

**ORGANIZATIONAL LEARNING MECHANISMS DURING ADVANCED
MANUFACTURING TECHNOLOGY IMPLEMENTATION IN
AEROSPACE MANUFACTURING INDUSTRY**

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‘I/We hereby declared that I/We had read through this thesis and in my opinion that this thesis is adequate in terms of scope and quality which fulfil the requirements for the award of Bachelor of Technopreneurship.

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**The thesis is submitted in partial fulfilment of the requirements for the award of
Bachelor of Technopreneurship**

**Faculty of Technology Management and Technopreneurship
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DECEMBER 2019

DECLARATION OF ORIGINAL WORK

“I hereby declare that this dissertation is the result of my own, except certain explanations and passages where every of it is cited with source clearly.”

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DEDICATION

To dearest parents, siblings, family, lecturers and friends.

ACKNOWLEDGEMENT

Firstly, I would like to express my sincere gratitude to my supervisor, Puan Mariam Miri binti Abdullah for the continuous support of my research, for her patience, motivation, and immense knowledge. Her guidance helped me in all the time of research and writing of this thesis. I could not have imagined having a better advisor and mentor.

Not forgetting my family members; my father, Aris bin Tusimin, my mother, Nor Azmah binti Othman@Kassim, my brother Afif bin Aris and my sister Nisa binti Aris. I am grateful to have them supporting me not only in completing this dissertation, but their support and prayers were with me all the time I was in UTeM.

Finally, thank you to all my friends for their constant source of inspiration and motivation, pushing me through to finish this research.

ABSTRACT

Aerospace manufacturing sector is facing challenges to survive in the modern world due to rapid globalization and technological advancements. Advanced manufacturing technology (AMT) implementation has been proven to improve firms' competitiveness. However, organizational learning (OL) is perceived as important to promote effectiveness in implementing AMT. This research aims to identify the various learning mechanisms undertaken by the aerospace manufacturing firm during AMT implementation and explain how organizational support affects OL. This research adopts its variables from Huber's Organizational Learning Framework; knowledge acquisition, knowledge interpretation, knowledge distribution/sharing and organizational memory. Organizational support is added as a factor affecting OL. The findings of this qualitative research are analyzed using thematic analysis to identify common themes during the semi-structured interviews with multiple informants from an aerospace manufacturing firm in Malacca. Based on the data analysis, the firm uses various learning mechanisms namely knowledge acquisition (internal and external knowledge source), knowledge interpretation (further actions and improvements), knowledge distributing/sharing (townhall, buddy system, performance review, CTRM TV, classes, meetings), and organizational memory (learning from failure, database, design library). Secondly, organizational support aids the firms' OL by giving allowances and providing employees with opportunities to be promoted. This research can act as a guide for other aerospace manufacturing firms in finding the right learning mechanisms and recognize the effect of organizational support on organizational learning.

Keywords: Organizational Learning, AMT Implementation, Aerospace Industry, Aerospace Manufacturing, Organizational Support

ABSTRAK

Sektor pembuatan aeroangkasa perlu mengharungi pelbagai cabaran dek arus globalisasi dan kemajuan teknologi di dunia masa kini. Teknologi pembuatan canggih telah terbukti meningkatkan tahap daya saing sesebuah organisasi. Namun begitu, proses pembelajaran organisasi adalah penting untuk meningkatkan tahap keberkesanan pelaksanaan teknologi pembuatan canggih. Kajian ini bertujuan untuk mengenalpasti kaedah pembelajaran yang digunakan oleh organisasi pembuatan aeroangkasa semasa pelaksanaan teknologi pembuatan canggih dan menerangkan bagaimana sokongan daripada organisasi mempengaruhi pembelajaran organisasi tersebut. Kajian ini mengadaptasi pembolehubah daripada kerangka Proses Pembelajaran Organisasi Huber; pengambilalihan pengetahuan, tafsiran pengetahuan, penyebaran pengetahuan dan memori organisasi. Sokongan organisasi ditambah sebagai faktor mempengaruhi pembelajaran organisasi. Dapatan kajian kualitatif ini dianalisa menggunakan analisa tema untuk mengenalpasti tema semasa tembus dijalankan bersama responden daripada syarikat pembuatan aeroangkasa di Melaka. Berdasarkan analisis, syarikat tersebut menggunakan pelbagai kaedah pembelajaran iaitu pengambilalihan pengetahuan (sumber pengetahuan dapatan dan luaran), tafsiran pengetahuan (tindakan yang perlu diambil dan penambahbaikan), penyebaran pengetahuan (townhall, sistem buddy, penilaian prestasi, CTRM TV, kelas, mesyuarat) dan memori organisasi (belajar dari kegagalan, pangkalan data dan storan data). Kedua, sokongan organisasi membantu pembelajaran organisasi dengan memberi elaun dan membuka peluang kepada pekerja untuk dinaikkan pangkat. Kajian ini boleh dijadikan panduan untuk syarikat aeroangkasa yang lain untuk mengenalpasti kaedah pembelajaran yang betul dan mengetahui kesan sokongan daripada organisasi terhadap pembelajaran organisasi.

Kata Kunci: Pembelajaran Organisasi, Pelaksanaan Teknologi Pembuatan Canggih Industri Aeroangkasa, Pembuatan Aeroangkasa, Sokongan Organisasi

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LIST OF ABBREVIATIONS

AMT	Advanced Manufacturing Technology
OL	Organizational Learning
MRO	Maintenance, Repairs & Overhauls
IT	Information Technology
MIDA	Malaysian Investment Development Authority
R&D	Research & Development
UAV	Unmanned Aerial Vehicle
ME	Manufacturing Engineer
SOP	Standard Operating Procedure
CATIA	Computer Aided Three-Dimensional Interactive Application
OJT	On-Job-Training
L&D	Learning & Development
ACTC	Aero Composite Training Centre
SPM	Sijil Pelajaran Malaysia
SLDN	Sistem Latihan Dual Nasional
OJA	On-Job-Assessment
NAQO	National Aerospace Quality Office
MITI	Ministry of International Trade and Industry
MAIA	Malaysian Aerospace Industry Association
CPD	Continuing Professional Development
NDT	Non-Destructive Testing
MPC	Malaysian Productivity Corporation
QC	Quality Circle
MSC	MacNeal-Schwendler Corporation
DCM	Diploma of Engineering Technology in Composites Manufacturing
BCM	Bachelor of Engineering Technology in Composites Manufacturing

MBA	Masters in Business Administration
DHU	DRB-HICOM University
PRS	Production Readiness Study
OEM	Original Equipment Manufacturer
MOF	Ministry of Finance
Q&A	Question & Answer
CBPR	CTRM Business Performance Review
CMD	CTRM Management Dialogue
KPI	Key Performance Indicator
NCR	Non-Conformance Report
MRB	Material Review
CNC	Computer Numerical Control
CMM	Coordinate Measuring Machine
HOD	Head of Division
HOS	Head of Section
4M1E	Material, Man, Machine, Method, Environment
EAP	Employee Assistance Program

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Appendix 1	Interview Guide & Questions
Appendix 2	Thematic Analysis
Appendix 3	CTRM Posters

CHAPTER 1

INTRODUCTION

1.1 INTRODUCTION

This chapter describes the background of the study, problem statement, research questions, research objectives, significance of study and scope of study.

1.2 BACKGROUND OF STUDY

According to an analysis conducted by AeroDynamic Advisory and Teal Group Corp, the aerospace industry is worth an estimated US\$838 billion globally. The aerospace industry constitutes activities relating to the development, production, maintenance and support of aircraft and spacecraft. This includes engines, system, aerostructures and sub-tier suppliers, manufacturing, maintenance repair and overhaul, including spare parts and materials (ShowNews, 2018).

In the Malaysian context, Malaysia is currently home to more than 200 aerospace companies comprising both international and local industry players. The aerospace industry in Malaysia can be classified into the following sub-sectors:

Table 1: List of companies in Malaysia's aerospace industry		
<i>Source: MIDA (Malaysian Investment Development Authority)</i>		
Sub-Sectors	Products/Services	Number of companies
MRO	Aircraft, Ground Systems, Simulators, Ground Set Equipment	66
Aero-Manufacturing	Aero Structures, Avionics Equipment, Engines, Airframe Equipment, R&D, Design, Parts Assembly	33
Education and training	Tertiary & above, Diploma, Technical Skills	25
Systems Integration	Ground Systems, Simulators, Spacecraft, UAV, Aircraft Avionics, Missiles & Rockets	11
Engineering and design	Detailed Design, Analysis & Certification, Manufacturing Design & In-Service, Concept	11

The National Aerospace Industry Coordinating Office (NAICO) Head Shamsul Kamar Abu Samah stated that the local aerospace industry's manufacturing segment had shown tremendous growth since the 1990s and recently surpassed the maintenance, repairs and overhaul (MRO) segments as the top revenue contributor in the aerospace sector (The Star, 2018). Therefore, as a high-technology industry, it is important for these aerospace manufacturing firms to put more focus on advanced manufacturing technology (AMT) implementation to promote efficiency and growth.

Advanced manufacturing technology (AMT) implementation has been proven to increase firms' competitive advantage in their industry (Percival & Cozzarin, 2009; Fulton & Hon, 2010; Martinsuo & Luomaranta, 2018) especially if market is uncertain

and demands a variety of products to adapt to changing customer needs (Martinsuo & Luomaranta, 2018). However, lack of knowledge can cause firms fail to obtain maximum benefit from advanced manufacturing technology (AMT) implementation.

This is where organizational learning fits in. Adapting and evolving through learning can help organizations to last (Moon et al., 2017). In addition, researchers have explained that organizational learning promotes effectiveness in implementing change, gaining competitive advantage, creating business value, enhancing sustainability and improving performance (Imran et al., 2016; Shih & Ramser, 2019). One of the vital concepts in advanced manufacturing technology (AMT) implementation is to make sure that the users are capable of using the new technology. Therefore, an understanding on how firms learn can explain the success in advanced manufacturing technology (AMT) implementation.

On the other hand, organizational support is found to be helpful in aiding the organizational learning mechanisms to ensure the success of AMT implementation. In today's competitive environment, human resource of an organization can be used to gain competitive advantage, given that the working condition is conducive for human work. Furthermore, organizational support is often perceived as a key factor in increasing employees' motivation and commitment (Rozaini et. al., 2015) to the organization.

As a result, the main goals of this research are to identify the various learning mechanisms undertaken by manufacturing firms and explain how organizational support affects organizational learning during advanced manufacturing technology (AMT) implementation. This can guide firms in planning and managing the organizational learning mechanisms and understand the effect of organizational support on organizational learning that occur during the advanced manufacturing technology (AMT) implementation period.

1.3 PROBLEM STATEMENT

The government has identified Malaysia's aerospace industry as one of the '3+2' strategic sectors with high potential for growth. Moreover, the industry is considered as a strategic industry with wide potential in the country's industrialization and technological and development programmes. The industry generates an annual revenue of RM 12.7 billion and currently employs more than 21,000 skilled workers.

Due to its importance, the Malaysian Aerospace Industry Blueprint 2030 was launched during Langkawi International Maritime & Aerospace Exhibition (LIMA) 2015 in Langkawi, Kedah. According to Malaysian Investment Development Authority (MIDA), this blueprint charts the long-term plan for the development of the aerospace industry in Malaysia until 2030. The goal is to make Malaysia the leading aerospace nation in South East Asia and be an integral part of the global market by the year 2030.

Furthermore, as stated by MIDA, Malaysia is equipped with all the necessary ingredients to be a prominent player in the global aerospace market. Efforts had been undertaken to develop local clusters and other facilities that foster the growth of the industry (e.g. KLIA Aeropolis).

Over the past few years, the aerospace industry has seen countless innovations coming to realization (Brand, 2017). Many highly specialized technologies such as 3D printing, zero-fuel aircraft, smart automation and not forgetting advanced manufacturing technologies (AMT) are used in the sector. The use of these technologies is important because it speeds up and making the process simpler than what it used to be. Secondly, AMT can help manufacturing organizations in terms of flexibility, improved quality, quicker delivery, and global competitiveness (Goyal & Grover, 2012).

Advanced manufacturing technology (AMT) implementation can be defined as the decision by an organization or individual to utilize and implement a technology (Tattnall, 2009). In organizational context, advanced manufacturing technology (AMT) implementation is said as commitment to invest towards implementing and using a technology to support core business functionalities (Umapatahy, 2009). However, without enough knowledge of the technology, the implementation of AMT might not be as effective. Someone who work should be an expert in the specific knowledge in the area. Personnel involved in the absorption of knowledge applied (technical knowledge transfer) have the potential to impact results for the company or their own department (Guzella, 2016). Therefore, developing a strategic framework for organizational learning mechanism is important for better management of learning mechanisms during advanced manufacturing technology (AMT) implementation.

Furthermore, organizational learning is still widely discussed in the literature across various different fields (Tohidi et al., 2012) due to its importance for firms' growth and survival (Char et al., 2013; Tattnall, 2009). The need to compete in a highly volatile business environment has pushed dynamic organizations to take organizational learning as their source of competitive advantage (Imran et al., 2016; Liao & Wu, 2010). Hence, a further study of organizational learning can help to guide the company in organizing and implementing learning activities during advanced manufacturing technology (AMT) implementation.

In summary, there are a few reasons why organizational learning should be associated during advanced manufacturing technology (AMT) implementation. First, adopting a technology without a thorough understanding its learning dynamics will be insufficient because organization and its members continuously learn, so are the process of successful advanced manufacturing technology (AMT) implementation. Second, the need to understand the effect of organizational support on organizational learning is crucial due to the positive impacts it gives to organizations based on previous researches.

1.4 RESEARCH QUESTIONS

There are several important questions that support the research objectives, related to the mechanisms used by the manufacturing companies and the effect of organizational support on organizational learning during the advanced manufacturing technology (AMT) implementation. This research will be guided by the following research questions:

- What are the mechanisms used by aerospace manufacturing firm in organizational learning during advanced manufacturing technology (AMT) implementation?
- What is the effect of organizational support on organizational learning during advanced manufacturing technology (AMT) implementation in aerospace manufacturing firm?

1.5 RESEARCH OBJECTIVES

To answer the proposed research questions, this research will focus on the following research objectives:

- To identify the various learning mechanisms undertaken by the aerospace manufacturing firm during advanced manufacturing technology (AMT) implementation
- To explain the effect of organizational support on organizational learning of aerospace manufacturing firm during implementation of advanced manufacturing technology (AMT)

1.6 SCOPE OF STUDY

This research is aimed at a relevant sample of aerospace manufacturing company operating in Malacca. It is focused on the organizational learning mechanisms during the implementation of advanced manufacturing technologies (AMT) in the firm. Secondly, this research also looks into the effect of organizational support on organizational learning during the implementation period.

Thirdly, this study is only conducted on the company that has guaranteed full support in terms of providing the most information possible. In order to obtain the richest information, this research employs the methods of semi-structured, in-depth interviews and company visits.

Fourthly, this study is concentrated mainly on examining the use of learning mechanisms at individual company rather than the industry as a whole. Therefore, only the aspects of organizational learning at organizational level will be taken into consideration.

Finally, high technology-based industry, namely the aerospace manufacturing industry in Malacca, Malaysia is being focused on. The selection of one industry group is to reduce the number of variables involved in the analysis and to avoid the study from being generalized.