

CHAPTER 5

SYSTEM ESTABLISHMENT

Australian and New Zealand Standard AS/NZS 4360: 1999 provides a generic guide for the establishment and implementation of the risk management process involving establishing the context and the identification, analysis, evaluation, treatment, communication and ongoing monitoring of risks. This standard will be exceptionally useful as it provides a thorough analysis of risk management generic to all industries.

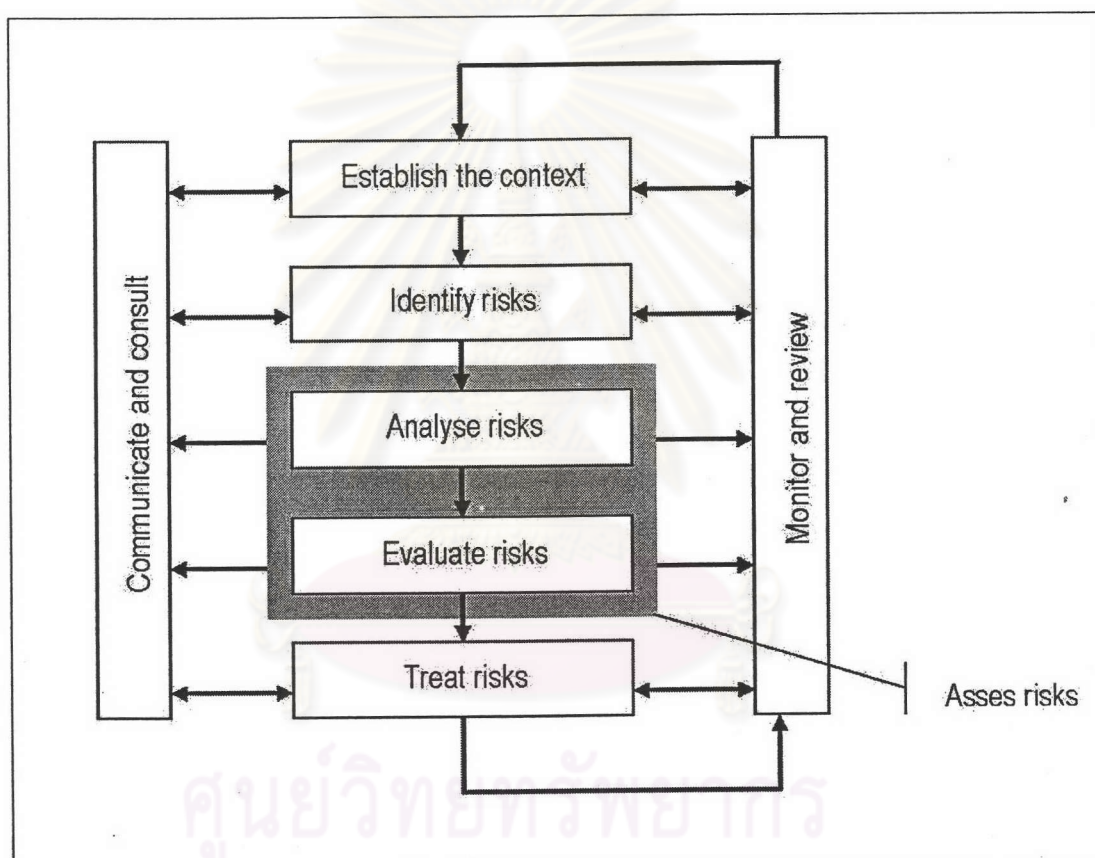


Figure 5.1: Risk Management Process

Source: AS/NZS 4360: 1999

According to the AS/NZS 4360 Standard, the Enterprise Risk Management System is established and described step-by-step as follow:

- Step 1: Establish the context
- Step 2: Identify the risks
- Step 3: Assess the risks
- Step 4: Treat the risks
- Step 5: Monitor and review
- Step 6: Communicate and consult

Note: The Detailed methodology of AS/NZS 4360:1999, Australian/New Zealand Risk Management, is discussed in Appendix II.

5.1. ESTABLISH THE STRATEGIC CONTEXT

This step includes External, Internal and Risk Management Context.

5.1.1. External Context

External Context starts with a definition of the relationship of the organisation with its environment, including identification of the enterprise's strength, weakness, opportunities and threats (SWOT analysis). This context-setting also identifies the various stakeholders (shareholders, employees, customers, community) as well as the communication policies with these stakeholders. SWOT analysis of the case organisation are summarised below.

(The details of external context, such as SWOT, Portfolio Analysis, Competitive Force Analysis, are shown in Background Analysis, Chapter 5.)

Strengths:

- Technical Know-how and Solid Experience
- Located in a good strategic/geographic locations
- Funded by the main airline
- Cheap labour costs compared to the developed countries.

Weaknesses:

- Bureaucratic and cumbersome management
- Silos of organisational structure
- Insufficient human resource management
- Lack of strategic planning
- Poor management information system
- Increasing number of personnel

Opportunities:

- Trend towards outsourcing most of the works by most of the airlines regardless the size of their fleets.
- Numbers of private airlines, which have been established in the recent years.
- Barriers to entry into the MRO business due to high investment
- Exchange Rate makes the service price become attractive

Threats:

- Aging aircraft and engine will be brought out of service sooner. Therefore, requirement for maintenance and repair will be reduced.
- Trend for the OEM to establish the MRO firms on their own or on joint-venture basis with the airlines especially the regional competitors.
- High Investment cost for new generation aircraft maintenance component repair and test equipment.
- Some competitors can provide one-stop shopping which they are capable to perform airframe D-Check, landing gear overhaul, and engine overhaul per one heavy maintenance visit.

5.1.2. Internal Context

Internal Context starts with an understanding of the overall objective of the case organisation, its strategies to achieve those objectives and its key performance indicators.

To understand the case organisation's approach to extending the scope of its risk management activities, it is necessary to understand the organisational culture which has been developed. The case organisation has responded positively to changes. Senior management positions the organisation as a strategic business unit of the main airline, pursue modern management practice to compete in aircraft maintenance business. Many excellent management practices have been introduced, such as the Balanced Scorecard, Six Sigma, ISO9002, ISO14001 etc. The conventional planning and controls system has been replaced by computerised system, such as 'MOPS' Maintenance and Overhaul Planning System, 'MASTII' Material Administration System.

Maintenance, repair and overhaul of commercial aircraft is a primary business of the case organisation, which means the organisation is focusing on safety and regulatory compliance together with generating profits for the main airline, as a strategic business unit.

The Strategic Plan 2003/2004 of the case organisation states the Generic Strategy, which is described as the Hold and Maintain stage. This reflects that investment and reinvestment are still required but will be aimed at improvement and market expansion, which should result in high return on investment capital. Improvement should be focused on technical skill advancements and human resource development, increasing communication skills and staff participation. The business strategies are:

- Expand but moderately and economically. Pay attention to asset utilisation.
- Put effort to earn excellent return on invested capital.
- Grow from year to year and maintain existing market share. Penetrate further market.
- Investment process is mainly for the purpose of:
 - Relieving bottlenecks
 - Improving quality
 - Enhancing continuous improvement and measurement
- Innovate product or process
- Establish alliance.

When the vision and missions has been identified, the strategic objectives are set. These objectives are based on the generic strategy of Hold and Maintain. The long term objectives are classified into four perspectives:

- Financial
- Internal Process
- Customer
- Learning & Growth

Financial Perspective: How will the case organisation be successful financially according to Thai Airways' objectives?

Customer Perspective: How will the case organisation expand the market by retaining the existing customers and acquire the new one? The emphasis will be placed on customer satisfaction, quality, turnaround time, competitive price, corporate image, and relationship.

Internal Process Perspective: How will the case organisation improve the operating efficiency and quality to meet customers' demand and satisfy their needs?

Learning and Growth Perspective: To archive the vision and mission what must the case organisation employees learn and improve? The emphasis will be placed on employees' skills, competencies and participation, all of which may be achieved and sustained through effective information system, motivation, empowerment and alignment.

5.1.3. Risk Management Context

Risk Management Context identifies the risk categories of relevance to the enterprise and the degree of coordination throughout the organisation, including the adoption of common risk metrics.

As the major risk assessment is time-consuming and costly, it is worthwhile to do a preliminary scoping and pilot study.

To establish the ERM system, the management agree that risk management committee assume responsibility for the strategic risk management. The objectives are set to identify the principal risks and developing appropriate solutions to manage them are effectively as possible. The top management commitments to risks are:

1. Risks must be identified.
2. Risks must be evaluated, including analysis and quantification of the impact.
3. The optimum mix of risk management strategies must be determined. The organisation must reduce, prevent and avoid risks.

The enterprise risk management objective is to improve the risk management within the organisation, which can be translated to the practical objectives as listed below:

- To discuss risk management and why we need to manage the risks we face
- To examine the risk management process
- To discuss the application of the risk management process
- To discuss the implementation of enterprise risk management programme
- To identify personal ongoing risk management activities, draw conclusions and make recommendations from the workshop

5.1.4. Enterprise Risk Management Team

To identify and assesses the significant of enterprise risks, the case organisation set the ERM team of 5 people from across the engineering department. As the time scale was tight, a small ERM team of key personnel was assembled, comprised of

1. Airworthiness Manager
2. Senior Maintenance Planner
3. Two Engineers
4. Group Facilitator

The Nominal Group Technique was used for the ERM system establishment. The team was working with the researcher, which acts as a group facilitator, in a brainstorming workshop. The criteria for selecting of ERM team members depend on the perspective and understanding of the operations and job responsibility. These key personnel are selected because of their understanding of different aspects of the case organisation's operations.

The following key responsibilities of the ERM team are:

- Identify and evaluate the significant risks faced by the organisation
- Provide adequate information in a timely manner to the organisation and its committees on the status of risks and controls.
- Approach to solving risk problems.
- Advise and implement policies to treat the risks.
- Encourage good risk management practice within the organisation.
- Key risk indicators will be identified and closely monitored on a regular basis.
- Implement policies on risk management and internal control.

The Airworthiness Manager has a key role to play in the management of risk. His role is to:

1. Set the tone and influence the culture of risk management within the organisation. This includes:
 - determining whether the organisation is 'risk taking' or 'risk averse' as a whole or on any relevant individual issue
 - Determining what types of risk are acceptable and which are not setting the standards and expectations of staff with respect to conduct and probity.
2. Determine the appropriate risk appetite or level of exposure for the organisation. Approve major decisions affecting the organisation's risk profile or exposure. Monitor the management of significant risks to reduce the likelihood of uncertainties.
3. Satisfy itself that the less significant risks are being actively managed, with the appropriate controls in place and working effectively. Annually review the organisation's approach to risk management and approve changes or improvements to key elements of its processes and procedures.

5.2. RISK IDENTIFICATION

"In the highly competitive aircraft maintenance industry, the MRO service-providers face continuous pressure to ensure customer satisfaction, and to increase profitability and growth. The industry is characterised by razor-thin margins, so the best path to an improved bottom line is through tightened financial controls and reduced costs." Airworthiness Manager

5.2.1. Brainstorming Session

Risk identification session started by discussion about the generic risks that usually occurred in the case organisation by using Brainstorming technique. The rules are:

1. Members call out potential risks.
2. No criticism allowed.
3. Members are encouraged to 'think the unusual'.
4. The ideas are written on the flipchart

The study of Zea (2002), as shown next page, has been applied to identify the risks within the case organisation, which is a strategic business unit of an airline as some risks are fairly similar. The primary risks facing the airline industry fall into four categories; they are Strategic Risk, Financial Risk, Operational Risk and Hazard Risk.

The concept of Order Winner / Order Qualifier was also introduced to assist the risk-identification-brainstorming, which it served to provide an additional framework for understanding how the services can gain sales in the MRO market. The order winner/order qualifier in Aircraft Maintenance Industry is similar to those of the manufacturing industry. They are:

- Company Reputation
- Technical Specialisation
- Delivery and speed and reliability
- Warranty
- Service Quality
- Price

In general, aircraft maintenance risk management has been limited to hazard risk, such as the protection of physical assets, and significant attention has been given to safety and security issues. From the participation among the group members, the possible risks of the case organisation that have a big impact to the business are:

Strategic Risks:

- Competitive pressure
- Core Competency
- Customer demand shortfall
- Limited Capacity / Capability

Operational Risks:

- Ineffective Management
- Cost overrun
- High Turnaround Time
- Low Service Quality

Financial Risks:

- Recession
- Foreign macro-economic
- Interest Rate

Hazard Risks:

- Health & Safety
- Liability
- Accident

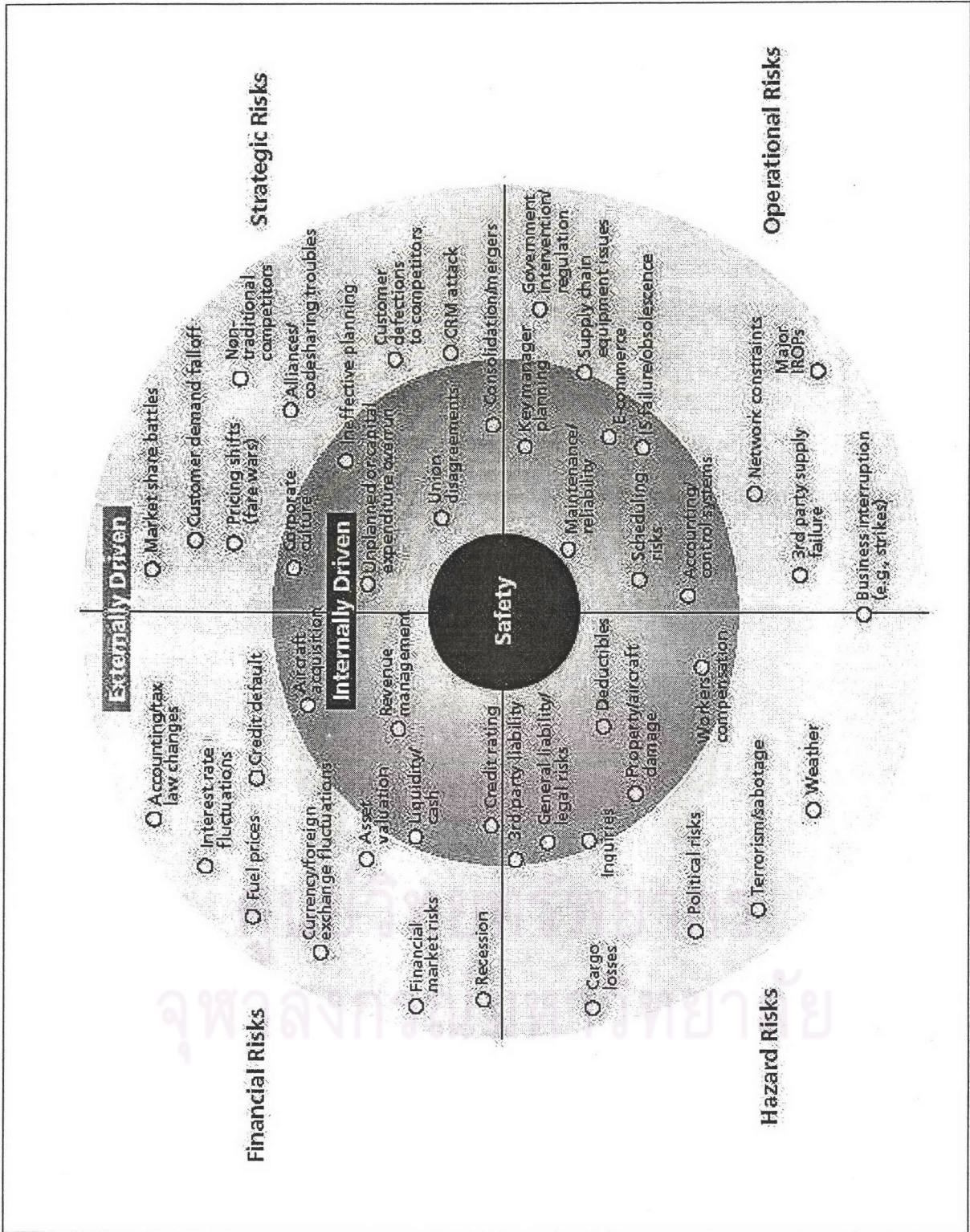


Figure 5.2: Risk in Aviation Industry
 Source: Zea (2002)

5.2.2. Potential Risks

The purpose of identifying the potential risks is to keep the attention of the risks that mainly affect the organisational performance. The ERM team focused on the risks that are most likely to cause profit reduction. The following list contains the potential risks that the ERM team identified during the brainstorming session.

Table 5.1: Rationale of the potential risks

Potential Risk	Rationale
Accidents	Engineering activities always cause accident, which accidents lead to loss of organisation's reputation, employee satisfaction. Safety is the first priority in the case organisation.
High Turnaround Time / Maintenance Lead-time	High turnaround time and maintenance lead time reflects a low level of aircraft utilisation. From the concept of 'value adding activity', aircraft can only add value and generate profit to the airline when they are operating in the air, not grounded in the hangar. The airlines are highly concerned to the aircraft utilisation.
Limited service to only aircraft operated by the main airline	The case organisation is capable of providing the Heavy Maintenance Service to the aircraft types, which are operated by the main airline only. This is a limited capability for the repair of new generation aircraft, e.g. B777, A330.
Low Service Quality and Defected Products	Similar to any industry, customers always demand for high quality services/products. Low service quality and defected products can definitely lead to poor customer satisfaction.
Core Competency	The core competence in aircraft maintenance of the case organisation must present a high uniqueness and low substitutability. The organisation may decide what is at the heart of the business and must never outsourced.
Cost Overrun	Maintenance Industry may be regarded as a service industry, which high operating costs, such as equipment cost, manpower allocation, asset utilisation, pose a significant link to the profitability of the organisation.
Ineffective Management	Similar to any industry, ineffective management certainly lead to ineffective operations. Strategies must be well formulated and clearly communicated to operational level. This is a common risk to any corporations.

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

After the risks have been identified, the airworthiness manager argued that some risks are being managed; however, these risks must be better managed with insights gained through in-depth analysis.

5.3. RISK ASSESSMENT

After the potential risks were identified, the next step was to validate the perceptions of the significant of the identified risks. The concept to assess the risks is whether the case organisation knows enough about the principal risks to begin developing solutions.

There risk assessment can be subdivided into two main areas:

1. Risk Analysis
2. Risk Evaluation

5.3.1. Risk Analysis using the FMEA

The Failure Mode and Effects Analysis was used as a risk assessment tool, as suggested by the AS/NZS 4360: 1999. Organisational knowledge and professional experience were used as criteria to analyse the causes of each potential risks. The ERM team also studied the causes of risks that had not been considered and facilitated the development of a range of mitigation measures that may reduce the operational risks in the department.

In theories, the causes of the risks, in the manufacturing industry, are found in the following areas:

- Asset utilisation
- Scheduled maintenance
- Non-routine maintenance
- Work management
- Inventory management
- Manpower Allocation
- Regulatory compliance

As shown in the FMEA, next page, some risks are beyond the organisation's control, which the causes of these risks are involved with the third party, which they are beyond the case organisation's control. They causes of these risks are:

- Government Regulation regarding Property and Inventory Management
- Bureaucratic and cumbersome management
- Semi-SBU of the Main Airline

Hence, these causes are ignored in this study as the time limitation.

At the end of risk analysis, the Airworthiness Manager *comments that "...whether you are working on these risks, the important thing is to know exactly what it is so that the action or inaction is a well-informed response This Risk Identification may overcome the risks. The ERM team needed more information of the risks in the history. It could have led to a better understanding of the potential effects of the risks analysed."*

Table 5.2: Risk Assessment - Failure Mode and Effects Analysis

Item Name: Risk Assessment - Airline Engineering Department (Q1 2004)		FMEA Team: THAI Technical Department - Thai Airways International Plc.			Prepared by: Chonnanart Salkaew FMEA Date (Orig): Friday 16-Jan-04, 0930hrs (Rev.):				
Process Step	Potential Risks	Potential Effects	SEV	Potential Causes	OCC	Current Controls	DEC	RPN	Strategy Recommended
Aircraft Maintenance	Accidents	Organisation's Image and Reputation	8	Poor Health & Safety in Workplace	8	Sustain Accident Free Operations	4	256	Continually improve quality and safety + Motivate organisational culture awareness
		Poor Customer Satisfaction	6	Government Regulation regarding Property and Inventory Management	6	-	10	360	-
	High Turnaround Time	Poor Customer Satisfaction	6	High Lead-time for Spares-parts procurement	6	Improve Operating Process & Efficiency	4	144	Implement Effective Planning and Production Control
		Poor Customer Satisfaction	6	Maintenance Planning & Controls	3	Improve Operating Process & Efficiency	3	54	Implement Effective Planning and Production Control
	Limited Service to only Aircraft Model Operated by the Main Airline	Loss of Customer	9	High Investment for Equipments and Personnel Training	7	-	10	630	Increase Capability + Retain & Acquire Customers
		Poor Customer Satisfaction	6	Poor Customer Relationship Management	5	Motivate Customer Relationship Management	4	120	Manage Customer Relationship
		Poor Customer Satisfaction	6	Low Personnel Competency	7	Upgrade Personnel Competency	6	252	Re-skill employee
		Poor Customer Satisfaction	6	Poor Requirement Capture of Customer's Needs	4	-	10	240	Identify and Respond to Customer's needs
	Low Service Quality and Defected Products	Poor Customer Satisfaction	6	Maintenance Planning & Controls	3	Improve Operating Process & Efficiency	3	54	Implement Effective Planning and Production Control
		Profit Reduction	8	Low Personnel Competency	7	Upgrade Personnel Competency	6	336	Develop Technical Specialisation Programme
Core Competence	Profit Reduction	8	Maintenance Planning & Controls	3	Improve Operating Process & Efficiency	3	72	Implement Effective Planning and Production Control	
	Profit Reduction	7	Outdated EDP system in aircraft maintenance and inventory control.	6	-	10	420	Implement Effective Information System	
Organisation and Management	Cost Overrun	Profit Reduction	7	Increasing Number of Personnel	6	-	10	420	Re-organise SBU Structure + Expand Capacity
		Profit Reduction	7	Complex organisational structure	4	-	10	280	Re-organise SBU Structure
	Profit Reduction	7	Poor Asset Allocation and Utilisation	7	Maximise Asset Utilisation	3	147	Continually improve asset utilisation	
	Profit Reduction	7	Increasing personnel cost	7	Improve Operating Process & Efficiency	3	147	Implement Effective Planning and Production Control	
	Profit Reduction	7	Manpower Allocation	5	Improve Operating Process & Efficiency	4	140	Implement Effective Planning and Production Control	
	Profit Reduction	5	Bureaucratic and cumbersome management	5	-	10	250	-	
	Profit Reduction	5	Semi-SBU of the Main Airline	5	-	10	250	-	
	Profit Reduction	5	Insufficient Management Information System (MIS)	5	-	10	250	Implement Effective Information System	
	Profit Reduction	5	Complex organisation structure	4	-	10	200	Re-organise SBU Structure	
	Profit Reduction	5	Insufficient Human Resource Management	6	Improve human resource performance, evaluation, rewarding and motivation	6	180	Develop HRM	
Profit Reduction	5	Poor Strategic Planning	3	Seminars and Training for Management	3	45	Knowledge & Intellectual capital management		

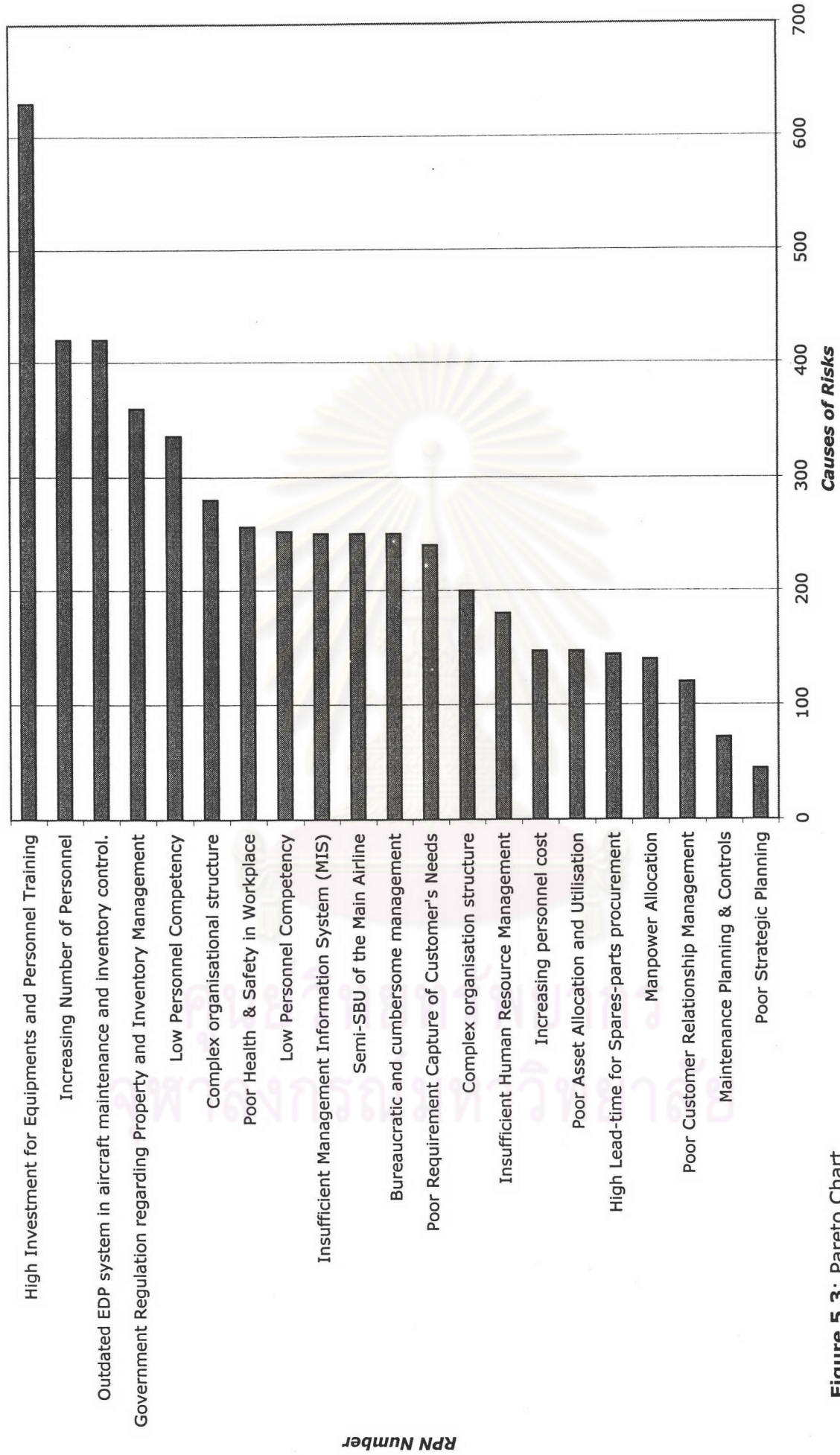


Figure 5.3: Pareto Chart

5.3.2. Risk Evaluation

From the previous section, the FMEA established the RPN, Risk Priority Number, which is the product of Severity, Occurrence and Detection, quantifying the impacts of risks. By using this quantitative analysis, the ERM team can evaluate the causes of risks by the magnitude of the RPN number.

There is a well argue which some operational risks cannot be quantified, which usually include Technology Risk, such as the Computerise Maintenance Planning System, which keep changing time by time, as new systems are coming out to the market every single day. So the quantitative analysis may give an inaccurate result.

From the Pareto Chart, it can be seen that the analysis and risk assessment process confirmed that the major causes of risks are:

Table 5.3: Summary of Risks and Their Causes

Priority	Potential Risks	Causes of Risks
1 st	Limited Service to only Aircraft Model Operated by the Main Airline	High Investment for Equipment and Personnel Training
2 nd	Cost Overrun	Outdated EDP system in aircraft maintenance and inventory control.
		Increasing Number of Personnel
		Complex organisational structure
3 rd	Core Competence	Low Personnel Competency
4 th	Ineffective Management	Insufficient Management Information System (MIS)
5 th	Accidents	Poor Health & Safety in Workplace Practice
6 th	Low Service Quality and Defected Products	Low Personnel Competency
		Poor Requirement Capture of Customer's Needs

Note: The case organisation views the MIS and EDP system differently, which:

- *EDP System, Electronic Data Processing, is the information technology, comprising of database and data Processing. (technology aspect)*

- *MIS, Management Information System, is the information system for knowledge management for planning and controls. (management aspect)*

The following causes of risks are based on the judgment of the team. The ERM team adopt the approach of taking the highest score for a given risk put forward by an ERM team as we provided a rational reason. It reduces the time spent on debate, and anyway the risk score will be reviewed at following senior management meetings when more information will be available to support the scoring judgment. Where the detection is unknown then it should be scored as high until more information becomes available.

A. High Investment for Equipment and Personnel Training

Modern aircraft models require special equipment to handle the maintenance operation. Moreover these new aircraft models require skilled technician and license engineers to perform the maintenance. However the budget for high-tech equipment and personnel training are tided up with the annual budget of the main airline.

B. Outdated EDP System in Aircraft Maintenance and Inventory Control

EDP, electronic data processing, an infrequently used term for what is today usually called IS, information services or system, is the processing of data by a computer and its programs in an environment involving electronic communication.

If the new EDP system is implemented, the system can support the 'point of maintenance' information management and a paperless maintenance process through its "Smart Card" token-based electronic signature capability. This technology allows case organisations to take advantage of the FAA's acceptance of digital signatures and electronic record keeping to streamline the maintenance process through effective workflow management and the elimination of paperwork.

C. Increasing Number of Personnel

More than 60 percent of personnel in the case organisation are skilled technicians, these people are very well paid. Moreover as maintenance industry is labour intensive. With a combination of labour cost and labour intensive, this has become a potential problem in the case organisation.

To accommodate the increasing number of personnel, Base Realignment and Closure (BRAC II) funding has been allocated for construction of a new training facility, hangar, ramp and associated support projects at Naval Air Station Jacksonville.

D. Complex Organisational Structure

Although the case organisation is now a strategic business unit of the airline, it is still an airline engineering department, which is in charge of aircraft maintenance for the main airline's own fleet. So the structure of the case organisation appears to be an ordinary engineering department of the main airline, which is still strategically managed under the main airline's board of directors. The strategic planning is not totally independent. The business strategy still depends on the corporate strategy of the main airline. Moreover as the case organisation used to be a Thai state-enterprise, there are many layers of management, leading to ineffective management within the organisation.

E. Low Personnel Competence

The possible cause of risk within the case organisation appears to be a risk involving the competence and capability to perform maintenance operations. For a long run, sustainable success, the case organisation must develop the right capabilities, which is called 'Proper Preparation'. Maintenance Service Industry is becoming more dependent in a value chain on a link consisting of services or intellectual activities. In a study of Hamel and Prahalad (1994), organisation must be patient and persistent accumulation of knowledge and understanding in order to acquire the competency. The organisation must think that what we can do that other companies could not easily do. By cultivating the right competency early enough, the case organisation can survive and become the leader in the industry.

So the concept of core competence brings the case organisation back to the concept of 'Intellectual Capital' which is what the organisation should develop. The following statements summarise the thinking of core competencies (Rumelt, 1994):

- Core competencies support several business and products
- Products and services are only a temporary manifestation of core competence, the core competence develops more slowly and is more stable than product.
- Competence is knowledge and therefore increases with use
- In the long run, competence, not products or services, will determine who succeeds in competition.

F. Insufficient Management Information System (MIS)

Lack of MIS, management information system, may obstruct the organisation to providing advanced planning, maintenance forecasting, and project plan optimisation, which, nowadays, the maintenance control and planning & scheduling has become a vital activity for line, heavy and shop maintenance. Moreover the information system is often a complex mix of disparate information systems, from ERP backbones to the main airline, customer's, supplier's system, such as flight scheduling. To address this issue, the case organisation must facilitate the integration of the information system to external systems, in order to provide an effective and seamless operation to the external information.

G. Poor Health & Safety in Workplace Practice

From the suggestion of the Airworthiness Manager, the accident during maintenance operations, caused by poor health & safety in workplace practices, is highly concerned as they are at any responsible aircraft maintenance organisation. It is highly regarded as an ultimate operational risks both project and organisational level. A problem has been to ensure that the most relevant up to date practices and procedures are followed as a part of day-to-day operations. Unfortunately it is common for business to appear to be reactive. By the environmental concerns, the case organisation implemented the ISO14002 to manage every environmental aspect. Apart from these risks, the case organisation wants a culture of concern and attention to environmental and safety issue. The health, environmental and safety group was established, which there are safety staffs and compliance people within each of the maintenance units.

H. Poor Customer Requirement Captures of Customer's Needs

The customers in aircraft maintenance business are the international airlines. These customers demand fast and reliable services. As aircraft are the high valued asset, which provides a monetary flow to its owner. Aircraft can only add value and generate profit to the airline when they are operating in the air, not grounded in the hangar. The airlines are highly concerned to the aircraft utilisation. So the basic requirement could be the short turnaround time for line/light maintenance and short maintenance lead-time for heavy overhauls.

Once the risks have been analysed, the workshop is finished. The facilitator then put all the details onto a spreadsheet, rank the risks by total RPN number, (highest at the top) and then issue it to the ERM team.

5.4. RISK TREATMENT

There is a potential benefits in using the quantitative analysis, like FMEA, which provides information on the aggregate affect of the potential risks. The values do not only show what the risks are but also systematically quantifying their severity, detection and frequency. Until the top management appreciate the effect, it is difficult to make a right decision to accept/share/transfer/eliminate these risks. Once the management of the case organisation knows the levels of risks, it can make better decision to formulate the strategies for the forthcoming strategic plan. The new strategic plan may prefer to transfer the risks to the their party, such as spare-parts suppliers, which there is some expense, or find the better ways to manage these risks and implement the effective risk-management-strategies.

The purpose of this risk mitigation plan is to outline the likelihoods of risks that have been assessed by the ERM team as having highest probability to impact the business. Lucas (1997) makes suggestions about the error of human behaviour which may affect the organisation in different aspect. The solutions to the risks are shown as in table 5.4.

Table 5.4: Solution to the Risks by Human Errors

Source of Risk	Basic Assumption	Solution
Engineering	People are the unreliable component in the system	Remove people from the system by automation
Individual	Poorly motivated people commit unsafe acts.	Discipline those involved
Cognitive	A mismatch between individual capability and the demand of the job	Ensure job and workload can be done
Organisational	Poor management create conditions that make errors likely	Examine and audit management systems.

Source: Lucas (1997)

The Australian/New Zealand Standard Risk Management lists the treatment options as follows:

- a) Avoid risks. Exposure to risks might be eliminated by introducing remote operations or by replacing dangerous facility or through using a less risky process. Poor technology should be overtaken by something better. Costly retrofitting to meet safety standards can be avoided through adequate risk identification and consideration of alternative. It will always be cheaper to mitigate risks at an early stage.
- b) Mitigate the impact. The impact of risks may be mitigate by either reducing its likelihood, e.g. through the introduction of some control system to trip when parameter reaches a critical value, or reducing its consequence should the risks be realised by good management practice.
- c) Adapt the risks. Adaptation is a form of mitigation or minimisation of the risks
- d) Duplicate resource. Duplication of operations enhances reliability by introducing redundancy. This is the commonest approach in many cases, and is a very effective option. The likelihood of experiencing the risk is thereby reduced, provided any standby or backup unit does not share a common element with the main unit.
- e) Transfer the obligation. Risk transfer is a contractual or financial instrument whereby responsibilities are transferred or an insurance policy is purchased, so that there is recompense in the event of an adverse effect. There is no change in the physical risk level, and normally this method of treatment an enterprise risk is used in conjunction with other measure to reduce the level itself. Risk transfer can ultimately be an expensive option if the transfer has been made to a wrong party or become burdensome.
- f) Transform the risk. This is another form of mitigation in which the risky process is transformed into one that poses less of a treat or may be more easily treated.
- g) Retain the risk. After risks have been reduced or transferred, there may be residual risks, which retained by the organisation. Plans should be put in place to manage the consequence of risk if they should occur, including the means of financing the risks.

From the potential causes of the risks, the risk reduction strategies are formulated which they can be transformed to the action plans.

With an attempt to manage the risks in each perspective, the action plan can be systematically formulated after the risk reduction strategies were found, which are shown as follow.

Table 5.5: Risk Mitigation Plan - Limited service to only aircraft model operated by the main airline

RISK STATEMENT	
LIMITED SERVICE TO ONLY AIRCRAFT MODEL OPERATED BY THE MAIN AIRLINE	
Cause of Risk <ul style="list-style-type: none"> • High Investment for Equipment and Personnel Training 	Mitigation Plan <ul style="list-style-type: none"> • Increase Capability • Retain & Acquire Customers
Action Plan <ul style="list-style-type: none"> • Increase aircraft maintenance / overhaul and relevant support shop capacity <ul style="list-style-type: none"> ○ Increase airframe overhaul capacity ○ Expand seat shop and hydro chemical shop capacity ○ Increase line maintenance service/fleet expansion at Domestic line station • Increase engine capacity and capability • Increase calibration lab capability and capacity • Establish aircraft maintenance service provision at line station • Establish customer support unit • Establish customer database 	
Indicators <ul style="list-style-type: none"> • Ranking in industry benchmark • Total sales on existing customer 	

ศูนย์วิทยทรัพยากร
 จุฬาลงกรณ์มหาวิทยาลัย

Table 5.6: Risk Mitigation Plan – Cost Overrun

RISK STATEMENT COST OVERRUN	
Cause of Risk <ul style="list-style-type: none"> • Increasing Number of Personnel 	Mitigation Plan <ul style="list-style-type: none"> • Expand Capacity • Re-organise SBU Structure
Action Plan	
<ul style="list-style-type: none"> • Increase aircraft maintenance / overhaul and relevant support shop capacity <ul style="list-style-type: none"> ○ Increase airframe overhaul capacity ○ Expand seat shop and hydro chemical shop capacity ○ Increase line maintenance service/fleet expansion at Domestic line station • Restructure organisation 	
Indicators	
<ul style="list-style-type: none"> • Total sales on new customer • Ranking in industry benchmark 	
Cause of Risk <ul style="list-style-type: none"> • Outdated EDP system in aircraft maintenance and inventory control. 	Mitigation Plan <ul style="list-style-type: none"> • Implement Effective Information System
Action Plan	
<ul style="list-style-type: none"> • Study to develop and implement new EDP system <ul style="list-style-type: none"> ○ Study eligibility and apply the budget for the new EDP system • Establish supply chain management programme 	
Indicators	
<ul style="list-style-type: none"> • System reliability index • Communication index 	
Cause of Risk <ul style="list-style-type: none"> • Complex organisational structure 	Mitigation Plan <ul style="list-style-type: none"> • Re-organise SBU Structure
Action Plan	
<ul style="list-style-type: none"> • Restructure organisation 	
Indicators	
<ul style="list-style-type: none"> • Ranking in industry benchmark 	

Table 5.7: Risk Mitigation Plan – Core Competence

RISK STATEMENT CORE COMPETENCE	
Cause of Risk	Mitigation Plan
<ul style="list-style-type: none"> • Low Personnel Competency 	<ul style="list-style-type: none"> • Develop Technical Specialisation Programme
Action Plan	
<ul style="list-style-type: none"> • Retain selected retired certifying personnel as technical trainers • Establish and implement career path and succession plan • Formulate employee satisfaction index 	
Indicators	
<ul style="list-style-type: none"> • Ranking in industry benchmark • Number of training day per year • Employee satisfaction index 	

Table 5.8: Risk Mitigation Plan – Accidents

RISK STATEMENT ACCIDENTS	
Cause of Risk	Mitigation Plan
<ul style="list-style-type: none"> • Poor Health & Safety in Workplace Practice 	<ul style="list-style-type: none"> • Continually improve quality and safety • Motivate organisational culture awareness
Action Plan	
<ul style="list-style-type: none"> • Revise accident prevention and report system • Develop and implement aviation safety program • Promote organisation value and culture 	
Indicators	
<ul style="list-style-type: none"> • Mean time between service interruption • Number of incident/accidents per 20,000 working hours • Number of suggestions per employee • Number of suggestions implemented 	

Table 5.9: Risk Mitigation Plan – Low Service Quality and Defected Products

RISK STATEMENT LOW SERVICE QUALITY AND DEFECTED PRODUCTS	
Cause of Risk • Low Personnel Competency	Mitigation Plan • Re-skill employee
Action Plan • Identify training needs • Establish syllabus for training to promote sense of ownership and service mind. • Develop training need identification procedure	
Indicators • Number of training day per year • Employee satisfaction index	
Cause of Risk • Poor Requirement Capture and Customer's Needs	Mitigation Plan • Identify and Respond to Customer's needs
Action Plan • Establish customer information database • Establish and implement customer relationship awareness training programme. ◦ Outsource training customer relation awareness.	
Indicators • Customer satisfaction index • Total on new customer	

Table 5.10: Risk Mitigation Plan – Ineffective Management

RISK STATEMENT INEFFECTIVE MANAGEMENT	
Cause of Risk • Insufficient Management Information System (MIS)	Mitigation Plan • Implement Effective Information System
Action Plan • Implement E-Business System ◦ Develop e-procurement • Define and develop effective communication media • Formulate communication index	
Indicators • System reliability index • Communication index	

5.5. RISK MONITORING AND REVIEW

5.5.1. Risk Early Warning System

Risk management needs to be actually embedded in the day-to-day operations of the business to be effective and sustainable. It needs to appeal to capture the attention of operational line management by focused on the areas of real risk to the business and help. Hence risk early warning system can embed risk management which give a linkage between risks and performance, driving risk management through specifically derived performance indicators, focused on the causes of key business risks. Risks are often monitored using traffic light reporting of these operational 'lead' indicators, focusing on measuring the cause and driver of key risks, rather than 'lag' indicator describing the symptoms or impact of those risks. This provides a framework for early warning of future problems so that timely management action can be taken.

From the objective of this study to establish the Risk Early Warning System which acts as an assistant to the Organisation's Balanced Scorecard, the risks related key performance indicators, KPIs, are selected via Participatory Management among the key personnel. The risk early warning KPIs are shown next page:

5.5.2. Responsibility

All ERM team members agreed that the responsibility is allocated to Airworthiness Manager and the Senior Maintenance Planner. Alternatively, if the Airworthiness Manager or the Senior Maintenance Planner cannot attend then someone in the room should be responsible for communicating the risk and responsibility to the appropriate person. This is to ensure that all risks identified are allocated to someone on the ERM team. The allocation of clear responsibility is a key part of the risk management process. Without this there is a danger that each ERM team member will 'assume' that someone else is dealing with it. Once Airworthiness Manager and the Senior Planner have been given the responsibility for risk management, they will feel empowered to ask others in the organisation for information and help in managing that risk. Without being specifically allocated that risk it is much less likely that they would initiate action to manage it.

The risks should then be reviewed about once a month, at a project/department meeting. As risk management actions are completed, both the impact and probability scores will change for a given risk. Typically the number of risks scoring 6 or more decrease as the risks is effectively treated. It is quite common for new risks to be identified and added to the list as well.

Table 5.11: Airline Engineering Department Risk Early Warning Kpis – Q1 2004

AIRLINE ENGINEERING DEPARTMENT RISK EARLY WARNING KPIS – Q1 2004						
No.	Strategy	Measures	Current Period	Previous Period	Traffic Light	Trend
1	Identify and respond to customer's needs Retain & acquire customers Expand capacity and increase capability	Customer satisfaction index				
		Total sales on existing customer				
		Total sales on new customer				
2	Re-skill employee Develop technical specialisation programme	Employee satisfaction index				
		Number of training day per year				
		Ranking in industry benchmark				
3	Continually improve quality and safety	Mean time between service interruption				
		Number of incident / accidents per 20,000 working hours				
4	Motivate organisational culture awareness	Number of suggestion per employee				
		Number of suggestions implemented				
5	Implement effective information system	System reliability index				
		Communication index				

5.5.3. Annual Review

The top management is responsible for reviewing the effectiveness of internal control of the organisation, based on information provided by the risk management ERM team. Its approach is outlined as follow. For each significant risk identified, the board will review the previous year and examine the organisation's track record on risk management and internal control and consider the internal and external risk profile of the coming year and consider if current internal control arrangements are likely to be effective.

In making its decision the board will consider the following aspects.

Control environment:

- the organisation's objectives and its financial and non-financial targets
- organisational structure and calibre of the senior management team
- culture, approach, and resources with respect to the management of risk
- delegation of authority
- public reporting.

Ongoing identification and evaluation of significant risks:

- timely identification and assessment of significant risks
- Prioritisation of risks and the allocation of resources to address areas of high exposure.

Information and communication:

- quality and timeliness of information on significant risks
- time it takes for control breakdowns to be recognised or new risks to be identified.

Monitoring and corrective action:

- ability of the organisation to learn from its problems
- Commitment and speed with which corrective actions are implemented.

The senior management team will prepare a report of its review of the effectiveness of the internal control system annually for consideration by the top management.

After system has been used, the enterprise risk management system needs to be actually embedded in the day-to-day operations of the case organisation to be effective and sustainable. Managers can adopt the risk early warning system as their own performance reporting system, which it is aligned with what they need to achieve, leading to the opportunity to pre-empt problems and address key concerns in advance. Additionally the mere of measuring the cause of risks drives behaviours to improve the management of them. What is measured really does get done.