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**TQM DIMENSION IN THE
RMAF INTERNAL SUPPLY
CHAIN MANAGEMENT:
ANALYSIS ON CENTER FOR
AEROSPACE AND
ENGINEERING SERVICE
(CAESE)**

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2021

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- A list of figures and tables (if applicable).
- A glossary of terms (where appropriate).
- A clear statement of my project objectives.
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Date: **1 March 2021**

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RMAF INTERNAL SUPPLY CHAIN MANAGEMENT:
ANALYSIS ON CENTER FOR AEROSPACE AND ENGINEERING
SERVICE (CAESE)**

LT KOL SAMSURI BIN ABU BAKAR RMAF

Final project paper submitted to National Defence University of Malaysia in fulfilment of the requirements for the Master of Business Administration (Supply Chain and Logistics)

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ABSTRACT

The Royal Malaysia Air Force (RMAF) depends on external and internal supply chain to support its operation. One of the important organisations in RMAF is the Centre of Aerospace Engineering Services (CAESE) that functioned as the center of expertise for Research and Development. The RMAF depends on CAESE for sustainable design and development to lessen the dependencies on the foreign aircraft and system manufacturer, for specialized support and modernization. CAESE provides the technical support, maintenance support and predictive maintenance to RMAF squadrons to ensure that RMAF's aircraft will always meet with operational requirement and readiness. As demands grows due to the progressive nature of aircraft ageing, and increasing of operational requirement, CAESE had been challenged by the limited resources of personnel, materials, and equipment in continuing supporting RMAF's squadrons with efficient and effective technical solutions. The RMAF supply support was threatened with disruptions, delays, inaccuracy and substandard quality of products and services, that caused the RMAF sustainable design and development support degradation, that further reduced RMAF capacity and capability. This research paper seeks to analyse the issues of supply support in CAESE focusing on the supply chain management and the application of total quality management principles and dimensions to help mitigate and find innovative solutions. The qualitative study had analysed the documented data from CAESE's records and supported by interviews and substantiate with secondary data from available literatures and journals. The results showed a significant and positive relation of total quality management dimensions consist of leadership commitment, customer focus, employee participation, continuous improvement and innovation, and training and education, towards improvement in the supply chain flexibility, efficiency, performance, and cost reduction, with compliance to the airworthiness regulatory standards. These findings may help RMAF to identify the important factors in assisting future policy and regulatory development for a better supply supportability in its organisations.

ABSTRAK

Tentera Udara Diraja Malaysia (TUDM) bergantung pada rantai bekalan luaran dan dalaman untuk menyokong operasinya. Salah satu organisasi penting dalam TUDM adalah Pusat Perkhidmatan Kejuruteraan Aeroangkasa (CAESE) yang berfungsi sebagai pusat kepakaran untuk Penyelidikan dan Pembangunan. TUDM bergantung kepada CAESE untuk reka bentuk dan pembangunan lestari untuk mengurangkan kebergantungan pada pengeluar pesawat dan sistem asing, untuk sokongan dan pemodenan khusus. CAESE memberikan sokongan teknikal, sokongan penyelenggaraan dan penyelenggaraan ramalan kepada skuadron TUDM untuk memastikan bahawa pesawat TUDM akan sentiasa memenuhi keperluan operasi dan kesiagaan. Ketika permintaan semakin meningkat kerana faktor penuaan pesawat yang progresif, dan peningkatan keperluan operasi, CAESE telah dicabar oleh sumber tenaga kerja, bahan dan peralatan yang terbatas dalam terus mendukung skuadron TUDM bagi terus memberikan penyelesaian teknikal yang efisien dan efektif. Sokongan bekalan TUDM telah berhadapan dengan ancaman gangguan, kelewatan, kualiti produk dan perkhidmatan yang tidak tepat dan tidak berkualiti. Ini telah menyebabkan kemerosotan dalam sokongan reka bentuk dan pembangunan TUDM yang selanjutnya telah mengurangkan kapasiti dan kemampuan TUDM. Penyelidikan ini bertujuan untuk menganalisis isu-isu sokongan bekalan di CAESE yang memberi tumpuan pada pengurusan rantai bekalan dan penerapan prinsip dan dimensi pengurusan kualiti total untuk membantu mengurangkan dan mencari penyelesaian inovatif. Kajian kualitatif telah menganalisis data yang didokumentasikan dari rekod CAESE dan disokong oleh wawancara dan pembuktian melalui data sekunder dari literatur dan jurnal. Hasil kajian menunjukkan hubungan yang signifikan dan positif dari keseluruhan dimensi pengurusan kualiti terdiri dari komitmen kepemimpinan, fokus pelanggan, penyertaan pekerja, peningkatan dan inovasi berterusan, dan latihan dan pendidikan ke arah peningkatan fleksibiliti, kecekapan, prestasi, dan biaya rantai bekalan dengan piawaian peraturan kelayakan udara. Penemuan ini akan dapat membantu TUDM untuk mengenal pasti faktor-faktor penting dalam membantu pembangunan dasar dan polisi masa depan untuk sokongan bekalan yang lebih baik.

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This final project paper titled, “**TQM DIMENSION IN THE RMAF INTERNAL SUPPLY CHAIN MANAGEMENT: ANALYSIS ON CENTER FOR AEROSPACE AND ENGINEERING SERVICE (CAESE)**” produced by **LT KOL SAMSURI BIN ABU BAKAR RMAF** Matric No **3201308** has been accepted as having fulfilled the partial requirements for the Master of Business Administration (Supply Chain and Logistics).

.....
(Signature of Supervisor)

Lt Kol Hamzan bin Abdul Jamil (Retired)

Date:

DECLARATION

I have read and understood the rules on cheating, plagiarism and appropriate referencing as outlined in my handbook and I declare that the work contained in this paper is my own, unless otherwise acknowledged. No substantial part of the work submitted here has also been submitted by me in other assessments for this or previous degree courses, and I acknowledge that if this has been done an appropriate reduction in the mark I might otherwise have received will be made.

Signed candidate:

You are required to justify your submitted Project Paper against the degree definition for which you are registered.

Project definition for my degree:

The project should normally be related to supply chain and logistics environment. It could address many different aspects such as business, administration, and management issues. My project relates to this definition in the following way:

1. The project is centered on TQM dimensions related to supply chain management.
2. This project addresses the aspect of supply support in Center of Aerospace Engineering Services (CAESE).
3. The intention of the project is to assist and improve Royal Malaysian Air Force – CAESE Supply Chain Management.
4. The recommended improvements in this project are based on the best practices taught in the MBA modules.

The above shows the relevance of the work to the degree for which it is submitted.

	Signed	Agree (√)	Disagree (√)
Supervisor: Lt Kol Hamzan bin Abdul Jamil (Retired)			

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ABBREVIATION

AMO	Aircraft Maintenance Organisation
AEO	Authorised Engineering Organisation
ASIP	Aircraft Structure Integrity Program
CAESE	Centre Aerospace Engineering Services Establishment
CBM	Condition Based Maintenance
DGTA	Directorate General Technical Airworthiness
FMEA	Failure Mode and Effect Analysis
ILS	Integrated Logistics Support
MCY	Malaysian Commercialization Year
MRO	Maintenance Repair and Overhaul
MTO	Military Transport Officer
RMAF	Royal Malaysian Air Force
SC	Supply Chain
SCM	Supply Chain Management
TQM	Total Quality Management
QMS	Quality Management System

CHAPTER 1

INTRODUCTION

1.1 INTRODUCTION

Supply chain management include series of activities in a system that integrate all the suppliers and manufacturers through a network of connection, transportation and warehouses that linked the products to the final users. The supply chain may be long or short, massive or simple depending on the products or the services. The chain of entities involves along the path of the product create a map that describe the total journey of materials from one part to another. To ensure the chain of entities meet with the user requirement in term of time and cost, it is important that the supply supportability consideration is given attention. Supply supportability involved the supply chain resources planning and designing, to meet with the operational requirement.

As the supply chain management and supply supportability becoming an important subject of thoughts, the Total Quality Management and its principle had been included to improve the organisations supply chain with the objective of cost reduction, quality improvement and productivity enhancement. Integration of the TQM in the supply chain management had created a more superior performance and termed as supply chain quality management. Today, TQM had become as an important tools and standards across the organisations to promote customer satisfaction and competitiveness of the organisation. The efforts that tailored to the TQM principles had created a conducive environment that promoted continuous improvements in delivering high quality products and services to the customers.

1.2 BACKGROUND OF THE STUDY

The Royal Malaysian Air Force is an organisation that ensures the integrity and security of the Malaysian airspace as well as supporting humanitarian aid and disaster relief missions by providing strategic airlift capabilities. The range of aircraft that are being used by the organisation had created a wide network of supply chain involving assets that were intended to fulfil the

fighting capabilities, maritime surveillance, strategic and tactical airlift and airspace monitoring and control systems. In order to ensure the quality of the products and services, RMAF had adapted the related TQM principles in the internal supply chain that cover establishments such as the aircraft squadron, airspace monitoring facilities, maintenance, engineering and logistic support organisations, warehouses and the transportations entities. The main aim of TQM in RMAF is to ensure the cost effectiveness and productivity of the organisation remain at a competitive range due to the strict expenditure control by the government. The elements of TQM principles had been published in the RMAF quality manuals, that act as a guidance to the implementations. However, the application parts of the TQM principles in the organisation are still open for improvements to allow effective supply chain and ensure the continuation in cost reduction and productivity improvement. In order to gauge the success of TQM implementation in the RMAF organisations, a study need to be carried out to ascertain the effectiveness and to identify the gaps and shortcomings in the RMAF supply chain organisations.

1.3 PROBLEM STATEMENT

One of the important organisations in RMAF is the Centre of Aerospace Engineering Services (CAESE) that functioned as the centre for Research and Development in RMAF that provides and supply the technical support, maintenance support and predictive maintenance to RMAF squadrons. As demands grows due to the progressive nature of aircraft ageing, and increasing of operational requirement, the limited resources of expertise, materials and equipment had challenged CAESE in supporting RMAF's squadrons with efficient and effective technical solutions that had caused delays, inaccurate and unairworthy products and services. Faced with limited resources beyond its control, CAESE had to find, develop and execute alternative and innovative measures to support the demand through systematic and structured resource planning and supply chain management to avoid disruptions in the supply support.

The scope of CAESE in the RMAF supply chain is focused on providing engineering technical solutions to the aircraft squadrons and therefore it is very important to ensure that the product quality meet with requirement through a control process. Some of the services provided by CAESE are as follows:

a. **Design and Technical Support.**

CAESE is the only organisation in the RMAF that can alter or modify aircraft maintenance procedures, parts, and components. Some of the project involved alteration, modification, productions and certification of aircraft parts and changes to aircraft maintenance instructions. In recent years CAESE had been able to produce several aircraft parts such as the carrier system for laser guided bomb LGB on Su30-MKM fighter aircraft, fabricating of aircraft brake parachute system for Su30-MKM, produced the launch platform for Aircraft Combat Maneuvering Instrumentation ACMI pods onboard Su30-MKM and produced the alternative overhaul procedures for Su30-MKM.

This segment of service in CAESE had offered RMAF the alternative supportability without depending on the external supply chain and thus, allowing for a certain degree of flexibility to lower the dependability on the upstream supply network. The important factors that contributed to the success in this service segment is the assets, including human resources, equipment, process and data management in CAESE and its support network.

This segment of design and technical support services required the presence of CAESE's team with their related equipment at the RMAF squadrons in Air Bases across Malaysia. The efficiency of transportation is important to avoid delays in providing services that are increasing in frequency. The ground transportation that connects CAESE to its long-distance supply chain network ranging from 560 km away in RMAF Gong Kedak, 436 km to RMAF Alor Setar, 350 km to RMAF Butterworth and 250 km to RMAF Kuantan had faced with the issues of shortage of divers that caused delays in providing technical services to the squadrons. Without efficient transportation, CAESE supply chain network will face with delays and subsequently will cause negative impact to the RMAF operational capabilities and readiness. Thus, this issue needs to be analysed and improved since the performance of transportation management is critical for CAESE to deliver technical service within the fastest time required.

b. Maintenance Support

The maintenance support provided by CAESE is in the area of Non-Destructive Testing (NDT), Aircraft Metallic Structure Repair and Aircraft Weighing. The data from the NDT and weighing activities will be used to verify and validate the status of the aircraft, the structure and its systems.

The quality of the maintenance support provided by CAESE depends on the quality of the equipment used and the accuracy of the information given by the squadrons. The correct information on the structural defects found on the aircraft at the squadrons will allow accurate diagnostic procedure to be carried out in CAESE. This includes preparing the right repair plates for the structure repair scheme before the repair work can be carried out on the aircraft at the squadrons. This is because metal forming capabilities currently only available in CAESE.

The information of the defect's categories, dimension, shapes, and locations (with pictures) are passed through defect reports from the squadron to CAESE via the internet. However, the information often has inaccuracies to the dimensional measurement that had jeopardized the repair services. The situation had caused unwanted delays and prolonged of 'aircraft on ground' status. Thus, the quality of the defect reporting and communicating procedures need to be analyzed and improved to ensure that the quality and efficiency of CAESE in delivering the correct products and services on time.

c. Predictive Maintenance

Predictive maintenance is part of preventive maintenance under the concept of condition-based maintenance. CAESE is the only organisation in RMAF that provide predictive maintenance in form of Spectrometric Oil Analysis Program (SOAP) and Aircraft Structure Integrity Program (ASIP).

The Aircraft Structure Integrity Program (ASIP) used flight and maintenance data from the aircraft in the squadrons that is gathered daily and analysed in CAESE. The data will form as the basis for the predictive maintenance of the structure that are customised according to the aircraft type and flight profile, that are reported on monthly basis to the RMAF Air Support Command. RMAF Air Support Command will then use the predictive data to plan for maintenance activities that include aircraft modernisation, structure life extension and to acquire the maintenance support from the aircraft manufacturer. The ASIP program is tasked to CAESE because the program required special technical knowledge, engineering expertise and database control processes.

RMAF Air Support command managed the supply support for all the squadrons with high dependencies on aircraft manufacturer in the upstream supply chain due to the airworthiness regulatory requirements. However, when disruption occurs in the upstream supply chain, RMAF had to turn to CAESE as the internal resources to provide alternative solutions.

In 2017, the Russian aircraft manufacturer Rosoboronexport through official correspondence, had stated that all the Su-30MKM need to be overhauled after reaching 10 years in service with a cost projection of RM2.2 billion. The overhaul is mandatory or RMAF will face a critical risk of flying with unworthy condition.

Facing with the sudden disruptive situation in RMAF supply chain, CAESE had to depend on the ASIP data to analyse and to propose alternative structure life extension program with a cheaper cost. Thus, the quality, validity, and reliability of the ASIP data gathering and analysing processes need to be justified to ensure that the alternative solution in structure maintenance proposed by CAESE will meet with RMAF airworthiness requirement. Without the justification process, the alternative maintenance solution may not be accepted by RMAF Air Support Command as the customer, or in the worst case if it is accepted due to negligence, then there is a fair chance that the structure will catastrophically fail in the air. Thus, the ASIP data is very crucial for the

sustainability of the RMAF supply chain and thus the quality and reliability need to be validated to ensure success.

In order to deliver the products and services mentioned above, CAESE had to ensure that the assets inclusive of human resources, equipment, processes and the technical data are managed effectively. TQM principles may help CAESE to achieve the desired products and service quality, with effective cost and delivered perfectly within the planned time range. By engaging the TQM principles in those areas, CAESE may achieved:

- a. Efficient technical and maintenance support provider.
- b. Better services and products quality.
- c. Better process management that promotes effective cost and productivity.
- d. Improvement in data management capability to ensure product quality and safety.

1.4 **RESEARCH OBJECTIVES**

The research objectives are as follows:

- a. To identify the TQM dimension that are important to the supply support in RMAF Centre of Aerospace Engineering Services (CAESE).
- b. To analyse each of the TQM dimensions in related to the supply support in RMAF Centre of Aerospace Engineering Services (CAESE).
- c. To identify benefits of the TQM best practises applications to the supply support in the RMAF Centre of Aerospace Engineering Services (CAESE).