Measurement and Management of Risk

Inadequate protection of both Information assets and Information System assets leaves any organization vulnerable to computer crimes and can have catastrophic consequences, particularly when confidentiality is involved. This article discusses various aspects of data security from the professional perspective and also some of the measures that can reduce the risk of leakage of data.

Risk Management covers different types of risk in a corporate enterprise pertaining to market, credit, liquidity, event or operations. Five key forces are changing the way the senior managers in major companies round the world view their future—new technologies, globalisation, non-bank competition, deregulation and opening up of previously protected markets. The true measure of a business' success is the rate at which it can improve its range of products/services and the way it produces and delivers them. Risk Measurement and Management is also one of the important function of the finance manager. In the changing global environment his decisions are affected by risk in a perceptible way.

Meaning of Risk

There are many definitions of risk depending on the specific application and situational contexts. In general, every risk (indicator) is proportional to the expected losses, which can be caused by a risky event, and to the probability of this event. James C. Van Horne has defined risk as "the variability in the expected earnings of a company". Therefore, the differentiation of risk definitions depends on the losses context, their assessment and measurement, as well as when the losses are clear and invariable, for example in the case of a human life, the Risk Assessment is focused on the probability of the event, event frequency and its circumstances. We will try to define the term risk from the point of view of engineers and financial managers.

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Engineering definition of risk:

$$\text{Risk} = \frac{\text{Probability of Accident}}{\text{Events per Time Period}} \times \frac{\text{Consequences in Lost Money}}{\text{Per Event}}$$

Financial definition of risk:

It is "the chance that an investment's actual return will be different than expected. This includes the possibility of losing some or all of the original investment. It is usually measured by calculating the standard deviation of the historical returns or average returns of a specific investment". Risk in finance, as defined by Ron Dembo, is a general method to assess risk as an expected after-the-fact level of regret. Such methods have been successful in limiting interest rate risk in financial markets. Financial markets are considered to be a proving ground for general methods of risk assessment. A fundamental idea in finance is the relationship between risk and return. The greater the amount of risk that an investor is willing to take, the greater the potential return. The reason for this is that investors need to be compensated for taking an additional risk.

Risk Measurement

In the words of William Shockley measure is a comparison to a standard. The process of measurement involves estimating the ratio of the magnitude of a quantity to the magnitude of a unit of the same type (length, time, mass, etc).

A measurement is the result of such a process, expressed as the product of a real number and a unit, where the real number is the estimated ratio. It is true that only quantifiable and identifiable risks are managed in terms of providing hedge cover or insurance. It is pertinent that enterprises identify its key risks and the volume of exposure, before it could decide on the type of hedging and its timings, to optimize risk-return payoff. Range, Standard Deviation, Coefficient of Variation and other Econometric tools are used for the measurement of risk.

Risk Management

It is the process of identifying, analyzing and evaluating the risk and selecting the best possible methods for handling it. There is no standard approach for Risk Management. However, there are some common elements of successful risk management efforts:

(i) Recognition of the risk is the responsibility of a programme management.

(ii) The Risk Management process includes planning for risk management, continuously identifying and analyzing programme events, assessing the likelihood of their occurrence and consequences, incorporating handling actions to control risk events and monitoring a programme's progress towards meeting programme goals. In an ideal Risk Management, a prioritisation process is followed whereby the risks with the greatest loss and the greatest probability of occurring are handled first, and risks with lower probability of occurrence and lower loss are handled later. In practice, the process can be very difficult, and balancing between risks with a high probability of occurrence but lower loss vs. a risk with high loss but lower probability of occurrence can often be mishandled. Risk management faces a difficulty in allocating resources properly. This is the idea of opportunity cost. Resources spent on Risk Management could be instead spent on more profitable activities. Again, ideal Risk Management spends the least amount of resources in the process while reducing the negative effects of risks as much as possible.

Objectives

The main objectives of the study are:

a. To explain the concept of Risk, Risk Measurement and Risk Management.

b. To discuss the different types of risk

c. To analyse the techniques of risk measurement

d. To suggest the steps involved in the Risk Management process.

e. To present the summary of the study

Types of Risk

A number of factors influence the risk. Depending upon the cause, the risk can be broadly classified into the following three major categories:

1. Strategic Risks
2. Operational Risks
3. Investment Risks

Strategic Risks: These risks are the issues, which require companies to think on a large scale. These risks have a major impact on the company's costs, prices, products and sales. Some of the solutions, which companies bring to bear such risks, are shown in Table A.

Operational Risks: These risks can be categorized according to their occurrence. Some occur at suppliers, others at the point of production, in the distribution chain or when the product is consumed. Operation risk stems from a variety of sources. Broadly speaking, these are process risk, people risk, technology risk and disasters. Each of these categories must be investigated to identify the risk elements, assign a probability of occurrence, consequences if the event did happen and thus arrive at the weightage assigned to that risk operation hazards classified by time are presented in Table B.

TABLE - A		
Strategic Risks		
Strategic Risks	**Have an Impact Upon the Company's**	**Solutions can be found in**
Government and Economic Factors	Costs	Strategic Planning of Markets and Products Empowerment
Customers	Prices	Quality Management
Competitors	Products	Customer Care
New Technology	Sales	Investment Innovation Cost Reduction

TABLE-B				
Operational Risks				
Suppliers	**Process and Internal Risks**	**Distribution**	**Customers**	**Competitors**
Interruption of Supplies	Fire	Counterfeiting	Payment Problems	Competitor Activity
Poor Quality Supplies	Pollution, Fraud, Computers Accidents Labour Disputes Terrorism, Kidnap and Ransom	Tampering	Changing Needs, Product Liability	

Some Important Operational Risks are:

(a) Process Risks: These stem from the design of the process and the extent of manual or human element in the steps of the process. A common risk is incorrect data capture. Since data capture is often the very first step in a process, an error there has consequences in all the succeeding steps and rectifying the error in turn involves many stages of rollback. Data capture can easily be classified as a risk with a high probability of occurrence and with costly consequences, thus making it a high weightage risk.

(b) People Risk: This risk is rarely considered a formal risk. At the back of his mind, a manager is probably aware that there is excessive dependence on one person, but this also means that he is too busy to train someone else. A formal identification of key persons and a strategy to contain that risk is essential. Likewise, formal process documentation, recruitment, induction, ongoing training and motivation policies are very important to mitigate those HR risks.

(c) Technology Risks: The financial industry is the leading user of technology worldwide. Even in India, banks, brokerages, exchanges and mutual funds are aggressive users of the latest technology. As technology becomes a key part of the process, its maintenance and performance becomes a key risk factor. The risks associated with the hardware side of technology are somewhat easier to contain, because they involve simple monetary costs in redundancies. Hardware and networking skills are somewhat at a premium, but these are generic skills and can be had at a cost. The risk associated with the application side is far more insidious and difficult to manage. Application technology

is invariably customized to that particular business need.

Investment Risks: Every investment involves uncertainties that make future investment returns risky. Some of the sources of uncertainty that contribute to investment risks are aggregated into (a) Interest Rate Risk (b) Purchasing Power Risk (c) Bull-Bear Market Risk (d) Default Risk (e) Liquidity Risk (f) Callability Risk (g) Convertibility Risk (h) Political Risk (i) Industry Risk (j) Currency Risks (k) Portfolio Risk and (l) Country Risk.

(a) Interest Rate Risk: It is defined as the potential variability of return caused by changes in the market interest rates. The degree of Interest Rate Risk is related to the length of time to maturity of the security. If the maturity period is long, the market value of the security may fluctuate widely. Further, the market activity and investor perceptions change with the change in the interest rates and interest rates also depend upon the nature of instruments such as bonds, debentures, loans and maturity period, credit worthiness of the security issues, etc.

(b) Purchasing Power Risk: This is the variability of return an investor suffers because of inflation. It is closely related to interest rate risk, since interest rates generally rise when inflation occurs. Purchasing Power Risk is more relevant in case of fixed income securities; shares are regarded as hedge against inflation. It is the risk that the real rate of return on security may be less than the nominal return. There is always a chance that the purchasing power of invested money will decline or that the real return will decline due to inflation. The return expected by investor will change due to change in real value returns. Cost-push inflation is caused by rise in the costs due to inadequate supplies and rising demand.

(c) Bull-Bear Market Risk: It arises from the variability in market returns resulting from the operators of bull and bear market forces. When a security index rises fairly consistently from a low point, called a peak, for a period of time, this upward trend is called a bull market. The bull market ends when the market index reaches a peak and starts a downward trend. The period during which the market declines sharply is called a bear market.

(d) Default Risk: It is that portion of an investment's total risk that results from changes in the financial integrity of the investment. It is a failure of the borrower to pay the interest and principal amount within the stipulated period of time. The default risk has the capital risk and income risk as its components; it means not only failure to pay but also delay in payment.

(e) Liquidity Risk: It is that portion of an asset's total variability of return which results from price discounts given or sales commissions paid in order to sell the asset without delay. It is a situation wherein it may not be possible to sell the asset. Assets are disposed of at great inconvenience and cost in terms of money and time. Any asset that can be bought and sold quickly is said to be liquid. Failure to realise with minimum discount to its value of an asset is called liquidity risk.

(f) Callability Risk: It is that portion of a security's total variability of returns that derives from the possibility that the issue may be called as the Callability Risk. Callability Risk commands a risk premium that comes in the form of a slightly higher average rate of return. This additional return should increase as the risk that the issue will call increases.

(g) Convertibility Risk: It is that portion of the total variability of return from a convertible bond or a convertible preferred stock that reflects the possibility that the investment may be converted into the issuer's common

stock at a time or under terms harmful to the investor's best interests.

(h) Political Risk: It arises from the exploitation of a politically weak group for the benefit of a politically strong group. An effort of various groups to improve their relative position increases the variability of return from the affected assets. Regardless of whether the changes that cause political risk are sought by political or by economic interests, the resulting variability of returns is called political risk if it is accomplished through legislative, judicial or administrative branches of the government.

(i) Industry Risk: It is that portion of investment's total variability of return caused by events that affect the products and the firms that make-up the industry. It involves international tariffs and/or quotas on the product produced by an industry.

(j) Currency Risk: These are associated with international investments not denominated in the home currency of the portfolio manager's beneficiaries. These risks involved the international payment of cash. Currency risks on a global basis may be close to unsystematic meaning that they are uncorrelated across economies and are not prices.

(k) Portfolio Risk: Portfolio managers attempt to maximize returns given an acceptable level of risk. Industry practitioners describe the five different Portfolio Management Risks as: interest rate risk, liquidity risk, credit risk, operating risk and currency risk.

(l) Country Risk: It involves the possibility of losses due to country specific economic, political or social events or because of company specific characteristics, therefore all political risks are country risks but all country risks are not political risks. A sovereign risk involves the possibility of losses on private claims as well as on direct investment. Sovereign risk is important to banks whereas Country Risk is important for MNCs.

Risk Measurement

Risk refers to variability. A variety of measures have been used to capture different facets of risk. The more important ones among them are: Range, Standard Deviation, Coefficient of Variation and Semi-variance. Apart from this, we also use – Sensitivity Analysis, Breakeven Analysis, Simulation Analysis, Decision Tree Analysis, Value at Risk Analysis and Cash Flow at Risk Analysis.

Sensitivity Analysis: With the help of Sensitivity Analysis it is possible to show that the profitability of a project alters with different values assigned to the variables needed for the computation (unit sales prices, unit costs, and sales volume). This analysis is frequently used if the simple and discounted methods of evaluation do not show a satisfactory profitability.

There is always a chance that the purchasing power of invested money will decline or that the real return will decline due to inflation. The return expected by investor will change due to change in real value returns. Cost-push inflation is caused by rise in the costs due to inadequate supplies and rising demand.

Breakeven Analysis: The financial manager is interested to know how much should be produced and sold at a minimum to ensure cost recovery and this is called breakeven analysis. The minimum quantity at which loss is avoided is called the breakeven point.

Simulation Analysis: The decision maker in an organisation may like to know the likelihood of risks. The information can be generated by Simulation Analysis, which may be used for developing the probability profile of a criterion of merit by randomly combining values of variables, which have a bearing on the chosen criterion.

Decision Tree Analysis: It is a useful tool where sequential decision making in the face

of risk is involved. This analysis involves four important steps— (i) identifying the problem and alternatives (ii) delineating the decision tree (iii) specifying probabilities and monetary outcomes and (iv) evaluation of various decision alternatives.

Value at Risk Analysis (VAR): It is one of the proven and the most used measures of risks by financial institutions. VAR measures the likely change in marked to market value of a portfolio, at specified time periods with certain confidence.

Cash Flow at Risk Analysis (C-far): It has been specifically developed for non-financial organisations with cash flow as variable. The following two features of non-financial organisation had resulted in the development of the C-far model. Firstly, certain assets of non-financial organisations could be accurately valued at market prices. Secondly, the risk free and continuous future cash flows represent the value of any a non-financial organisation. Hence, cash flows are taken as proxy for measuring risks. Cash Flow at risk measures the deviation of cash flows from the expected volume. In other words, it gives an idea as to how much of cash flow the portfolio might lose in a given time with given probability.

Risk Management

Risk Management is the process of identifying assets at risk, assigning appropriate values, identifying threats to those assets, measuring or assessing risk and then developing strategies to manage the risk. In the risk management the following steps are to be taken to minimize the risk.

Step 1: Identification of Assets at Risk: The first step in the Risk Management process is to identify the assets in support of critical business operations. The assets could fall under different groups, which are physically tangible and conceptual assets.

Step 2: Valuation of Assets: The assets so identified and grouped in the previous step are to be valued and categorised into different classes, such as critical and essential.

Step 3: Identifying the Threats: Threats can be defined as anything that contributes to the interruption or destruction of any service/ product. Various threats can be grouped into environmental, internal and external threats.

Step 4: Risk Assessment: The process of Risk Assessment includes not only assessment as to the provability of occurrence but also the assessment as to the potential severity of loss, if risk materialises. This will assist in determining the appropriate risk mitigation strategy, the residual risk and investment required to mitigate the risk.

Step 5: Developing Strategies for Risk Management: Once risks have been identified and assessed, the strategies to manage the risk fall into one or more of these four categories:

(i) *Risk Avoidance:* Not doing an activity that involves risk and losing out on the potential gain that accepting the risk might have provided.

(ii) *Risk Mitigation:* Implementing controls to protect infrastructure and to reduce the severity of the loss.

(iii) *Risk Reduction/Acceptance:* Formally acknowledge that the risk exists and monitoring it. In some cases it may not be possible to take immediate action to avoid/mitigate the risk. All risks that are not avoided or transferred are retained by default.

(iv) *Risk Transfer:* Causing another party to accept the risk i.e. sharing risk with partners or insurance coverage.

Conclusion

Risk Measurement and Management is one of the important functions of the finance manager. The changing global environment constantly affects his decisions. But effective Risk Measurement and Management is a must for all business organisations to survive profitably in the long run. ❐