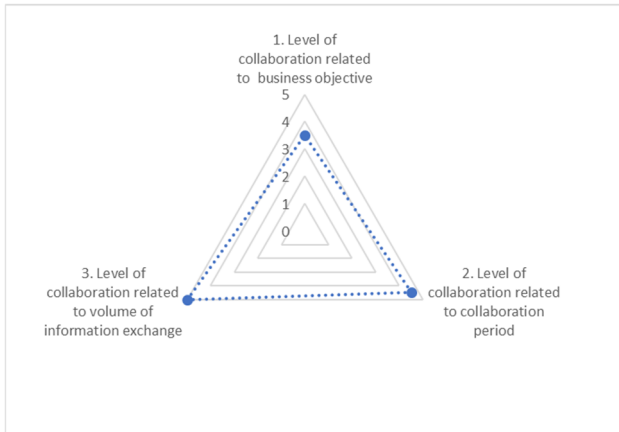
Figure 5 Median score for type of level of collaboration which effect to selecting SRM type

The collaboration degree between purchasing and supplier focuses on the areas of information-sharing, time-line of collaboration and business purpose, the median score for all area are over than 3.5. Cooperative SRM is suitable to employ with the suppliers who have greater level of information-sharing, longer perceived duration of collaboration and financial recuperation, and ventures into other areas. The interquartile range for every factor are equal to 1, therefore, it is considered as significant, respectively.

The result of important activities in both SRM types is shown as radar charts for sub-factors as Figure 6 - Figure 11.
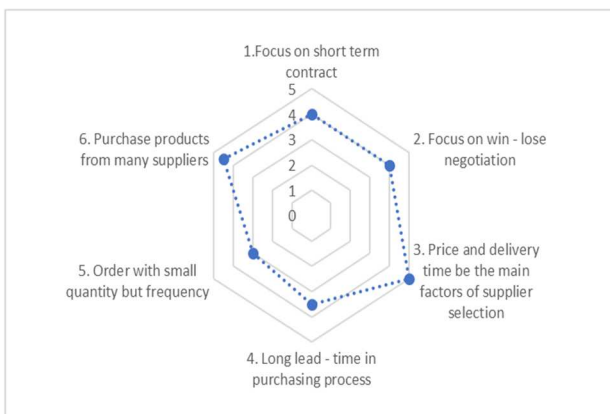

Figure 6 Median score for Arm's-length SRM in purchasing activities

The purchasing activities in arm's-length SRM that most specialists paid the greatest attention to is selecting

suppliers through bidding processes by comparing prices. It followed by determining supplier quantity, making contracts and negotiating. Purchasing activity which got the least attention is making frequent small quantity orders. The median score for is 3, lower than 3.5. Specialists explained that arm's-length SRM focuses on price, competition, and goods delivery. In most purchasing activities the buyers need to contact multiple suppliers. This results in longer lead-times in the purchasing process.
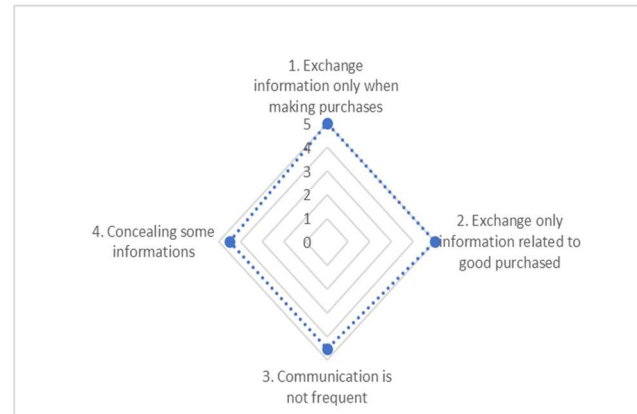

Figure 7 Median score for Arm's-length SRM in information-sharing activities

Specialists paid much attention to information-sharing of related activities in both cooperative SRM and arm's-length SRM but differ in the details of information sharing. For arm's-length SRM, the results showed that purchasing and sales only exchange information related to the products, or parts purchased when making orders. The communication is not frequent and there is concealment of information between companies.
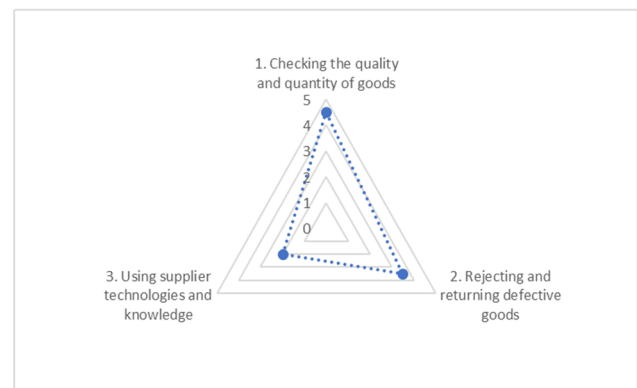

Figure 8 Median score for Arm's-length SRM in other related activities

Specialists also emphasized other related activities, such as quality and quality checking of incoming delivery, rejecting or returning defects when they have been assessed. However, they do not give priority to activities which use supplier technologies and knowledge, the median score is 2, which is lower than acceptable median

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score. Specialists explained that in term of purchasing they did not use much supplier technology and knowledge; however, they need to collaborate more with supplier in the technical and technology area.
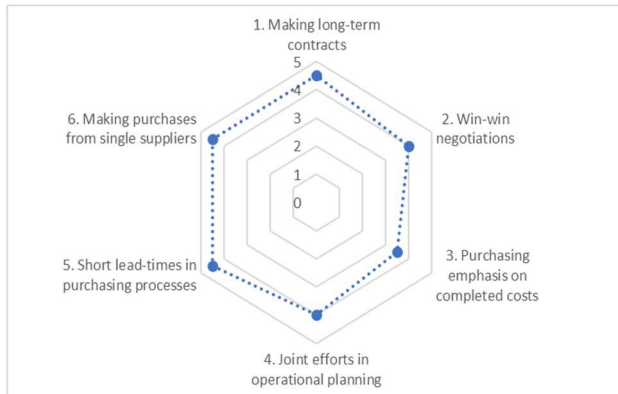

Figure 9 Median score for Collaborate SRM in purchasing activities

Figure 9 shows the level of importance of purchasing activity in cooperative SRM. Specialists gave their priority to purchasing activities relating making long-term contracts, making purchases from single suppliers, and shortening lead-times in the purchasing process, with the median score 3.5 and above. They explained that these three activities mentioned are required in cooperative SRM. Win-win negotiations and joint-efforts in operational planning are the purchasing activities which specialists gave the second priority to. According to the specialists, purchasing activity which focuses on total cost is the least important.
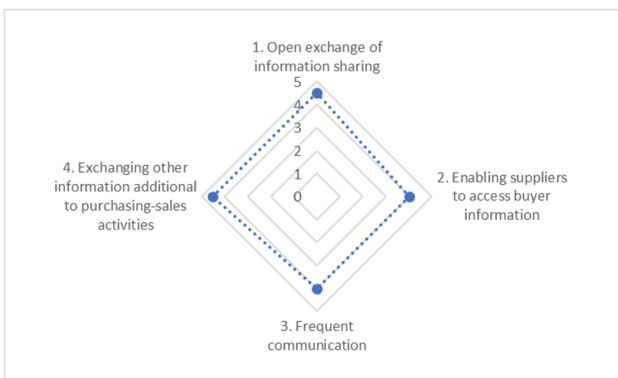

Figure 10 Median score for Collaborate SRM in information-sharing activities

From information-sharing activities, the results showed that specialists paid the most attention to open exchanges of information sharing, exchanging other information aside purchasing-sales operations, and sharing important information which is not related to purchasing and sales. It is followed by activities related to enabling suppliers to access to buyer information and those involved frequent contact between purchasing and sales. According to

specialists, purchasing needs to consider which information to exchange and share, so that it will not affect the image of the organisation, the management techniques, nor the business competitiveness.
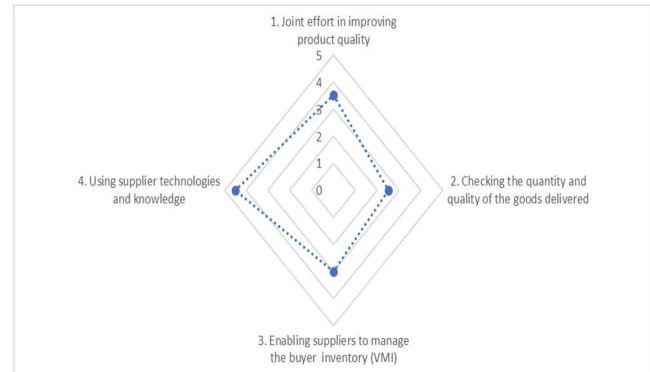

Figure 11 Median score for Collaborate SRM in other related activities

For other related activities, specialists gave top priority to using supplier technologies and knowledge, and the second lies in jointing efforts to improve product quality. However, the results showed that specialists gave low priority to activities related to VMI and activities related to quantity and quality checking of goods delivered. It is because the suppliers who are in a cooperative relationship must reach certain standards in quality and in-time delivery of their goods. The purchasing department does not have to waste time rechecking. For activities related to VMI, specialists explained that most suppliers of important aircraft parts are located abroad. Urgent delivery from abroad will increase transportation costs. As a result, purchasers will allow suppliers to store their goods in the company warehouses instead. The interquartile range for both SRM types is equal to 1, therefore, it is considered as significant, respectively.

The result of the impacts of arm's-length and cooperative SRM to purchasing performance is shown as radar chart for each sub - factors as Figure 12 - Figure 19.
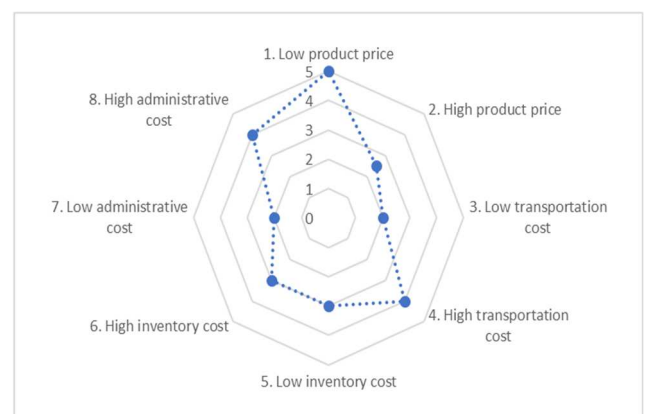

Figure 12 Median score for impact of arm's-length SRM to purchasing cost

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Figure 12 shows the result of the impacts of arm's-length SRM to purchasing performance in purchasing cost. The specialists agreed that arm's-length SRM reduces products price by using bidding and price comparison method. However, it increases transportation costs and administrative costs due to more frequent purchase, as shown from the median score below 3.5 in both factors. In addition, specialists noted that no clear impacts of arm's-length SRM on inventory costs were found. From further interviews, most specialists confirmed that arm's-length SRM reduces products price but increases transportation costs and administrative costs in return. While the inventory costs will vary according to delivery times and purchasing volume. Therefore, the impacts of arm's-length SRM on inventory cost cannot clearly be adjusted for.
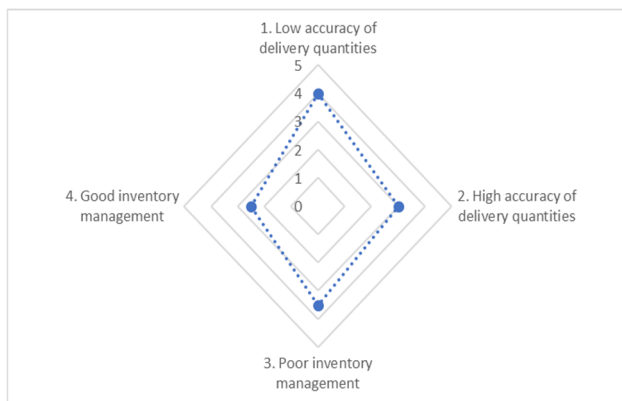

Figure 13 Median score for impact of arm's-length SRM to product purchased quantity

For the impacts on product purchase quantity, arm's-length SRM causes low accuracy in delivery quantity and poor inventory management. Due to a lack of information-sharing between purchasing and sales, and poor supplier ability to respond to immediate change, arm's-length SRM delivers poor accuracy in quantity. Furthermore, it causes poor inventory management. The specialists commented that insufficient quantities of product in stock is still the main problem for purchasing under arm's-length SRM. The median score for good inventory management and high accuracy of delivery quantities are below 3.5.
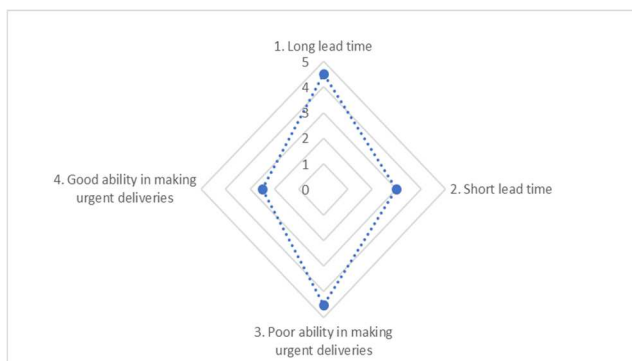

Figure 14 Median score for impact of arm's-length SRM to delivery lead-times

For the impacts of arm's-length SRM on supplier performance in terms of delivery lead-times, specialists commented that suppliers are unable to deliver goods on time as promised and take longer lead-time. Arm's-length SRM causes suppliers to be poor in responding to changes or urgent orders. The median score for short lead-times and good ability in making urgent delivery are lower than 3.5.
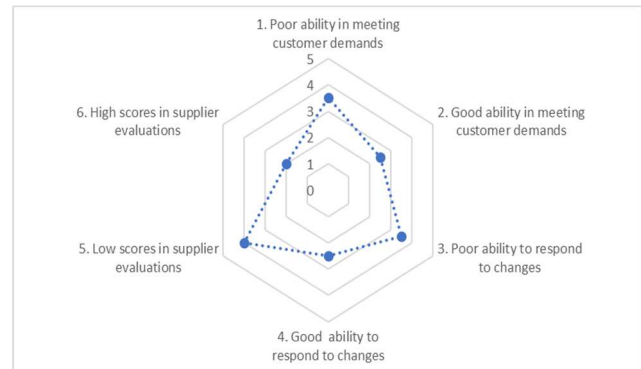

Figure 15 Median score for impact of arm's-length SRM to supplier performance

For the impacts of arm's-length SRM on supplier performance, specialists also commented that most suppliers in arm's-length relationship are poor at meeting customer demands. As a result, suppliers get standard scores in supplier evaluations and do not get a chance to develop cooperative relationships with purchasers.
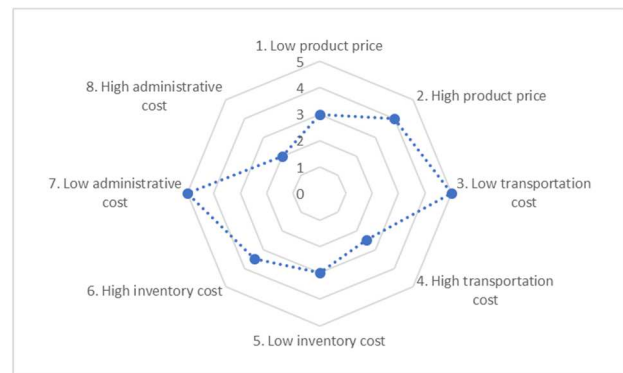

Figure 16 Median score for impact of cooperative SRM to purchasing cost

The importance level for the impacts of cooperative SRM on purchasing performance is shown in Table 16–19. For the impacts on purchasing cost, cooperative SRM causes higher product prices due to no price comparisons and limited suppliers, yet reduces transportation and administrative costs. Some specialists commented that cooperative SRM increases inventory costs, as in airline MRO suppliers permit the buyers to store their spare parts in buyer's warehouses instead. Specialists are allowed to borrow from suppliers instead of keeping more inventory or paying more for transportation when they need it in urgent.

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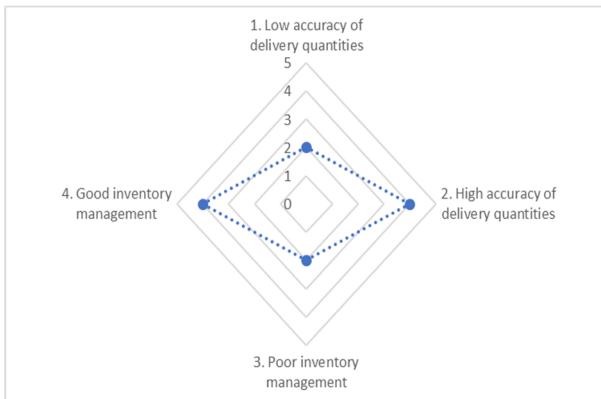Peter Madzik, Noppadol Suwannasap

Figure 17 Median score for impact of cooperative SRM to product purchased quantity

For the impacts on products purchased quantity, the results showed that cooperative SRM leads to higher accuracy in delivery quantity and leads to good inventory management. The median score for low accuracy of delivery quantity and poor inventory management are 2, which is lower than acceptance median score.
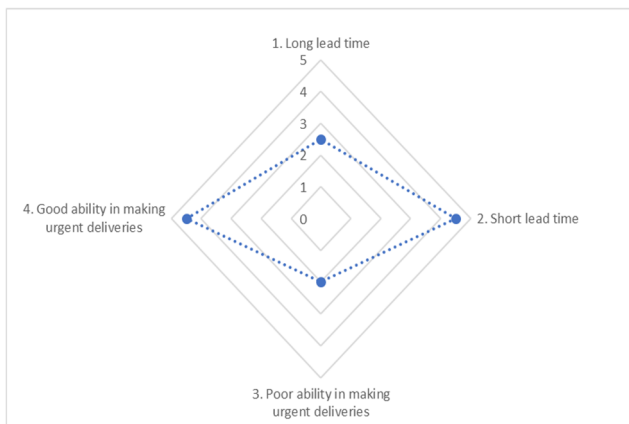

Figure 18 Median score for impact of cooperative SRM to delivery lead-times

For the impacts of cooperative SRM on supplier performance in terms of delivery lead-times, specialists commented that suppliers can deliver products on time as contractual agreement and take shorter lead-times. It makes suppliers respond efficiently to urgent orders. The results showed that open exchange of information sharing between purchasing and sales in cooperative SRM leads to better purchasing performance in terms of delivery lead-times, accuracy of delivery quantity and the ability to respond to urgent orders.
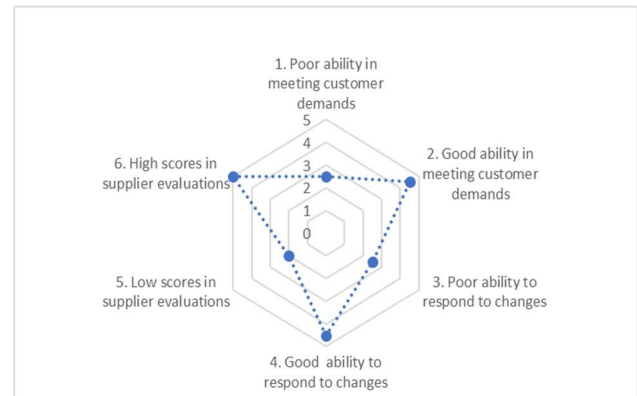

Figure 19 Median score for impact of cooperative SRM to supplier performance

For the impacts on supplier performance, all specialists agreed that joint efforts in operational planning and information sharing between purchasing and sales in cooperative SRM enhances supplier ability in meeting and responding customer demands. In addition, they agreed on using cooperative SRM with suppliers which have higher scores in evaluations. The interquartile range for both SRRM types impact on purchasing performance are equal to 1, therefore, it is considered as significant, respectively.

By analyzing the data collected according to the Delphi technique in Round 2, the data are used to build a supplier relationship management model and the impact on procurement performance as shown in Figure 20.

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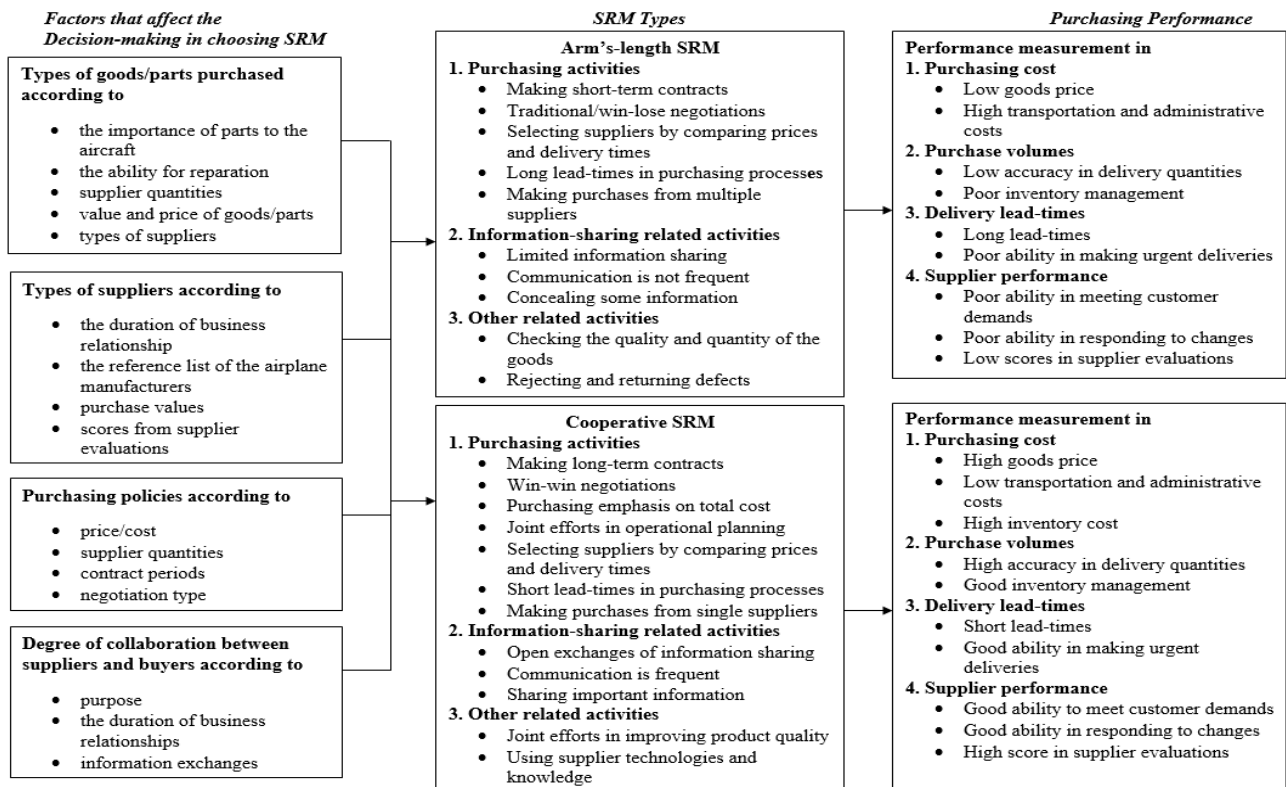Peter Madzik, Noppadol Suwannasap

Figure 20 Conceptual Model SRM in aircraft maintenance, repair, and operation industry

5 Conclusion

5.1 Conclusion and discussion

The results showed arm's-length SRM and cooperative SRM are used in the aircraft MRO industry in Thailand, which are different from the literature review which showed four types of SRM. Factors that affect the decision in choosing SRM types are product type, supplier type, purchasing policies and collaboration degrees between purchasers and suppliers. The important activities of arm's-length SRM in the aircraft MRO industry in Thailand consist of (1) purchasing activities, including contract period, win-lose negotiation, bidding, price comparison, making purchases from multiple suppliers. (2) information-sharing related activities, including exchanging information related to the products purchased, less–frequent of communication between purchaser and supplier, and the concealment of information. (3) other activities, including checking the quality and quantities of products, and rejecting and returning defects. The important activities of cooperative SRM consist of (1) purchasing activities, including making long-term contract, win-win negotiation, purchasing which focuses on complete costs, joint efforts in operational planning and making purchases from single suppliers. (2) information-sharing related activities, including open exchange of information sharing, exchanging other information besides purchasing-sales, sharing important information and frequent contact between purchasing and sales. (3) other related activities, including joint efforts in improving product quality and using supplier technologies and knowledge.

Different SRM types have different impacts on purchasing performance. Cooperative SRM helps reduce transportation and administrative costs but increase goods price and inventory costs. The result is consistent with research of Wang (2007), Tobias and Peter (2009) and Hines (2020) indicating that strong relationship management styles help increase the efficiency of procurement costs if compared to weak relationships. However, the impact of Cooperative SRM on increasing inventory cost showed the different result from other research; because Cooperative SRM allows airline keep some of the important aircraft spare parts in their inventory before making an order. Cooperative SRM also helps improve supplier performance to meet the purchasing requirements, reduce errors in transportation and inventory management, reduce the lead-times, and respond to customer demands and changes efficiently. This research showed similar result with the study of Joseph and Christian (2001) and Wang (2007) which explained that cooperative relationship improves supplier performance and increases customer satisfaction. In contrast, arm's-length SRM causes some problems in inventory management, product delivery time, the accuracy of quantities delivered, the ability to meet customer demands and the ability to respond to changes requirement. Similar with the research result of Wang (2007), Tobias and Peter

(2009), Ghaith, Ayman and Khaled (2014) and Hines (2020), this research proved that weak relationship cause poor supplier responsibility. However, this research result showed that arm's-length SRM brings benefits in reducing purchase price and making supplier switching easier, but it increases transportation cost, especially urgent shipment cost.

In the aircraft MRO industry of Thailand, both SRMs are applied in purchasing aircraft spare parts. However, the results in this research showed that all specialists agreed that developing arm's-length SRM into cooperative SRM will bring better impacts on purchasing performance.

5.2   Limitation and suggestion

The results showed that appropriate SRM model will help improve procurement performance in aircraft MRO industry. However, this study still has some limitation in term of amount of data and limited period of time, the result only represented for specific group of industry and in some specific situations. Therefore, the results of applying the SRM model with other industries or organizations that are different from the case study may give results that do not match the research presentation.

This SRM model in the aircraft MRO industry was developed by collecting data from a small population, which suitable for using qualitative research method. Therefore, the research results may cause discrepancies if the number of populations increases. Future study using quantitative research methods is recommended to study the details of the SRM activities according to the model on how affects procurement in each aspect.

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