CHAPTER 6

SUMMARY AND RECOMMENDATIONS

6.1. SUMMARY

6.1.1. Overview of System Establishment

The aircraft maintenance industry is capital intensive, involving heavy investment in advance technology and high labour cost. There are many service providers in the industry but there is no significant rivalry. Competition in this market for Aircraft MRO was intensified by the link to the upper market for aircraft sales to many international airlines.

Cross functional team of four key personnel was in charge of conducting the ERM workshop. The ERM team classified generic risks into four areas, which are Financial, Hazard, Operational and Strategic risks. The team then evaluated the identified potential risks using the Failure Mode and Effects Analysis (FMEA) to quantify and to find out the potential causes-effects of these risks. Then the risk mitigation plan was formulated together with the key risk measures in the form of Risk Early Warning System.

From the Risk Identification using brainstorming, the potential risks are identified and these risks were assessed by the Failure Mode and Effects Analysis, FMEA, to find out the likelihood, route causes of the risks. The causes of the potential risks within the case organisation are shown in table 6.1.

Table 6.1: Summary of Potential Risks

Priority	Potential Risks	Causes of Risks
1st	Limited Service to only Aircraft Model Operated by the Main Airline	High Investment for Equipment and Personnel Training
2nd	Cost Overrun	Outdated EDP system in aircraft maintenance and inventory control.
		Increasing Number of Personnel
		Complex organisational structure
3rd	Core Competence	Low Personnel Competency

4th	Ineffective Management	Insufficient Management Information System (MIS)
5th	Accidents	Poor Health & Safety in Workplace Practice
6th	Low Service Quality and Defected Products	Low Personnel Competency
		Poor Requirement Capture of Customer's Needs

The criteria which the team used to judge the risks are that these risks represent core business risks and they are under organisation's control. Other risks are ignored as they are beyond the case organisation's control, which cannot be managed effectively within the organisation.

The Mitigation Strategies and their Action Plans have been formulated as shown in Table 5.5 to Table 5.10 in Chapter 5. The Risk Early Warning System has been established as shown in Table 5.11 in Chapter 5.

6.1.2. Highlights of the Project

The primary objective of this ERM system establishment is to consider enterprise risks in both the day-to-day operations and in the management decision making. Since the system has been established, the highlights of this project are discussed as follow:

- Combination of AS/NZS 4360 and FMEA: Australian/New Zealand Risk Management Standard, AS/NZS 4360: 1999, has been used as a basic framework, giving systematic approach to the enterprise risk management, which this standard is widely used and accepted in many engineering organisations. The quantitative analysis technique, Failure Mode and Effects Analysis (FMEA) has been used to assess the risks, which FMEA is a simplicity method that does not require extensive training in statistical analyses or large quantities of historical data. It is subjective and depends on the user's perceptions and understanding of the risks being evaluated. It can assist the AS/NZS 4360 in assessing the risks, giving a higher level of accuracy in risk assessment.

- Wider Perspective of Risks: This risk management workshop enormously helped the organisation to manage risks in an enterprise perspective. Since the system has been established, the benefits related to organisational objectives and the management process are the achievement of organisational objectives and better focus on business priorities, strengthening of the planning process and the means to help management identify threats. The benefits to the management process include: a cultural change that supports open discussion about risks and potentially damaging information; improved financial and operational

management by ensuring that risks are adequately considered in the decision-making process; and increased accountability of management.

- Linking market trend to core competency by the enterprise risk management: For future development, the case organisation may link Market Risks, which is one of the main enterprise risk factors, to the organisation's core competency. As the case organisation has an expertise on GE engine overhaul, but the demand of Rolls-Royce engine overhaul is increasing which the trend is shifting from GE engine to Rolls-Royce engine. This might be a potential risk (strategic risk) for the case organisation. The case organisation should build the competency in Rolls-Royce engine overhaul in order to catch up the trend and to cope with the trend in the other market segments.

- Using ERM system to assist the Balanced Scorecard: There are many similarities between risk management and performance management, such as tracking progress objectives, regularly review by management, measurement activity, significant differentiators are also apparent from the literature reviews as well as from the case studies. While strategic control uses performance management frameworks such as Balanced Scorecard to identify and monitor what 'should happen', risk management frameworks initially focus on the identification of what 'should not happen'.

6.1.3. Problems When Establishing the ERM System

Apart from the advantages and benefits of this project, some problems occurred because of the time limitation. The researcher is a third party that could not get involved with the management of the organisation. Moreover the researcher does not have authority to conduct the project in a full scale.

- System Overlapped: There are many management systems within the case organisation, creating extra works, such as planning or documentations, to the administration. Enterprise risk management may be overlooked as it is not a core management system, so some of the benefits stated above could not be achieved as management does not see the importance of the ERM.

- Different Types of Risks: One of the biggest problems when trying to establish a risk management system is to define the different types of risk. Thus they become even more difficult to control. One example is the operational risk. Furthermore significant time and resources are wasted in adjusting the Process FMEA to assess the risks.

- Group Decision Making: The group decision making in the risk assessment session is not satisfied. The airworthiness manager seems to have a big influence in the group decision making, which the other team members seem to follow the decision of the airworthiness manager. Moreover, as intended to use Nominal Group Technique, the ERM team do not thoroughly understand the proposed techniques, so the technique could not really be followed and turned out to be an

Interacting Group Technique because the group members talked to each other during the workshop, individual ideas are merged.

- The Risks discovered should have reflected the real Enterprise Risks: Potential risks discovered seem to be operational risk, which in fact they should have been the Enterprise Risks. This problem is caused by the ERM Team, which the team members are mostly tactical management personnel, so the ideas are limited to the operational level. According to the Airline Risk Factor in Figure 5.2 of Chapter 5, it can be seen that the risks can be mainly divided into two areas, which are Internally Driven and Externally Driven. Further these risks can be subdivided into four specific areas, which are Strategic, Operational, Financial and Hazard risk. Comparing this concept to the work in this thesis, the risks discovered seem to be Internally Driven in the area of Operational Risk, which the outer areas (externally driven risk) are overlooked. These problems might be occurred the brainstorming session, the team members had paid attention and focused mainly on day-to-day operations, which in fact they should have focused on risks at enterprise-wide perspective such as marketing trend, supply chain collaboration or merger/alliance/acquisition.

- Commitment from Top Management: Similar to any management systems, Risk Management required commitment from the top management of the organisation.

- Low level of Authority to run the workshop: As the researcher was in charge of the Group Facilitator, having low level of authority, the workshop did not run at full-capacity. Moreover there is a time constraint. So the system established may not reflect the fact of risks. However this pilot project is satisfied.

6.1.4. Human Errors in Risk Assessment

The technique of quantitative risk assessment has seen increasing application in many industries over the last decade. Human errors are associated with the type of response, so that skill-based behaviour is prone to slips and lapses, such as Pressing the wrong button, while rule-based and knowledge-based behaviour is prone to mistakes, such as Wrong decision or action plan even if correctly executed. Slips are failures in the execution stage of an action sequence while lapses are more covert error forms, usually linked to inattention. Mistakes are not more dangerous and less understood than slips. Knowledge-based mistakes are, in general, most dangerous because they are hardest to detect. (Kletz, 1991) characterises human errors into a number of groups. These are:

- Errors due to slips or lapses, in attention (where the intention is correct, but the execution is wrong);
- Errors due to poor training, inadequate instructions or lack of physical or mental ability (mistakes arising from not knowing what to do);
- Errors due to lack of motivation or a deliberate decision to ignore the instructions (sometimes called violations);
- Errors caused directly by the system or the manager or supervisor – most errors could be traced to this factor.

6.2. RECOMMENDATIONS

From the ERM system establishment, two lessons can be learned from those problems regarding the establishment of a risk management system.

1. There is a big difficulty to differentiate between different types of risks it could be recommendable to establish an overall control system first and then to insert further tools for risks, which can be clearly defined.
2. The supporting technology/tool should be introduced for risk assessment session. The use of enterprise wide risk management software can be useful

Generally the FMEA should be customised to be used as a Risk Assessment tool, the Process FMEA used in this project is not appropriate to assess the risks as the Process FMEA usually focuses on the defects of the mechanical components or the manufacturing process, but risks are not entirely defects, in the other hand, risks may pose significant opportunities for the organisation. The FMEA needs to be slightly customised to the work. The scoring criteria in the FMEA should remain the 10-point system, the Delphi Group Technique may be introduced, which the RPN, Risk Priority Number, can be analysed using Applied Statistical Method, such as Mean or Median, which the accurate RPN values may be obtained, reflecting the fact of risks in the organisation.

Moreover the Risk Early Warning System, comprising of KPIs to measure the risks, should be continually revised, otherwise it will be totally useless as it acts as assistant to monitor the future risks against the strategic plan, and these information about future risks will be used in the forthcoming Risk Management Meeting.

The Risk Management Division should be established as personnel in the organisation usually refuse to take responsibility outside their job. This could be the cause-effect of Thai culture, which most people need to be forced to do their job, otherwise they will not do it.

From this study, the case organisation should respond to the risks, which the action plans were formulated together with the risk early warning system. The Airworthiness Manager and the Senior Maintenance Planner are responsible for on-going risk monitoring, which the risks should then be reviewed about once a month at a department meeting. The top management is responsible for reviewing the effectiveness of internal control of the organisation, based on information provided by the risk management team.

There are two main recommendations, which one is for the research and academic improvement and another is one is for the case organisation.

6.2.1. Recommendations for Research and Academic Improvement

More Access to Risk Information

Further research is needed to have more access to the risk information within the organisation. There is a question when establishing the ERM system *"what are we getting from ERM? Fact or Fiction?"*

Alternative Risk Assessment Technique:
As the risks are changing, the new processes or tools for managing the risks are required. The practices must continually adapt to a changing environment. Risk assessment tools should be reviewed as circumstances change.

The process used in this study, Failure Mode and Effect Analysis, has the benefit of being quite simple and quick. There are much more sophisticated techniques used to estimate and manage enterprise risks such as the Monte Carlo simulation which uses statistical analysis to determine the risks. But these techniques generally require a lot more time and resource to carry out.

Risk Matrix:
After the risk management team has identified and quantified the enterprise risks, the researcher may apply the risk matrix prioritise the risks as to their severity and frequency. The figure 6.1 shows an example of the risk matrix. This risk matrix does not indicate the correlations between risks but rather shows the severity and frequency of a particular risk. It can further provide the ranking of the risks and their causes.

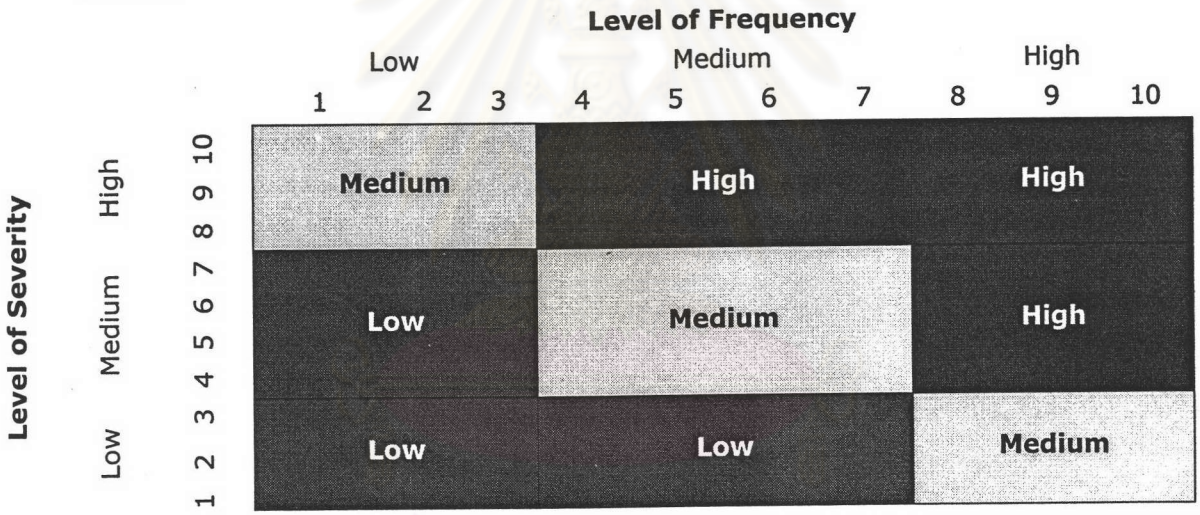

Figure 6.1: Risk Management Matrix

The concept of this matrix is applied from the Australian/New Zealand Risk Management, using 10-point scale instead of 5-point scale that may give higher level of accuracy to the risk assessment.

Moreover this risk matrix should be applied to closer the gap between the view of Strategic and Tactical Management advised by Microsoft Corporation, which "*there is a line between tactical and strategic management, the line should be consistent between financial and business risk management.*" The Tactical Management and Strategic Management view risk in different perspective, leading to different decisions. Hence the researcher may advise the organisation to use this risk matrix to look at risks strategically and tactically. When risks, severity and frequency, are fully understand, the management may come up with better risk-treatment solutions, such as retain, transfer, share or avoid.

6.2.2. Recommendations for Case Organisation

People in Charge of Risk Management:
The risk management teams included:

- Line management, human resources and risk management professionals.
- Multi-disciplinary teams for risk identification with varying risk attitudes.
- A cross-functional risk management committee with representation from operating units and treasury/finance, human resources and risk management.
- A risk management strategy steering group where all major functions are represented.
- A risk management committee composed of division heads.

A risk-management workshop requires the members of the key personnel and can be usefully combined with a department meeting. The workshop takes between one and three hours. It is best carried out at a meeting with space to stick flipchart pages around the walls of the room. It is usually better if the facilitator is not a member of the project team in order to be seen to be objective and independent. It also helps if the facilitator has some experience of risk management and workshops, in order to answer questions that may come up.

Sometimes there will be a debate about the objective that may highlight differences in the team members' expectations of the business, which itself is a enterprise risk and needs to be recorded as such later in the process. The agreed objective should be written on the flipchart and stuck on the wall.

The case organisation may appointed a senior-manager, operational risks, to be the head of risk management which directly report the risks to the top management. This head of risk management should have a wide perspective on the business, such as commercial, maintenance operations, financial skills etc. This head of risk management should encourage other managers to manage risks in their own division, while he collects all the risks and manage them at corporate level.

Teamwork is a mechanism to manage risks. It is perceived as a way to focus diverse disciplines on common objectives, one of which is minimising risk. Teams provide balance. Also, teams pollinate a concern for risk management throughout the organisation, rather than being the concern of a function or discipline. While the practice of teaming is recognised as a "best practice", there was no common practice concerning the composition of the team.

Centralised Risk Management:
The case organisation may establish a centralised risk management activity, which the processes apply to every division of the organisation. Each division complies risk registers, which have to be presented for review at corporate level, by the head of risk management. This risk register may be reviewed as a part of the normal quarterly review of business performance.

Risk Sharing:
The case organisation may manage the risks by sharing risks with other world-class companies. Investment in development of computerised maintenance planning system, personnel training, and equipments for maintenance of new models may be done by collaboration and alliance between each Aircraft MRO service providers. Through this knowledge or risk sharing, the organisation can:

- Focused each partner on the link between investment and profits
- Brought spare-parts suppliers together to meet the objectives.
- Apply best management practices.
- Encourage the integration of organisational culture and personnel skills.

Risk Management Software:
The ERM Process is still in its early stages. The case organisation may move towards an automated monitoring process, which will involve both tracking loss events, and automated gathering of Key Risk Indicators (automatic linking from existing data systems).

Currently, the Airworthiness Manager and head of every division are responsible for reporting the key risk measures on a quarterly basis. By identifying and tracking these items, real world information can be reviewed by the Risk Managers to support the risk assessments. For example, a key indicator for the risk of 'Employee Satisfaction' could be the rate of staff turn over in a group. This information, when tracked by the risk manager, provides independent feedback on the risk assessment.

There are many off-the-shelf software packages that are designed to help progressive organisations monitor, compare, guard against and take advantage of their corporate risks. As this study used the AS/NZS 4360: 1999 risk management methodology, the case organisation should use the software that complies with Australian/New Zealand Standard AS/NZS4360. Risk Management software must be able to:

- Review operations and exposures
- Review present strategies
- Review existing risk measures
- Provide suggestions for improvement
- Provide written strategies to implement change

The software can give management and staff at every level the ability to assess the impact of known risks, determine priorities and review and activate programs to mitigate the downside of risks, or take advantage of the upside.

Risk Management Training:
Risk management training includes all statutory, mandatory and required training, such as, fire, Health and Safety, manual handling, violence and aggression, etc.

A risk management training sub-group of the Training and Education Committee should be established to develop risk management training, and ensure that risk management training opportunities are taken up by those staff whose roles are

identified as carrying particular risks. Two issues are emerging as immediate priorities for the group

- the volume of risk management training necessary to meet the requirements;
- non-attendance at risk management training.

Organisational Learning:

In a study of Wells (1997), most organisations gather extensive amounts of information about risks. Such records include accidents, reports, data on day-to-day operations, observations. This data collection should be enable organisations to learn from the past to do better in the future. Some organisations sometimes have a culture of not wanting to know. An adequate and effective communication between all levels of management is essential to reduce the likelihood of significant risks being left untreated. Such communication can only work when qualified persons with technical insight have positions at all levels in an organisation. So that information can be put into the correct context and appreciated.

The Australian/New Zealand Standard AS/NZS 4360:1999 recommends that each stage of the risk management process should be documented, including assumptions, methods, data sources, and results. Such documentation demonstrates that the process has been conducted and provides a record to develop an organisation database of knowledge that facilitate ongoing monitoring and review. It means that information can be shared and stored.

Implementing risk management requires resources. Investments will be required in: training, developing processes and techniques, management systems, specialist groups. Senior management must be committed to supporting the initiative with the required resources.

To this end, majority of the problems are caused by the organisational culture and Thai culture, which people do not really see the importance of the Risk Management, unlike Japanese culture that people are alert to improve and never satisfied in what they acquired. I would like to conclude that "It seems to be an easy task in theory, but it has been a very difficult job in practice". From my experience in this thesis, the key element to establish the ERM system is the commitment from everyone in the organisation.