

Critical Factors Influencing Project on Effective Maintenance, Repair and Overhaul (MRO) in Aircraft Aviation Industry

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ABSTRACT

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This study aims to identify the critical factor influencing the project as regards successful aircraft maintenance, repair, and overhaul (MRO) in the aviation industry. Furthermore, this research also aims to investigate whether regulation of project changes plays a role in moderating the relationship between the independent variables and dependent variables described in this research. Through the literature review process, it was found that top management support, stakeholders, key factors competency, acceptance, risk management, project plan monitoring, and effective communication are among the critical factors identified. Referring to a completed project, this research showed that project progress was in two dimensions in a maintenance context, which this research classifies as a successful micro and macro project. The macro viewpoints of project success mean the organizational stage of the project must be recognized and accomplishment relies on the consumer or collaborators to share. The micro perspective of project success can help to manage a project in small levels and is normally alluded to at the finishing line of the project. The summary result for the 4 hypotheses tested, all of them were significant. The result obtained clearly expressed all of the dependent variables have positive influences on project success in MRO aircraft in the Malaysian aviation industry. This research also demonstrates through trial and error that project key factors' competency and project mission are critical factors in influencing the micro-project success and as well for macro project success, top management support and project mission are two main critical factors.

Keywords:

Critical success, aviation, project success

1. Introduction

Generally, the aviation industry is referring to the business sector dedicated to manufacturing and operating all types of aircraft [1] and the airline industry can be considered as one of the most

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dynamic, diverse, and also a quite puzzling industry in the whole world. This industry is fast-evolving, labor-intensive, capital-intensive, hyper-competitive, and highly susceptible to the receded and flow of business cycles and it is also one of the most regulated of deregulated businesses. Besides, the airline industry is also considered as a big or major economic force as it operated on its own and it also brings certain impacts on the related industries such as the manufacturing and tourism of the aircraft [2]. The aviation industry is mainly defined as the global transportation network that carries goods and passengers by air. The bulk of the worldwide aviation industry is involved with the use and manufacture of airplanes [3].

In Malaysia, civil aviation is considered an important part of its globalized economy. The aviation landscape in Malaysia seems to grow significantly as is also having a rapid development. It is progressing well alongside the other global advances in the aviation industry. Besides, it can also be said that the Malaysian aviation authorities are very committed to environmental protection, safety, and security, and also the sustainable development of air transport. This is done by the Malaysian aviation authorities by working with all of the stakeholders in the aviation market known as the Civil Aviation Authority of Malaysia (CAAM). Malaysia also aspires to lead the aviation industry in this region. The aspiration is followed by a very comprehensive policy that covers all of the main aspects of aviation. The main focus would be on the objectives of strategic development, growth areas, long-term strategies as well as the approaches for transformations [4].

By looking at this situation, it can be predicted that the aviation industry as well as other aviation-related projects will become much more sophisticated and complex. Besides, aviation management will also become much more complicated. This is due to the growing need for technology, human necessities, fresh inventions, and also techniques.

Due to the challenging opportunities and environment that are brought by technological developments, the increasing boundaries of knowledge, dynamic and aggressive market conditions, shift in environmental regulations, the initiatives towards shorter product life cycles, rising in customer involvement, and the increasing complexity of inter-organizational relationships, the reasons behind the expansion of work with a project-based has been raised [5].

By analyzing the improvement in individual and unit performance and coordination as well as the reduction in maintenance errors, the effectiveness in any maintenance will be measured. It is a well-known fact that aircraft maintenance is a very demanding and complex process. The success of aircraft maintenance is measured by looking at the safety of the passengers and it also depends on communication and also teamwork. The operations for aircraft maintenance will be successful if the crews work in a very integrated way and communicate as a team compared to when they are working as individuals who are committed to independent actions.

Most projects begin with the expectations to achieve success and failure is not an option. The answers to why a project gains its success are not known to many. The success of an aviation project depends on the aircraft MRO project and it is a very crucial factor. This research will further investigate the success of a project in the aviation industry which depends on the significant focus on the aircraft maintenance project.

MRO might be characterized as, all activities which have the goal of holding or re-establishing a thing in or to a state in which it can play out its required capacity. The activities incorporate all of the specialized and relating regulatory, administrative, and supervision actions [6]. Process implementation for this maintenance project same as other projects, which is the project manager responsible for planning, directing, and coordinating the projects which often require considerable resources and high levels of functional integration. Will have to ensure project goals are accomplished within the prescribed time frame and funding parameters. Also, to ensure adherence

to quality standards, reviews project deliverables and may communicate with user and stakeholder regarding the status of specific projects.

As written in Borneo Post Online [7], the President of ATR Eastern Support Pte Ltd, Luigi Celmi has mentioned Malaysia's expertise and facilities in providing advanced maintenance works and these could reinforce its position and capability as the producer of major aircraft parts. The statement indicates that Malaysia is believed to obtain a massive share in the global aviation market for the manufacturing of components and maintenance works. It is also believed that Malaysia is ready to play a better role in the global aviation market.

The aviation industry in Asia has countless opportunities for the MRO companies, the manufacturers of aerospace as well as the general aerospace and aviation players. Malaysia is becoming an increasingly attractive base in Asia. The aerospace sector will emerge as a strong growth sector in Asia over the next few years, with Boeing predicting that the Asia-Pacific region will account for 40% of new airplane deliveries over the next twenty years. Most aircraft and engine original equipment manufacturers or also known as "OEMs" will try to be closer to their customers by expanding their territories in Asia and by doing this; the spending for aerospace procurement will increase in the particular region. Hence, it can be said that Asia, particularly Malaysia, is becoming an important part of the supply chain for the aerospace sector. Malaysia is an increasingly important aerospace hub in Asia, with the Malaysian government's Economic Transformation Programme (ETP) focusing on the sector as a key industry for the future growth of value-added output and employment [8].

Selangor is believed to become the main attention for MRO investments as it is supported with an advanced infrastructure. The infrastructure includes the biggest international airport and it is also believed that Selangor has most of the air-traffic in Malaysia, as shown in Figure 1. This success is achieved due to the support given by the Malaysian Government since the government has promoted Malaysia as the newest hub for MRO-related activities [9].

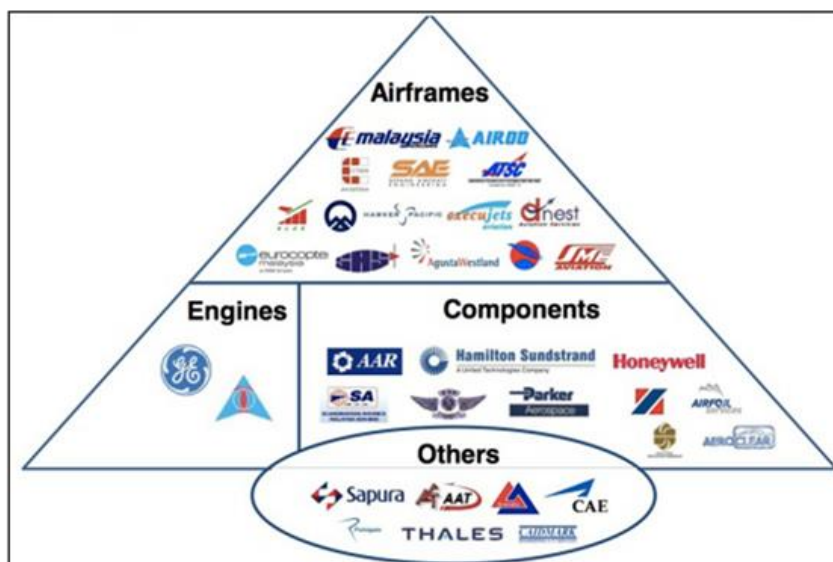


Fig. 1. Malaysia's MRO Industry 2010/11 [9]

The MRO industry seems to be growing over the last few years and is also demonstrating strong potential. Besides, this industry is also estimated to have a turnover of RM4.9 Billion in the year 2012, as shown in Figure 2. Up until June 2011, twenty-five corporations that are related to MRO have been registered by the Malaysian DCA. Besides, thirty related corporations are already listed by the Malaysian Industry-Group for High Technology and the Malaysian Investment Development [9].

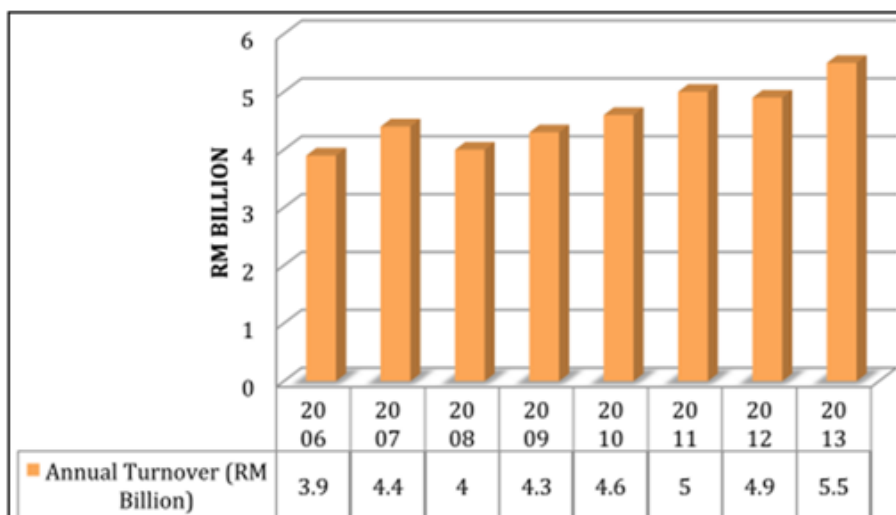


Fig. 2. MRO in Malaysia – Annual Turnover [9]

Results regarding all these three types of projects have been collected. It can be seen that the rate of success is only 16.2% while the other 52.7% and 31.1% belong respectively to challenging projects and impaired or canceled projects. According to the research report of the Association for Project Management [10], it has been able to discover the situation of the most recent project for the successful respondents. 90% of the respondents considered their project to be successful, however, only 22% of the projects can achieve their original objectives. The research made has also discovered that from eight projects, around one project was unable to meet the planned budget and from six projects, one project also failed to finish on time. Looking on the positive side, although it is very hard for most projects to succeed, only 6% are wholly unsuccessful, which is a very small fraction. Due to this success rate, this information is vital and needs to be researched and investigated to ensure the implementation can be expanded to other projects, especially in aviation projects. By identifying these criteria, it can guide the key actors to propose the best design that meets the safety standard with the specific proportion of cost, ecstatic, and durability that could be accomplished [11]. At the same time, all parties in the aviation project will be able to see a clearer view of the clients' requirements and promoting all parties to realize the regulatory and airworthiness requirements.

Therefore, this project aims to identify the critical success factors that influence the project success towards the effectiveness on the MRO of the aircraft aviation industry, especially in Malaysia based on the Project Management Body of Knowledge (PMBOK) Guide and Project Implementation Profile (PIP).

2. Methodology

The research methodology in this study is based on a quantitative research approach and the data are collected by using a Google Docs survey questionnaire. The questionnaires are then distributed to the key factors of MRO activities in Malaysia. The performance of measurement data is collected mostly from Selangor since this state is the hub for MRO in Malaysia [9]. The collected data are then analyzed by the survey, which includes the operator of the aircraft and supplier besides the top management and executives. At this stage of the study, the result has been obtained by using the SPSS software and the conclusion and any recommendation have also been discussed. In this study, some of the proposed hypothesis is generated based on the research question and that describes as follows:

Hypothesis 1 (H1) -The success of the project in aviation is positively related to having a very clear project mission.

Hypothesis 2 (H2) - In aviation, the success of the project is positively related to having supportive top management.

Hypothesis 3 (H3) - The success of a project is positively related to the usage of a detailed project schedule or plan and the plan needs to be used effectively.

Hypothesis 4 (H4) - A significant relationship exists between Project management practices by the local player and the project outcome or project success.

This research only targeted (managers, engineers, support, and ground crews) and there are 150 respondents (15 managers and 135 engineers, support and ground crews). Statistical methods are used in collecting respondents and summarizing the data. The statistical techniques that will be adopted in this study are factor analysis, reliability analysis, demographic analysis, descriptive analysis, and lastly, correlation and regression analysis by using SPSS.

3. Results

Hypothesis Analysis

H1: A Clear Project Mission Is Positively Related to Project Success in Aviation

Table 1 represents the overall sample of project success in aviation with a clear project mission. The results showed project mission had a significant relationship with the project success at the 0.05 level. The probability of the F statistic (45.386) for the overall regression relationship for project mission is $p < 0.05$. The research earlier estimation regarding having a clear mission in a project will have a positive impact on project success in aviation has been supported by the findings. The results explain 56.1% of the variance of the project success. The R^2 (31.4%) of the project success is mainly due to the project mission factor and the 68.6% indicates another factor.

Table 1

The Relationship between Project Mission and Project Success

	Unstandardized Coefficients		Standardized Coefficients		
	B	SE	B	T	Sig
Constant	0.177	0.532		0.332	0.741
Clarify Project Mission and Goal	0.852	0.126	0.561	6.737	0.000

(Source: Derived from analysis)

$R=0.561$, $R^2=0.314$, Adjusted $R^2=0.307$, F-statistic=45.386, p-value=0.000

H2: High Support from the Top Management Is Positively Related to Project Success in Aviation

Table 2 represents the overall sample of project success in aviation with top management support. The results showed that top management support had significant relation to project success at the 0.05 level. The probability of the F statistic (35.758) for the overall regression relationship for the top management support is $p < 0.05$. This finding supports the research estimation that there is a statistically significant relationship between top management supports and project success. The results explain 51.5% of the variance of the project success. The R² (26.5%) of the project success is mainly due to the top management support factor and the 73.5% indicates another factor.

Table 2

The Relationship between Top Management Support and Project Success in Aviation

	Unstandardized Coefficients		Standardized Coefficients		
	B	SE	B	T	Sig
Constant	0.754	0.502		1.500	0.137
Top Management Support	0.714	0.119	0.515	5.980	0.000

(Source: Derived from analysis)

R=0.515, R² = 0.265, Adjusted R²= 0.258, F-statistic=35.758, p-value=0.000

H3: A Detail Project Schedule/Plan and Effective Use of Plan Is Positively Related to the Project Success in Aviation

Table 3 represents the overall sample of project success in aviation with the project schedule. The results showed project schedule had significant relation to project success at the 0.05 level. The probability of the F statistic (49.570) for the overall regression relationship for top management support is $p < 0.05$. This finding supports the research estimation that there is a statistically significant relationship between the project schedules with the project success. The results explain 57.8% of the variance of the project success. The R² (33.4%) of the project success is mainly due to the project schedule factor and 32.7% indicates another factor.

Table 3

The Relationship between Project Schedule and Project Schedule

	Unstandardized Coefficients		Standardized Coefficients		
	B	SE	B	T	Sig
Constant	0.184	0.508		0.362	0.7178
Project Schedule/Plan	0.840	0.119	0.578	7.041	0.000

(Source: Derived from analysis)

R=0.578, R²=0.334, Adjusted R²=0.327, F-statistic=49.57, p-value=0.000

H4: There Is a Significant Relationship between Project Management Practices by Local Player and the Project Outcome or Project Success

Table 4 represents the overall sample of project success in aviation with project management practices. The results showed project management practices had significant relation to project success at the 0.05 level. The probability of the F statistic (31.373) for the overall regression relationship for project management practices is $p < 0.05$. This finding supports the research estimation that there is a statistically significant relationship between project management practices and project success. The results explain 49.1% of the variance of the project success. The R² (24.1%) of the project success is mainly due to the project management practices factor and the 75.9% indicates another factor.

Table 4

The Relationship between Project Management Practices with Project Success

	Unstandardized Coefficients		Standardized Coefficients		
	B	SE	B	T	Sig
Constant	1.127	0.470		2.399	0.018
Project Management	0.609	0.109	0.491	5.601	0.000

(Source: Derived from analysis)

R = 0.491, R² = 0.241, Adjusted R² = 0.233, F-statistic = 31.373, p-value = 0.000

A hypothetical model was designed to measure the project in aviation influenced by a clear project mission, high support from top management, a detailed project schedule/plan, and a significant relationship between project management practices by the local player and project outcome. The result of the hypothesis shown in Table 5 represents the result of hypothesis testing with their status of acceptance or rejection. From this table, it can be seen that all four (4) hypotheses in this research have been statistically significant.

Table 5

Summary of Hypothesis

Hypotheses	Result
H1: A clear project mission is positively related to project success in aviation	Significant
H2: High support from the top management is positively related to project success in aviation	Significant
H3: A detail project schedule/plan and effective use of plan is positively related to the project success in aviation	Significant
H4: There is a significant relationship between project management practices by local player and the project outcome or project success	Significant

(Source: Derived from analysis)

The result of the hypothesis is significant. This finding pointed out that a clear project mission is positively related to project success in aviation is contradicted with formal project management

practices, which explain who are involved directly or indirectly in the project shall know the purpose and shall be on the same track to certify project success. The result of respondent demographic has proved that the participant of this research, is mostly from ground crews or technician, procurement, and there have less than five years working experience and its might affected the hypothesis test. This type of the participant is only receiving the work order to complete the task of the project manager and their immediate superior. This results in inconsistent practices and infrequent project performance predictability with the high possibility of cost overruns, schedule delays, and defective deliverables projects. A project management office has a greater responsibility in supporting day-to-day business and implemented a high level of standardized project management procedures to ensure effective industrial project implementation.

Top management support is more important during the planning stage to ensure that the project is designed in the correct erection and can communicate the project's mission clearly during the planning stage. More importantly, explicit communication helps to accelerate project progress by guiding as the project leader rationalizes activities and reduces the project scope to save time which ultimately leads to success in project delivery. However, in hypothesis two, finding pointed out that high support from the top management is positively related to project success in aviation and it shows the different result and it's rejected. Hence, it proved the job position in respondent demographic in chapter four, play the role and less support from top management in this research affected the result which is, in the project management practices, support from top management are one of the key factors to ensure the project is successful. Top management support is defined as "the willingness of top management to provide the necessary resources and authority for project success" and top management has a high degree of influence to project success by being responsive to requests for additional resources when the need arises. It provides a clear vision of the market concept which leads to explicit goals that help resolve design conflicts and keep projects on track.

The importance of project planning, including scheduling, has been considered a major cornerstone of every successful project [13]. The importance of project planning is also supported by the number of studies done as it is one of the critical elements that influence the success of projects. A realistic project plan serves as a guide for the team to work toward industrial project success. An industrial project with a plan does not guarantee success, but an industrial project without a plan will probably guarantee failure [12]. Furthermore, realistic project planning allows the team to work toward the project goal and work against any changes that might happen during the execution stage [14]. Previous researchers also suggest that project success is positively correlated to the requirements definition and development of technical specification [15]. This further proves the importance of including all requirements into the project plan for industrial project success. In this research, a test result is rejected and contradicts the realistic aviation project management. The test result also shows that the project schedule is not influencing independent variables among others. A realistic plan plays an important role and explained this model the most. Hence, project management personnel should ensure the planning of each industrial project is done properly. They should ensure the approved plan is realistic and achievable based on the resources project owned.

Pearson Correlation (PC) was used on hypothesis four to assess the significant relationship between project management practices by the local player and the project outcome or project success. In actual the project manager can be grouped under project management, however since this individual is the most important person running the project; therefore, it is worth studying his/her skill and competency in managing the project. Meanwhile, the result of the analysis indicated in hypothesis four is rejected. This finding pointed out that a skillful and competent project manager and the project outcome or project success are not significantly correlated. The result is not surprising as other studies had also indicated similar findings. Previous findings on project delay oil and gas

construction projects in Kuwait by [16], during PMI India National Conference Theme (09/2018) that the weakness of project manager and project management are the main factor toward the oil and gas project delay and with recommendation on to improve the overall project management methods and also to carefully formulated contracts processes.

4. Conclusions

The objectives of the research were to identify and evaluate the critical success factors that influence the project success towards the effectiveness on the MRO of the aircraft aviation industry, especially in Malaysia. There are several variables addressed in this research; statement of project success, clarify of project mission and goal, top management support, project schedule/plan, client consultation and involvement, the competence of project personnel, effective managing of technical task, client acceptance, and satisfaction, effective monitoring and feedback of project activities, effective communication between project stakeholder and troubleshooting and problem-solving as a dependent variable. The hypotheses were tested to see which factors influence the project success in the MRO aircraft aviation industry. Out of the 4-hypotheses tested, all of them were rejected. The results obtained from this research clearly expressed that all of the dependent variables have positive influences on project success in MRO aircraft in the Malaysia aviation industry. To conclude, it can be said that all of the objectives in the study have been achieved and the outcome that was achieved from this study was much better than what was originally expected.

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