Impact of Operational Risk on Profitability

A study of select Banks in India

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by

P.S.SUBHA PRADA
(12MBPH01)

Under supervision of

PROF.P.JYOTHI

SCHOOL OF MANAGEMENT STUDIES

UNIVERSITY OF HYDERABAD

HYDERABAD-500046

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School of Management Studies
University of Hyderabad

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Place: Hyderabad

DECLARATION

I hereby declare that the research embodied in the present thesis entitled, "Impact of Operational Risk on Profitability – A study of select banks in India" has been carried out by me and is an original research work under the supervision of Prof. P. Jyothi, School of Management Studies, University of Hyderabad in partial fulfilment of the requirement for the award of the degree of Doctor of Philosophy in Management.

I declare to the best of my knowledge that this thesis or a part thereof has not been earlier submitted for the award of degree at any another University or Institute

Signature of the candidate

P.S.Subha Pradha

12MBPH01

School of Management Studies

Date
Place: Hyderabad

CERTIFICATE

This is to certify that the research work embodied in the present thesis entitled "Impact of Operational Risk on Profitability – A study of select banks in India" has been carried out by P.S.Subha Pradha (12MBPH01) under my supervision, for the full period prescribed under Ph.D. ordinances of the University of Hyderabad.

Dean

School of Management Studies

Supervisor

(Prof. P. Jyothi)

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Abstract

The growth of banking industry over the past few decades has been phenomenal both at the global level as well as in India. However, this growth has been plagued by many banking failures in the past owing to many kinds of risks that banks are exposed to in the present day banking environment dominated by intense competition, complex financial innovations, stringent regulatory requirements and other challenges. These developments led banks to develop a comprehensive understanding and management of risks for business survival and enhanced profitability.

Risk Management in banking allows a bank to identify and assess risks before they become a threat to the survival of the bank. It allows the banks to identify risks namely the credit risk, liquidity risk, market risk, operational risk and other risks and take appropriate risk management measures to minimize the loss. It acts as an alert system that identifies risk indicators to assess the severity of risk and the urgency to attend to it.

Among the significant risks that a bank faces, operational risk has emerged to be a significant one. The nature of operational risk makes quantifying it challenging when compared to credit or market risk. Hence, operational risk is also more difficult to manage. While banks can make a conscious decision to take a certain amount of credit or market risk; operational risk is a necessary part of doing business.

The present study examines the determinants of operational risk among banks in India, the operational risk management practices, the trends in operational risk capital maintained by banks, the impact of operational risk on profitability of banks, and the interaction effects of operational risk capital and the operational risk management practices on the relationship between operational risk and profitability.

The findings of the study indicate that people risk and technology risk have a significant contribution towards operational risk, and that operational risk has an adverse impact on bank profitability. The findings also indicate that there is not much difference among the public, private Indian and private foreign banks in their operational risk management practices. The

study also suggests that operational risk capital does not have any influence on the relationship between operational risk and profitability while reinforcing that operational risk management practices moderate the relationship.

Keywords: Risk, Operational Risk, Operational Risk Management, Operational Risk Capital, Mediation, Moderation.

Chapter I
Introduction

CHAPTER I

INTRODUCTION

"Risk comes from not knowing what you`re doing." Warren Buffett

As Warren Buffet has rightly put it, risk adversely affects individuals and organisations alike as they are not either aware of it or prepared for it.

Financial industry across the globe has experienced huge transformation owing to intense competition, rising customer expectations, increased regulatory requirements and rapid growth of financial innovations. Integration of services across varied sectors owing to financial convergence became common blurring the boundaries across financial markets. One of such sectors that has undergone a tremendous transformation is the global banking system.

The global banking industry has been affected by significant changes in the past few decades that have changed the face of the industry. The first driver of change was the integration of different financial markets like the stock market, markets for foreign exchange, markets for interest rates etc. Such an integration made the banks more vulnerable to risks and failures due to their inability to implement efficient risk management systems.

Financial disintermediation was another major driver of change that made banks move from their traditional business of loans and deposits to more profitable avenues owing to increased competition and thinning boundaries between banks and other types of financial institutions. This move exposed them to a lot of new risks that needed understanding and managing them.

The supervisors' growing focus on financial stability was another significant driver of change. The introduction of capital adequacy norms mandated banks to maintain enough capital to absorb losses so as to avoid catastrophic losses. This required banks to have a thorough understanding of risks they are facing and the ways of mitigating them. The aforesaid intertwined changes namely greater financial integration, convergence among the various financial intermediation models, disintermediation, regulators' capital adequacy norms and growing awareness among the equity holders of the bank have reinforced the relevance and importance of risk and the capability of the management in value creation for the shareholders. In meeting the value creation objective, banks aim for higher profits that are often associated with new business expansions and new risks. The regulations and economics call for higher capital that needs to be supported by increased profits. Though in the short term this can be

achieved through operational efficiency and reduction in operating expenses, in the long term, it requires the bank's risk adjusted profitability to be optimised through effective risk measurement and management systems, effective capital allocation process and organisation (Sironi & Resti, 2007). In the process of carrying on the business while coping with the intense competition, adapting to the complex financial innovations and meeting the liquidity constraints due to regulatory capital requirements, banks became vulnerable to many kinds of new risks.

1.1 Statement of the Problem

Many banks suffered huge losses leading to failure of many banks like the German Herstatt Bank (1974), the Spain banking crisis (1978- 1983), Norwegian banking crisis (1988-1993), the Swedish banking crisis (1990s), Swiss banks (1991-1996), Bank of Credit & Commerce Intl (1991), Barings bank (1995), and India's Global Trust bank (2001). In addition, the growing number of operational losses, most of them exceeding $100 million, have highlighted the need to take stock of operational losses worldwide. Banks globally have incurred huge losses resulting from operational losses crossing several million dollars. The following table 1 describes the operational losses exceeding hundred million from banks across the world as disclosed by the Basel Committee on Banking Supervision (BCBS).

Table 1: Operational Losses listed by Basel

Category of Operational Loss	Cause	Name of the Institution	Amount of Loss
Internal Fraud	Fraudulent Trading	Allied Irish Bank	$700 mn
		Barings Bank	$1 bn
		Daiwa	$1.4 bn
External Fraud	Fraud by custodial client	Republic NewYork Corp	$611 mn
Employment Practices & Workplace Safety	Legal Settlement	Merrill Lynch	$250 mn
Clients, products and business practices	Improper lending practices	Household International	$484 mn

	Improper sales & billing process	Providian Financial Corp	$405 mn
Damage to physical assets	9/11 terrorist attack	Bank of NewYork	$140 mn
Business Disruption and system failures	Change in computing technology	Salomon Brothers	$303 mn
Execution delivery and Process Management	System Integration Failures	Bank of America	$225 mn
	Transaction Processing Failures	Wells Fargo Bank	$150 mn

Source: Risk Management and Financial Institutions (p.429),Hull, 2013, Wiley India

Looking at the magnitude of operational losses, the Basel committee has introduced capital for operational risk to be allocated by banks for absorbing operational losses through Basel II accord**.** After Basel II, banks had some framework in place for managing operational risk. The new capital requirements have made banks to considerably increase the resources they devote to measuring and monitoring operational risk.

Despite the increasing importance of Operational Risk, it is much behind other types of risks like credit and market risks, in its measurement and management models. In-fact, as of the early 2000s many large banks did not have a precise measurement technology, or a clear management policy or an effective capital allocation system for this type of a risk. This can be attributed partly to the challenges encountered in achieving a universally-shared definition of Operational Risk. The standard definition used by banks today for regulatory purposes was only given in the year 2004.

This delay presented a good opportunity for banks and scholars interested in Operational Risk Management. Some analysts reiterate that operational risk represents the risk category in banks for which investments in human resources and technology will be most significant in the years to come. Risk Management failure, the root cause of many financial crises, is mainly about people risk which is at the core of operational risk. In this backdrop, the study examines operational risk management in banks in India in a detailed manner.

1.2 Risk and Risk Management

"Risk is like fire: If controlled it will help you; if uncontrolled it will rise up and destroy you." Theodore Roosevelt

Though formally risk can be said to describe any situation in which there is an uncertainty about the consequence or the outcome, in the world of finance, risk can be defined as " any event or possibility of an event which can impair corporate earnings or cash flow over short/ medium/ long-term horizon"(Bradstreet, 2006). Risk can be viewed as exposure to an unfavourable and adverse situation that could lead to a financial loss. However, risk cannot be described as a single concept as its meaning varies depending on the environment and context in which it is referred to. Risk is involved in every activity and decision in our daily lives. It is the condition where there is a possibility of an adverse deviation from what is expected or hoped for(Vaughan, 1995). Risks could be either financial or non-financial in nature. To state in broader terms, financial risk is one which directly affects the financial position of an individual or an organization. Individuals manage risks with the help of informed decisions before taking up an activity.

An organisation or institution which can be defined as an aggregation of individuals, must manage risks in a different manner: it must adopt the 'take-informed-decisions-before-performing-any activity' principle in a systematic way. .Aiuppa (2001) states that every activity of an organisation can have outcomes which vary from the expected outcome, in an adverse way and that a significant part of every manager's time is dedicated to coping with the unfavourable or adverse deviations, either before the adverse deviation or after it or on both occasions. This approach to risk management, especially for a financial institution, is also motivated by the fact that it deals with public funds and works under a regulated environment.

Aiuppa (2001) integrates the goals of risk management with the objectives of the firm. One such definition of risk management given by him states that, "Risk management is a systematic approach for dealing with adverse deviations in such a way that allows a firm to achieve its objectives". For firms that aim for maximization of shareholder wealth, the definition risk management becomes "Risk management is a systematic approach for dealing with adverse deviations in such a way that maximizes the wealth of the owners". The term 'systematic' states that the risk management involves step-by-step procedures. All organisations deal with risk based on their nature and the magnitude. This is most relevant for banks and financial institutions as they deal with money. In accordance with the focus on the need for organisations and specifically financial institutions to spend substantial time and effort on managing risk, banks have evolved considerably in their risk management approaches and practices.

Banks are highly leveraged financial institutions that accept money in the form of deposits from individuals to supplement their goals of lending loans and investing. Hence it becomes their prime responsibility to safeguard their depositors' money under any unfavourable circumstance. They mobilise household and corporate savings and make them available to deficit entities. As they are associated with credit creation through loans and advances, banks encounter many risks. And since the banking institutions deal with 'money', the vital element that fuels the economy, risk management becomes paramount. Taking risk, in fact lies at the core of many products and services provided by banks or financial institutions.

The following activities that banks/ financial institutions deal with, expose them and make them vulnerable to varied types of risk.

- Mobilisation of funds: Funds are mobilised by banks through acceptance of term deposits and also by means of account balances that are left by customers.
- Deployment of funds: The funds that are pooled by a bank have to be used to meet regulatory or mandatory requirements that are prescribed from time to time. Banks have to deploy certain proportion of their funds in certain government instruments. The funds that are available after meeting the regulatory requirements are used by banks to disburse as loans.
- Transfer of funds: One of the important activities that banks perform is moving the funds on behalf of their customers. They act as agents to companies in meeting their liquidity needs. They also take up the responsibility of being a settlement agent in the realisation and payment of funds by corporates.
- Transfer of Risk: In the course of their business, companies might be exposed to a variety of risks that arise because of their business models, product obsolescence, distribution channels etc. However, while these risks are managed centrally by the concerned firms, the risks that emanate from financial markets are passed on to the banks as risk management is the core competence of banks. As such, banks are required to handle even those risks that are passed on to them by their client firms in addition to the risks that arise because of their own business activities.
- Transaction services: Banks facilitate trade transactions that are both domestic and international in nature. These transactions require huge money and dealings in varied and multiple currencies. Banks because of their global presence and network form the backbone of international trade.

- Credit enhancement: In the event of trade among unfamiliar parties, banks assess and sometimes enhance the credit worthiness of the buyer/customer.

All the above functions necessitate dealing with risks. Insufficient risk management might not only negatively affect the banks' earnings but also might threaten their survival in the long run (Bradstreet, 2006).

The effect of any adverse situation faced by the banking industry can be large and spiralling, and affect all the other industries which reinstates the tremendous importance of risk management in the banking sector. Thus, the highest responsibility is placed on banks, and the national regulator, to have a robust risk management system in place to address unforeseen unfavourable situations. Hence, banking regulators attribute great significance to the effectiveness and stability of risk management in banks.

The banking sector is highly interconnected with activities of every other industry because of its very nature of facilitating money transfer. Growing technological innovations, advances in telecommunications has facilitated swifter creation and movement of money across nations. As a result, banks are exposed to more risky situations that are likely to have a contagion effect on many nations across the world highlighting another rationale for adoption of the best practices in risk management by banking institutions.

Intense global competition have compelled banks to offer a broad spectrum of diversified products and services, using sophisticated technology, innovative delivery channels, and automation for speedy execution and timely delivery of services. In the process, the banks are vulnerable to several risks, namely credit risk, market risk, operational risk, strategic risk, reputational risk, liquidity risk, etc. Among these risks, credit, market and operational risks are the primary and major risks that banks encounter commonly. These primary risks can have a significant impact on the financial position of the banks and if not managed in a timely and appropriate manner, can lead to a disastrous situation for the bank. It is for this reason that the central banking regulators of different nations globally and Bank for International Settlement (BIS), emphasise primarily on these three types of risks. Working towards the need to maintain solvency of banks, the Basel Committee has introduced the minimum capital adequacy ratio (CAR) in the 1980s considering the three major risks mentioned above.

The international banking regulator, the Basel Committee on Banking Supervision (BCBS), also known in short as Basel Committee, drafts guidelines for commercial banks and regulators for an effective risk management framework. It has been continuously formulating several measures from time to time in consultation with the central banks of its member countries to manage different risks faced by the banks. The first guideline of BCBS or the Basel I Accord pertaining to credit risk management was released in 1988. This Accord emphasised on measurement and monitoring of credit risk alone. It recommended that banks maintain a CAR of 8%. The Accord defined different weights for different types of credit exposure to arrive at risk weighted asset (RWA). Later, market risk was added in the computation of minimum CAR of the bank through an amendment made to the Accord during '90s. Few banking failures during '90s, that posed challenges to the risk management framework in the banks, and emergence of new types of risks, required the committee to revamp the existing approaches. Subsequently, following a series of meetings and consultations, the Basel committee came up with a new Accord called the Basel II Accord in 2004. The new Accord overcame several limitations of the old Accord and most significantly, brought operational risk management into the ambit of minimum CAR for the bank. Hence, as per the Basel II Accord, banks are required to maintain minimum CAR considering credit, market and operational risks. The new Accord enhanced capital requirement for the bank, which benefits the customers and shareholders, as a higher capital buffer will reduce the chances of being insolvent. In response to the circulation of Basel II guideline, the Reserve Bank of India (RBI) notified all the commercial banks in India to adopt and implement Basel II Accord within a given and stipulated timeframe.

The accord is based on three pillars in which the first pillar is about the estimation of minimum capital requirement for credit, operational and market risks. The second pillar is that of the supervisory review process and the third one is about market discipline. Credit risk arises when the counterparty fails to meet its financial contractual debt obligation towards the bank i.e. when the customer of a bank does not repay principal or interest on a loan leading to a credit loss to the bank. Market risk arises due to changes in market related variables such as interest rate, foreign exchange rate, price level, etc. Operational risk emanates from the operations of a bank, both financial and non-financial. This type of risk arises due to failed or inadequate process, people and system, or from external events. The domain of operational risk is wider than credit and market risk, since it covers all activities of the bank unlike the other two types of risks. Measuring these risks is critical for an effective risk management framework, since it directly affects the capital buffer that the bank should maintain to remain solvent during

unforeseen adverse situations. Thus, the modeling of credit, operational and market risks is the foremost activity of banks for a better and effective risk management framework.

Basel II Accord defines a set of risk measurement methods starting from standard approaches to advanced approaches. While the accord recommends both Standardized and Internal Rating Based (IRB) approaches for credit risk, IRB approach is the most risk sensitive approach. For operational risk measurement, the Accord defines three approaches: The Basic Indicator Approach, the Standardized Approach and the Advanced Measurement Approach (AMA). AMA is the most risk sensitive approach since it uses actual losses of the bank, whereas the other two approaches use gross income of the bank to compute operational risk capital charge. The Basel Committee is contemplating to replace the gross income used in computation of operational risk capital charge with business income as it is a better proxy of business operations. For market risk, it defines standardized approach and internal rating based approach. After the implementation of Basel II Accord, a pressing need for modeling credit, operational and market risks has been felt by banks across the world.

The inter-dependence of the world of finance with the entire economy of countries was once again demonstrated in 2007-08 with the collapse of Lehman and the sub-prime crisis, the effect of which resonated across the world adversely affecting all countries and economies. The impact was so wide spread and significant that the Basel Committee felt an immediate need to revamp Basel II and thus Basel III was born. For credit risk, sophisticated modeling techniques have evolved to predict probability of default of a borrower, before sanctioning credit, which is one of the key components of credit risk modeling. The traditional approach of measuring the probability of default of a customer was based on expert judgment and qualitative assessment. Contemporary modeling techniques implement statistical models, ranging from accounting based models to market based models. Accounting based models use financial information of a company taken from its balance sheet and income statement, to predict probability of default; whereas, market based models use market information pertaining to stock data, bond data along with financial information, to predict probability of default.

While the credit and market risks modeling evolved over the years and continues to evolve, modeling operational risk is a relatively new concept for banks. Though there is no clear regulatory direction as far as operational risk modeling is concerned, banks globally are adopting various modeling techniques to compute operational risk capital based on advanced

measurement approach. There is no published literature available on operational risk management and modeling techniques used for operational risk in India. None of the Indian banks have implemented AMA for operational risk capital computation so far giving rise to the need for literature on the practical aspects and challenges in the operational risk management and modeling techniques.

The regulations and economics call for higher capital that needs to be supported by increased profits. Though in the short term this can be achieved through operational efficiency and reduction in operating expenses, in the long term, it requires the bank's risk adjusted profitability to be optimised. However, it needs to be reiterated that risk management does not aim at avoidance of risk as taking well-understood and reasonable risks lead to enhanced returns and better profitability of banks. This mandates judicious policies and procedures to "identify, measure, monitor and control risk". A robust and prudent risk management system brings in an order to the risk quantification process; facilitates assigning a quantitative value to estimated risk; marks situations of extreme risk for immediate and necessary corrective action; enhances risk awareness; helps in objective performance evaluation by means of risk-adjusted capital employed and increases the valuation of the company while decreasing the cost of capital (Bradstreet, 2006).

In this backdrop, the study tries to carry out a detailed analysis of the determinants of operational risk, the operational risk management practices, the impact of operational risk on profitability of banks and the interaction effects of operational risk capital and the operational risk management practices on the relationship between operational risk and profitability of banks. It is a modest attempt to fill in the gap in a small but significant way.

1.3 Evolution of Risk Management in Banking

The field of risk management can be said to have evolved from insurance purchasing and insurance management. Being a form of management, insurance management had processes and guidelines for the efficient acquisition of insurance. Risk management was then introduced as a larger process which focused on the identification of exposures and the usage of non-insurance treatment like loss control and several retention methods(Aiuppa, 2001).

The role of risk management in financial companies has grown much beyond the concept of "simple insurance" of identified risks, to a discipline that centres on complex econometric and financial models of uncertainty(Kühn & Neu, 2003).

The discipline of Risk Management has significantly evolved since the 1970s owing to the application and development of sophisticated quantitative techniques. While Risk Management initially was passive in nature comprising of risk monitoring, risk valuation and limit setting, it has transformed into a proactive function comprising of performance measurement, risk-based pricing, portfolio management and economic capital allocation. Apart from the reduction of potential losses due to risks, contemporary risk management also aims at contributing significantly towards shareholder value creation, which ultimately is the objective of any firm(Balthazar, 2006).

Another significant factor that has contributed immensely to the growth of risk management is the evolving banking regulation. The banking regulation that began as a set of simple rules to ensure financial stability has undergone many changes to meet the growing demands following the innovations of the financial industry. Beginning with the 1988 Basel Accord, the regulations were revised several times to the present Basel III guidelines. These two reasons give banks an opportunity to develop their risk management frameworks to make investments which while meeting the regulatory requirements will also confer the advantage of shareholder value creation through efficient and robust risk management(Balthazar, 2006).

The Basel Committee (2001) defines Financial risk management as a "sequence of four processes: the identification of events into one or more broad categories of market, credit, operational, and ''other'' risks and into specific subcategories; the assessment of risks using data and a risk model; the monitoring and reporting of the risk assessments on a timely basis; and the control of these risks by senior management".

Of the changes in financial markets, deregulation has led to a significant impact on risk management practices today. The deregulation of capital flows since the 1970s has led to great rise in globalization (Sverrisson, Van Dijk, & Van Dijk, 2000). Further, the deregulation of financial operations have added new risks, with few banks offering insurance products and insurance companies writing market and credit derivatives (Broome and Markham, 2000). The size of Over-the-counter derivative markets grew multi-fold compared to the other markets,

but capitalization across countries decreased during this period, and by the early 1980s, some individual banks had become highly vulnerable. As a consequence, the regulation of banks and other financial firms has increased with the introduction of the Basel norms.

As a result of increased competition owing to deregulation, some financial services were concentrated in the hands of a very few firms (Fraser and Zardkoohi, 1999; Stiroh and Strahan, 2003). The new Basel Accord introduced regulatory capital for a few services like the agency and custody services. To make it economically viable, the banks outsourced these services. On the other hand, many types of financial services like insurance, banking and asset management were being merged into one large complex banking organization which needed a firm wide risk management function that is capable of managing the total risks of the whole organization (Berger, Demsetz, and Strahan, 1999).

To assess and make risks and returns comparable across banks, regulators mandated a shift from ‘‘product-based’’ capital requirements to ‘‘rules-based’’ capital requirements that can be uniformly applied. Disintermediation in the traditional banking industry has significantly changed the structure of financial institutions. Many large corporates are raising funds through direct issue of debt and equity in capital markets rather than borrowing from banks (Bhattacharya, Boot, and Thakor, 1998). Consequently, banks are depending more on fees and commissions on services in corporate finance. While the role of intermediation through banks was on a decline, there has been a rise in other types of financial intermediaries, including non-banking financial companies and pension and mutual funds (Allen and Santomero, 1997). Multi-layered intermediation has increased and the interlinkages in the financial sector has become more and more complex. (Freedman, 2000). Thus new technological developments have enabled the delivery of financial services from novel intermediaries, with Internet- and intranet-based technologies ensuring improved communications, database, security and order management(Alexander, 2005).

To sum it up, Risk Management has gained a lot of prominence in the past few decades. From the publication of JP Morgan’s Risk Metrics in 1990s, Risk Management departments have grown considerably in their role and importance. Apart from meeting regulatory requirements, Risk Management departments aim at identifying the risk profile of the bank through quantitative risk assessment, developing and integrating IT solutions to meet the growing

business volumes and process huge data, and to integrate this information into the risk-return process of the bank. A proper risk management function is recognized by rating agencies and stakeholders and enhances shareholder value of the bank.

1.3.1 Recent Trends in Financial Markets and their impact on Risk Management

Alexander (2005) discussed the risk management impact of recent trends in financial markets that can be summarised as follows.

- Increased capital flows, rapid dissemination of information, and faster transfers of funds have all served to increase market risks

- Deregulation of capital flows in the worlds emerging economies has been the main catalyst for globalization in Eastern Europe and Asia, where the unchecked growth of capitalism, poor accounting standards, and inefficient and inappropriate financial intermediation led to some major credit crises during the 1980s (Bisignano, 1999)

- Recent trends across nations in financial markets have increased many types of operational risks. The proliferating growth of some new companies adopting dubious and unfair accountancy and management practices followed the deregulation of industries and consequently there has been a profound increase in company fraud (e.g., Enron formed after deregulation of the U.S. energy market in the early 1990s);

- Systems risks have escalated with increasing reliance on technology. The accumulation of key financial services at a single geographical location increases operational risks arising mainly from damage to physical assets. Modern financial institutions offer extremely structured products that have access to a wide range of asset classes around the world. The complexity associated with these financial instruments highlights several types of operational risks;

- With very little transparency in trading, and new and complex systems, systems risk has considerably increased. Products and business practice risks are also likely to increase because of the threat of mis-pricing and mis-selling these products; and

‘‘human’’ risks in general increase as in the present contemporary scenario, only a few experienced people appreciate and understand the systems and the products.

- The evolution and growth of complex structured products has clearly increased the vulnerability to pricing and model risk. Model risk cannot be ignored as it is not a high-frequency, low severity operational risk. It can affect the operational risk regulatory capital charge adversely and significantly and should therefore be a major focus for operational risk control.

- Business risk which arises due to the risk of insolvency following inefficient management decisions, has grown as the structure of financial institutions continues to change. Increasing demand for corporate finance, despite a decrease in demand for banking loans has the effect of decreasing credit and market risks for banks, but in the process exposing them to greater business risks.

- Systemic risk is the risk of an event leading to bulk insolvencies in the banking and other allied sectors. It emanates from the ‘‘domino effect’’ resulting from a limited “idiosyncratic shock” when the behaviour of agents is identical.

- The similar risk management practices practiced across the world can increase chances of systemic risk because of increased ‘‘herding’’ behaviour.

- Increased integration amongst the components of financial industry has augmented the vulnerability to contagion effect that is vital to systemic risk (Rochet and Tirole, 1996).

1.3.2 Risk Management - The Indian Scenario

In the past, banking environment in India was regulated and was having a limited risk exposure. However, contemporary banking is exposed to numerous risks because of its increased level of operations and diversified services the banks offer. Liberalization of banking services has brought to the fore a plethora of financial innovations. These financial innovations in terms of products and services in the banking industry as well as financial convergence with other sectors have created huge business opportunities for banks. At the same time, they have made the banks vulnerable to many risks that were not known of earlier. More importantly, these

risks have a contagion effect and are capable of bringing down the entire financial system down as was evident in the 2008 global financial crisis.

The past three decades have seen major transformation in the Indian Economy and Indian Financial System. The opening up of the economy and the new Economic Reforms steered the direction of the Indian Financial System in the 1990s. While consistent higher growth rates, adoption and implementation of core banking solutions, transformation in payment systems, and integration with the global economy were the financial highlights of the last decade, the present decade has seen a huge surge in the volume of business which is growing at a tremendous pace. Information Technology (IT) has paved way for banks to deal with the huge numbers and volumes of business, also bringing along several types of risks and the need for efficient risk management. Human resources and IT have played a pivotal role in risk management in India as elsewhere in the World.

While risk management is present in almost every walk of life, risk management is all the more critical in the area of finance. Owing to the economic reforms and the subsequent rise of trade and capital flow between different parts of the globe, risk management has become essential across the entire financial sector. In the olden economies that were characterised by administered prices, fixed exchange and interest rates, risk was considered relatively mild. Under such conditions, the sovereign authority undertook risk management. As the systems were very rigid without any flexibility, "economic adjustments" did not happen on a daily basis and risks effectively accumulated until external economic adjustments like changes in administered pricing, interest rates and exchange rates were thrust on the system. It was realised that a system where these prices are adjusted as per the market on a daily basis would favour economic and financial stability. It was also felt that wider spread of risks among economic agents would enhance the stability.

The phased deregulation, relaxation and abolition of capital controls, the globalisation post the USSR collapse have served as a platform and incentive for the emergence and evolution of Risk Management Concepts and Practices.

1.4 Evolution of Indian Banking System

The existence of banking worldwide evolved with money lenders taking deposits and giving receipts in their place. Money lending was prevalent even during the Vedic Period (2000 to

400 BC). A system of banking that catered to the needs of the people at that time was in place centuries before "the science of banking became an accomplished fact in England" (W E Preston, 1926). Banking regulation had also evolved along with banking. Kautilya's Arthashastra(400 BC) had a mention about creditors, lenders, lending rates along with the norms for liquidation of banks.

Banks have been dominant participants in Indian Financial System and its economic development right from the Vedic Period. Over ages banks have undergone a major overhaul following innovations in information technology and service delivery. Modern banking in India can be dated back to the British regime during which agency houses played the role of banks. From the establishment of the first bank, the evolution of banking in India can be categorized into three distinct phases.

Phase I: This phase can be said to be the early phase of banking ranging from primitive Indian Banking to Nationalization of Banks in 1969.

Phase II: This phase of Indian banking can be marked from Nationalization of Banks in 1969 to economic liberalization and reforms in 1991.

Phase III: The phase following the financial sector reforms of 1991.

1.4.1 Phase I

Banking system in India can be said to have begun during this phase. The origin of commercial banking in India can be dated back to 18th century when joint stock banking was introduced into the country by English Clearing Agencies. The Bank of Bombay was established in Bombay in 1720 and was the pioneer bank of joint stock nature. The Hindustan Bank was the first bank established in 1770 at Calcutta under European Management. It was liquidated in 1829-32. The General Bank of Bengal and Bihar was established in 1773. The Bank of Bengal (1806), Bank of Bombay (1840) and the Bank of Madras (1843) were formed and were together called as the Presidency Banks. These presidency banks were amalgamated on January 27th, 1921 to form the Imperial Bank of India. The Reserve Bank of India(RBI) was established in 1935 under the Reserve Bank of India Act,1934.The establishment of RBI paved way for a new era in Indian banking.

Subsequently, the Imperial Bank of India came to be known as the State Bank of India following the passing of the State Bank of India Act, 1955. Under the State Bank of India

(Subsidiary Banks) Act, 1959, eight state associated banks, now called as its subsidiary banks, were taken under the control of the State Bank of India.

The Allahabad bank established in 1865 was the first Indian owned bank. Many joint stock banking companies like Punjab National Bank Ltd (1895 in Lahore), Bank of India Ltd(1906 in Mumbai), These were set up under private ownership. Canara Bank Ltd, Central Bank of India Ltd, Indian Bank Ltd, Bank of Baroda Ltd, were formed under Swadeshi movement. These banks were joint stock banks with Indian ownership.

By December 1913, there were 56 reporting commercial banks in India. This included 3 Presidency banks, 18 Class 'A' banks (having capital of greater than Rs.5 lakh), 23 Class 'B' banks (having capital of Rs.1 lakh to 5 lakh) and 12 exchange banks. While Class A and Class B banks were joint stock banks, Exchange banks were foreign owned banks that mainly transacted in foreign exchange business through foreign bills of exchange and foreign remittances for travel and trade . However, Presidency banks dominated this era of banking as can be seen in the deposits and paid-up capital in Table 2.

Table 2: Paid up capital and deposits of banks in 1935

	No. of reporting commercial banks					Paid up capital & reserves				Deposits				
End Dec	Presidency / Imperial Bank @	Class A *	Exg bank	Class B **	Total	Presidency / Imperial Bank	Class A *	Class B **	Total	Presidency / Imperial Bank	Class A *	Exg bank	Class B**	Total
1870	3	2	3	-	8	362	12	-	374	1197	14	52	-	1263
1880	3	3	4	-	10	405	21	-	426	1140	63	340	-	1543
1890	3	5	5	-	13	448	51	-	499	1836	271	754	-	2861
1900	3	9	8	-	20	560	128	-	688	1569	808	1050	-	3427
1910	3	16	11	-	30	691	376	-	1067	3654	2566	2479	-	8699
1913	3	18	12	23	56	748	364	#	1112	4236	2259	3104	151	9750
1920	3	25	15	33	76	753	1093	81	1927	8629	7115	7481	233	23458
1930	1	31	18	57	107	1115	1190	141	2446	8397	6326	6811	439	21973
1934	1	36	17	69	123	1128	1267	149	2544	8100	7677	7140	511	23428

@ The 3 presidency banks were amalgamated into the Imperial Bank of India in 1921
* Banks with capital and reserves above Rs 5 lakh
** Banks with capital and reserves above Rs. 1 lakh and below Rs.5 lakh
# Negligible

Adapted from RBI statistical tables of banks

1.4.1.1 Impact of World War I on Indian Banking

World War I resulted in an alarming economic situation throughout the world marked by high inflation due to war financing. This resulted in the neglect of the rural sector and the agriculture

that further added to the economic woes. During this period many banks failed in India. Low capital base, merging of trading with the banking activities and low cash and other liquid assets were the main reasons cited for the failure of banks. Table 3 depicts the paid up capital of failed banks during the period. Few big banks with a good paid up capital also failed as it had speculated in silver. To a large extent, the committees on banks attributed bank failures to "individual imprudence, mismanagement, fraudulent manipulation by directors and managers; and incompetence and inexperience".

Many banks in India had granted large advances (unsecured) to firms of directors. Lack of stringent regulatory mechanism allowed top and middle management to mislead depositors and shareholders. This highlighted the necessity for an adequate regulatory machinery for Indian commercial banks. Global economic downtrend had led to the failure of many banks in this period owing to external factors concerning parent countries, the adverse effects of the World War and inflation.

Table 3: Bank Failures – 1913 – 1921

Year (Jan – Dec)	No. of Failed Banks	Paid-up Capital (Rs. '000)	Avg Paid-up Capital (Rs. '000)	Avg Paid-up Capital of Reporting Banks in Class A & B (Rs. 000)
1913	12	3514	293	1152
1914	42	10902	260	1195
1915	11	451	41	1190
1916	13	423	33	1170
1917	9	2526	281	1315
1918	7	146	21	1433
1919	4	403	101	1585
1920	3	725	242	1675
1921	7	125	18	1901
Class A : Banks with capital and reserves above Rs 5 lakh Class B : Banks with capital and reserves above Rs. 1 lakh and below Rs.5 lakh				

Source: Banking and Monetary Statistics of India, RBI, 1954

1.4.1.2 Post World War

In 1921, the three presidency banks were amalgamated to form a single bank, the Imperial Bank of India. Several banks that belonged to the princely states of Jaipur, Mysore, Patiala and Jodhpur were merged with the Imperial Bank of India. The Imperial Bank of India also acted as a central bank before the RBI was established in 1935. It functioned in multiple roles of a

commercial bank, central bank and the banker to the government. There were 107 commercial banks by 1930, Imperial Bank being the major one.

1.4.1.3 The Great Depression

India, as the rest of the World had to grapple with the adverse impact of the Great Depression that lasted from 1928 – 1934. Bank failures in India during this period were mounting due to rising bad loans. Many small banks suffered failures that was demonstrated by the average capital of failed banks vis-s-vis the average capital of Class A and Class B Banks as exhibited in Table 4.

Table 4: Capital and Reserves of Failed Banks

Year (Jan – Dec)	No. of Banks Failed	Paid-up Capital of Failed Banks (Rs. '000)	Average Paid-up Capital of Failed Banks (Rs. '000)	Average Paid-up Capital of Reporting Banks in Class A & B (Rs. 000)
1926	14	398	28	1017
1927	16	311	19	1005
1928	13	2312	178	1022
1929	11	819	74	1105
1930	12	4060	338	952
1931	18	1506	84	984
1932	24	809	34	1008
1933	26	300	12	973
1934	30	623	21	851
1935	51	6596	129	861
Class A : Banks with capital and reserves above Rs 5 lakh Class B : Banks with capital and reserves above Rs. 1 lakh and below Rs.5 lakh				

Source: RBI Bank Statistics

In 1929, Indian Central Banking Enquiry Committee was put up to elaborately to study the problems faced by banks in India, suggested the establishment of a central bank for the country. It had also noted that the credit to the agricultural sector was a dismal 0.3% of GDP and that the needs of the farmers remained largely unmet considering the fact that India was an agrarian economy. In 1931, the rural indebtedness was projected at Rs.900 crore, and was contributed mainly by old indebtedness, high rates of interest, excessive social and ceremonial expenditure, land lease for high prices, frequent loss of cattle owing to drought and disease and lease. The farmers were losing their lands to the moneylenders. The unavailability of banking in all rural areas and hence their relying on the alternate sources of finance was a serious concern.

1.4.1.4 The Reserve Bank

The Indian Central Banking enquiry committee that was constituted to study bank failures in India, suggested that a central bank be established for integration of loosely connected banking structure and greater governance in the country. The need for a separate entity that does not carry out the regular banking business was emphasized as that would confer the entity to handle the central banking functions more efficiently and diligently. As a consequence, the "Reserve Bank of India Act 1934" was enacted that led to the establishment of Reserve Bank of India (RBI). The prominent factors that contributed to the setting up of the RBI were the banking failures rampant in the economy and the necessity to cater to the growing agricultural requirements of the economy.

The banking sector was brought under the domain of the Reserve Bank in 1935. Around that time, the joint stock banks held the largest share of the deposits, followed by Imperial Bank of India and then the exchange banks as can be seen in Table 5. The RBI Act empowered the Reserve Bank to control issue of bank notes and the custody of cash reserves of commercial banks to maintain monetary stability and to operate the currency and credit system in the country.

The key functions of the Reserve Bank are:

1. to act as a banker to the Government;
2. to issue notes;
3. to act as a banker to other banks; and
4. to maintain the exchange ratio.

The RBI Act enabled only a restricted control on banks though its responsibilities were specified in very clear terms. Accompanied with this was some extent of built-in flexibility as the Reserve Bank was conferred with extra powers that could be exercised under extra-ordinary circumstances with the prior approval of the 'Governor General in Council' or the 'Central Board of the Bank' depending on the case in point.

Table 5: Number of Commercial Banks in India and Deposits with them **(**Amount in Rs. Crore)

End-December	Imperial Bank of India		Exchange Banks		Joint-Stock Banks		Total-All Banks	
	No.	Deposits	No.	Deposits	No.	Deposits	No.	Deposits
1926	1	80(37.4)	18	72 (33.3)	76	63(29.4)	95	215
1929	1	79(37.3)	18	67 (31.4)	79	66 (31.2)	98	212

1932	1	75(33.6)	18	73(32.5)	87	76 (33.9)	106	225
1935	1	79(32.3)	17	76 (31.1)	106	90 (36.7)	124	245
Figures in brackets are the percentage shares in total								

Source: Statistics of Banks in India, 1935

Initially RBI took up the responsibility of improving credit to the agricultural sector which till then was dominated by moneylenders who charged usurious interest rates. From 1935-1950, the RBI focused on the agricultural credit through the co-operative movement.

However, the RBI did not have much supervisory powers initially to audit the banks or identify unsound practices to recommend corrective measures or penalise them, as the banks were governed by the Company Law. New banks could be set up without the necessity of RBI approval. This led to the establishment of many banks. The banks were classified into A1, A2, B, C and D categories. The erstwhile category A banks were classified into A1 and A2 and new categories C and D were added. Banks that had capital and reserves above Rs.5 lakh and were included in the second schedule to the RBI Act 1934 were categorised as Class A1. The remaining non-scheduled banks that had capital and reserves above Rs.5 lakh were categorised as Class A2. Based on their size, other non-commercial banks were classified as B if their capital and reserves were between Rs. 1 lakh and Rs.5 lakh, as C if their capital and reserves were between Rs 50,000 and Rs. 1 lakh and as Class D if their capital and reserves below Rs.50,000. The number of banks reporting rose to 654 in 1940 as shown in Table 6.

Table 6: Number of reporting banks

End Dec	Imperial Banks	Class A1	Exchange Bank	Class A2	Class B	Class C	Class D	Total
	Scheduled Banks			Non-Scheduled Banks				
1936	1	27	19	9	71			127
1940	1	41	20	17	122	121	332	654
1947	1	80	15	68	185	119	188	656
1950	1	74	16	73	189	123	124	600
1951	1	75	16	70	186	117	96	561
1952	1	75	15	70	194	114	60	529
Class A1 – Banks with capital and reserves above Rs. 5 lakh and included in the second schedule of RBI Act, 1934 Class A2 – Non-Scheduled banks that had capital and reserves above Rs.5 lakh Class B – Non-Scheduled banks with capital and reserves between Rs. 1 lakh and Rs.5 lakh Class C – Non-Scheduled banks with capital and reserves between Rs 50,000 and Rs. 1 lakh Class D – Non-Scheduled banks with capital and reserves below Rs. 50,000								

Source: Evolution of Banking, RBI

The number of small banks that were reporting to the RBI increased hugely in the initial years after the RBI was established owing to the free entry and exit policy for banks. Inadequate supervision had led to many governance issues that culminated in many bank failures. The RBI had limited powers that restricted it to monitoring of cash reserves with the RBI and inspecting banks for the purpose of evaluating their appropriateness of retention or addition in the second schedule of the RBI Act. RBI had no control over the operations or the practices of the smaller non-scheduled banks. Consequently, the Indian Companies Act was amended in 1936 to strengthen the regulatory framework in the country. Guidelines pertaining to minimum cash reserve and capital requirements, and operations related to banking were incorporated as a separate chapter in the Companies Act, 1936. RBI provided advice and guidance to the non-scheduled banks in order to integrate them with the organised banking. As absence of regulation was found to be the main reason for the growing failures of small and non-scheduled banks, need for a strong and comprehensive regulatory mechanism that addressed the major issues of low reserves and mounting bad debts due to over-extension of loans, was felt. In 1939, the Reserve bank submitted a proposal for legislation of banking in India. However, the legislation was not taken up by the government owing to the Second World War.

1.4.1.5 Impact of World War II

The Second World War (1939 – 1945) had a profound impact on Indian economy. The government spending on war and supply to the allies led to currency expansion in the country. A variety of factors like restricted spending on imports, controls on investment channels, inadequate internal supplies due to rerouting to the needs of the war, disparities in the income distribution patterns left huge unspent money with the higher income groups which again led to a surge of deposits with the banks. This culminated in huge growth of bank branches dominated by the scheduled banks, the exchange banks along with banks that were non-scheduled as represented in Table 7.

Table 7: Number of bank branches – 1940 – 1945

End-Dec	Imperial Bank of India	Exchange Banks	Other Scheduled Banks	Total Scheduled Banks	Class A2 Non-Scheduled Banks *	Class B & C Non-Scheduled Banks **	All Banks (5+6+7)
1	2	3	4	5	6	7	8
1940	383	87	844	1314	105	545	1964
1941	393	84	937	1414	204	678	2296

1942	392	84	971	1447	263	869	2579
1943	399	84	1395	1878	400	996	3274
1945	428	77	2451	2956	811	1434	5201
* : Banks with paid-up capital and reserves above Rs.5 lakh. ** : Banks with paid-up capital and reserves between Rs.50,000 and Rs.5 lakh.							

Source: Evolution of Banking, RBI

Several mounting concerns led to the failure of many small banks as shown in Table 8. These included misuse of public funds to gain control over nonbanking companies by purchasing their shares at exorbitant prices; large advances that were not secured to people related to the management; huge advances against over-priced shares and advances against immovable property which were not recoverable.

Table 8: Bank Failures from 1936 – 1945 (Amount in Rs. '000),

Year (Jan – Dec)	No. of Failed Banks	Paid-up Capital (Failed Banks)	Avg Paid-up Capital (Failed Banks)	Avg Paid-up Capital of Reporting Banks *
1936	88	500	6	684
1937	65	1152	18	552
1938	73	3000	41	514
1939	117	2491	21	162
1940	107	2390	22	188
1941	94	1239	13	281
1942	50	1407	28	327
1943	59	749	13	406
1944	28	627	22	468
1945	27	474	18	503
* : Banks reporting in A, B, C and D categories only				

Source: Evolution of Banking, RBI.

Though there were numerous bank failures, the impact did not have a contagion effect across the sector as the sector was not very well developed and was not interlinked. The impact was only localised even when large banks had failed partly also because of the slow means of communication.

1.4.1.6 Indian Banking during the early Independent years – 1947 – 1967

When India attained its independence, the banks were completely private sector banks. The dominant players in the sector being the "Imperial Bank, the Central Bank of India Ltd., Punjab

National Bank Ltd., Bank of India Ltd., Bank of Baroda Ltd. and United Commercial Bank Ltd.", with each bank holding an aggregate of Rs. 100 crore public deposits. All other banks had an aggregate public deposits amounting less than Rs. 50 crore and were regional in their operations. Incidentally the Reserve Bank was also nationalised only in 1948, when it became fully State owned through the Reserve Bank of India (transfer to Public Ownership) Act, 1948.

Banking was also one of the sectors that has seen huge transformation post Indian independence. Many problems marred the Indian banking scenario as stated by the then governor, Deshmukh (1920) "The difficulty of the task of the Reserve Bank of India in dealing with the banking system in the country does not lie in the multiplicity of banking units alone. It is aggravated by its diversity and range. There can be no standard treatment in practice although in theory the same law governs all".

The partition of the country also adversely affected the banking sector especially in the states of Punjab and West Bengal. Of the 38 banks that failed in the country in 1947, 17 were from the State of West Bengal. A number of small banks failed during the period 1947 – 1955 as shown Table 9.

Table 9: Bank Failures from 1947 – 1955 (Amount in Rupees. lakh)

Year (Jan – Dec)	No. of Failed Banks	Paid-up Capital (Failed Banks)	Avg Paid-up Capital (Failed Banks)	Avg Paid-up Capital of Reporting Banks *
1947	38	83	2	105
1948	45	183	4	90
1949	55	131	2	84
1950	45	129	3	102
1951	60	62	1	73
1952	31	16	1	139
1953	31	114	4	135
1954	27	48	2	154
1955	29	47	2	142
* : Banks reporting in A1, A2, B, C and D categories.				

Source: Evolution of Banking, RBI

As many as 45 large banks were shut down in 1948 as a consequence of rapid expansion that became unsustainable owing to the limited resources and huge advances they had against poor security. The successive failures eroded people's trust in the banking system and led to increased investments in alternatives like physical assets and postal savings as they were considered safer. The circumstances prevalent in the economy reinforced that banking soundness played a pivotal and critical role in the economic stability and well-being.

The Banking Companies Act, 1949, tried to fix the problem of bank failures to a certain extent. The act empowered the Reserve Bank with the supervision powers. This marked the beginning of the regulatory steps by the independent government aimed at streamlining the banking activities in the country. The Reserve Bank could now control addition of new banks and branches, audit books of accounts of the banks, avoid wilful closure of licensed banks. Reserve Bank had the authority to inspect any bank to reiterate suitability for a licence, opening of new branches, bank amalgamations, and conformance with the revised guidelines of Reserve Bank as and when issued.

Even after the Banking Companies Act, banks continued to fail, albeit in lesser number. The failures of multiple small banks in the 1950s resulted in consolidation of the Indian Banking system as amalgamation of banks was believed to prevent failure of many small and big bank failures across the country. This led to the subsequent amendment of the Banking Companies act. The Banking Companies (Amendment) Act 1961 allowed mandatory amalgamation or reconstruction of banks. The Act permitted mandatory consolidation of a bank with the State Bank of India or any of its subsidiaries. Prior to this, amalgamation was permitted with only other banks. 300 banks were amalgamated between 1954 and 1966. To further strengthen the banking system, banks that were not viable were weeded out through liquidations. From 1954 to 1966, about 154 banks were liquidated.

The Banking Companies (Second Amendment) Act, 1960, with a view to providing a safety net to bank depositors, sought to make prompt payments to them in the event of liquidation and also conferred the Government and the Reserve Bank with added powers to rehabilitate banks in case of eventualities. Deposit Insurance Corporation of India was established in January 1962, following the enactment of the Deposit Insurance Corporation Act, 1961 to safeguard the deposits of small bank depositors. At that time, very few countries introduced this kind of a deposit insurance that provided insurance cover against loss of a part or all of deposits held with an insured bank to a certain extent. Another amendment to the RBI act was passed in 1963 and came into force from February 1, 1964 that allowed the Reserve Bank to limit the control of a few personnel related to management over the affairs of the bank, limit loans and advances, and bank guarantees.

Another significant objective after the independence was providing bank facilities to the rural sector as most of the bank at that time was concentrated in the urban areas. For enhancing agricultural and rural credit, Imperial Bank of India was nationalised. The All India Rural

Credit Survey Committee (AIRCS) in 1951 recommended that a critical role needs to be played by the Imperial Bank of India in credit institutionalization to agriculture, and recommended the statutory amalgamation of Imperial Bank and major state associated banks to form the State Bank of India. Following the enactment of the State Bank of India Act in 1955, the Imperial Bank of India was converted into the "State Bank of India" in 1955.

To protect SBI from political pressures, SBI was owned by the RBI. The rising income levels helped in fostering the banking habits among people. SBI surpassed its target and opened 416 branches in unbanked centres in 5 years (Mathur, 1995). The aggregate deposits of scheduled commercial banks that posted a negative growth in 1951-1953, a small positive growth of 1.9 per cent in 1953-54, increased by 10-12 per cent in 1954-55 and 1956-57. Eight banks that had formed subsidiaries of SBI were nationalised in 1960 to spread institutional credit pervasively to help people break the usurious interest rate and the debt cycle. To improve the working and efficiency of the managerial staff in the banking sector, the Bankers' Training College was established in 1954 by the Reserve Bank.

1.4.1.7 Introduction of Administered Structure of Interest Rates

The growing deficit and the rising inflation led to an administered structure of interest rates and several other micro controls. Earlier, the Reserve Bank depended on direct control over the lending rates of banks, rather than on indirect control through instruments such as the Bank Rate for influencing the cost of bank credit. This was usually carried out by specifying minimum rates of interest. Interest rates were further sub-classified with minimum lending rates separately stipulated for credit against various commodities covered under selective credit control. Additionally, concession or ceiling on rates of interest were applicable to advances for certain purposes or to certain sectors to lessen the interest burden, thereby facilitating their development. Interest rates on deposits were also regulated in September 1964. The objectives behind fixing the rates on deposits were to avoid unhealthy competition amongst the banks for deposits and keep the level of deposit rates in alignment with the lending rates of banks to ensure the profitability of banks. Prior to these, changes in interest rates were governed by voluntary inter-bank agreements amongst the important Indian and foreign banks which used to fix ceilings on interest rates.

The period during 1961 to witnessed two wars and a series of poor harvest seasons. The concentration of resources in the hands of a few entities deprived the genuinely productive sectors. Hence, in 1966, the banking sector was increasingly subjected to selective credit controls. Measures were taken to support effective use of credit and prevent the larger borrowers from blocking scarce credit and enlarging the spectrum of borrowers covered by bank credit in the overall national interests.

On the whole, the banking environment in the early independence phase had three distinct alarming features. First, continuing bank failures had led to suspicions regarding the soundness and stability of the banking system. Second, there was huge concentration of resources from deposits mobilisation in a few hands of business families or groups. Banks raised funds and lent them largely to their controlling entities. Third, agriculture was neglected to the extent bank credit was concerned. A major development during this period was the enactment of the Banking Regulation Act empowering the Reserve Bank to regulate and supervise the banking sector. These powers were necessary as banks continued to fail even after Independence, albeit with a decrease in the number of banks that failed. The Reserve Bank was fairly successful in improving the safety and soundness of the banking sector over time as several weak banks were weeded out through amalgamations/liquidations.

1.4.2 Phase II - Period of Social Control over Banks- 1967 To 1991

Major concerns about banking at the time of independence were the interconnections between the banks and industry, and the neglect of agriculture. These continued even after 20 years of independence causing concern to the authorities. Fears that a few business houses might gain control over a greater proportion of country's banking assets through the banks associated with them. Hence, the concept of social control over banking was introduced in December 1967 through the Banking Laws (Amendment) Act 1968, which came into effect on February 1, 1969.

The objectives of social control was to garner a wider spread of bank credit, prevent misuse of bank credit, direct a major volume of credit flow to priority sectors and make it a more effective tool for economic development. The National Credit Council (NCC) was established in February 1968 to assist the Reserve Bank and the Government in allocation of credit as per the plan priorities. It was assigned the task of estimating the demand for bank credit from different sectors of the economy; and setting priorities for grant of loans or for investment after

considering the availability of resources, and the needs of the priority sectors, specifically agriculture, small scale industries and exports. However, in spite of the social control on banks, a major chunk of the population remained outside the purview of the organised sector credit.

1.4.2.1 Nationalisation of Banks

Though the Indian banking had achieved some progress in terms of deposit growth in the 1950s and the 1960s, its presence was more in the urban areas. The progress in terms of social objectives was not satisfactory. A dominant feature of Indian commercial banking was the control of major banks by leaders of commerce and industry. Banks were satisfying their requirements rather than adhering to commercial principles. The result was the gradual depletion in the capital base of banks. It was opined that "if bank funds had to be channelled for rapid economic growth with social justice, there was no alternative to nationalisation of at least the major segment of the banking system". Accordingly, the Government of India nationalised 14 banks (with deposits of over Rs.50 crore) by promulgating the Banking Companies (Acquisition and Transfer of Undertakings) Ordinance, 1969. The Indian banking system underwent major structural transformation after the nationalisation of banks in1969. To address the issue of urban concentration, specific emphasis was laid on making banking facilities available in the then unbanked areas. The nationalisation also led to a significant reorientation of bank lending to speed up the process of development, especially of the priority sectors of the economy.

Few private banks had suffered some governance issues. There was an increasing necessity to address the need of credit delivery in a larger way. Accordingly, six banks, namely Andhra Bank, Corporation Bank, New Bank of India, Oriental Bank of Commerce, Punjab and Sind Bank, and Vijaya Bank (with deposit liabilities of Rs.200 crore and above), were nationalised by the government in April 1980. With this, the number of public sector banks, including the State Bank of India and its associate banks increased to 28 in April 1980, constituting almost 91 per cent deposits of the banking sector.

The trade-off between growth and inflation was prominent during this period as the high investments made as a part of the Five Year Plans were supported by deficit financing that was inflationary. The Government borrowed from the Reserve Bank through automatic monetisation of deficit by adhoc Treasury Bills, whose consequence was an increase in reserve money and money supply. To counter the effect of deficit financing that propelled excess

money growth, the Reserve Bank was required to increase the cash reserve ratio (CRR) frequently. The CRR was gradually raised from 5.0 per cent in June 1973 to 15.0 per cent by July 1989. Additional CRR of 10.0 per cent was also introduced with effect from November 1983. The logic was to reduce the credit creation capacity of the banks by affecting the credit multiplier. At the macro level, credit rather than money supply was viewed as the factor affecting demand. The banking sector also became a captive source of funds by means of the statutory liquidity ratio (SLR), the proportion of net demand and time deposits that banks were required to maintain in India in cash, gold and unencumbered approved securities. Between 1970 and 1991 the SLR was revised by 12.5 percentage points. Although the SLR was introduced in 1949 as a prudential requirement, it became an instrument of financing the deficit of the central and state Governments as also certain public sector entities. Thus, by 1991, 63.5 per cent resources of the banking sector were pre-empted in the form of SLR and CRR. Table 10 and Table 11 depict the changes in CRR and SLR respectively.

Table 10: Changes in CRR from 1973-1990

Effective Date	Cash Reserve Ratio*	Effective Date	Cash Reserve Ratio*
June 29, 1973	5.00	June 11, 1982	7.00
September 08, 1973	6.00	May 27, 1983	7.50
September 22, 1973	7.00	July 29, 1983	8.00
July 01, 1974	5.00	August 27, 1983	8.50
December 14, 1974	4.50	November 12, 1983	8.50
December 28, 1974	4.00	February 04, 1984	9.00
September 04, 1976	5.00	October 27, 1984	9.00
November 13, 1976	6.00	December 01, 1984	9.00
January 14, 1977	6.00	October 26, 1985	9.00
July 01,1978	6.00	November 22, 1986	9.00
June 05, 1979	6.00	February 28, 1987	9.50
July 31,1981	6.50	May 23, 1987	9.50
August 21, 1981	7.00	October 24, 1987	10.00
November 27, 1981	7.25	April 23, 1988	10.00
December 25, 1981	7.50	July 2, 1988	10.50
January 29, 1982	7.75	July 30, 1988	11.00

April 09, 1982	7.25	July 1, 1989	15.00
*: Data for CRR are as percentage of domestic net demand and time liabilities (NDTL)			

Source: Handbook of Statistics on the Indian Economy, 2006-07

Table 11: Changes in Statutory Liquidity Ratio from 1970-1990

Effective Date	Statutory Liquidity Ratio *
February 05, 1970	26.00
April 24, 1970	27.00
August 28, 1970	28.00
August 04, 1972	29.00
November 17, 1972	30.00
December 08, 1973	32.00
July 01, 1974	33.00
December 01, 1978	34.00
September 25, 1981	34.50
October 30, 1981	35.00
July 28, 1984	35.50
September 01, 1984	36.00
June 08, 1985	36.50
July 06, 1985	37.00
April 25, 1987	37.50
January 2, 1988	38.00
September 22, 1990	38.50
* : As percentage of domestic net demand and time liabilities (NDTL).	

Source : Handbook of Statistics on the Indian Economy, 2006-07

Several controls dominated this phase. The increase of administered interest rates, directed credit arrangements and rise in statutory obligations had a negative and unfavourable effect on the profitability of banks. The banks' return on assets (RoA) drastically decreased between 1975 and 1985 before marginally improving in the second half of the 1980s in response to the measures initiated towards liberalisation. Table 12 sums up the RoA during the period. The

decline in profitability was observed among all bank groups, although it was more pronounced in the State bank group.

Table 12: Return on Assets(percent) of Commercial Banks

Year (January-December)	SBI	Nationalised Banks	Other Indian Scheduled Commercial Banks	Return on Assets *
1970	0.48	0.64	0.65	0.59
1975	1.19	0.57	0.59	0.77
1980	0.86	0.56	0.59	0.66
1985	0.08	0.06	0.13	0.07
1989-90@	0.12	0.15	0.23	0.15
@ : April-March				
"Net profit before tax as a percentage of total assets"				

To summarize, major concerns in this period were the interconnections among banks and industry leading to agriculture being totally ignored. The government aimed to break the link and facilitate the credit flow to agriculture. This was achieved through nationalisation of large banks and organisation of directed credit in the form of priority sector lending. The nationalisation of banks in 1969 and again in 1980 brought a large segment of the banking business under government ownership.

In the post-nationalisation phase, the nation was capable to shape up financial infrastructure to hasten the process of resource mobilisation to cater to the growing needs of the economy. The nationalisation of large commercial banks in 1969 was a main step in ensuring timely and adequate disbursal of credit to the productive activities of the economy. It was intended to make the system extend to the small man and the rural and semi-urban areas.

Although the banking system succeeded in bringing a sharp rise in resource mobilisation, the demands on the banking system was also mounting. The Reserve Bank was compelled to hike the SLR of banks in order to finance the increase in fiscal deficit of the Government. At one point of time, 63.5 per cent of the resources of the banking sector were pre-empted by way of

CRR and SLR and such deployments were not adequately remunerated. Increased demand for funds made the traditional sectors to look for funds from sources other than the banking system, such as capital market and raising deposits directly from the public, leading to disintermediation. Due to priority sector lending concept, interest rates varied based on the certain attributes of borrowers. Rates of interest were quite lesser for certain firms like oil companies, firms engaged in procurement of food etc.

Many such changes led to the erosion in the productivity, efficiency and profitability of the banking system. Capital position of banks was also in doldrums as they had to bear the burden of large non-performing assets. Measures were then taken in order to "liberalise and advance the profitability, health and soundness of the banking sector In the mid-1980s, which by then had transformed from a largely private owned system to the one dominated by the public sector".

1.4.3. Phase III – Phase of Financial Sector Reforms

In the backdrop of serious problems in the country's Balance of Payments, the Central Government initiated structural reforms in the early 1990s. This led to the need for presence of a competitive financial sector, specifically the banking sector in order to gain the maximum benefit of the structural and financial reforms. A high powered committee chaired by Mr.M.Narasimham was constituted in August 1991 to study the organisation, structure, procedures and functions of the financial system. While the committee lauded the growth of the banking sector in terms of its geographical spread and operations that contributed to the growth of financial intermediation and economic growth, it raised concerns over the poor health of the banking sector and the need for immediate action. The committee had made many wide-range suggestions that formed the basis for reforms of the banking and financial sector. The progress of the banking sector during this period could be divided into two sub-phases - from 1991-92 to 1997-98 and 1997-98 onwards.

1.4.3.1 First Phase of Reforms: 1991-92 to 1997-98

The problems faced at the beginning of the sub-phase 1991-92 to 1997-98 were i) poor financial performance, ii) weak capital position of banks, iii) low asset quality and iv) the absence of acceptable competition. Government, the Reserve Bank and the banks initiated many measures

to improve their profitability, capital position and overall financial health. Important measures initiated included the introduction of objective prudential norms, lessening the statutory obligations and functional autonomy and operational flexibility to public sector banks.

Methods of assessment of the health of the banking sector was subjective and lacked consistency. Internationally accepted prudential norms pertaining to asset classification, income recognition, and capital adequacy were introduced in April 1992. Non-performing assets were clearly defined to dispel the ambiguity and were based on objective criteria. Working towards strengthening the capital base of banks, capital to risk-weighted assets ratio (CRAR) was introduced for banks in India in a phased manner. To meet the financial requirements of banks for the prudential provisioning and capital adequacy norms the Government had undertaken a recapitalisation programme of nationalised banks from the financial year 1993-94. However, as the infusion of funds was not able to fully meet the requirements of banks, the Government permitted public sector banks to approach the capital market directly to mobilise equity funds from the public through amendment of the relevant acts. Moreover, in an effort to restrict new NPAs from arising on account of adverse selection, banks were warned against the defaulters to other lending institutions by sharing credit data from April 1994.

In view of several risks faced by the banking sector in a liberalised economic environment, additional emphasis was laid on strengthening the supervisory processes. Many measures introduced had a great impact. A significant progress was observed in the "financial performance, asset quality and capital position" by the end of this sub-phase. The financial performance had tremendous improvement as the banks were required to implement the objective accounting norms. Improvement in asset quality along with widening of net interest margins had also contributed to the progress. One of the several objectives of reforms was creation of competitive conditions. Although several measures were taken up to build up competitive environment, competition remained subtle.

The several reform measures introduced in this phase led to a change in the behaviour of banks as they began to focus progressively on improving their financial health and profitability. In spite of significant improvement, there were some concerns at the end of this period. First,
The levels of NPA of public sector banks was very high by international standards. Second, some banks could not achieve the mandated ratio pf capital adequacy even after two years of

the given time period. Third, some banks including two public sector banks continued to record financial losses at the end of this phase, although the banking sector, on the whole, turned around during the period 1994-95 and posted profits,. Fourth, lack of immense competition allowed banks to garner high net interest margins. Despite the enhanced credit flow to agriculture prior to the onset of reforms, rural financial institutions faced serious problems. Though the program to restructure them boosted their financial condition, the credit to the agricultural sector slowed down.

1.4.3.2 Second Phase of Reforms: 1998 and Onwards

After nearly ten years of the second phase of reforms, the face of the Indian banking sector changed considerably. The concerns raised in this sub-phase required to (i) strengthen the mandatory norms in tandem with the international best practices while ensuring that the risk aversion did not heighten; (ii) ensure increased flow of credit to the agricultural sector and SMEs; (iii) include a large section of excluded population into the ambit of the banking sector; (iv) reinforce the corporate governance practices; (v) reinforce the urban cooperative banks and additionally resolve the conflict of dual control; and (vi) enhance the customer service. On almost all the arenas, there was a significant development. With the implementation of prudential norms, banks were developing risk aversion. To address this issue, while strengthening prudential norms, to enable banks to recover their past dues institutional arrangements were enforced. The measures introduced had a positive effect as banks were able to recover huge amounts locked up in NPLs. Banks, from thereon, gradually left their risk aversion and a sharp rise in credit was observed beginning from 2004-05. NPLs level of banks gradually dropped to the global level. Their gross NPAs decreased from a huge15.4 per cent at end-March 1997 to 2.5 per cent at end-March 2007. This can be stated as the most commendable achievement of this period. The profitability of commercial banks as depicted by their average return on asset improved, though marginally, from 0.8 per cent in 1997-98 to 0.9 per cent in 2006-07. This was noteworthy given that the competition intensified during this phase as indicated by the increased number of mergers and acquisitions (M&As) activity and the decline of net interest margins. In spite of the increased competition, banks posted improved profitability owing to a sharp decline in NPLs; and enhanced credit volumes. To further enhance their profitability in a competitive environment, banks had undertaken diversification of activities leading to financial conglomerates. The capital adequacy ratio of banks had also improved considerably from 8.7 per cent at end-March 1997 to 12.9 per cent at end-March 2007. The CRAR of most banks was over 10 per cent at an individual level, higher

than the mandated target which in itself was higher than the international norms. Thus, the fruits of reforms introduced in the early 1990s became clearly visible in this phase making the Indian banking sector become competitive, profitable and strong.

Issues concerning corporate governance practices in banks in India were a concern. The issues of concentration of ownership among few and the quality of management that controlled the bank. Norms were revised to ensure spread and diversification of ownership, and that bank owners and directors fulfilled the 'fit and proper' clause. Lending to the SME and agricultural sectors slowed down in the 1990s and early years of the next decade. The Government and the Reserve Bank made conscious efforts to upsurge the flow of credit to these sectors. Increase in credit to agriculture led to significant rise in credit intensity of agriculture. The restructuring of RRBs made them bigger and stronger to serve as an improved instrument of rural credit delivery. Credit flow to SMEs also accelerated in the following years.

However, a huge segment of population falling under the low income group continued to remain outside the banking system. Banks were asked to open 'no frills' accounts with nil or minimum account balances. This measure adopted by banks could bring a large number of financially excluded people (about 13 million) within their purview in a short time of two years.

The use of technology increased predominantly in this phase. Huge number of public sector bank branches (86 per cent of total branches) were computerised, of which nearly fifty percent were under core banking solutions. The number of ATMs installed also increased remarkably leading to improved customer service. A steep increase in the use of electronic payment transactions was recorded. A specific mechanism was adopted to benchmark the customer service delivery against the international standards and best practices. Largely, the banking sector by the end of this phase had experienced massive transformation from the one with low profitability, weak capital base, poor asset quality to the one with good profitability, strong capital base and high asset quality (RBI).

Even today, the Indian banking system has been evolving continuously to become one of the robust banking systems in the world that could keep it sailing even during the 1997 South-east Asian crisis, the 2007-08 global financial crisis, and the European financial crisis, which devastated many powerful economies.

1.5 Indian Banking Industry: Current scenario

According to KPMG-CII report, "with the potential to become the fifth largest banking industry in the world by 2020 and third largest by 2025, India's banking and financial sector is growing rapidly. The Indian Banking industry is currently worth USD 1.96 trillion (FY 2015) and banks are now utilizing the latest technologies like internet and mobile devices to carry out transactions and communicate with the masses" (Master, 2016).

The Indian banking system consists of 27 public sector banks, 23 private sector banks, 43 foreign banks, 56 regional rural banks, 1,589 urban cooperative banks and 93,550 rural cooperative banks, in addition to cooperative credit institutions. Public-sector banks control nearly 80 percent of the market, thereby leaving comparatively much smaller shares for its private peers (RBI).

1.5.1 Highlights of the banking sector

- In 2015, value of public sector bank assets were USD1.4 trillion. Total Indian banking sector assets has reached USD1.96 trillion in FY15 from USD1.3 trillion in FY10, with over 70 per cent accounted by the public sector
- Total lending and deposits have increased at a compound annual growth rate (CAGR) of 6 per cent during FY11-15 and 12.9 per cent, respectively, during FY06-15 and are further poised for growth, backed by demand for housing and personal finance
- Total number of ATMs in India have increased to 189,189 by the end of August'15 and is further expected to double over the next few years, thereby taking the number of ATMs per million population from 105 in 2012, to about 300 in 2017.
- Total asset size of banking sector assets is expected to increase to US$ 28.5 trillion by FY25.
- Deposits have grown at a CAGR of 13.6 per cent during FY05–15 to an estimated US$ 1.48 trillion in FY15. - Deposit growth has been mainly driven by strong growth in savings amid rising disposable income levels.
- Total credit extended was USD1089 billion by FY15.
- Credit offtake slowed down to 9.4% in FY15 from 14.3% recorded in FY14.
- The growth in deposits of scheduled commercial banks (SCBs) at 10.7% in FY15 was much lower than the growth at 14.1% in the previous financial year.

- Base rate of major banks fell to 9.75%-10% in April and declined further to 9.3%-9.7% by the end of 2015.
- Deposit rates have fallen from 8%-9.25% in FY15 to 7%-7.9% towards the end of 2015.
- While the credit growth of public sector banks has more than halved to 7.1% that of private sector banks has improved from below 17% to 18.7% in FY15
- The aggregate profit after tax (PAT) of banks has risen by 10.1% in FY15 as compared to a decline of 14% in the preceding year.
- The return on assets (RoA) remained static at 0.8% whereas the return on equity (RoE) dipped slightly from 10.7% to 10.4% in FY15
- Public sector banks reported a marginal decline in RoA from 0.5% to 0.46%. Private sector banks saw their RoA improve from 1.65% to 1.68% during the year.
- The gross NPAs of banks (PSBs + private) increased over the last one year from 3.9% to 4.6% as on March 2015
- The capital adequacy ratio (CAR) of banks slipped from over 13% to 12.9% as on 31 March 2015. PSBs continued to report the lowest CAR that stood below 12% whereas private banks recorded a CAR of around 16% as at 31st March 2015."

1.5.2 Main Drivers of Banking and Financial Services industry

The Banking Laws (Amendment) Bill was passed by the Parliament in 2012. The bill permitted the "Reserve Bank of India (RBI) to draft final guidelines on issuing new bank licenses". Additionally, the central government has also been putting in commendable efforts towards the expansion of the banking sector. The new guidelines issued by RBI aim at curtailing the unfair practices of lenders and rationalize the domestic loan system. In the future, India could see an upsurge in the number of banks in the country, a transformation in operations of banks, which could simultaneously evolve by integrating modern technology in the industry.

One of the latest trends observed in the banking sector is the extensive use of social media applications like Facebook and WhatsApp to attract customers. In September 2013, ICICI bank "launched a Facebook bill payment and fund transfer service called 'Pockets' for customer convenience".

The Information Technology Industry spend in banking and financial services vertical was about USD 3.5 billion by Financial Year 2014. The growing maturity of Indian banking organizations in IT adoption helped immensely as technology is seen as one of the key drivers of business value. “Technology firms have a huge potential to explore in the BFSI sector, which contributes to about eight per cent of India's Gross Domestic Product”. (Master, 2016)

1.5.3. Trends in Hiring in Banking Sector

The Banking and Financial Services Industry (BSFI) is poised to recruit about 8.4 million people as suggested by the growth rate each year. BSFI manpower requirement between 2008 and 2022 is anticipated to be about 4.2 million and the sector may generate up to about 20 lakh new jobs in the next 5-10 years.

The granting of new licences and efforts made by the RBI and the Government to expand the financial services into rural areas might further propel the hiring trend among the public sector banks. Since a major chunk of banking workforce is scheduled to retire in the times to come, there would be huge requirement of new talent. According to Randstad India, global HR service provider in the country, the banking sector will generate 7-10 lakh jobs in the decade and the sector would be the among top job creators in 2016(Master, 2016).

As per the “Human Resource and Skill Requirements in the Banking, Financial Services & Insurance Sector (2022) report, apart from the on-rolls employment there is significant contractual employment across all the above segments through various financial positions such as Direct Selling Agents (DSA’s), Insurance agents, Mutual Fund Advisors, etc”.

1.5.4. Roadblocks in Banking Sector

The major challenge in front of the Indian Banking and Financial sector is the alarming level of financial exclusion in India and the inadvertent requirement to find a plausible solution to the same. The IBA–BCG survey of banks disclosed that the level of confidence in searching profitable solutions for bringing about financial inclusion is low. Financial inclusion which has earlier been resting solely on public sector banks is now being taken up by the private sector as well since inclusive growth has become one of the criteria for new licences as new banks have to open 25 per cent of their branches in rural areas. Presently, public sector banks have more branches than other banking group in both rural and semi-urban areas.

The banking industry is also confronted by intense competitive pressures, shifts in customer loyalty, stern regulatory environment and entry of new banks, all of which are compelling the banks to design new business models, restructure operations and continually improve processes(Master, 2016).

1.5.5. The Road Ahead

A report by IBA-FICCI-BCG suggests that "India's gross domestic product (GDP) growth over years to come will brand the Indian banking industry as the third largest in the world by 2025. According to this report, the Indian banking industry is set for a remarkable growth in coming years with the size of its assets likely to reach USD 28,500 billion by 2025. With the deposits increasing at a CAGR of 21.2 per cent (in terms of INR) in the period FY 06–13, there has been prominent growth in the overall industry.

This growth can be ascribed to banks redirecting focus to client servicing. Both public and private sector banks are leveraging rapidly growing technological infrastructure, in order to enhance customer experience and gain a competitive advantage. Taking benefit of internet and mobile banking, banks are increasingly implementing an integrated approach for asset–liability management, credit and derivatives risk management" (Master, 2016). Table 13 gives a snapshot of the banking industry.

Table 13: Snapshot of banking industry

Supply	Under the control of Reserve Bank of India (RBI).
Demand	Credit demand is huge.
Barriers to entry	Licensing requirement, capital and regulatory requirements, technology and branch expansion,
Bargaining Power of Suppliers	High during periods of tight liquidity.
Bargaining Power of Customers	High due to the availability of large number of banks.
Competition	High due to large number of players

Source:https://www.equitymaster.com/research-it/sector-info/bank/Banking-Sector-Analysis-Report.asp

To sum it up, Risk Management in banks has gained a lot of prominence in the past few decades. From the publication of JP Morgan's Risk Metrics in 1990s, Risk Management departments have grown considerably in their role and importance. Apart from meeting regulatory requirements, Risk Management departments aim at identifying the risk profile of the bank through quantitative risk assessment, developing and integrating IT solutions to meet the growing business volumes and process huge data, and to integrate this information into the risk-return process of the bank. A proper risk management function is recognized by rating agencies and stakeholders and enhances shareholder value of the bank(Kühn & Neu, 2003).

In this backdrop, the study examines the major factors contributing to operational risk and its impact on the profitability of banks in India, the operational risk management practices of banks and also looks into the possible influence of these practices on the influence of operational risk on profitability. The trends and the influence of operational risk capital on the relationship between operational risk and profitability has also been analysed.

CHAPTER II
BANKING REGULATIONS AND RISKS

CHAPTER II

BANKING REGULATIONS AND RISKS

Normally in the course of business, when a bank encounters liquidity problems, the authorities pump in funds temporarily to overcome the liquidity problem. However, in case a bank encounters “insolvency”, it affects the bank adversely. The governments might be required to redirect public money as the insolvent banks might not have enough capital to absorb losses. In addition, banks in the process of executing their day to day activities encounter a number of risks, the dominant ones being the credit risk, operational risk, market risk among others. These risks can threaten the survival of the bank if not addressed continuously. Given the interdependence among international economies, the risks would make a contagion resulting in a financial catastrophe. Thus, risk management becomes one of the critical functions of banks. The central banks or the national regulators are the major players in risk management as they constantly issue guidelines on the identification, measurement and mitigation of the risks that banks are exposed to and the timely actions warranted from banks. The present chapter deals with the Basel I, II and III accords, and the types of risks that banks are exposed to.

A look at the history of banks and the patterns there-in, along with banking failures help in emphasizing the need for banking regulations. Banking Regulations set a common benchmark and sound business practices for banks, the role of supervisory authorities and primarily aim to enhance the safety of banks through capital allocation that is aligned with the risk exposure of banks. The capital charge motivates banks to adopt best risk management practices as efficient risk management reduces the need for huge capital allocation. The regulatory guidelines help in the development and improvement of internal risk models and processes of banks. These help banks in recognising and defining risks clearly and measuring them quantitatively(Mishra, 2014).

2.1. Evolution of Regulatory Guidelines

Banks in the course of their business are exposed to several kinds of risks and therefore have strong reasons for developing risk-based practices and models to avoid potential losses. In

addition, mandatory compliance imposed by regulators has made risk management a major priority for the banking industry because of the possibility of a systematic risk, the risk of the entire banking industry collapsing because of the interlinkages among the entities of the financial system. Regulators play a very active role in promoting pre-emptive policies for avoiding individual bank failures and for helping the industry absorb the shock in the eventuality of failures. Keeping this in mind, the regulators have revised and revamped the regulatory framework. They promoted and enforced new guidelines for measuring and controlling the risks of individual players of the banking industry.

Initially, banking regulations were very passive and conservative requiring each bank to exercise caution. These rules were not universal and varied with business lines. Differentiated rules across business lines segmented the market as some banks enjoyed certain privileges while others did not. The rules were becoming obsolete with innovations in banking as banks were finding ways to surpass them. Barriers between the lines of business were becoming thin as banks began to compete directly across business lines by surpassing rules. This along with other players paved way for gradual deregulation. However, banks with unequal capabilities were competing with each other resulting in increased risks and subsequent failures. This created the need for reregulation which led to the genesis of the current regulatory regime, the Basel accords. Banking regulation is characterized by phases of deregulation followed by stricter policies at the time of crises.

The new regulation in banking saw the evolution of Capital Adequacy and Cooke ratio in 1988. The regulators maintained that the capital must be able to absorb potential losses occurring due to the present risks. This set a proactive measure unlike the earlier regulatory measures that believed in corrective actions after the losses had occurred.

2.1.1. Pre- 1988 Bank Regulation

Before 1988, bank regulators within a country regulated bank capital by setting minimum levels for the ratio of capital to total assets. The definitions of capital and the ratios considered acceptable varied across countries. In a global scenario, banks that were operating in a country with lenient capital regulations gained an edge over banks that were operating under tougher capital regulations. The expanding basket of transactions undertaken by banks led to exposures that were ‘off-balance-sheet’ and did not reflect in the ‘level of assets’ reported by the banks.

Hence they did not affect the capital that the bank was required to maintain. This meant that the total assets was not an appropriate indicator of the total risks taken.

2.1.2. The Basel Committee on Banking Supervision

The Basel committee on banking Supervision (BCBS) was formed in 1974 under the "auspices of Bank for International Settlement", with an initiative of G-10 countries (presently it is G-20 group of nations). It had representatives from "Belgium, Canada, France, Germany, Italy, Japan, Luxembourg, the Netherlands, Sweden, Switzerland, the United Kingdom and the United States".

Various banking failures of Europe, Japan, the United States apart from the bankruptcy of West German Herstatt Bank, Mexican debt crisis and the U.S stock market crash of the 1980s highlighted the need to protect the banking system and safeguard the global economy from the after-effects of such crises. An agreement in 1988, the Basel Accord, marked the evolution of international standards for bank regulation.

2.1.2.1. The 1988 BIS Accord

The first major result of the meetings was a document referred to as "The International Convergence of Capital Measurements and Capital Standards", popularly called the 1988 Basel Accord or Basel I. It was the first attempt to set international risk based standards for capital adequacy. It paved the way for significant increases in resources banks devote to measuring, understanding and managing risks. The main objectives of the accord were to provide a framework to "strengthen the soundness and stability of the international banking system and ensure that the framework be fair and consistent across banks in different countries so as to reduce competitive inequality among international banks".

The Basel I accord mainly addressed the credit risk of banks. The Basel I was categorised into four sections. The first section deals with the constituents that should make up the capital. The second section deals with the risk weighting system. The third part discusses the standard target ratios and the fourth one with the transitional and implementing arrangements.

I. Capital Constituents

Core Capital: The committee emphasised that the main element of capital that the banks world-wide have to focus on equity capital and disclosed reserves as this is the published information that forms the basis for capital adequacy judgements, market standing and a bank's profitability. Apart from the core capital, the accord also states that the following elements also need to be a part of the capital.

Supplementary Capital: This included undisclosed reserves, general provisions/ reserves, revaluation reserves, hybrid debt capital instruments, subordinated term debt. The accord had suggested that the capital that banks hold for supervisory purposes would have to be allocated in two tiers. At least 50% a bank's capital had to be core capital comprising of equity capital and disclosed reserves from retained earnings in Tier I and the Tier II capital consisted of the elements of the supplementary capital equal to the amount of core capital.

Deductions from capital: A few deductions were suggested by the accord. Goodwill had to be deducted from Tier I capital. Investments in banking subsidiaries that were not consolidated had also to be deducted.

It also defined two requirements that bank capital had to satisfy. While the first one is the required ratio of banks' assets to its capital, the second requirement was the Cooke ratio which was the key regulatory requirement. The ratio of banks' assets to its capital was required to be less than 20. The Cooke ratio involved both on-balance-sheet and off-balance-sheet items to calculate a bank's total risk-weighted assets. This ratio was used as a measure of total credit risk exposure(Hull, 2012).

2. The Risk Weights

The accord had suggested that weighted risk ratio using which capital is related to various asset categories or off-balance-sheet items based on the riskiness relative to them. This allowed for a fairer comparison among international banking systems. Only 5 weights were proposed to keep the process simpler – 0%, 10%, 20%, 50% and 100%. The risk weights for various asset classes are tabulated in Table 14.

Table 14: Risk weights for different asset classes as per Basel I

Risk Weight	Asset Class
0%	Cash, Claims on central govt.s and banks, Other claims on OECD central govt.s , claims guaranteed by OECD central governments,

0, 10, 20 or 50% (at national discretion)	Claims on domestic public-sector entities, excluding central government, and loans guaranteed by such entities
20%	Claims on multilateral development banks (IBRD, IADB, AsDB, AfDB, EIB) and claims guaranteed by them. Claims on banks incorporated in the OECD and claims guaranteed by them. Cash items in process of collection
50%	Loans fully secured by mortgage on residential property that is or will be occupied by the borrower or that is rented
100%	Claims on the private sector. Claims on commercial companies owned by the public sector. Premises, plant and equipment and other fixed assets. Real estate and other investments. Capital instruments issued by other banks and all other assets.

Source : The Basel I document, BIS

3. The Standard Ratio

The Accord required banks to keep capital equal to at least 8% of the risk weighted assets. The accord had set the standard ratio of capital to weighted risk assets at 8%, of which the core capital had to constitute 4% i.e

The capital had to consist of

1. Tier I Capital (equity and disclosed reserves): At least 50% of the required capital (i.e 4% of risk-weighted assets) had to be in Tier I with 2% of risk weighted assets to be common equity.
2. Tier II Capital (supplementary capital): This had to constitute another 50% of capital and cannot exceed the core capital. Subordinated debt within the supplementary capital has to be less than 50% of Tier I.

4. Transitional and Implementing Arrangement

Banks across countries were given a period of transition of four years till the end of 1992 to meet the Basel I standard in full. Each country was allowed to decide on the method in which the Basel recommendations would be introduced and implemented depending on the existing supervisory and legal framework of the country(Hull, 2012).

$$\textbf{\textit{Basel I capital adequacy ratio}} = \frac{\textbf{\textit{Capital}}(\textbf{\textit{Tier I+Tier II}})}{\textbf{\textit{Risk Weighted Assets}}(\textbf{\textit{RWAs}})}$$

Merits of Basel I

The accord played a very critical role in striving for the stability of the International Financial System. It set a benchmark for international banking regulation with more than 100 countries accepting to implement it. It paved way for uniform capital requirements across countries. It set new standards in management of credit risk. This accord required banks to maintain their capital above the regulatory minimum capital requirement in order to absorb losses. Banks that had higher risk weights as per Basel I had to bear the brunt of higher opportunity costs and banks that had lower risk weights reaped the benefits of lower capital requirement. The Risk based capital framework required banks to constantly review their regulatory capital ratios to meet the changing market conditions. These capital ratios considered both balance sheet and off-the balance-sheet exposures.

Limitations of Basel I

Basel I requirements were said to be lacking risk sensitivity. Under this accord, all loans by a bank to a firm had a risk weight of 100% and required the same amount of capital. Loans to companies with different credit ratings were treated in the same way. Capital requirements were considered only to be moderately associated to a bank's risk taking. This was anticipated to create challenges in economic decision-making and supervision. As per Saidenberg and Scheurmann(2003), the accord was not dynamic and was not capable of quickly adapting to the dynamic banking activities, innovations and risk management developments. The accord extensively focused on credit risk and did not give due importance to other banking risks like market risk and operational risk. The accord gave importance to minimum capital requirement without stressing on the risk management practices of the bank (Ong, 2006).

Moreover, the accord treated risk exposures of all banks to be similar. Another major drawback was the very simple methodology used for measuring credit risk exposure of a bank. The accord was focusing only on credit risk while exposures to other risks like market and operational risks were mounting. The uniform 8% capital charge was applicable to all corporate loans irrespective of the risk profile of the borrowers. The accord also did not consider the diversification effects of lending to different sectors. On the whole, the "one-size-fits-all"

approach of the Basel I accord did not work too well as the requirements for different banks were the same, irrespective of the risk level, sophistication, and activity of the bank.

2.1.2.2. The 1996 Amendment

The amendment aimed at keeping capital for the market risks associated with trading activities. Banks were required to use marking to market or fair value accounting for all assets and liabilities that are used for trading purposes to revalue them on a daily basis. These include derivatives, marketable equity securities, foreign currencies and commodities that constitute the trading book. Banks are not required to use fair value accounting for assets that are expected to be held for their life for investment purposes. These assets which include some debt securities and loans constitute banking book.

Under the 1996 amendment, the credit risk capital charge in the 1988 Accord continued to apply to all on-balance-sheet and off-balance -sheet items in the trading and banking book, except positions in the trading book that consisted of (a) debt and equity traded securities and (b) positions in commodities and foreign exchange. The amendment introduced a capital charge for the market risk associated with all items in the trading book.

The amendment proposed a standardized approach for measuring the market risk capital charge. The standardized approach allocated capital separately to foreign exchange risk, debt securities, equity securities, commodities risk and options. Correlations between different types of instruments were not considered. Bigger banks with well-established risk management functions were permitted to use an 'International model based approach' for allotting market risk capital. This involved calculating a Value-at-risk (VaR) measure and converting it into a capital requirement using a formula specified in the 1996 amendment. Banks showed more interest in adopting the international model based approach because it captured the benefits of diversification and led to lower capital requirements.

The VaR measure was calculated with a 10-day time horizon and a 99% confidence level. It was defined as a loss that had a 1% chance of being exceeded over a 10-day period. The calculation of VaR reflected changes in market variables like interest rates, stock indices, commodity prices and exchange rates. It however, did not include specific company risks like its share price movements(Hull, 2012).

2.1.2.3. Basel II

Though the 1988 Basel Accord enhanced the way capital requirements were determined, it had a few significant weaknesses. Keeping in view these shortcomings, the committee came up with a set of new guidelines called Basel II to overcome the drawbacks. Apart from aligning the minimum capital requirements with the technological and banking innovations, the new accord also enhanced the supervisory review process and the emphasised the need to disclose it to the general public as an element of market discipline. The three pillars of Basel II are depicted in Figure 1.

The Basel Committee proposed new rules referred to as Basel II in June 1999. These were again revised in January 2001 and April 2003. After a number of Quantitative Impact Studies (QIS) were carried out prior to the implementation of the new rules, a final set of guidelines were published in June 2004. This was further updated in November 2005. After additional QIS, the implementation of the Basel II rules began in 2007. Basel II intended to equip banks with their own methodology of internal risk management. Banks that had better risk management garnered greater incentives. The accord intended to enhance risk calculation in the measurement of capital through introduction of three pillars.

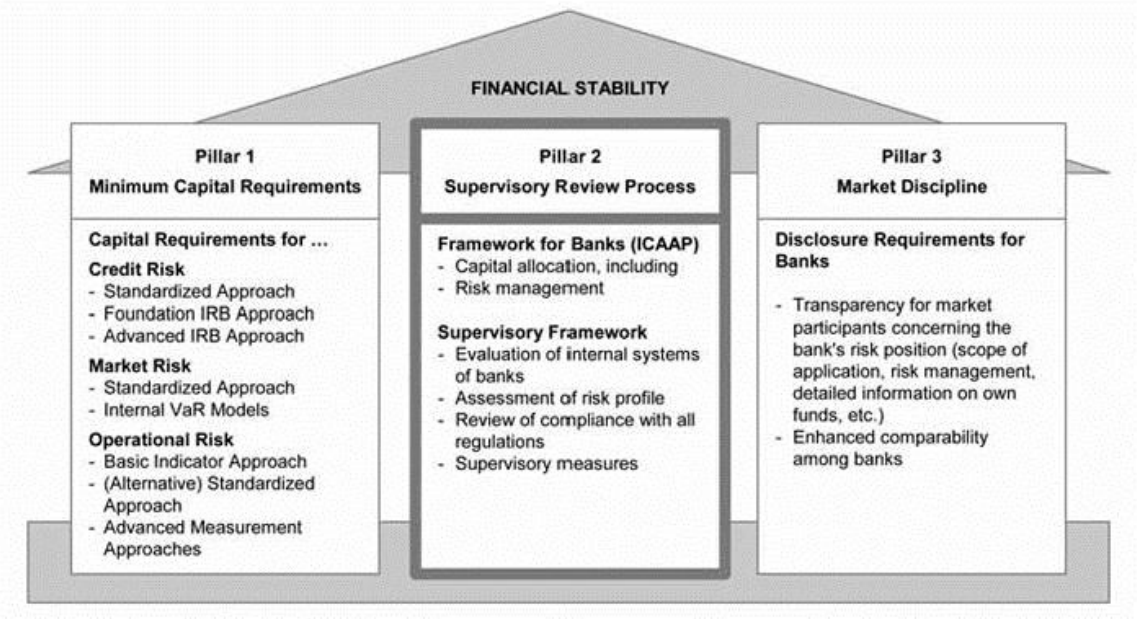


Figure 1: The three pillars of Basel II; Source: Basel documents

The three pillars of Basel II:

- Minimum Capital Requirements
- Supervisory Review

- Market Discipline

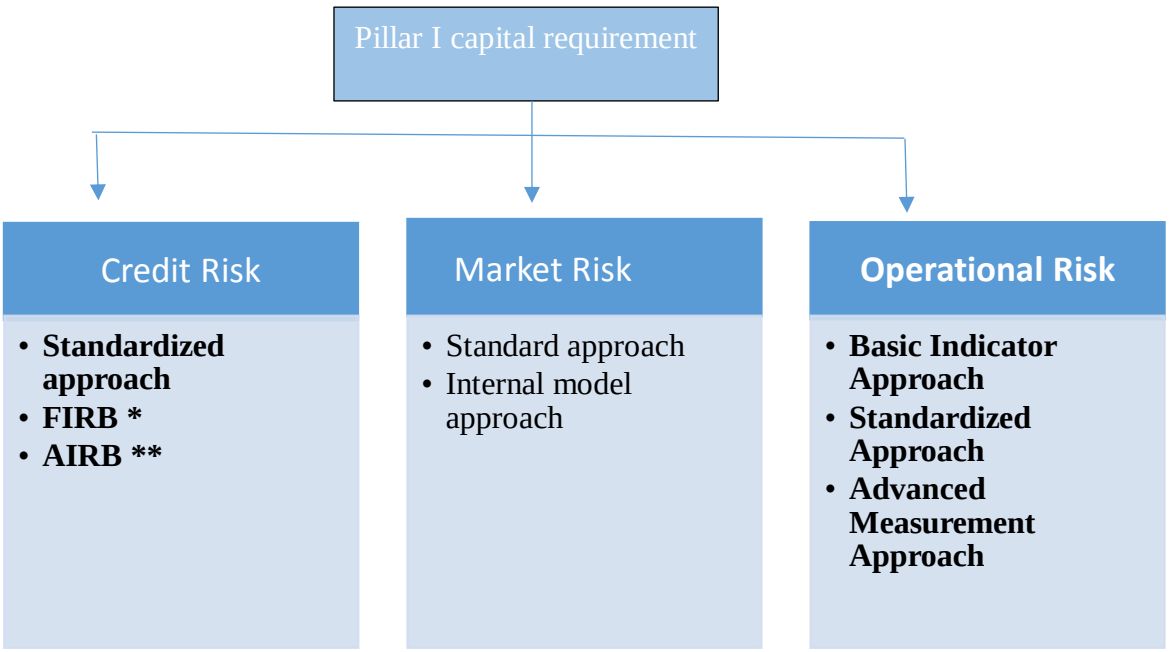
In Pillar I, the minimum capital requirement for different kinds of risks is specified as an expansion to Basel I requirements. This takes the external credit ratings into consideration. The capital for credit risk in the banking book is calculated in a new way that reflects the credit ratings of the counter parties. With the approval from the supervisors, the banks can use an internal rating framework described in the accord for the measurement of credit risk. The capital requirement for market risk remains unchanged from the 1996 amendment and a new capital charge and framework for operational risk was proposed.

Capital components under the Basel II accord comprised of Tier 1,Tier 2 and Tier 3 elements.

- **Tier 1:** It consisted of i) Paid-up share capital and ii)Disclosed reserves
- **Tier 2:** It consisted of i) Undisclosed reserves, ii) Asset revaluation reserves, iii) General provisions/ general loan-loss reserves iv) Subordinated debt v) Hybrid (debt/equity) capital instruments. However, this capital is limited to 1005 of Tier 1.
- **Tier 3:** The banks may also use a Tier 3 capital that consists of short-term subordinated debt, as per the discretion of the national regulator. Tier 3 capital can only be used for meeting the requirement of a part of market risk capital.

As per Basel II, the main element of the capital that needs to be emphasised is the equity capital and disclosed reserves since this is common across banking systems of all countries. As this information is publicly available in the annual reports, it forms the basis of judgement about a bank's profitability, competitive ability and more importantly about its capital adequacy.

Pillar I of Basel II develops on the existing regulatory capital computation by i) adopting a more granular approach to credit risk weights, ii) allowing banks to choose from alternative ways of capital allocation for different types of risk, and iii)incorporating operational risk for capital allocation. Figure 2 represents the Pillar 1 capital requirement as per the Basel II accord.



*The foundation Internal Ratings Based(IRB) approach

** The Advanced Internal Ratings Based approach

Figure 2: Pillar I capital requirements. Additions are marked in bold. Source : Basel documents

2.1.2.3.1. Credit Risk Capital

Basel II has specified three approaches for calculation of capital charge for credit risk.

1. The Standardized approach
2. The foundation Internal Ratings Based(IRB) approach
3. The Advanced IRB approach

Basel II accord has prescribed two methods for calculation of risk weighted assets for credit risk- (a) The Standardized Approach; (b) The Internal Rating Based (IRB) Approach. The internal rating based approach is further divided into Foundation Internal Rating Based Approach and Advanced Internal Rating Based Approach. The IRB approach is the most sophisticated approach. Banks that were not conversant to use the IRB approach were allowed to follow the standardized approach used under Basel I with an addition of risk-weights in capital charge calculation. Under the IRB approach, the allocation of capital was based on the VaR calculated with a one – year time horizon and a 99.9% confidence level. As the expected

losses were covered by the way a bank prices its products, the capital requirement for credit risk estimated by deducting expected losses from VaR(Hull, 2012).

2.1.2.3.2. Market risk capital

Basel II Accord defined two approaches for calculating capital charge for market risk, - (a) The Standardized Approach; (b) The Internal Model Based Approach.

2.1.2.3.3. Operational Risk Capital

In addition to a revised method of calculating capital for credit risk, Basel II mandated banks to allocate separate capital for operational risk. Operational risk is the risk of losses arising from incidents when the bank's procedures and functions do not work as intended or there are unfavourable external events like fire accidents in a facility that culminate into significant losses to the bank. Basel II proposes three approaches to capital charge calculation for operational risk.

1. The Basic Indicator Approach
2. The Standardized Approach
3. The Advanced Measurement Approach

The Basic Indicator approach is the simplest approach which equates the operational risk capital to product of a bank's average gross income of previous three years and 0.15. In the standardized approach, a different factor is used to multiply with the three year average gross income, depending on the business lines. Under the Advanced Measurement approach, a bank is permitted to use its own internal models for calculation of operational risk loss, that it is 99.9% confident will not be exceeded in one year.

The second pillar, concerned with the supervisory review process, allows regulators in different countries some discretion in how rules are applied but seeks to achieve overall consistency in the application of rules. It reviews the internal procedures of banks for capital determination as per their risk profiles. It places more emphasis on early intervention when problems arise. Supervisors are required to look beyond minimum capital requirement and encourage banks to develop and use better risk management techniques and to evaluate these techniques. The accord also states that "The supervisory review process recognizes the responsibility of bank management in developing an internal capital assessment process and setting capital targets that are commensurate with the bank's risk profile and control environment. In the Framework,

bank management continues to bear responsibility for ensuring that the bank has adequate capital to support its risks beyond the core minimum requirements (BCBS, 2006)"

The third pillar, market discipline requires banks to disclose more information about the way they allocate capital and the risks they take. Banks will be subjected to added pressure to make sound risk management decisions if shareholders and potential shareholders have more information about those decisions. The disclosure would also help the market participants and the general public to have a better grasp of the bank's risk profiles and capital adequacy, the procedures adopted to calculate capital adequacy and its risk management framework. The Basel II document states that "the Committee aims to encourage market discipline by developing a set of disclosure requirements which will allow market participants to assess key pieces of information on the scope of application, capital, risk exposures, risk assessment processes, and hence the capital adequacy of the institution. The Committee believes that such disclosures have particular relevance under the Framework, where reliance on internal methodologies gives banks more discretion in assessing capital requirements (BCBS, 2006)".

Regulatory & Economic Capital

The Basel II accord has emphasised the concept of minimum regulatory capital. The minimum capital requirement i.e. the Capital Adequacy Ratio was specified as 8%. The CAR was computed as

$$CAR = \frac{Tier1 + Tier\ 2 + Tier\ 3\ Capital}{RWA + 12.5 * C_{MR} + 12.5 * C_{OR}}$$

Where Tier 1 capital refers to Core Capital,

Tier2 refers to the Supplementary Capital,

Tier 3 refers to short-term subordinated debt,

RWA refers to the risk weighted assets for credit risk,

C_{MR} & C_{OR} refer to the Capital requirements for market and operational risks respectively.

Elements of Regulatory Capital

The core capital or the Tier 1 capital primarily consists of the equity share capital and disclosed reserves. It includes paid up share capital, capital reserves arising out of surplus from sale proceeds of fixed assets, disclosed free reserves and other innovative perpetual debt instruments. The supplementary or the Tier 2 capital consists of undisclosed reserves, revaluation reserves, loan-loss reserves, general provisions, hybrid instruments and

subordinated term debt. Tier 3 Capital comprises of Short-term subordinated debt covering market risk. As defined in the Basel document (BCBS, 2006), for short-term subordinated debt to be eligible as Tier 3 capital, it has to be capable of becoming part of a bank's permanent capital, thus being available to absorb losses in the times of insolvency.

Economic Capital

Economic Capital (EC) is the amount of capital that a bank requires in order to safeguard itself with a chosen level of certainty against insolvency due to unexpected losses over a given time period, at a specified confidence level. EC can also be considered as that capital which the top management or shareholders would choose to hold in the absence of regulation considering the cost and benefit of holding optimum capital. EC is a more forward looking requirement as it is based on an assessment of potential future losses. It is a number which summarizes the current risk profile across all risks – inclusive of market, credit, operational - for a financial institution.

The calculation of economic capital depends on the extent of certainty with which a bank would like to protect itself against various risks including that of insolvency. The higher the chosen level of certainty, the greater the amount of economic capital that needs to be set aside. The time horizon also influences the estimation of economic capital. The longer the time period, in which losses are expected to accumulate, the greater would be the amount of economic capital required. An incorrect estimation of any of these factors would lead to inaccurate depiction of the bank's risk profile, eventually resulting in erosion in value of shareholders' investments or leading the bank to insolvency. A widely used model for computation of economic capital for operational risk is based on Value at Risk (VaR) approach, where bank estimates both expected and unexpected losses at a given level of confidence over a specified period, usually, one year. Computation of economic capital is usually based on unexpected losses that a bank could in a worst case scenario experience over the specified period.

2.1.2.3.4. Principles for Management of Operational Risk

The Basel document "Sound Principles for Management of Operational Risk, 2011" clearly defines the measures that banks should adopt for effective management of Operational Risk. These principles are grouped as 1. Fundamental Principles of Risk Management; 2. Governance 3.Risk Management environment and 4. Role of Disclosure (Basel documents),

Basel II Principles on Operational Risk Management

Principle I: This principle insists on the establishment of a strong risk management culture that appreciates and rewards responsible and professional behaviour. The Board and the Senior Management must establish clear and well defined standards on operational risk management.

Principle II: The banks should create a framework for operational risk that is guided by their size, nature, complexity, risk profile etc. This framework needs to be fully integrated into the overall risk management.

Principle III: The Board of Directors should play a crucial role in establishing the framework and reviewing it periodically. They should ensure that the senior management should formulate policies, processes and systems to be implemented at all levels.

Principle IV: The Board of Directors need to define a risk appetite for the bank and the level of its tolerance towards risk. It should identify the nature, the type and the level of operational risk that the bank is willing to assume. The board needs to periodically review its risk appetite and tolerance statements.

Principle V: The senior management has to develop an effective and strong governance structure. It needs to lay down clear lines of responsibility, accountability and reporting. The senior management has to ensure that the policies, processes and systems for operational risk management are implemented at all levels and in all of the bank's products, activities and services.

Principle VI:. The Senior Management has to make sure that operational risk that is present in the bank's products, services and activities must be well identified and assessed to understand the risk and the rewards associated with them.

Principle VII: The Senior Management has to make sure that there is an approval process which analyses operational risk for all new products, services and activities of the bank.

Principle VIII: The Senior Managements should periodically monitor the operational risk profiles of the bank and exposure to operational losses periodically. These should be reported to the Board, Senior Management and appropriate business levels concerned with management of operational risk.

Principle IX: The banks should have strong internal controls and a strong control environment. The banks need to have in place risk mitigation and risk transfer policies.

Principle X: Banks need to have well defined business continuity and resiliency plans so that the business can operate uninterruptedly in cases of critical disruptions.

Principle XI: The banks should make public disclosures that enable the stakeholders to understand their approach towards operational risk management.

The above said principles aim at the creation of a robust operational risk management system across banks globally that is capable of averting catastrophic losses by identifying them before the damage is done. The capital for market risk was however not revised much after the 1996 amendment. On the whole, Basel II proved to be a marked improvement over the Basel I accord. While Basel I advocated a "one-size-fits all" approach, Basel II suggests different weightages to different risks. The new framework aimed at adequate capitalisation of banks with greater emphasis on risk management to enhance financial stability.

As prescribed by the Basel II accord, the Reserve Bank of India issued a draft guideline in March 2007 regarding the implementation of the new capital adequacy framework, asking "foreign banks operating in India and Indian banks having foreign operational presence to migrate to the new Basel Accord with effect from March 31, 2008; all other scheduled commercial banks were required to migrate by March 31, 2009". Table 15 shows the focal points of Basel I and II.

Table 15: Comparison of Basel I and II

Basel I	**Basel II**
Focuses on a single risk measure, the credit risk. Market risk was appended later.	Emphasises all possible types of risks namely, credit, operational and market risks. Focuses on the implementation of internal risk management methods, supervisory review and market discipline.
One Size Fits All approach in risk measurement	Flexibility in the usage of approaches for risk measurement. Incentives in capital for better risk management
Gives a broad picture of risk management in banks.	Granularity in the valuation of assets and the kinds of business lines and in their system risk profiles Greater emphasis .on risk mitigation techniques. Greater risk sensitivity on the basis of structure, asset class and business class. Multi- dimensional monitoring on all operational components of the business

Source: The New Basel Capital Accord, BIS

2.1.2.4. Basel 2.5

During the credit crisis, it was recognized that some changes were necessary to the calculation of capital for market risk in the Basel II framework. These changes are referred to as Basel 2.5 and the implementation date was December 31, 2011.There are 3 changes involving:

- The calculation of a stressed VaR ,
- A new incremental risk charge, and
- A comprehensive risk measure for instruments dependent on credit correlation.

The measures have the effect of greatly increasing the market risk capital that large banks are required to hold.

2.1.2.5. Basel III

Following the 2007-2009 credit crisis, the Basel Committee realized that a major overhaul of Basel II was necessary. Basel 2.5 increased capital requirements for market risk. The Basel Committee wanted to increase capital requirement for credit risk as well. It also considered that the definition of capital needed to be tightened and that regulations were needed to address liquidity risk. The final version of the Basel III regulations was published in December, 2010. There are six parts to the regulations:

1. Capital Definition and Requirements
2. Capital Conservation Buffer
3. Countercyclical Buffer
4. Leverage Ratio
5. Liquidity Risk
6. Counterparty Credit Risk

The regulations are being implemented gradually between 2013 and 2019.

Basel III can be seen as an extension of Basel II framework with additional guidelines for building a strong and robust capital base while ensuring a sound “liquidity and leverage ratios” to withstand any crisis in the banking sector thereby contributing to financial stability. It also focuses on avoiding a contagion spread of banking crises in the highly interlinked global economy.

The major changes proposed by Basel III document are

1. Enhanced Capital Requirement :
    - The regulatory Tier I Capital would increase from 2% of risk weighted assets before regulatory deductions to 4.5% after the regulatory deductions.
    - The overall capital requirement of Tier I and Tier II would increase from 8% of risk weighted assets to 10.5 %
    - Banks will have to additionally maintain a capital conservation buffer of 2.5%
    - Banks also have to maintain a counter cyclical capital buffer of 0 – 2.5%
2. Narrower definition of regulatory capital :
    - While common equity will be core Tier I capital, most outstanding hybrid capital instruments need to replaced by instruments that are more loss absorbing and have less redemption benefits
    - Distinction between upper and lower Tier 2 instruments and all Tier 3 instruments will be abolished.
    - All non-qualifying instruments issued under Tier 1 and Tier 2 would be derecognized with effect from January 1, 2013.
    - From, December 31, 2010 re-securitisation exposures and liquidity commitments in the banking book will require more capital.
3. Enhanced Capital Charges :
    - From December 31, 2010 banks were required to maintain more capital for re-securitisation exposures and liquidity commitments in the banking book.
    - Trading Book :
        i. From January 1, 2011 the trading book of banks will be subject to stressed VaR models, increased capital charges and restrictions on correlation trading portfolios.
        ii. From January 1, 2013 banks will be subjected to increased and expanded counterparty risk charges, including exposures to other financial institutions.
4. New Liquidity Ratios :
    - A new 30 day Liquidity Coverage Ratio comprising of high quality liquid assets that should be greater than or at least equal to highly stressed cash outflows will be required to be maintained by banks from January 1, 2015.

- From January 1,2018 a one year Net Stable Funding Ratio that requires available stable funding to exceed or equal to the required stable funding has to be maintained by banks.

5. New Leverage Ratio :
    - A minimum 3 % Tier 1 Leverage Ratio calculated against gross balance sheet and not against risk weighted assets will be tried till 2018 and then will be adopted from January 1, 2019. Table 16 shows the enhancement of different Basel III ratios from their Basel II values on the basis of the time frame.

Table 16: Enhancement of Basel III ratio from Basel II values

	2011(B II)	2012	2013	2014	2015	2016	2017	2018	2019 (B III)
Minimum Common Equity Capital Ratio	2.0%	3.5%	4.0%	4.5%	4.5%	4.5%	4.5%	4.5%	4.5%
Capital Conservation Buffer	0%	0%	0%	0%	0%	0.625%	1.25%	1.875%	2.5%
Minimum Common Equity plus Capital Conservation Buffer	2.0%	2.0%	3.5%	4.0%	4.5%	5.125%	5.75%	6.375%	7.0%
Phase-in of deductions	0%	0%	0%	20%	40%	60%	60%	100%	100%
Minimum Tier 1 Capital	4.0%	4.0%	4.5%	5.5%	6.0%	6.0%	6.0%	6.0%	6.0%
Minimum Total Capital	8.0%	8.0%	8.0%	8.0%	8.0%	8.0%	8.0%	8.0%	8.0%
Minimum Total	8.0%	8.0%	8.0%	8.0%	8.0%	8.625%	9.25%	9.875%	10.5%

Capital plus Capital Conservation Buffer									

Source : BIS documents

To sum it up, under the new regulatory scheme, initiated with the Cooke ratio in 1988, 'risk-based capital' or 'capital adequacy' is the central concept. The philosophy of 'capital adequacy' is that capital should be capable of sustaining the future losses arising from current risks. The philosophy provides an elegant and simple solution to the difficult issue of setting up a 'pre-emptive','ex-ante' regulatory policy. By contrast, older regulatory policies focused more on corrective actions, or 'after-the-fact' actions, once banks failed. Such corrective actions remain necessary. They were prompt when spectacular failures took place in the financial industry (LTCM, Baring Brothers). Nevertheless, avoiding 'contagion' when bank failures occur is not a substitute for pre-emptive actions aimed at avoiding them. The practicality of doing so remains subject to adequate modelling. The trend towards more internal and external assessment on risks and returns emerged and took momentum in several areas. Through successive accords, regulators promoted the building up of information on all inputs necessary for risk quantification. Accounting standards evolved as well. The 'fair value' concept gained ground, raising hot debates on what is the 'right' value of bank assets and how to accrue earnings in traditional commercial banking activities. It implies that a loan providing a return not in line with its risk and cost of funding should appear at lower than face value. The last New Basel Accord promotes the 'three pillars' foundation of supervision: new capital requirements for credit risk and operational risks; supervisory processes; disclosure of risk information by banks. Together, the three pillars allow external supervisors to audit the quality of the information, a basic condition for assessing the quality and reliability of risk measures in order to gain more autonomy in the assessment of capital requirements. Regulatory requirements for market, credit and operational risk, plus the closer supervision of interest rate risk, pave the way for a comprehensive modelling of banking risks, and a tight integration with risk management processes, leading to bank-wide risk management across all business lines and all major risks. The following section deals with different kinds of risks that banks are vulnerable and are exposed to.

2.2. Types of Risk

Financial Risk

Financial risk can be defined as any event that may adversely affect a firm's ability to achieve its goals and execute its strategies. It can also be alternatively defined as the quantifiable likelihood of loss or less than expected returns.

Why Manage Financial Risk?

The need to manage financial risk can be looked at from the perspective of various stakeholders.

The Societal Perspective

The society, for its well-being, among others is heavily dependent on the smooth functioning of banking and insurance systems and their stability. The regulatory Basel norms evolved to monitor and manage systemic risks which could possibly disrupt the normal functioning of these systems as was demonstrated by the recent financial crises. In such situations, society looks at risk management positively and entrusts the regulators with the responsibility of safeguarding its interests.

The Shareholder Perspective

Firms that are not mandated by financial supervisory authorities are also evincing keen interest in risk management activities as it is believed that proper financial risk management can increase the firm's as well as shareholder value. Understanding the relation between shareholder value and financial risk management has significant implications for design of risk management system. The firm should decide on the risks it decides to manage and how managing them increases the value of the firm. The risk management concerns should be a part of investment policy and capital budgeting.

Economic Capital

A firm has strong incentives to restrict and reduce the probability of bankruptcy due to its associated costs. This in turn is related to a firm's economic capital which is the capital that shareholders should invest in a company to limit the probability of default to a given confidence level over a given time horizon.

Economic capital is so called as it measures risks in terms of economic realities rather than regulatory or accounting rules. Part of the measurement process involves converting a risk distribution into the amount of capital that is required to support the risk in line with the firm's target financial strength (eg. Credit rating). Hence the calculation of economic capital is a

process that begins with quantification of risks that a firm faces over a given time period. These risks include those that are well defined from the regulatory point of view, such as credit, market and operational risks, and also includes other categories like insurance, liquidity, reputational and strategic and business risks.

Classification of Banking Risks

Risks are uncertainties resulting in adverse variations of profitability or in losses. Banking is exposed to a large number of risks. These risks need to be defined carefully to enable quantitative measurement. The regulations, imposing capital charges against all risks, greatly helped the process. Banking risks are defined as adverse or negative impacts on profitability. Risk measurement requires capturing the source of the uncertainty and the magnitude of its potential adverse effect on profitability. Profitability includes both accounting and mark-to-market measures.

Types of Banking Risks

1. Credit Risk
2. Liquidity Risk
3. Interest rate Risk
4. Market Risk
5. Foreign exchange Risk
6. Solvency Risk
7. Operational Risk
8. Model Risk
9. Others

Since credit risk is a major risk that banks were exposed to right from the evolution of banking, the regulators insist on a continuous effort towards its measurement to quantify the amount of capital that banks should hold. Market risk is comparatively easy to quantify due to the ready availability and huge volume of price observations. Operational risk has gained focus in the past two decades. It covers all organizational misdeeds, both intentional and unintentional, whose consequences can be, at times fatal to an institution. It indicates a failure of internal controls.

2.2.1 Credit Risk

Credit risk is the oldest of all risks and stands first in terms of importance. Default risk, a major source of loss, is the risk that customers might default and fail to comply with their

obligations to service debt. In the banking portfolio, the default triggers a complete or partial loss of any amount lent to the counterparty. In the trading portfolio, a decline in the credit standing of an obligor of the issuer of a bond or stock also leads to credit risk (Bessis & O'Kelly, 2015).

2.2.2 Country and Performance Risks

Some risks are close to credit risk because of their nature, but distinct because of the context - country risk and performance risk.

2.2.2.1 Country Risk

Country risk is the risk of a 'crisis' limited to a country. This risk might take several forms like

- Sovereign risk is the risk of default of sovereign issuers, such as central banks/ public sector banks. The risk of the issuers defaulting might arise because of debt restructuring for countries.
- A deterioration in a country's economic conditions might lead to a decline of the credit standing of domestic obligors. Companies tend to default more in adverse economic conditions.
- A deterioration in the value of the local currency because of foreign exchange rate fluctuations in terms of the bank's base currency.
- The inability to transfer funds from the country, either because of restrictions imposed locally or because the currency is no longer convertible.
- A market crisis triggering large losses for those holding exposures in the local markets.

Abrupt restrictions on transfer of funds might make the corporate sector vulnerable to several risks.

2.2.2.2 Performance Risk

As the name suggests, Performance risk depends more on the performance of the borrower in specific projects or operations. Credit standing of the borrower has a lesser role in this risk. Performance risk is common in commodity transactions. The focus here is on the delivery of commodities rather than the credentials of the borrower. Performance risk is 'transactional' because it relates to a specific transaction. Commodities shift from one owner to another during transportation. Risk remains more transaction-related than to the various owners because of the commodity value underlying the transaction (Bessis & O'Kelly, 2015).

2.2.3. Liquidity Risk

Liquidity can be described in terms of inability to raise funds at normal cost; inability to sell assets due to an inactive market or an absence of it; inability to sell assets due to the nature of assets. Inability to raise funds manifests into funding risk. It might arise when the market perceives the issuer to be risky and investors hesitate to lend to the firm. In addition, the cost of raising funds might be high depending on the credit standing of the bank. A decline in the bank's credit standing might in-turn lead to increase in the cost of funds and subsequent investments. Inflated cost of funds also adversely affects the profitability of the bank.

A market that lacks volume might also add to liquidity woes and thus liquidity risk of the bank. Absence of volume might fuel price volatility with huge variations from the par making the market participants unwilling to trade.

Sometimes, the nature of assets also make them less liquid in spite of the presence of a market. The presence of liquid assets insulates against fluctuating market liquidity. These liquid assets can be used to meet short term obligations without a need to raise funds from outside. The banking regulators insist on a favourable liquidity ratio for which banks have to maintain short-term assets in excess of their short-term liabilities to meet their short-term obligations.

Liquidity risk is another significant risk that banks are vulnerable to and can become a major risk for the banking portfolio. Severe lack of liquidity leads to bankruptcy, making liquidity risk a fatal risk. However, extreme adverse situations are often the outcome of many other risks. Any sign of unanticipated losses creates a panic among the depositors and they rush to get their money. This also sends negative signals to lenders who might not come forward to lend and help the troubled bank tide over the crisis. This results in blocking of credit lines on the one hand and the pressure of massive withdrawals on the other, ultimately leading to bankruptcy. To avoid such a catastrophe, banks should hold liquid assets that mature in the short-term as market prices of long-term assets are more volatile in nature and might lead to losses in case of a sale(Bessis & O'Kelly, 2015).

2.2.4. Interest Rate Risk

The interest rate risk is the risk of fluctuations (reduction) in earnings due to the movements of interest rates. Since banks primarily are in the business of deposits and loans that are purely interest rate driven, their revenues and costs are highly interest rate centric. As the interest rates

tend to fluctuate and are unstable, the earnings of the banks also tend to fluctuate. A drop in interest rate results in a decline in earnings in lending, whereas a hike in interest rate results in a borrower paying more, when the interest rates are variable. Both the positions involve risk as the earnings are dependent on the market rates. At the same time, the exposure to interest rate risk offers benefit to one of the parties involved. There is an upside potential in this risk exposure (Bessis & O'Kelly, 2015).

2.2.5 Market Risk

As the trading book is marked-to-market, any attempt to carry out transactions in the trading book is prone to wide fluctuations in its value due to market movements. This risk of adverse variation in trading portfolio because of market risk assimilates into market risk. As the period to liquidation gets longer, so does the deviation from the current market value as the value depends on the time at which the portfolio is liquidated.

The earnings are determined by the Profit & Loss generated by trading. The change in P&L between two time periods is the variation of the market value. Any drop in value is a market loss. As the holding period or the time horizon increases, the market volatility also increases which is likely to increase potential losses. However, this risk can be managed by limiting it to the liquidation period as these instruments can be traded or hedged at any time. The liquidation period of these instruments varies depending the type of instrument. It ranges from short i.e one day to different time horizons as prescribed by the regulators of the market (Bessis & O'Kelly, 2015).

2.2.6 Foreign Exchange Risk

Foreign exchange risk could either be in the form of currency risk or conversion risk. The exchange rate risk or currency risk is the risk arising as a result of incurring losses due to changes in the exchange rates. This risk occurs when a financial transaction is denominated in a currency other than the base currency of the firm. The variations in earnings due to changes in exchange rates and variations in the value of assets and liabilities because of their denomination in foreign currencies might adversely affect earnings there by exposing the bank to currency risk.

The conversion of all foreign currency denominated transactions into a base reference currency manifests into conversion risk. A credit loss in a foreign country might result in magnified

losses in local currency if the local currency depreciates relative to the currency of the foreign exposure (Bessis & O'Kelly, 2015).

2.2.7 Solvency Risk

Solvency risk is the risk arising due to the inability to absorb losses generated by all types of risks, with the available capital. It arises when the magnitude of losses due several risks is very huge compared to the capital allotted to absorb these losses. Solvency risk is different from bankruptcy risk which results from a failure to meet debt obligations and inability to raise funds for meeting such obligations. Solvency is a joint outcome of available capital and of all risks. Banking regulators world-wide insist on "Capital Adequacy" that defines the level of capital a bank should allot to sufficiently absorb all potential losses arising out of all risks so as to maintain an acceptable solvency level. Capital Adequacy is an essential element of risk management in banks(Bessis & O'Kelly, 2015).

2.2.8 Operational Risk

Operational risks "are results of improper functioning of the information system, reporting systems, internal procedures and internal risk-monitoring rules that are designed to take timely corrective actions, or the compliance with internal risk policy rules. The New Basel Accord of January 2001 defines operational risk as 'the risk of direct or indirect loss resulting from inadequate or failed internal processes, people and systems or from external events'.

Operational risks appear at different levels:

- People.
- Processes.
- Technical.
- Information technology.

People risk involves human errors, fraud, incompetence, lack of compliance with existing procedures and policies while Process risk includes:

- Insufficient procedures and controls for reporting, monitoring and decision-making.
- Poor procedures associated with processing information like errors in booking transactions and legal documentation.

• Organizational insufficiencies.

• Inadequate risk surveillance, management deficiencies in risk monitoring like lack of incentives for risk reporting and non-compliance to procedures.

• Errors in the recording process of transactions.

• The technical deficiencies of the information system or the risk measures.

Technical risks are related to model errors, inaccurate measurement tools, deficiencies of the information system and system failure.

2.2.9 Model Risk

Model risk is a major risk in the market as the market uses various models for pricing purposes. Model risk is gaining more significance, as modelling techniques are being applied to other risks, notably credit and operational risks, where data scarcity is a major difficulty for testing the reliability of models and inputs.

Model risk manifests as variation between predicted values of variables, such as the VaR, and their actual values. Models are usually based on assumptions which might always not be realistic. They might be subject to several misspecifications, as few parameters might not be considered for practical reasons. Model implementation generally might suffer errors of statistical techniques, absence of observable data used for obtaining reliable fits, judgmental choices on dealing with 'outliers' and observations that models fail to capture with reasonable accuracy(Bessis & O'Kelly, 2015).

2.2.10 Business and Strategic Risk

Rapid changes in the economic and operating environment of a bank might sometimes necessitate a modification in its line of behaviour or activity for survival and success. The risk that a bank might have to revise its strategy or formulate a new one manifests into strategic risk. Activities like introduction of a new business line or reengineering an existing process to adapt to growing demands might often lead to strategic risk.

2.2.11 Reputational Risk

Reputational Risk is associated with the perception of stakeholders about the bank and the trust they repose in the bank. It can be the perception among the regulators, shareholders or the customers. This is the risk of failure in meeting expectations of the customers or the shareholders or the regulators. Private Banks are more vulnerable to reputational risk. Risks

related to protection of customer data and privacy, e-banking and e-mail services, information disclosure often lead to reputational risk.

2.2.12 General Legal Risk

Legal risk is the risk that a bank would have to change its activities due to changes in the legal system in which it is operating. New law enforcements or tax codes might affect the banking operations and make it vulnerable to legal risk.

Different financial and nonfinancial risks were mentioned in this chapter. In all these financial risks, credit, operational and market risks are treated as three major risks that a bank faces in its business activities. Strategic and reputation risks indirectly affect financial health of the banks. If a management's business strategy goes wrong or if the reputation of the bank is at risk due to some adverse situations, it will lead to financial losses since business volume will be unfavourably affected, customer base will diminish, and there will be public fear to do business with such banks(Bessis & O'Kelly, 2015).

Risk management is one of the core activities of any financial institution or a bank. BCBS circulated various Basel Accords for an effective risk management of the banking sector globally. From the old Basel I Accord to the recent Basel III Accord, the committee has brought in a series of reforms to address risks faced by the banks, particularly with reference to credit, market, operational and liquidity risks.

CHAPTER III

OPERATIONAL RISK FRAMEWORK AND MANAGEMENT

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"*Operational risk is not a new risk… However, the idea that operational risk management is a discipline with its own management structure, tools and processes... is new.*"

The quote from British Bankers Association very well describes the development of operational risk management in the past two decades. Until the BCBS proposed 'Basel II' reforms, Operational Risk was treated as a residual risk that could not be categorised as credit or market risks. So any risk that could not be fit in the category of either credit risk or market risk was categorised as operational risk. Moreover, these residual risks were difficult to quantify and manage in traditional ways. The present chapter discusses the operational risk

management (ORM) framework as specified by the Basel II Accord for commercial banks and that given by RBI specifically for Indian banks. The different approaches used for calculation of operational risk capital charge and the components of advanced measurement approach are also discussed.

Basel II has institutionalised operational risk as a new category of risk that garnered regulatory and managerial attention. Businesses in general and banks in particular have known the problems emanating from faulty information technology and infrastructure, rising frauds, business disruptions, and from legal liability for many years. However, the categorisation of these risks within the realm of 'operational risk' re-positions them for managerial and regulatory purposes.

The Basel II accord further creates new links between the management of operational risk and good corporate governance placing these 'old' risks in a new galaxy of regulatory, political and social expectations. The evolution of operational risk has made good governance and risk management increasingly intertwined.

Though "Operations Risk" existed even in the 1990s (COSO 1991), Operational Risk gained widespread prominence with Basel II. Nicholas Leeson, the rogue trader responsible for the debacle of the Barings Bank in 1995, can be regarded as the inventor of Operational Risk(Power, 2005).

The growing number of large loss events that were labelled as operational risk failures challenged the residual status of operational risk Several projects of defining and determining 'operational risk' were undertaken in financial organizations. These projects, however, faced serious difficulty and found that operational risk is 'extremely hard to define(Goodhart, 2001)'.

These were some of the definitions of operational risk used by large international banks:

1. "The potential of any activity to damage the organization, including physical, financial, legal risks and risks to business relationships".

2. “The risk that deficiencies in information systems or internal controls will result in financial loss, failure to meet regulatory requirements or an adverse impact on the bank’s reputation”.

3. “The risk of loss through inadequate systems, controls and procedures, human error or management failure”.

4. “All risks which are not banking (i.e. it excludes credit, market, and trading risks, and those arising from business decisions etc.)”.

In January 2001, BCBS defined Operational Risk as “The risk that deficiencies in information systems or internal controls will result in unexpected loss. The risk is associated with human error, system failures and inadequate procedures and controls” (Basel 2001a). In September 2001, the definition was revised as “**the risk of loss resulting from inadequate or failed internal processes, people and systems or from external events”** which was confirmed in the final accord of 2004. **It includes legal risk but excludes reputation and strategic risks**. The Basel Committee associates the unexpected losses arising from four main factors to Operational Risk namely i. human errors, ii. Information system failures, iii. Inadequate controls and procedures and iv. External events.

3.1 Operational Risk Factors

1. People: This factor refers to losses that originate from events associated with people such as human errors, frauds, violations, incompetence and negligence of a bank’s human resources.
2. Systems: This factor refers to losses that emanate from events related to technology and information systems in general. They include hardware and/or software failures, computer hacking or viruses, and telecommunications failures. Usually this includes losses caused by events like “unauthorized access to information and systems security, excessive risk taking due to software failures, loss of data due to information system failures, and utility outages”.
3. Processes: This factor refers to the losses that emanate from inadequacies in the internal processes and procedures. Events such as “ violation of the information system security due to insufficient controls (security risk), errors in the execution

and/or settlement of securities and foreign currency transactions (transaction and settlement errors), inadequate record-keeping, accounting and taxation errors, mispricing and errors in risk measurement due to problems in the internal models and methodologies (model risk), and breaches of mandate" usually lead to losses.

4. External events: This factor refers to all the losses suffered by a bank as a result of a broad range of external events which usually are not under the control of the bank's management. These normally include events such as "changes in the political, regulatory and legal environment that negatively affect the bank's profitability, operational failures at suppliers or outsourced operations, criminal acts such as theft, vandalism, robbery, or terrorism, and natural events such as fire, earthquake and other natural disasters".

British Bankers' Association Survey segregates operational risk as depicted in the following table 17 and 18**.**

Table 17: Internal Risk Factors

People	Process	Systems
• Employee collusion and fraud • Employee error • Employee misdeed • Employee liability • Employment law • Health and Safety • Industrial action • Lack of knowledge and skills • Loss of key personnel	• Accounting errors • Capacity risk • Contract risk • Product complexity • Mis-selling/ suitability • Project risk • Settlement / payment error • Reporting error • Transaction error • Valuation error	• Data quality • Programming errors • Security Breach • Strategic risks • System capacity • System compatibility • System delivery • System failure • System suitability

Adapted from Financial Risk Management, Dun and Bradstreet

Table 18: External Risk Factors

External	Physical
• Legal • Money Laundering • Outsourcing • Political • Regulatory • Supplier risk • Tax	• Fire • Natural disaster • Physical security • Terrorism • Theft

Adapted from Financial Risk Management, Dun and Bradstreet

3.2 Uniqueness of Operational Risk

Operational Risk is a natural consequence of business activities undertaken by a bank unlike its credit and market risks. While a bank can choose to avoid credit and market risks by rejecting a loan or by trading positions, the same cannot be done with operational risk. Operational risk is associated with all banking activities ranging from lending, securities trading, investment banking, payment services, underwriting etc making it impossible for a bank to avoid it. In-spite of the growth of several risk transfer instruments, Operational Risk hedging is hindered by lack of a liquid secondary market that are available for other types of risks.

Operational Risk by its nature is a pure risk unlike other risks that are speculative in nature. Risks such as interest rate risk or market risk are associated with volatility of returns that may either lead to profits or losses, whereas Operational Risk does not at any point of time lead to positive variability but only leads to possibility of losses.

Operational Risk does not share an increasing relationship with returns. While higher risks are usually associated with higher returns in case of market or credit risks, the same cannot be applied to Operational Risk.

Another peculiarity of Operational Risk lies in its complexity and understanding because of the wide range of factors that can cause Operational Risk. This complicates the measurement

of Operational Risk. Finally, it is worth mentioning that Operational Risk is distinct from other risks because of absence of hedging instruments. Although financial institutions and insurance companies are offering risk transfer instruments for hedging losses from specific events especially the external events, a secondary market for Operational Risk hedging does not exist yet(Sironi & Resti, 2007).

3.3 Operational Risk Events

The Basel Committee has recognised the following types of operational risk events as having the potential to lead to substantial losses:

- Internal fraud: Events under internal fraud can be in the form of" intentional misreporting of positions, employee theft, and insider trading on an employee's own account".
- External fraud: "Robbery, forgery, cheque kiting, and damage from computer hacking" are the possible events under external fraud.
- Employment practices and workplace safety: Loss events under this category are "workers compensation claims, violation of employee health and safety rules, organised labour activities, discrimination claims, and general liability".
- Clients, products and business practices: "Fiduciary breaches, misuse of confidential customer information, improper trading activities on the bank's account, money laundering, and sale of unauthorised products" are the usual events under this category.
- Damage to physical assets: "Terrorism, vandalism, earthquakes, fires and floods" are normally categorised as damage to physical assets.
- Business disruption and system failures: Events under this category are "Hardware and software failures, telecommunication problems, and utility outages".
- Execution, delivery and process management: "Data entry errors, collateral management failures, incomplete legal documentation, and unauthorized access given to client accounts, non-client counterparty mis-performance, and vendor disputes" are the common events under this category (RBI, 2005, (Bradstreet, 2006)).

3.4 Operational Risk Management Framework in India

Increasing operational losses and the Basel II capital adequacy norms have made Operational Risk Management an integral element of Risk Management. Management of Operational Risk encompasses "Identification, assessment and/or measurement, monitoring and control /

mitigation of operational risk". The core elements of a risk management system are "identifying the risks the bank is exposed to, assessing their magnitude, monitoring them, controlling or mitigating them using a variety of procedures, and setting aside capital for potential losses including expected losses and unexpected losses"(Basel)

The Reserve Bank of India, in its guidance note on operational risk management (2005), has identified the possibilities of new risks arising owing to

i. Highly automated technology: Extensive dependence on sophisticated systems and technology has the potential to translate risks from manual processing errors to that of system failure.
ii. E-Commerce Explosion: The rapid growth of E-Commerce has increased the scope for incidence of frauds and system security breaches.
iii. Extensive Growth of Banking: Splurge in the volume of banking business calls for robust internal controls and back-up systems.
iv. Outsourcing: While outsourcing and clearing and settlement has helped substantially in mitigation of certain risks, it has exposed banks to other kinds of risks.
v. Consolidations: The wave of mergers, de-mergers and consolidation among banks pose a challenge to the viability of integrated entities.
vi. Hedging: Hedging strategies like collaterals, asset securitisation, derivatives used for mitigation of other risks like credit risk and market risk may lead to other risks like legal risk.

3.4.1 Organisational Set-up for Operational Risk Management

Effective Risk Management has to originate from the Board and senior management which must create and support an enabling organisational culture that imbibes sound operational risk management and efficient operating procedures.

While a variety of factors like size, nature, sophistication and complexities are capable of influencing the approach for operational risk management that a bank can adopt, an effective operational risk management framework is characterised by

- Well defined strategies by the Board of Directors and Senior Management

- A strong operational risk culture : A culture characterised by “a combined set of individual and corporate values, attitudes, competencies and behaviour that determine a bank's commitment to and style of operational risk management”
- Internal control culture that encompasses clear lines of responsibility along with the segregation of duties
- Effective internal reporting and
- Contingency planning

An organizational set up for operational risk management as suggested by the RBI, should comprise of

- Board of Directors
- Risk Management Committee of the Board
- Operational Risk Management Committee
- Operational Risk Management Department
- Operational Risk Managers
- Support Group for operational risk management

As per the RBI, the organisation chart for the implementation of Operational Risk Management function is mentioned in Figure 3

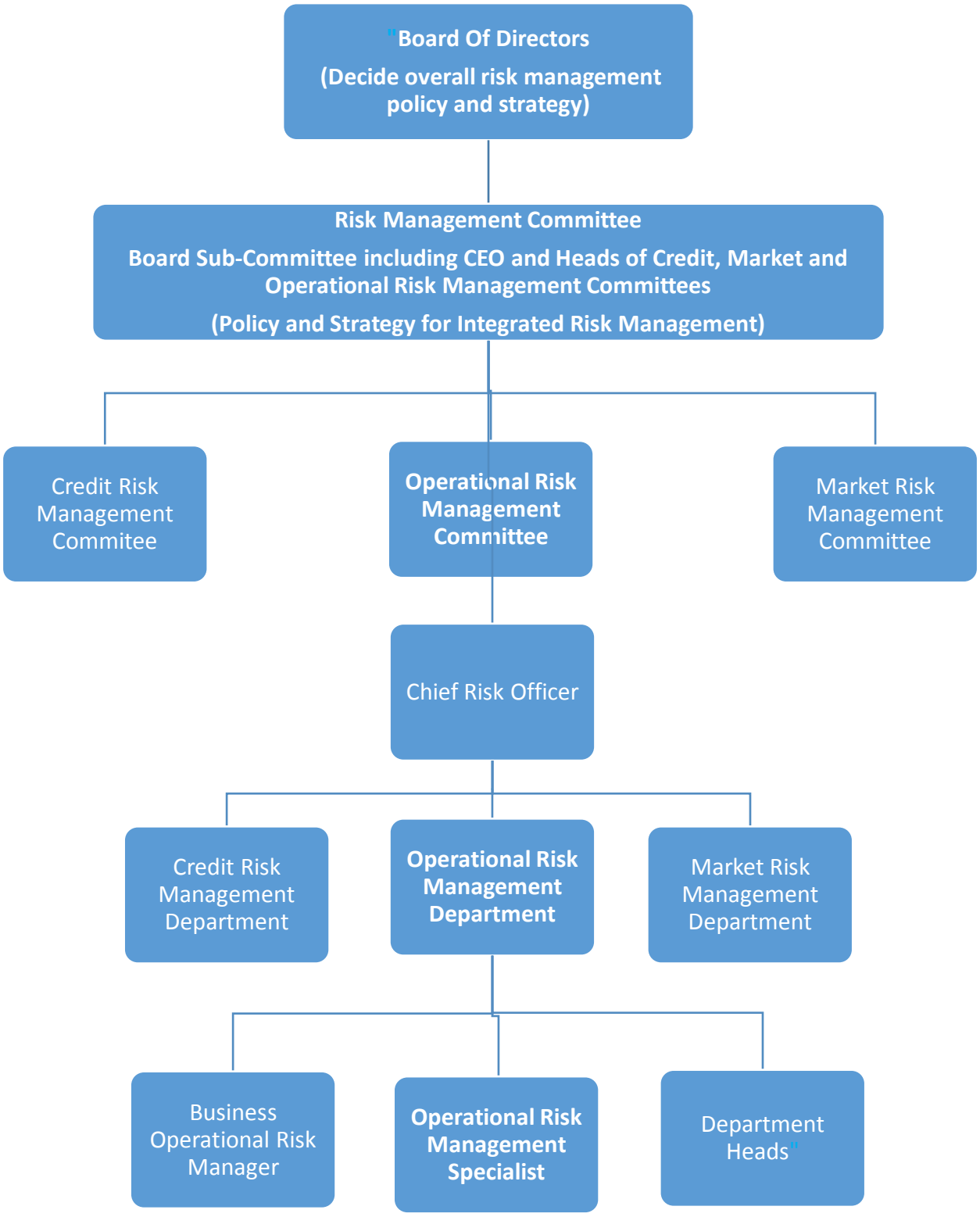

Figure 3: Organisation Chart for Operational Risk Management. Adapted from RBI Guidance Note on Operational Risk Management, 2005

Banks need to handle each of the key risks – credit risk, market risk and operational risk independently with the help of corresponding risk management committees. The Central Bank has clearly outlined responsibilities for each level in the organisation chart. While the Board of Directors is mainly responsible for effective management of operational risk, it can delegate specific operational risk management responsibilities to the Committee to the Board. It needs to create and approve an operational risk management framework for the entire bank in addition to providing clear guidance and direction to the Senior Management on the implementation of this framework.

An operational risk management gives a strategic direction while ensuring an effective operational risk measurement and management process is adopted throughout the bank. Each bank has to adopt a unique operational risk management framework that is developed based on the scale and materiality of the operational risk and the size of the bank. Operational risk management techniques are developing rapidly with the evolution of new applications, business models and technologies.

The strategic orientation of risk management should aim at i) minimising and ultimately eliminating losses and customer dissatisfaction because of failures in processes; ii) Focusing on defects in products and their design that can expose the bank to losses due to fraud etc. iii) Aligning business and incentive systems to reduce conflicts between employees and the bank; iv) Analysing the impact of failures in technology or systems and develop mitigants that can minimize such impact; v) Develop alternative plans for external shocks that can adversely impact the continuity in the bank's operations. A decisive factor for operational risk mitigants could be the cost of implementing them vis-à-vis the benefit of reducing operational losses.

The main elements of operational risk management process of a bank must comprise of
i) Policies and procedures that precisely describe major elements of the Operational Risk Management framework including identifying, assessing, monitoring and controlling / mitigating operational risk. ii) Measures for identification and measurement of operational risk iii) Effective and active risk monitoring and reporting iv) a sound system of internal controls and v) Suitable testing and verification of the Operational Risk Framework.

Banks in the earlier ages used internal control mechanism and audits for operational risk management. While these continue to be an essential part of operational risk management, new

processes need to be developed and adopted to handle operational risk efficiently. Most of the operational losses in the past were due to failures of internal controls which were categorised as i) Absence of control culture ii) Inadequate identification and assessment of risk activities, iii)Inadequate key control structures, iv) Insufficient Information Sharing and Communication and v) Inadequate audit and monitoring programs (RBI, 2005).

Hence, the following are considered as essential elements of internally oriented controls:

- Clear segregation of duties for ensuring that a single individual is not responsible for the execution as well as settlement of transactions.
- Independent check from more than one source
- Verifying and tallying the balance in the books of accounts with the actual bank balance
- A "diary system" that helps banks in monitoring or tracking important events and actions
- All the modifications, deletions of records need to be carefully tracked and available for a supervisory review (Bradstreet, 2006).

The externally oriented controls comprise of the following:

- Trade confirmations from counterparties of banks
- Verification of rates and prices used in valuation from independent and third party data sources
- Authorisations and also "maker-checker controls" (Bradstreet, 2006).

Operational risk management is essentially becoming an important element of sound risk management practices in contemporary financial institutions. Guiding principles of operational risk management are i) identification, ii) assessment, iii) monitoring and iv) control which are discussed in detail in the following sections(RBI, 2005).

3.4.1.1 Identification of Operational Risk

The RBI guideline states that "Banks should identify and assess the operational risk inherent in all material products, activities, processes and systems. Banks should also ensure that before new products, activities, processes and systems are introduced or undertaken, the operational risk inherent in them is identified clearly and subjected to adequate assessment procedures".

Risk Identification is vital for the development of a robust operational risk monitoring and control system. The process of risk identification takes into consideration bank specific factors - like the bank's structure, organisational changes, nature of bank's activities, employee turnover, employee quality and external factors like technological, political and industry advances that can influence the achievement of a bank's objectives adversely(RBI, 2005) .

Risk identification begins with listing out the business lines where the bank has its presence. Basel II Accord has identified 8 generic business lines into which banking activities can be classified across all commercial banks. These are: "1. Corporate Finance, 2.Trading and Sales, 3. Retail Banking, 4.Commercial Banking, 5. Payment and Settlement, 6. Retail Brokerage, 7. Agency Services and 8. Asset Management". The detailed classification of the business line is mentioned in Appendix 1. Listing of activities is done by analysing the products within each product team under each of the above mentioned business lines. Once the products are listed, different operational risk events associated with all the products is documented. An operational risk event is an instance that has inflicted or has the capability to cause material loss to the bank. Risk events are related with the people, process and technology associated with the product. These can be identified by their incidence in the past, individual intuition and judgement, events linked with other risks and the regulatory requirements.

3.4.1.2 Assessment of Operational Risk

Apart from identifying operational risk events, banks should also assess operational risk to get a better understanding of the risk profile and optimal utilisation of risk management resources. Banks may use a variety of tools for operational risk assessment ranging from Risk Control and Self-Assessment (RCSA), Risk Mapping and Key Risk Indicators.

Self-risk assessment is a process to assess inherent risks associated with a product or service. This qualitative assessment is internally driven and uses checklists and workshops to identify the strengths and weaknesses of operational risk environment on an ongoing basis. RCSA is an important tool through which banks get an understanding of their operational risk exposures. Scorecards are used to translate qualitative assessments into quantitative measures that rank different types of operational risk exposures relative to each other.

Key Risk Indicators (KRIs) are by-product of any attempt aimed at understanding and measuring risk. They are key tools in operational risk management. KRIs are quantitative

metrics of risks. These provide insight into the bank's risk position and are reviewed from time to time. These indicators help to define an alert level for risk and give an indication when the risk exceeds or falls below the alert level based on the risk concerns. They act as an early warning system to monitor the level of operational risk in a bank. The idea is that the KRIs can recognise potential pitfalls and allow corrective actions to be taken before losses occur(Hull, 2012).

In risk mapping process, all the business units, organizational functions and process flows are mapped by risk type. This process identifies areas of weakness and helps in prioritizing consequent management action.

3.4.1.3 Measurement of Operational Risk

". . . Operational risk measurement is not the same as operational risk management. Quantifying those operational risks that lend themselves to quantification and neglecting the rest does not constitute best practice . . . "(Cagan, 2001)

A vital element of risk management is measuring the size and scope of a bank's risk exposures. Banks may develop their own risk measurement techniques based on the size and complexities of their operations, resources and loss data availability. Though banks may quantify their operational risk exposure using a variety of approaches, using historical loss data would provide useful insights in assessing the same and subsequently formulating a policy to mitigate/control the risk.

Banks are expected to collect historical loss data for specified periods, typically for 5 years at the minimum under AMA and fit each loss incident into the business line and event type matrix. Additionally, by tracking the severity and frequency of each loss event, a bank can identify significant events with high impact across the bank along with the business practices that are more vulnerable susceptible to operational risk. After defining the loss events and actual losses, a bank can analyse and model their occurrence by constructing databases for tracking such losses and defining risk indicators that summarize the data. All risk events need to be classified into one of the following four categories based on their frequency and severity - high frequency-high severity, high frequency-low severity, low frequency- high severity, low frequency-low severity in the decreasing order of the risk exposure.

Possible threats are from the events that are high frequency-low severity (HFLS) and low frequency- high severity (LFHS).Losses on data from HFLS events can be retrieved from a bank's internal auditing systems. Anticipated future losses due to operational risk from these events can be predicted quite accurately. As the LFHS events are not very common, sufficient data might not be available from a single bank for modeling purposes. In such cases, scenario analysis can be used for filling up scarce data.

Scenarios are probable future events which need to be captured in terms of their potential frequency and potential loss severity. Scenarios are generated for all material operational risks faced by the bank. The scenarios so created are assessed by the business experts based on past historical losses, insurance coverage, key risk indicators, risk factors, control environment, etc. This data can be entered into an internal model for generating economic capital requirements for operational risk.

Internal and external factors that are capable of adversely affecting the performance of the bank should be identified and evaluated as part of risk assessment. All risks that a bank is facing at all levels should be taken into consideration. The assessment should consider both historical and potential risk events. Historical risk events are assessed on the basis of factors like total number of risk events; total financial reversals; net financial impact; expected increase in volumes; total number of customer claims paid out; IT Uptime; Office Accounts Status etc. Potential risk events are assessed on the basis of employee related factors like productivity, turnover, expertise; clarity and complexity associated with the processes; level of activity that is outsourced; audit scores; IT indices ; volume spurts etc (RBI, 2005).

The following are the approaches that can be used to measure the operational risk.

- Qualitative approaches
- Structural approaches
- Actuarial approaches
- Mixed approaches

3.4.1.3.1 Qualitative Approaches

Qualitative approaches are based on the judgement and discretion of management on various sources of risk. This approach is dependent on the information gathered through questionnaires

and surveys conducted on the operating and management personnel. The surveys collect information on historical events and present state of affairs.

Historical events comprise of financial losses, write offs that might have led to near misses and actual losses. Near misses are events that could have resulted in losses but did not happen or were controlled. Information on non-critical mistakes that have occurred but did not lead to losses is also gathered.

Facts pertaining to current state of affairs concentrate on two aspects namely stress and reliability. Reliability of the system is affected by factors like quality of personnel and level of automation. Reliability can be at stake in case of

- Greater manual intervention
- Recording not being carried out meticulously
- High employee turnover
- Inexperienced staff
- Operational complexity
- Increased overtime

Banks could use this information to arrive at a credit scoring for each department and allocate capital on the basis of these credit scores (Bradstreet, 2006).

3.4.1.3.2 Structural Approaches

Structural approaches "use a model of causality that defines a set of linkages between various processes and the probability of loss events. " This allows managers to direct their efforts on links in the process that have a higher probability of losses. While the structural approach cannot be used for all operational risks, it can be useful for well-defined operational risks like process risk. In this approach, a flow chart of the concerned process is prepared. The manager identifies the weak links of the process and the incidence of expected losses. "The probability of each link failing can be estimated to quantify the loss for any given event" (Bradstreet, 2006).

3.4.1.3.3 Actuarial Approaches

As these approaches are statistical, they do not make many assumptions about the mechanisms and causes of loss. They estimate the loss distribution parameters i.e. they do not "identify the source of risk" but consider all of them.

3.4.1.3.4 Mixed Approaches

These approaches combine all the above methods. Operational risk is measured based on judgement, loss experience and structure. The Basel Committee also recommends this approach for the measurement of operational risk. Two popularly used approaches under this category are the i) Historical loss mapping and ii) Key risk indicators.

3.4.1.3.4.1 Historical loss mapping

Historical data is used to estimate the probability distribution of losses. It consists of the following steps:

1. "Historical loss data on operating loss events are collected from the bank as well as from the industry.
2. Loss data so obtained is segregated on the basis of type of event that caused the loss and the kind of business unit process in which the loss has occurred.
3. The processes and business units of a particular bank are classified similarly and the loss data for the industry is used the expected/ unexpected loss for the bank".

3.4.1.3.4.2 Key risk indicators (KRIs)

"KRIs are quantifiable measures of performance of the processes of the bank. If these indicators are well-defined, then changes in KRIs should be in line with the probability of loss. The KRIs for operational risk can include – volume of trades processed, volatility in Profit and Loss account, average overtime per employee, employee turnover rate etc. They are a very tool for management. However, till historical data that supports their connection to loss has been collected, their application to determine the capital charge for operational risk will remain limited". (Bradstreet, 2006)

3.4.1.4 Monitoring of Operational Risk

A robust monitoring process is a critical element for effectively managing operational risk. As per the RBI guidelines, "Regular monitoring activities can offer the advantage of quickly detecting and correcting deficiencies in the policies, processes and procedures for managing

operational risk. Promptly detecting and addressing these deficiencies can substantially reduce the potential frequency and/or severity of a loss event".

Apart from an effective monitoring system, early warning indicators like employee turnover, introduction of new products, transaction breaks, system downtime etc - that are forward looking should be developed. Associating these indicators with thresholds along with an effective monitoring process can identify key operational risks and enable the bank to take appropriate action.

Operational risk reports containing internal compliance, compliance and operational, data, along with external market information should be sent to the senior management periodically. Analysis of these reports should help in development of new operational risk management policies, procedures and practices (RBI, 2005).

3.4.1.5 Mitigation of Operational Risk

Risk management essentially deals with the mitigation of risks faced by banks. It is a critical element of efficient risk management. Risk mitigation techniques can be chosen based on the nature of losses. For operational losses that are likely to culminate from natural disasters can be mitigated through insurance while losses that are likely to arise from employee frauds can be mitigated with the help of strong internal control mechanisms. Losses due to failures in telecommunication can be mitigated through periodic backups. Fostering a strong internal control culture helps in an early detection of errors and frauds (RBI, 2005).

Operational risk is likely to be more evident where banks are extensively involved in new activities or the development of new products that might not be in line with the bank's core business strategies, or foray into markets that they are not familiar with, or engage in businesses that are located away from the head office. When banks operate in such scenarios, enhanced attention is to be given to internal control activities. A bank risk profile guides the sophistication of the operational risk framework in banks. Banks are required to have policies and procedure that govern operational risk mitigation. Operational risk profile should be repeatedly updated based on the risk limitation and control strategies, in view of the overall risk profile and risk appetite of the bank.

Once all the material operational risks are identified, the banks can take a call on whether they would like to control or mitigate these risks or bear these risks. When a bank identifies a risk

as one that cannot be controlled, it can either choose to accept the risk, reduce the level of activity or entirely closedown the activity. Few operational risks have low probabilities but a very large financial impact. Allocation of operational loss events into various risk categories depending on frequency and severity matrix help to prioritise the events to be tracked and controlled. Risk mitigation tools like insurance can be adopted to externalise the risk of "low frequency, high severity" losses arising from third party claims arising from omissions and errors , employee or third-party fraud, physical loss of securities, and natural disasters. However, risk mitigation tools need be used as complementary to internal operational risk control but not as their replacement. Banks need to thoroughly understand the extent to which the risk mitigation tools actually reduce or transfer the risk or create new risks.

Increased automation through information and process technologies contribute significantly to risk mitigation and control. On the flip side, these could convert high-frequency-low severity losses into low frequency-high severity losses that could lead to an extended disruption of activities or services attributable to both internal as well as external factors. This might hamper the bank's ability to conduct its normal business activities. Banks need to implement disaster recovery and business continuity plans to handle such risks.

Banks should also have policies for management of risks accompanying outsourcing activities. Though outsourcing reduces the operational risk through of business activity to third parties, it is the responsibility of the bank to ensure the activities are conducted in a safe and legally compliant way.

While the above mentioned measures describe the general steps to be followed in operational risk management, the following few paragraphs discuss the techniques that could be used for operational risk management. Operational risk management comprises of both preventive and damage limiting controls. While the former aim at reducing the probability of loss, the latter aim at limiting the loss incurred by an event's occurrence(Bradstreet, 2006). List of preventive techniques are:

- Self-assessment: The business units of the bank identify the nature and magnitude of operational risk in a subjective manner. High impact events are identified along with the probability of their occurrence and monitored carefully.
- Audit: An audit by third parties/external agencies on business processes and controls is a critical requirement of operational risk control. The audit could be pre-audit or a concurrent audit.

- Segregation of duties: In order to ensure that one person does not carry out a transaction or an activity from the beginning to the end, segregation of duties becomes essential. It facilitates the segregation or separation of functions into three distinct categories- front office, the middle office and the back office. The reporting lines for these categories are different and independent till it reaches the senior management level. Their responsibilities are clearly defined. For example, front office personnel should not – sign cheques, pass accounting entries, generate revaluation rates, approve or authorise credit limits, send conformations to the counterparty back office, approve overall market limits or handle regulatory reporting.

  Similarly the back office personnel are restricted to amend or write deal slips, quote rates to the market or finalise and carry out deals, approve market or credit limits.
- Independent Confirmation: An independent confirmation from the back office of the counterparty becomes a significant operational control element. This prevents the possibility of losses at a later stage. This also helps in ensuring the genuineness of the issuing bank.
- Authorisations: The delegation of authority at different levels of the organisation needs to be well defined, especially in decisions concerning signing cheques, authority to trade, settle trades etc.
- Technology Utilisation: Usage of technology ensures consistency in processing and minimises stress and human related errors. Albeit, technology brings with it a different set of risks which need to be controlled and managed.
- Model Validation: Models are usually built based on certain formulae and assumptions. Models need to be rigorously tested, verified and updated periodically.
- Dual Controls: Independent or third party approval and checking of system input minimises the possibility of errors within the system. Usually banks are keen on joint authorisations for transactions such as procurement orders and cheque payments.
- Reconciliation: "Reconciliation of two independent records is an important control. Outputs from two different records, such as profit estimates of the dealer and profit calculations by the middle office, should be reconciled".

- Process Manuals: Operations and processes should be documented to the extent possible through operations manuals. They give clarity on the steps involved in carrying out various processes as well as the responsibility of executing them. The ownership associated with each process has to be well defined and communicated. Diverse aspects like the legal, accounting, tax etc need to be considered. These manuals not only help new employees in doing their job better but also in process reengineering.
- Alert Systems: Alerts must be incorporated into the systems for all important dates and events. This will enable timely action.
- Departmental Checklists: In addition to the operations manual, departmental checklists provide operational control over the departmental operations. They provide details of daily, weekly, monthly, quarterly, biannual and annual tasks that need to be executed, including the persons responsible. On completion of the tasks, the checklists need to be updated by the responsible person. The accountability of failure lies worth the person responsible.
- Control over correction: Amendments to important documents are subject to the same rigorous controls as the original document. Corrections need to be preferable be accompanied by an amendment document. Minor corrections, however, do not need a separate document.
- Price verification: Middle office must calculate current and market prices independently and review them periodically to identify any out of line prices. "These out of line process could be used to manipulate the profit/loss of the trading book or derivative positions.
- Code of Conduct: Deciding a code of conduct is a prerequisite in managing operational risk. The code must specify the expectations from the employees as well as the management. It has to also cover the organisations' policies on gifts, personal account trading etc. A documented code along with the signatures of employees adds commitment of the employees towards organisational expectations.
- Incentive Payments: Investment banking usually involves large incentive payments that are more than the fixed pay component. This could lead to a conflict of interest unless the profit measurement is transparent and assessed independently as there are chances of influencing the incentives. Moreover, larger incentives might motivate the employees to take larger risks for personal gains, thus compromising

on the organisational well-being. Therefore, an overview on the operations is essential.

- Compliance Manual: With the increasing need for conformance and complexity of regulations, it becomes necessary to communicate the same to the employees in a simple and lucid manner. The manual has to be updated on a regular basis. Training sessions need to be conducted to share the contents of the manual. To induce greater discipline, employees should confirm in writing that they have read the manual and are complying with the same.
- Compulsory Annual Leave: Detecting fraud becomes easier when an employee who performs a certain function regularly is replaced by another employee. Insisting on a two week leave for each employee accomplishes this.
- Physical Controls: Environmental controls are essential complements to other operational controls. Physical and system access controls, fire controls, transit controls for movement of people and important documents and materials, burglary alarms help in avoiding losses.
- Know Your Client: This ensures that the counterparty or the customers are identified properly so that the client does not indulge in activities like money laundering and manipulative practices(Bradstreet, 2006).

3.4.2 Evaluation of the Operational Risk Management Function

It is the responsibility of the Board of Directors to ensure that the senior management creates and sustains an effective and robust system of well-established internal controls, risk measurement, a system for associating risks to the bank's capital level, and a system for monitoring and ensuring compliance with regulations, laws and internal and supervisory guidelines.

A bank constantly monitors its internal controls through the function of internal audit which provides an independent evaluation of the adequacy of the policies and procedures that are being implemented and the extent to which they are complied with, there by supporting the senior management and the Board of Directors in the risk management function. Depending on the risk exposures, the frequency of the internal audit program should be varied, to ensure the effective implementation of "operating policies and procedures".

3.5 Specification of Business Lines

For the purpose of operational risk management, the banking activities and products are categorised and allocated into eight business lines- Corporate Finance, Trading & sales, Retail Banking, Commercial Banking, Payment and Settlement, Agency Services, Asset Management and Retail Brokerage- as per the New Capital Adequacy framework formulated by Basel.

The following criteria need to be considered while mapping activities into business lines.

1. All the activities of the bank are to be mapped into the eight level -1 business lines. The addition must be mutually exclusive.
2. An objective mapping criteria needs to be used in cases where the activity cannot be easily mapped to any business line.
3. The mapping of business lines used in operational risk management has to be in-line with the definitions used in market and credit risk management.
4. The mapping process including the exceptions must be clearly documented.
5. The mapping process to business lines must be reviewed independently.

3.6 Computation of Capital Charge for Operational Risk

Once the organizational set-up and operational risk management framework are in place, capital adequacy needs to be computed and tracked on an ongoing basis. The Basel committee has prescribed three approaches towards the calculation of operational risk capital charges in the increasing order of "risk sensitivity and sophistication".

1. The Basic Indicator Approach
2. The Standardised Approach and
3. The Advanced Measurement Approach

RBI permits banks to initially adopt the simplest Basic Indicator approach for allocation of capital charge for operational risk. However, over a period of time banks are required to move along the spectrum to the Advanced Measurement Approach after meeting the qualifying criteria, due to the sophistication associated with the approach.

3.6.1 Basic Indicator Approach

All banks in India, as per the RBI mandate have to begin with the Basic Indicator Approach (BIA) for operational risk calculation under Basel II. Under this approach, operational risk is

calculated as a fixed percentage, i.e 15% of the gross income. This approach usually results in a higher operational risk capital charge.

The gross income is taken as an average of previous three years positive annual gross income. Figures for any year in which annual gross income is negative or zero should be excluded when calculating the average.

$$K_{BIA} = \sum GI/n * \propto$$

Where K_{BIA} = the capital charge under the Basic Indicator Approach

GI = annual gross income where positive over the previous three years

$\propto$ = 15% set by the committee relating the industry-wide level of required capital to the industry-wide level of the indicator

n = 3

Gross income is defined as net interest income plus net non-interest income as defined by national supervisor and/ or national accounting standards. Basel II Accord (BCBS, 2006) defines that "the measure of gross income should (1) be gross of any provisions (e.g. for unpaid interest); (2) be gross of operating expenses, including fees paid to outsourcing service providers (In contrast to fees paid for services that are outsourced, fees received by banks that provide outsourcing services shall be included in the definition of gross income); (3) Exclude realised profits/losses from the sale of securities in the banking book (Realized profits/losses from securities classified as "held to maturity" and "available for sale", which typically constitute items of the banking book under certain accounting standards, are also excluded from the definition of gross income); (4) Exclude extraordinary or irregular items as well as income derived from insurance".

3.6.2 The Standardized Approach

The standardized Approach (TSA) is advanced when compared to the Basic Indicator Approach. Under this approach, the activities of a bank are divided into eight business lines - corporate finance, trading & sales, retail banking, commercial banking, payment & settlement, agency services, asset management, and retail brokerage. Within each business line, gross

income is a broad indicator that could be used as a proxy for the scale of business operations and thus the likely scale of operational risk exposure within each of these business lines. The capital charge for each business line is calculated by multiplying gross income by a factor (denoted as beta) assigned to that business line. Beta serves as a proxy for the industry-wide relationship between the operational risk loss experience for a given business line and the aggregate level of gross income for that business line. The Beta factors as defined by the Basel Committee are depicted in the Table 19 below.

Table 19: Business Line-wise Beta Factors

Business Lines	**Beta Factors**
Corporate finance (β1)	18%
Trading and sales (β2)	18%
Retail Banking (β3)	12%
Commercial Banking (β4)	15%
Payment and Settlement (β5)	18%
Agency Services (β6)	15%
Asset Management (β7)	12%
Retail Brokerage (β8)	12%

Source: Basel II accord

While the capital charge in BIA is pegged at a fixed rate of 15% of gross income of the bank, under TSA, capital charge is measured using a differential factor of gross income for each business line. The total capital charge is calculated as the three-year average of the simple summation of the regulatory capital charges across each of the business lines in each year. In any given year, negative capital charges (resulting from negative gross income) in any business line may offset positive capital charges in other business lines without limit. However, if the aggregate capital charge across all business lines within a given year is negative, then the input to the numerator for that year will be zero.

The capital charge as per TSA is:

$$K_{TSA} = \frac{\sum_{j}^{3} \max[\Sigma_{i}^{8}(GI_i\beta_i\ , 0)]}{n}$$

where, K_{TSA} = The capital charge under the Standardized Approach.

GI_i= Annual gross income in a given year, as defined above in the Basic Indicator Approach, for each of the eight business lines.

β_i = A fixed percentage set by the Committee, relating the level of required capital to the level of the gross income for each of the eight business lines.

3.6.2.1 The Alternative Standardized Approach (ASA)

The Alternative Standardized Approach (ASA) is a special variant of TSA. Basel II Accord states that "at national supervisory discretion a supervisor can choose to allow a bank to use the Alternative Standardized Approach (ASA) provided the bank is able to satisfy its supervisor that this alternative approach provides an improved basis by, for example, avoiding double counting of risks (BCBS 2006)". In its February 2010 guidelines, RBI has mentioned ASA and the required qualifying criteria to migrate to ASA. Under the ASA, the operational risk capital charge and the methodology is the same as TSA except for two business lines, retail banking and commercial banking. For these business lines, loans and advances multiplied by a fixed factor 'm' are used in place of gross income as the exposure indicator. The betas for retail and commercial banking remain the same as in TSA. The ASA operational risk capital charge for retail banking (with the same basic formula for commercial banking) can be expressed as:

$$K_{RB} = \beta_{RB} \times m \times LA_{RB}$$

Where K_{RB} = capital charge for the retail banking business line

β_{RB} = beta for the retail banking business line

LA_{RB} = total outstanding retail loans and advances (non-risk weighted and gross of provisions), averaged over the past three years

m = fixed factor 0.035.

For commercial banking, the operational risk capital charge is calculated as,

$$K_{CB} = \beta_{CB} \times m \times LA_{CB}$$

Where K_{CB} = capital charge for the commercial banking business line

β_{CB} = beta for the commercial banking business line

LA_{CB} = total outstanding commercial loans and advances (non-risk weighted and gross of provisions), averaged over the past three years

m = fixed factor 0.035.

Overall capital charge under ASA will be calculated as:

$$K_{TSA} = \frac{\sum_{j}^{3} \max[\Sigma_{i}^{8}(GI_i\beta_i, 0)]}{n} + (\beta_{RB} \times m \times LA_{RB}) + (\beta_{CB} \times m \times LA_{CB})$$

where, K_{TSA} is the capital charge under TSA;

LA_{RB} is the total outstanding retail loans and advances (non-risk weighted and gross of provisions), averaged over the past 3 years;

LA_{CB} Is the total outstanding commercial banking loans and advances (non-risk weighted and gross of provisions), averaged over the past 3 years;

The value of the fixed factor m is 0.035 for both retail and commercial banking.

Under ASA, total loans and advances in the retail banking business line consist of the total drawn amounts in the credit portfolios consisting of retail, SMEs treated as retail, and purchased retail receivables. For commercial banking, total loans and advances consist of the drawn amounts in the credit portfolios consisting of corporate, sovereign, bank, specialized lending, SMEs treated as corporate and purchased corporate receivables.

For India, the RBI guideline also mentions that "if banks wish, under the ASA, they may aggregate retail and commercial banking using a beta of 15%. Similarly, those banks that are unable to disaggregate their gross income into the other six business lines can aggregate the total gross income for these six business lines using a beta of 18%. Like TSA, the total capital charge for the ASA is calculated as the simple summation of the regulatory capital charges across each of the eight business lines" (RBI, 2005).

3.6.3 The Advanced Measurement Approach (AMA)

Advanced Measurement Approach commonly referred as 'AMA' is the most sophisticated and the most superior approach in the computation of operational risk capital charge. The AMA is designed to be risk sensitive and takes a totally different approach vis-a-vis the former three gross-income based approaches. The capital charge computed using this approach is lowest

compared to the other three approaches which is a very strong incentive for banks to adopt this approach in spite of its complexity.

AMA also requires proper risk management framework in place that should include an independent risk management function. A dependable system for loss data collection and calculation of capital using statistical tools needs to be established. In terms of the costs involved, the AMA is the most expensive approach in comparison to the other two approaches. However, the quantitative impact study done by the Basel Committee has established that BIA and TSA approaches result in a higher capital charge vis-à-vis the AMA methodology. Taking into consideration all the factors required under AMA, large banks will have financial power to implement this approach and also benefit out of this in terms of reduction in capital requirement. Capital computation under advanced measurement approach is based on the actual loss data of the bank along with external data, scenario analysis and business environment and internal control factors. Loss Distribution Approach (LDA) is the most widely used and acceptable method to compute AMA capital for operational risk. It is also the most complicated and sophisticated approach. This approach models historical operational losses of the bank with the help of statistical techniques to compute operational risk capital. The loss data needs to be categorised as per the eight business lines and seven loss event types defined by the Basel Committee.

The historical loss data is used to fit suitable probability distributions for frequency and severity and the best-fit distributions are used in the simulation process to estimate expected and unexpected loss at a certain confidence level over a specific time horizon. The LDA approach involves modeling loss frequency and loss severity data separately and then combining these distributions through Monte-Carlo simulations to form an aggregated loss distribution for each operational risk category (ORC). The operational value at Risk (OpVaR) is obtained from aggregated loss distribution (RBI, 2005).

3.6.3.1 Components of Advanced Measurement Approach

There are four key elements of Advanced Measurement Approach (AMA) for calculation of capital charge for operational risk namely, internal loss data, external loss data, scenario analysis and business environment and internal control factor (BEICF). The BCBS document mandates a bank to have a transparent, credible, verifiable and well-documented approach for weighing these four fundamental elements in its overall operational risk measurement system. The guidelines specify that the overall operational risk capital charge for the bank should be

derived from the combination of these four data elements. The banks can exercise discretion in assignment of weights to the usage of these components. Some AMA-migrated banks, assign more weight to scenario analysis than internal loss data; while some banks assign more weights to internal loss data vis-a-vis scenario analysis. Regarding use of BEICF, some of the banks use it as a risk management tool while some banks use it directly or indirectly for capital calculation.

The key AMA elements are discussed in detail in the following sub-sections.

3.6.3.1.1 Internal Loss Data

Under the AMA methodology, internal loss data is highly important as it is directly used for calculation of operational risk capital charge using loss distribution approach. Basel II document insists that banks track internal loss data according as outlined by it. Loss data collection along with its classification and mapping is a complex and challenging task requiring a sound data collection comprising of data collection, tallying, verification, reconciliation, mapping of event type and business lines. Data integrity therefore, assumes very high significance in the loss database set-up. Whether the database is based on internal or external data or both these components, it is very important that the process and system assure a good quality, because incorrect and incomplete data will lead to wrong results and wrong capital number, expected and unexpected loss for the banks. Therefore, a clear data collection policy is a prerequisite for robust collection of loss data. This policy should clearly articulate what data is to be collected, as well as standards, roles and responsibilities for its collection. The detailed information required to be registered while collecting loss data is mentioned below in Table 20.

Table 20: Information to be Collected Related to Loss Data

Serial No.	Data to be collected
1	Event occurrence date
2	Event discovery date
3	Event write-off date
4	Organizational entity where loss occurred
5	Regulatory and internal business lines which bear the loss
6	Event category based on Basel classification

7	Amount of the loss- gross loss
8	Exchange rates if the amount is in foreign currency
9	Types of loss: Actual loss, potential loss* or near miss**
10	Recovery amount and recovery date
11	Type of recovery (e.g. insurance, rectification, reversal, other)
12	Indication as to whether the loss is associated with a credit or market risk Loss
13	Description of the event elaborating the root cause(s) and failed/missing Controls
14	General ledger account number to which the loss was booked
* Events where bank does not incur loss at the time of happening of the event, but could lead to loss in future.	
**Loss events which are rectified after occurrence of the events but before loss event takes place. Here, bank does not incur loss as rectification is done well within the time before any loss takes place	

Source: RBI,2011

The internal loss data is directly used for operational risk capital calculation. Banks are required to use a minimum of five years of internal loss data for calculating capital under AMA. However RBI prescribes that a three year historical data window is acceptable when banks first move to AMA. After collection of all relevant information, the next step is to map each operational risk event to relevant level 1 and 2 of risk event type defined by the Basel II Accord (Annexure 1). Each event is to be mapped to relevant business line defined by the Basel II Accord (Annexure 2). The banks are required to document objective criteria for mapping of business line. The mapping of event type can be on the basis of causes of the event, which means if there is a loss event due the fraudulent encashment of cheque by an external person, this has to be mapped to external fraud (level 1) and theft and fraud (level 2). Similarly, if this event has happened at the teller counter in the branch, this will be mapped to retail banking. The loss data falling above a threshold can be collected after identifying an appropriate threshold. However, these thresholds should be broadly consistent with those used by peer banks.

Banks usually encounter problems regarding boundary conditions that overlap credit, market and operational risks. There should be no duplication of data, i.e., if one event is considered as part of operational risk capital calculation, the same should get excluded from the capital charge for other risk types. This is based on the principle of avoidance of double counting that may lead to overstatement of the risk. Adopting the Basel II Accord, for the Indian scenario, the

RBI guidelines on operational risk states that the banks are required to include in their loss database operational risk cases that are related to credit risk, for internal operational risk management purpose only. However, for Operational risk capital calculation purposes, all such overlapping cases will be considered as part of credit risk event. As far as overlaps in market risk cases are concerned, the guidance note directs banks to consider operational risk cases related to market risk as a part of operational risk capital charge calculation. Operational risk is inherent in almost all activities carried out by banks. As per definition, operational risk is the risk of loss resulting from inadequate or failed internal processes, people, and systems or from external events. The above four factors may lead to financial loss in credit activities and treasury business of the bank. All such losses are termed as operational risk irrespective of whether it is considered for operational risk capital calculation.

Credit risk normally arises due to "counterparty default, i.e., when the credit-worthiness of the counterparty deteriorates and the bank cannot recover principal and interest from the customer". Sometime bank's people, process and system or external events are responsible for loss during the process of loan documentation, credit assessment or disbursement. For example, if the loan amount is disbursed to a wrong customer or excess amount is credited to the customer's account, this will lead to a loss to the bank. This loss is due to error made by the bank staff; hence it is an operational risk event due to failure of people. Similarly if the customer submits fake documents for a loan and the bank is not able to detect it and loan is sanctioned, this will lead to financial loss to the bank. Here the loss is due to failure of process or people or external events. Hence it is an operational risk event. As per Basel II Accord, banks are required to identify all such cases and maintain a database for risk management purpose.

In treasury related activities and processes, failure of people, process and system would lead to loss in treasury activities. A small error or mistake by a trader or a dealer may lead to a huge loss to the bank. If the bank fails to arrive at a settlement with the counterparty within the time frame, then it has to make a loss in terms of interest paid or compensation paid to the counterparty. If the trade has incorrect terms, e.g. an incorrect price, valuation of the position could be wrong, as well as the level of market risk calculated using erroneous figure. Operational errors like wrong trade, data integrity and operational failures like timely settlement failure lead to operational risk. If there are errors relating to market position, any measures based on these positions (such as VaR) will consequently be wrong and hence so will be any risk reports containing these figures. Basel II Accord insists that banks identify

operational risk events related to market risk and include them in operational risk capital calculation (RBI, 2011).

3.6.3.1.2 External Loss Data

External loss events for a bank are those events which are realized by banks across the geographies in general. Basel II Accord insists on using external loss data along with internal loss data for calculation of operational risk capital charge under the AMA method. Banks are required to collect external loss data and use them for their capital calculation after applying an appropriate scaling methodology. Scaling is required because the data is collected from external source; the size and scale of business, business environment and work culture and regulation would be different for different organizations.

Since banks are exposed to infrequent but potentially severe losses, Basel II Accord prescribed that the operational risk measurement system should consider such events even though these events are not realized by it, but are realized by their counterparts or peers. External data should include data on actual loss amounts, information pertaining to the scale of operations where the event had actually occurred, information on the circumstances and the causes that lead to the loss events, or other information that would be useful in analysing the relevance of the loss events for other banks. A bank should also have a proper methodology to incorporate such data in its modeling framework. A well-defined scaling mechanism can be used to scale external data. A bank can use them directly by incorporating in modeling framework or use them during scenario development process. The guidelines require that the conditions and practices for external data use must be regularly reviewed and documented.

The relevance of external loss data can be summarized in the following points:

1. External data can be used to offer a forward-looking perspective, as it contains events that may not have historically been experienced by a bank. It helps banks to consider events which are realised by other banks and could happen in their organization in future if not realised earlier. Hence any possible operational risk events which are faced by the banking industry should be captured for modelling.

2. It helps to populate loss events in those operational risk categories (ORCs) where there is a presence of statistically less number of events or no events. It is possible that banks will have some of the ORCs as blank or with very few data points, which will

inhibit performing statistical modelling. Here, the external loss data will help to populate data points in those ORCs.

3. Similar to scenario analysis, external data can be helpful in modelling high severity events particularly in instances where internal loss data is limited (RBI, 2011).

3.6.3.1.3 Scenario Analysis

In addition to loss data, under AMA, banks are expected to include scenario analysis for operational risk capital calculation. As per the Basel II Accord, a bank must be able to show that its method captures 'tail' loss events that are potentially severe. The severe tail events are unlikely to be available in internal loss data, but can be accessed through scenario analysis. Scenario analysis is thus an integral part of AMA. Scenario analysis helps in identification of possible unusual but catastrophic events, ascribing probability and consequences of such event in monetary terms e.g. a major fire could be an unusual event with the probability being low but the impact is severe in terms of monetary losses that could be in crores of rupees. A bank uses scenario analysis of opinion from different experts to evaluate its exposure to events that have high-severity. This method banks on the knowledge of experienced business, functional managers and risk management professional with expertise to arrive at reasoned assessments of probable severe losses. Over time, these assessments can be validated and re-assessed by comparing with the actual loss experience to ensure their reasonableness. Scenario analysis is useful for the following reasons.

1. Scenario analysis focuses on catastrophic events which are statistically termed as tail events, where the amount of probable loss due to the event is very high. The historical loss data may not have such events as the bank may not have faced any such catastrophic event in the past, but there is a probability of such an event happening in near or long term future.

2. As scenario analysis considers cases of high severity (high loss) and low frequency, the operational risk capital charge that is derived from internal loss data together with scenario analysis will better enable banks to weather high loss events.

3. Scenario analysis also helps in the analysis of the ORCs when bank's historical loss data shows presence of few or zero events, thereby enabling banks to compute capital from those ORCs using scenario data.

Scenario analysis examines the impact of catastrophic events on a bank's financial position. Various probable catastrophic events which bank may face in future should be listed out with detailed description. For example, the events like natural disaster, fire, critical system malfunctioning, major frauds and forgeries, major product flaws are some scenarios which result in a major loss to the bank. Then the financial impacts of these events should be assessed, which are termed as expected losses to the bank. The impact of operational risk scenarios can be evaluated based on a combination of qualitative and quantitative variables. The scenarios are assessed initially qualitatively, to determine the areas of impact, then quantitatively to value these impacts. A few examples of scenarios are given in the following Table 21

Table 21: Sample Operational Risk Scenarios

Name of the Scenario	**Possible Loss Impacts**	**Frequency**	**Severity**
Loss due to natural disaster like Earthquake / Flood / Cyclone etc.	1. Replacement cost of fixed assets 2. Compensations to employees for accident 3. Loss of tangible assets		
Major loss due to manmade disasters like Terrorist Attack/ Riot / Vandalism etc.	1. Replacement cost of fixed assets 2. Compensations to employees for accident 3. Loss of tangible assets 4. Expenditure on additional security systems		
Very Large loss due to fraud by Internal/External People (including losses by hacking / rogue trading etc.)	1. Customer compensations 2. Legal costs		

Source: RBI, 2011

In the above examples, the possible high impact scenarios are defined first. The assessment of these scenarios can be made by looking at the probable impact which will finally help us quantify the loss amount. The last two columns show frequency, which is number of times the event could happen in next 1 year or 5 years or 10 years and severity which refers to single

event loss amount. The response of frequency and severity obtained from the major units of the bank is then used for modeling capital charge. The potential financial impact of the scenario analysis could be (a) Increased operating costs e.g. external costs made to restore the operations of the bank following an operational risk incident; (b) Increased provisions in future years e.g. expected loss calculations demonstrate higher potential losses; (c) Impact on pillar I capital requirements for operational risk

There are certain advantages and limitations of scenario analysis. The primary advantage of scenario analysis is its incorporation of operational risk events that may not have become apparent yet. The basic constraint in scenario is the description, estimation of severity and frequency can be limited by management's past experience and imagination. Scenario analysis is by its very nature subjective and highly dependent on management's subjective assessment of loss severity for each operational risk scenario.

The frequency and severity data collected through scenario assessment are used for scenario modeling to generate operational risk capital charge. Scenario data either can be used along with the internal loss data for modeling or it can be used separately. Frequency information collected through scenario assessment may be once in a year, once in five or ten years. For modeling purpose, this needs to be converted into yearly frequency. Various statistical distributions are used to model scenario severity and frequency like internal loss data. Scenario capital can be estimated using simulation approach (RBI, 2011).

3.6.3.1.4 Business Environment and Internal Control Factor

Business Environment and Internal Control Factors (BEICFs) are indicators of a bank's operational risk profile that reflect underlying risk factors and an assessment of the effectiveness of the internal control environment. As per the guidelines of BIS and RBI, BEICF is one of the four data elements of AMA framework and should be incorporated, either directly or indirectly, into the operational risk measurement framework. Inclusion of BEICF into AMA framework helps banks to capture and analyse key drivers of operational risk and failure of underlying controls defined for various processes to derive risk profile of the bank. The incorporation of BEICF into AMA framework ensures operational risk capital estimates are sensitive to the change in banks risk profile. Based on the survey done by Basel Committee (BCBS, July 2009), some banks use BEICF directly or indirectly as an input - instead of using the factors to moderate - into modeling to derive operational risk capital requirement. BEICF

are also used by some of the banks as an ex-post adjustment to operational risk capital charge and it is often indirectly used as an input into scenario analysis process.

The BCBS document states that "the choice of each factor needs to be justified as a meaningful driver of risk, based on experience and involving the expert judgment of the affected business areas. Also, over time, the process and the outcomes need to be validated through comparison to actual internal loss experience, relevant external data, and appropriate adjustments made (BCBS, 2006)". Most of the banks do consider BEICF in their operational risk management framework with the help of two components: Risk and Control Self-Assessment (RCSA) and Key Risk Indicator (KRI), which are discussed below.

The RCSA process involves bank's assessment of its operations and activities against a menu of potential operational risk vulnerabilities. This process is internally driven and often incorporates check lists and/or workshops to identify the strengths and weaknesses of the operational risk environment. RCSA is used to identify gaps between risks and existing controls, and effectiveness of controls. Here the assessment is made both of the number of times the operational risk event would happen (frequency) and the financial impact due to a single event (severity). These frequency and severity values are used to generate risk profile for the unit. Once the assessment is done, business or functional units have to suggest an action plan or preventive measures to overcome the gaps between risk and controls. This information will be used to derive risk profile of the unit or groups of units or the bank. RCSA helps to obtain information on the level of risk faced by any units and the effectiveness of the existing controls. Accordingly the bank will take control measures to mitigate/ reduce risk. Another use of RCSA is to combine this information with the capital charge obtained from loss data and scenario analysis, as per the regulatory requirement. This can be achieved by defining an appropriate qualitative adjustment framework, which helps to adjust RCSA score with the capital obtained from LDA model.

One obvious limitation of RCSA is that it is subjective in nature. The response related to frequency and severity of an event is completely subjective. The answer is based on the expert judgment of the person who is providing information. This answer may differ from person to person. Hence, expected loss derived by this tool may not reflect the actual picture and may not actually occur in future.

Key Risk Indicators (KRIs) are one of the most common ways of measuring the actual values of risk causes, the risk events and their risk consequences. To illustrate, inadequate staffing

would be a cause, which would in turn lead to the inability of the service personnel to handle the number of calls that they receive per day. The consequences could be multiple, such as, the inability to meet the service level agreement and longer wait for customers for support, drop in customer satisfaction level and loss of potential new customers in future. A KRI is a variable that can be used as a reliable indicator for predicting the loss associated with a risk. A KRI can be a specific causal variable or a proxy for the drivers of the loss attributed to risks. It can be used as a predictive indicator of arising risks, risk events, and potential losses and it helps to generate risk profiles of various units and of the bank as a whole. The nature and usage of a KRI can be explained through the following example. The KRI considered is the number of untrained staff as a percentage of total staff. The information required is of the number of untrained staff during a month (based on new recruitment), which is known as Risk Driver (RD) and the total number of staff on rolls during that month, which is known as Exposure Indicator (EI). The above KRI is derived through the ratio of RD and EI. This value is then compared with the benchmark for that KRI and categorized as low, medium, high and very high, depending on the value of KRI. Each KRI can be classified into very low to very high based on criticality of the KRI for the unit, which in this example is very high. Depending on the value of KRI and criticality grade, risk profile is generated using mathematical calculation. KRI wise risk profile is further aggregated into risk profile for the unit and finally for the bank.

As noted earlier, the main sources of operational risk are people, process, system and external factors. A sample list of KRI related to the above four sources is mentioned in the Annexure 3 Because financial organizations are exposed to these sources of operational risks on a daily basis, organizations should identify KRIs in each of these elements and analyse how they affect business (RBI, 2011).

3.7 Operational Risk Management Scenario in India

As per the RBI guidelines, all the Indian banks with overseas presence were to move to Basel II Accord by March 2008 and other Indian banks were to be Basel II compliant by March 2009. It mandates banks to start with the Basic Indicator Approach for operational risk capital charge calculation and gradually move to the Advanced Measurement Approach (AMA). The banks have the option of directly migrating to the AMA without having to move to The Standardised Approach.

Presently all the scheduled commercial banks in India have implemented the Basel II Accord and are maintaining the mandated regulatory capital for operational risk. Some Indian banks

with foreign presence have also implemented Basel II Accord and started allocating operational risk capital as per the Basic Indicator Approach from the financial year 2008-09. Banks in India have a separate operational risk management function/ department in place, to initiate, look after and manage all matters pertaining to operational risk including gathering of loss data due to internal operational failure, study of bank-wide risk indicators and valuation of risks inherent in various products, activities and procedures the bank is involved in and the efficiency of existing internal controls.

Banks in India have begun the preparations for migrating to advanced measurement approach (AMA). AMA is the most risk sensitive approach among the three approaches in capital computation and it would help the banks in reduction of capital requirement for operational risk. As per the AMA approach, operational risk management framework constitutes four elements - internal loss data, external loss data, scenario analysis and Business Environment and Internal Control Factors. Few Indian banks are beginning to use one or some of these components initially and planning to incorporate all the four gradually. Banks like, HDFC Bank, ICICI Bank, Axis Bank and Punjab National Bank are maintaining loss database that comprises of operational loss events that have occurred over the last three to five or more years. Some Indian banks are also collecting external data from varied sources like published reports, internet, newspapers etc. or by subscribing to external database provided by third party vendor.

Apart from collection of loss data, banks have also adopted various factors of internal controls like Key Risk Indicators (KRIs) and Risk and Control Self-Assessment (RCSA) and have begun collecting and analysing data associated with these internal control factors. Few banks have also started collecting scenario data. Banks are in a continuous process of building up a robust and effective system for recording the various operational risk data elements, measurement and modeling that can act as a warehouse for historical loss data points, apart from implementing KRI, RCSA and scenario analysis and executing other operational risk related computations and calculations. Few reputed vendors, like CRISIL, SAS, Algorithmics and Oracle have developed software for operational risk management and some of the Indian banks have started using off-the-shelf or customized vendor-based systems. Many of the banks in developed economies like the Europe, U.S. and Australia have already migrated to the advanced measurement approach. The Indian banks have completed ground work and intend to apply while couple of big banks have already submitted letter of intent to RBI. They are likely to migrate to AMA by 2018-19 (Mishra, 2014).

To sum it up, The Basel Committee on Banking Supervision incorporated operational risk management in its Basel II Accord. As per the new accord, the capital adequacy ratio (CAR) of banks need to include capital allocation for operational risk in addition to credit and market risks. Operational risk arises due to lapses in process execution, insufficient and inappropriate process in place, unfair intention of the employee, or due to external events, or system failures. In carrying out their business, banks usually face operational risk events which might have a low impact. However, a few operational risk events that have high impact may erode the banks' profits drastically forcing proper measurement and management. The banks should have a proper operational risk management framework that promotes active participation of senior management and its board for efficient and effective management of risk. The Basel Accord has formulated certain guidelines concerning to organizational set up, role of senior management and respective units and measurement framework, which also includes statistical techniques. Among the three methods defined in the Basel II Accord for operational risk modeling, the advanced measurement approach (AMA) is the most risk sensitive approach as it uses actual losses of the bank and also considers potential high impact scenarios and business environment and internal control factor of the banks, in computation of operational risk capital. The Reserve Bank of India had also released a circular on timeframe of moving to advanced approaches on Basel II framework in India in July 2009. This circular has mentioned the broad timeframe to move towards more advanced approaches for the regulatory capital requirement. As of now all the banks in India have implemented Basel II framework with standardized approach for credit risk, basic indicator approach for operational risk and standardized duration approach for market risk for regulatory capital measurement (RBI, July 2009).

CHAPTER IV

REVIEW OF LITERATURE

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An extensive review of existing literature was undertaken. Scholarly artcles from several journals hosted on EBSCO were used for reviewing the literature. The literature that has been reviewed are categorised into the following areas.

1. Literature on Risk Management
2. Literature on Operational Risk
3. Literature on Operational Risk Capital Allocation
4. Literature on Operational Risk Modeling and Advanced Measurement Approach
5. Literature on Operational Risk Measurement
6. Literature on Operational Risk Management Practices
7. Literature on Risk and Financial Performance

I. Risk Management

Allan, Booth, Verrall, and Walsh (1998) conducted a study that provided an overview of the various financial risks that need to be managed in banking. The study also forayed into the details of the specific areas of operational risk, market risk and pricing loans. The author developed a cash flow model, which explicitly considers various financial factors that are capable of influencing the interest rate charged. The model is also applied to price loans with various features. The results of the model along with its shortcomings are demonstrated by the study.

Aiuppa (2001) presented a synthesis of risk management within a financial framework in his study. The author opined that "as risk management expands its scope, a coherent overview is needed to improve the understanding of risk, including the types of risk, the methods of managing risk and the impact of risk and its treatments on shareholder wealth". The work by the author highlights the presence of risk in all aspects and shows the possibilities of using the classic risk management beyond pure risks and moulding it into the wealth maximization paradigm.

Alexander (2005), in his study discussed about the research on "financial risk management applications of econometrics". He stated that the theme rests more on the precise evaluation of

credit and market risks with relatively less emphasis on theoretical or applied econometric research to other risk types, missing data, aggregation risk and optimal risk control. The author argues that crude aggregation rules, inadequate data and the model risk evolving thereby would result in a new class of reduced form Bayesian risk assessment models that should be fit within a common factor framework to enable suitable risk aggregation methods to be developed. The author also demonstrates a framework that provides crucial associations between risk assessments, risk control and optimal resource allocation.

Grody and Hughes (2008) carried out a study that showed that in financial crisis, the capital reserves held by banks was a measure by which a bank counts down to failure, rather than the system to proactively prevent it. This was proved by the bankruptcies and near-death scenarios of a number of financial institutions where risk management controls were ineffective. The authors argued that it is not capital that offers a financial institution its greatest protection against failure but it is the risk culture embedded in its people and processes. The authors stated that the crux of any risk culture were the incentives for individual reward that balance risk and return with short-term self-interest and long-term stakeholder goals. The authors further indicated that the embedded early warning systems highlight growing exposures to risk. The authors concluded that preventing financial crises in the future lies in the operational risk framework that intends to nurture a risk-adjusted performance culture.

Gupta (2009) conducted a study that focused on the basic understanding of the banking industry, the different kinds of risks faced and the measures undertaken for efficient risk management. The author studied risk management system of five International and National banks in India. The study focused on credit risk which is the possibility of loss due to deterioration in quality of counterparties. Since there are different types of counterparties and many different types of obligations, credit risk takes many forms. Financial Institutions manage it in different ways. The study also focused on the forces of Continuity and Change affecting Risk Management of these banks and formulating a strategy to deal with the changing environment and the competitions.

Bugalla, Kallman, Lindo, and Narvaez (2012) through their study propose a new model of governance and risk management containing four elements: (i) board risk oversight responsibilities, (ii) a board level risk committee, (iii) an executive risk committee and (iv) an individual with responsibility for overall risk management. The study suggests that “the new

model promotes greater risk disclosure, the audit committee should complement the risk management committee, the board level risk committee should have an independent member with extensive risk management experience, the board should develop a clear risk position, management should form an executive risk committee, have a chief risk officer, create an internal risk intelligence function and, if these are done, institutions will enjoy higher stock prices".

Ernst & Young(2012) and the Institute of International Finance (IIF) conducted surveys on progress in financial services risk management from the 2008 crisis. The first annual study in mid-2009, was conducted when the global financial industry was devastated with the 2008 crisis. It exposed many loopholes in risk management. Study participants were conducting assessments to identify gaps between risk management recommendations from the IIF and the Basel Committee on Banking Supervision and their implementation, and formulated plans deployed resources for improvement. The successive study showed firms in various phases of progress against these plans, and the next study showed continued effort and achievement. The results of the three surveys demonstrated that the constitution of risk management has undergone a significant change since the crisis. Risk appetite, which came out as a critical foundation of the risk management process, continued to be a key challenge for many firms. Though most firms have set up an enterprise-wide risk appetite, many have not yet been able to incorporate it into their businesses, with only 37% of the survey respondents indicating they have linked it to day-to-day business decisions. Data and systems were found to be constant hurdles to risk management. The findings also hinted that 77% reported an increase in IT spend post-crisis and 63% predict it will continue for at least the next several years. The report stated that "changing the culture to make risk everyone's business is an ongoing effort". The survey results also showed that there was a 58% increase in the focus on risk culture; 51% of boards have augmented emphasis on risk management and 87% have separate audit and risk committees; 51% have progressed in establishing enterprise level risk appetite; 77% have completed in depth reviews and discussions to identify and assess risks undertaken across businesses; 57% have modified capital allocation across varied businesses; 31% have finished formulating recovery plans; 75% have developed and implemented stress testing and 42% have reported increased risk transparency. All the above findings were reported for a period over12 months.

Selma, Abdelghani, and Rajhi (2013) explored the contemporary risk management practices of sixteen Tunisian banks by conducting a survey. The work attempted to learn the perceptions of Tunisian bankers about the importance of transparency, public disclosure and the understanding of risk profile of the institution. The findings indicate that the Tunisian bankers are aware of the importance and the contribution of efficient risk management in reducing costs and enhancing performance. The findings also point that Tunisian banks have adopted and implemented some effective risk strategies and risk management frameworks. It was also noted that the credit risk exposure methods were still underused by these banks. Collateral and guarantees were the most widely used risk mitigation methods that supported credit facilities in Tunisian banks. The paper identified the tools and techniques used in managing credit risk, market risk, liquidity risk and operational risk by Tunisian banks.

Skoglund, Erdman, and Chen (2013) study risk aggregation which is the sum-up of low-level risks or sub-risks to higher levels. They state that risk management for banks and insurance companies involves risk measurement and risk control at both the individual risk level, i.e market risk, operational risk and credit risks, and also the collective risk of these individual risks and to determine the total firm wide risk for a financial institution, all risks must be aggregated. They find that aggregation of risk is a challenging task as it requires an aggregated view of various levels of reporting risks, along with the differences in metrics and data sources, etc. and it is particularly complex to aggregate risk when the interdependence between all the individual risks has to be specified. The authors suggest allowing a combined approach to specify copula dependence among individual risks permits risk dependence to be stated step by step. They also argue that mixed copula aggregation does not entirely specify the joint distribution but rather provides the minimum amount of information to determine the aggregate risk. They opine this approach permits users to specify different dependence Risk aggregation using hierarchical copulas as is needed and that the complexity of the model can be adjusted to the complexity required by the risk aggregation.

The editors of "Journal of Risk Management in Financial Institutions" collected opinions and perspectives in 2014 from a few thought leaders on the scope of application of Behavioural Finance to Risk Management and the application of theories and research findings to practical day-to-day risk management problems. Eminent and respected people from the field were asked for their perspectives on two specific questions:" (1) Should banks and regulators include the findings of psychological/behavioural research in their risk management frameworks; and

(2) In the light of new UK legislation,1 should 'reckless' behaviour be regulated"? The author finds that the responses of the experts are enlightening, but as the one of the though leaders David Hillson notes "the question is not whether behaviour should be considered in risk management 'but how?'". The author opines that the "perceptive answers will trigger debate among risk management professionals as to how the theories can be applied".

Several authors namely Busman and Van Zuiden, 1998, Wai-King, 1999, Lonkevich, 1998, Pillsbury, 1997 Stalzen, 1999, and Todd, 1996 have promoted holistic or integrated risk management. Few studies have also focused on the flipside of holistic enterprise risk management, Kloman [2000] in his work has commented that "some of the problems of developing an integrated process are caused by lack of cooperation, lack of communication and fear of intrusion among the various risk-handling functions within a firm (finance, insurance, quality control, et al.)".

II. Operational Risk

Patrick McConnell(2009) tracks a chain of events that led to huge losses at ANZ, one of the largest. In March 2008, Opes Prime, a small stockbroker in Melbourne, Australia, was placed into administration. This set off a chain of events that caused ANZ, one of Australia's largest banks, to become involved in a series of messy legal actions. By the end of 2008, losses at the bank had been estimated to exceed A$250m, with litigation still pending. The losses sustained by ANZ in the Opes case constitute an 'operational risk loss event' as defined under new banking regulations, Basel II. Unlike significant operational risk losses at other banks, such as those sustained by the National Australia Bank, the losses have not been attributed to so-called 'rogue traders'. However, like those well-publicised disasters, similar systemic risk management failures were apparent and sowed the seeds for the losses that were eventually precipitated by the demise of Opes Prime. In a seminal work in decision literature, Professor Barry Turner identified a number of features that are common to the development of 'organisational disasters', many of which are apparent in the events leading up to the losses at ANZ. This paper reviews the ANZ/Opes case using Turner's framework, compares it to the events at other banks, and identifies some lessons for management, risk managers and regulators.

Power (2005) examined the emergence of operational risk from the category of residual risk to its emergence as a pivotal component of global banking regulation. He highlights the resentment of international banks over Basel proposals in the spheres of definitional issues, loss data collection and the quantification challenges. He discusses the concerns in these areas and projects the significance of operational risk as a culminating point for various concerns and as a "potential reinvention of a management knowledge hybrid between auditing and finance". He emphasises on the role of operational risk management framework in extending "enforced self-regulation' deep into the operations of banking, combining advanced technical modelling ideas on the one hand and softer corporate governance thinking on the other".

Laker (2006) in his study argues that increasing complexity of banking activities and greater dependence on technology and specialised skills has made operational risk as one of the most important risks facing banks of which outsourcing and technology risk are two major sources of operational risk.

Cvilikas, Kraujalis, and Karpavičienė (2006) noted that the need for managing operational risk arose in the context of Basel committee recommendations for bank supervision. The Basel Committee emphasized the growing significance of operational risk and its management in the field of finance and recommended frameworks to warrant an effective supervision of operational risk management in banks. The authors opined that the modern concerns of the activity of financial sector members justify the increasing attention of banks towards the security and effectiveness of internal processes. The complexities of banking activities and more intensive internal processes lead to preconditions for greater number of mistakes in internal banking systems. The authors conclude that all these compel bank managers to pay greater attention to the management of operational risk, the efficiency of which has a major impact on bank competitiveness and its success in the market. In this context, they add that it is important that prior to the estimation of operational risk in a bank, as suggested by the Basel Committee, it is necessary to examine the suitability and specificity of these approaches in the context of supervision of management of operational risk.

McConnell (2008) addressed the 'people' risk category following the Basel's identification of the people, process, system and external event categories of operational risk. The author states

that despite the fact that, under the new supervisory regulations, capital must be allotted to cover 'people' risks, the boundaries of this particular risk are not well defined. The author argues that without a clear definition of this risk, a company's risk managers, and their boards might not know whether these risks are being adequately managed. The author develops a framework for analysing people risk and concludes that "the scope of such risks cannot be solely managed by specialist operational risk management functions. Because of the sheer breadth of people risk, operational risk managers must reach out to other disciplines to properly understand its scope and to develop common approaches to its management".

Skinner (2008) reiterates that the growth and survival of banks depends upon the management and mitigation of operational risks given the intense competitive environment in which they operate. In the wake of recent financial mishaps like the sub-prime crisis in the US and disruption to businesses in Asia, the Middle East and North Africa owing to damaged undersea cables, Marshall (2008) suggested that there is a need to take a cross functional approach to risk management and business continuity strategies.

Anghelache and Olteanu (2009) worked on comparative analysis among banks using different methods of operational risk calculation. The results indicated that the capital requirements reduced with adoption of sophisticated methods for capital calculation. The authors noted that many a times, operational risks tend to be underestimated, assuming that the losses might not be large enough to threaten the survival of a bank and that losses resulting from these events culminate from a complex interaction among personal, market and organizational factors. The authors conclude that a look into the past reinstates that operational risk is a significant component of financial losses in the banking sector.

Davis (2009) notes that the September 11 terrorist attacks in the U.S. have changed the debate around operational risk. They had an adverse impact on firms' operations, as well as economic and regulatory consequence. Questions were raised about business continuity, processing automation and financial crime. The author opined that banks are beginning to understand that many losses that were earlier being referred to as credit or market risk, were in fact due to failing internal processes or operations."

Chunxi (2010) in his paper, established a comprehensive measuring index system for the operational risk in commercial banks from three facets namely banks' interim condition, macro

environmrnt and risk situation. The author then uses Grey Analytic Hierarchy process to set up an assessing model and for a rigorous research on a operational risk of a bank .

Fheili (2011) highlighted the role of IT risk in operational risk of banks. The author argues that "in contemporary technologically intense production processes, information technology (IT) risks cannot be considered independently of other types of risk, such as people risk, process risk and others. The introduction of any form of technology in a given production process or the mere modification of an existing IT environment necessitates a number of changes in staff skills, workflows, policies and procedures, and a host of other changes". The author states that identifying these issues and categorizing them as IT-related risks will be an added advantage to management. To mitigate these risks,the author suggets that it is important to apply IT governance while managing this type of expenses.

"The first rigorous studies on operational risk management were introduced in late 1990s, through studies by Prof. Embrechts. Given the scarcity and confidentiality of operational risk loss data, there are only a few papers that explore the specifics of operational risk data and are able to measure operational risk exposure with the accuracy and precision comparable with other sources of risk"(Rippel & Teply, 2011).

Flynn and Butler (2013) carried out a study and identified misconceptions among bankers, accountants, risk managers and government officials on the importance of operational risk and its contribution to the 2007 banking crises. The authors focused their attention on Ireland where many initiatives like the bank guarantee system and the establishment of a National Asset Management Agency (NAMA) to purchase troubled assets along with many other schemes were not able to resolve the banking crisis that Ireland has been experiencing. The role of the European Union along with the European Central Bank and their contribution to the financial turmoil were examined along and the Basel II and III rules. The paper concluded that initiatives like the generous tax breaks, increased government spending, International Financial Reporting Standards (IFRS) along with shortcomings in the Basel II rules contributed to the crisis. The IFRS because it concealed insolvency, the Basel II rules because it interfered with the subtleties of demand and supply, that created an excessive supply of heap loans to few sectors. The authors concluded that as a result of the misunderstanding and regulations, the 2008 guarantee offered by the Irish Government to Irish banks was faulty in practice.

GÂRLIŞTE (2013) noted that operational risks in banking are undeniable truths of the contemporary environment and their right handling is now both a necessity and a prerequisite for effective and efficient overall risk management process. Operational risk management is a double edged sword. On the one hand, there is a need to meet the regulatory capital requirements and on the other hand there is also a need for turning these requirements into a business opportunity. The study emphasized on operational risk in the banking sector and discussed theoretical approaches and evolutions in the field operational risk. The study also details the recommendations made by the Basel II Accord, integrated into the European banks and also the growth of the national regulations as incorporated into the National Bank of Romania Rules.

McCormack and Sheen (2013) focus on the role of operational risk in supporting an effective enterprise wide risk management framework, and in ensuring that the organization develops an effective risk culture that supports the business. The study also provides insights into the recent developments in operational risk, enhancing frameworks and also on operational risk governance, risk management life cycle, policies and documentation and risk management structures. They provide an overview of the role of effective operational risk management in developing and maintaining a robust enterprise wide risk management system.

III. Operational Risk Capital Allocation

Herring (2002) traced the Basel guideline evolution from the economic capital introduction to the 1996 market risk amendment of VaR and internal models to subsequent introduction of internal models to the management of credit risk. The author criticised the extension of capital regulation to operational risk and its attempt to decide the best practice pertaining to operational risk.

Frachot, Moudoulaud, and Roncalli (2003) conducted one of the initial studies on Loss Distribution Approach (LDA) to compute operational risk capital requirement. Their study focused on describing, in a systematic manner, how a full Loss Distribution Approach can be used and how both quantitative and qualitative perspectives can be reconciled. The study also presented some numerical calculations of the capital charge estimates. It suggested detailed procedure " to identify and fit severity and frequency distributions, identification of best-fit distributions on the basis of goodness-of-fit tests, scaling of data elements, scenario analysis, computation of operational risk capital charge and aggregation of capital estimates obtained

from different business line and event type combination". The study also suggested a few methods to verify for the parameter accuracy namely, bootstrap method and Gaussian approximation method.

Fontnouvelle et al (2003) worked on computation of operational risk capital charge for large internationally active banks using loss data collected from external public data sources since internal loss data of banks are not publicly available. The problem with external database is that it contains large number of high impact events and less number of smaller losses giving scope for modelling challenges. Operational risk capital charge was computed using loss distribution approach. Extreme value theory approach was adopted to model tail events as the data base had some tail events. Their study found that the operational losses are an important source of risk for banks and the capital charge for operational risk is usually higher than the capital charge for market risk. Another vital finding of the study was that the distribution of observed losses varied significantly by business line. The authors recommended that using internal data with external data on extremely large rare events might meaningfully improve banks' operational risk models.

Kashyap and Stein (2004) studied the relation between risk capital and business cycles. They argued that "if the shadow value of bank capital is less in expansions and high in recessions, optimal capital charges for each type of risk should depend on the state of the business cycle. Without such adjustments, capital requirements would be too low in expansions, when bank capital is relatively plentiful and has a low shadow value, and too high in recessions, when the shadow value of bank capital goes up, leading to the amplification of business cycle fluctuations".

De Fontnouvelle, DeJesus-Rueff, Jordan, and Rosengren (2006) through their study emphasise the growing importance and media attention attributed to operational risk owing to the regular financial scandals and multiple events crossing one billion dollars in adverse impact. The authors also highlight the increasing regulators' attention to this risk and their finalizing proposals that would require banks to hold capital for potential operational losses.

Brunner, Piacenza, Monti, and Bazzarello (2009) investigated the allocation of combined operational risk capital to different business units, as the Basel II regulation emphasizes a number of mandates for the allocation of operational risk capital in place of standalone

calculations for all legal entities within banking groups. The study presented a statistically sound framework to help meet the technical requirements of the supervisory context.

Couto and Bulhões (2009) focused on one of the primary concepts associated with the New Basel Accord – operational risk and its minimum capital requirements methodologies. According to them, the accord encourages banks to gradually move from basic to sophisticated computation methodologies as banks applying advanced and sophisticated methods will be rewarded with discounts on capital allocated when calculating the capital ratio. These methodologies are (i) the basic indicator approach (BIA), (ii) the standardized approach(TSA) and (iii) the alternative standardized approach(ASA). The purpose of the study was to evaluate and quantify the impact of the different approaches linked to operational risk, introduced by Basel II on several national banks.

Monti, Brunner, Piacenza, and Bazzarello (2010) demonstrated through a framework, that diversification effects in an institution can lead to a decrease in the amount of operational risk capital charge with the help of data from UniCredit Group. The implementation of this is relatively easier, as the institutions might make us of existing operational risk model, where in all the parameters are derived from the internal loss database of the firm. However, the author opines that the lack of data and a lack of understanding of the underlying mechanism of correlations among several operational risk types are not well explored in the context of diversification and correlations in operational risk domain.

Teply, Sekhri, and Chalupka (2010) carried out a study that focused on modeling economic capital for operational risk of a Central European Bank. The authors adopted two main approaches - the Loss Distribution Approach and Extreme Value Theory, in which two estimation methods - the standard maximum likelihood estimation method and the probability weighted moments (PWM) were used. The results supported a heavy-tailed pattern of operational risk data as demonstrated by many researchers. The results further showed that the PWM is consistent when there is limited data as it was able to provide consistent and reasonable capital estimates. Further the results indicate that when the Advanced Measurement Approach (AMA) rather than the Basic Indicator Approach (BIA) is used, the researched bank could save about 67% of its operational risk capital requirement. The authors noted that from a policy perspective, banks from emerging markets like the Central Europe are also able to register

operational risk events and estimate the distribution of these risk events with similar accuracy and success as those from developed markets.

Xie, Wu, and Hu (2011) emphasize the need for allocating separate capital for operational risk owing to the requirement of the New Basel Capital Accord following few serious loss incidents in operational risk globally. They state that operational risk is being accommodated in the risk management framework for the first time in New Basel Capital Accord, promoting itself to the three main risks along with credit risk and market risk that banks may take. In the present study, the data of Chinese commercial bank operational risk is analyzed by Monte Carlo simulation empirically. Research shows that China commercial bank needs to allocate 15 billon capital for its operational risk, capital reserve fund rate being about 4.79%.

Millar (2012) has suggested a few leads that could guide the reviews of BIS on operational risk capital approaches. The author hopes that the review does not solely focus on refining weightings and enhancing transparency of operational risk capital requirements. The author identifies the following focal points for the BIS Review:

1. Link between operational risk and the operational risk capital that is allotted on the basis of trade volumes (BIA & TSA), historical risk occurrences (AMA).
2. The scope and the definition of operational risk as it fails to include critical causal factors of the 2007 financial crisis – poor liquidity, poor governance, poor risk management, and unreasonable remuneration that encouraged uncalculated risk taking.
3. New risks like strategic, regulatory and reputational risks should be included in a bank's risk profile and risk capital calculation.

The author concludes that the link between operational risk capital requirement and its quantification should be broken, and instead a simple risk rating based multiplier should be used in its place. He hopes that the BIS review takes the discipline of operational risk management by a decade or two.

IV. OR MODELLING AND ADVANCED MEASUREMENT APPROACH

Operational risk garnered ideas from insurance mathematics in the development of its methodology (Cruz (2002), Panjer (2006) or Peters and Terauds (2006)). Therefore one of the first studies on operational risk management was done by Embrechts et al. (1997) who modeled extreme events for insurance and finance. Embrechts later carried out further research in the area of operational risk (Embrechts et al. (2003), Embrechts et al. (2005) and Embrechts et al. (2006)) and his work went on to become classic in the literature of operational risk. Cruz et al. (1998), Coleman and Cruz (1999) and King (2001) also carried out other early studies on operational risk management. Over a period of time, other researchers such as van den Brink (2002), Hiwatshi and Ashida (2002), de Fontnouvelle et al. (2003), Moscadelli (2004), de Fontnouvelle et al. (2005), Neslehova (2006) or Dutta and Perry (2007) investigated operational loss data over the years. Modeling of operational risk helps the risk managers to estimate and anticipate operational risk better thereby supporting a more efficient risk management. There are various quantitative and methodological tools and techniques developed to fit frequency and severity models including the earlier mentioned EVT (Cruz (2002), Embrechts et al. (2005) , Chernobai et al. (2007)), Bayesian inference (Schevchenko and Wuthrich (2006) , Cruz (2002)), dynamic Bayesian networks (Ramamurthy et al., 2005) and expectation maximisation algorithms (Bee, 2006). When modeling operational risk, other methods that refine the data pertaining to operational risk events are used. The first one is the statistical methods used by Chernobai and Ratchev (2006) that exclude outliers from a given data sample. On the contrary, a stress-testing method adds data to a data sample and is popularly used by financial institutions (Arai, 2006; Rosengren, 2006; Rippel and Teply, 2008). Later, van Leyveld et al.(2006), Chernobai et al. (2007), Jobst (2007c) or Rippel, Teply (2008) summarise an up-to-date development of operational risk management from both views of academics and practitioners.

McNeil and Frey(2000) extensively studied operational risk and combined the Extreme Value Theory with Time Series Model and integrated the Autoregressive Conditional Heteroscedasticity Model with the Extreme Value Distribution (EVD), and then the

retrospective test was used to calibrate veracity. After matching the data with the Time Series Model and capturing the fat-tailed situation by the EVD, the findings showed that the estimated VaR appears better than that simply done by the extreme value in operational risk assessment.

Medova and Kyriacou (2001) use several assumptions to analyse the general event and the rare event of the extreme value to arrive at a proper definition of operational risk and employ the EVT to calculate the capital adequacy ratio.

Peccia (2003) reinforces that modelling operational risk is gaining a lot of significance of late because the environment in which banks function has undergone a sea change. Rao and Dev (2006) state that the AMA not only deals with calculation of regulatory capital but also with managing operational risk.

Haubenstock and Hardin (2003) identified few additional steps that comprise the development of scenarios for stress testing, incorporating scorecards and risk indicators, to compute the capital charge using LDA

Moscadelli (2004) conducted a study on modeling of operational risk using loss data collected by the Basel Committee. The study calculated operational risk capital using loss distribution approach and compared the sensitivity of the results with those obtained from extreme value theory. The results showed that the extreme value model, in its Peaks over Threshold (POT) representation, well explained the behaviour of the operational risk data in the tail area. The study highlighted various aspects of operational risk modeling such as "distribution fitting for frequency and severity, identification of best-fit distributions using graphical data analysis tools and goodness of fit tests, modeling tail events using Generalized Pareto Distribution (GPD), identification of EVT threshold using mean excess plot (MEP)". The contributions of the expected losses to the capital values were appraised and the relationships between the capital charges and the corresponding level of Gross Incomes were established in the study.

Chapelle et al. (2004) state that while the AMA could utilise any good model, Loss Distributions Approach is the most popular AMA methodology. Operational risk models comprise of a variety of statistical and econometric models built to measure the regulatory and economic capital to be held for operational risk, and also models designed to examine its causes and consequences

Neil et al. (2005) used the Bayesian networks for modeling statistical loss distributions in operational risk scenarios. The study concluded that Bayesian Networks can efficiently pool qualitative and quantitative data from experts and historical loss databases, in a structured way and as such can fairly help in meeting the requirements of the draft Basel II Capital Accord for an AMA. A differing view expressed by Fujii (2005) demonstrates how the "scenario based advanced management approach (AMA) provides solutions to some of the problems of LDA".

In another study, Fontnouvelle et al. (2006) opine that quantification and management of operational risk has been restricted by the lack of both internal and external data on operational losses. The authors use data collected from public sources of information, and use the operational loss data to model operational risk among internationally active banks. The results of the study indicate that the amount of capital held for operational risk usually is greater than the amount of capital allotted for market risk and that the large banks can decide to allocate huge amounts to capital for operational risk depending on the size and scope of the activities and operations of the bank. The authors also opine that operational risk is presently garnering media attention as financial scandals have recurred regularly and most of the events have exceeded one billion dollars.

Peter et al (2006) worked on operational risk modeling using Bayesian approach. The Loss Distribution Approach was enriched by the usage of Bayesian technique in their study. Bayesian approach is relevant when subjective assessments are used in addition to internal loss data in a loss distribution setting. The authors recommend Bayesian approach to operational risk modeling as a worthy alternative for banks and financial institutions, as it offers a "mathematically rigorous paradigm" to pool expert opinion and observed data.

Kalyvas L, I. Akkizidis, I. Zourka, and V. Bouchereau (2006) observe that the AMA measurement system must take into account "internal data, external data, scenario analysis, and internal controls and business environment factors".

Cowell, Verrall, and Yoon (2007) examined the application of Bayesian networks as an emerging tool for a variety of risk management applications, particularly to the modeling of operational risk in a context when changes in the supervision of financial institutions have led to increased scrutiny on risk management of banks and insurance companies, thereby giving the industry a push to measure and manage operational risk. The focus of the study was

Bayesian networks, one of the non-linear methods, the usage of which is attributed to data limitations and complex interaction between operational risk variables. The authors construct a Bayesian network that models several risk factors and their combination into an overall loss distribution. The authors demonstrated how an established Bayesian network methodology can be applied to " (1) form posterior marginal distributions of variables based on evidence, (2) simulate scenarios, (3) update the parameters of the model using data, and (4) quantify in real-time how well the model predictions compare to actual data". The authors also suggest a specific example of application of Bayesian networks to operational risk in an insurance scenario.

Dutta and Perry (2007) conducted an elaborate study on modeling operational risk using loss distribution approach. They examined and compared several approaches that can be adopted to measure operational risk using financial institutions' internal loss data collected by the Basel Committee under the 2004 Loss Data Collection Exercise (LDCE). They used data collected from seven institutions that reported an adequate number of losses (at least one thousand total loss events). The study had undertaken a comprehensive evaluation of commonly used methods for modeling operational risk and also introduced new techniques to measure this risk. It also elaborates on the techniques used to identify best-fit distributions using different exploratory data analysis techniques and goodness-of-fit tests. Several heavy tailed distributions were used to model severity distributions. The study used a set of statistical distributions inclusive of Lognormal, Weibull, Generalized Pareto and g-and-h distribution. It described the steps to compute capital from internal loss data and also aggregated capital for the bank. One of the striking features of the study was the detailed analysis of modeling of tail events, including threshold selection for extreme value theory approach. It used Peak over Threshold (POT) technique to model tail part of the distribution. A logical and scientific approach to model both the body and tail of the distributions together was also dealt with in the study.

Jobst (2007) investigated the economic and regulatory implications of modeling operational risk in accordance with the standards in regulatory capital defined by the new Basel II Accord. The study adopted "Generalized Pareto Distribution, Generalized Extreme Value Distribution, g-and-h Distribution" to model operational risk. The findings indicated that the AMA-compliant risk estimates of operational risk under both Extreme Value Theory and g-and-h distribution produced reliable estimates of unexpected loss.

A study by Yashchin (2007) indicates that "a bank's operational losses may be traced to errors in transactions, frauds, human errors, lawsuits, or power outages". The relevant information about the magnitude and the frequency of losses is obtained through a number of sources such as printed, computerized, or internet based publications related to insurance and finance. The data consists of losses that are obtained in the search. The study assumes that the probability of a loss increases with the magnitude of the loss. The approach parallelly models the losses and also the "process of populating the database". The approach uses the data on operational risk losses based on an organisation's internal control structure.

Whalen (2008) demonstrated that public data benchmarks can be used to make a fair estimate of risk sensitive economic capital of financial institutions instead of excessive reliance on complex quantitative models that failed to anticipate the extreme risk events as was evident in the 2007 sub-prime crisis. The author argues that the quantitative models rely excessively on less expensive market data as primary inputs forcing the managers and the regulators to overlook the problems in the business model of a financial institution. Using market data rather than balance sheet data as an input to pricing risk often leads to a faulty estimate according to the author. The author opined that the sub-prime crisis was a complete failure of the contemporary risk management practices, internal systems and controls of the financial institutions.

Though many methods and approaches have been suggested to manage operational risk in the past, Damian Williams (2008) warns against firms predominating "silo approach" to risk management, since it lacks knowledge and transparency in an organisation leading to greater operational risk and losses. Operational risk management approaches worldwide have been extensively relying on different financial models. The models developed over the years failed to forecast and prepare the firms to face the eventuality. It was further observed that frequency and severity of losses recorded by AMA compliant banks using well-developed models were more as against non AMA banks. This could be attributed to the larger size of the AMA banks or the failure of these banks in picking up early warning alerts from these models and taking timely action.

Embrechts, Furrer, and Kaufmann (2009) suggest that Basel II requires an explicit treatment of operational risk among banks. Severe tail loss events have to be considered by banks in their management of operational risk. They argue that while the regulatory capital can be arrived through a risk measure called the Value at risk, operational loss data usually has irregularities which complicate the mathematical modeling. They demonsrate that traditional modeling approaches, including extreme value theory, have their limitations as the structure of operational loss data is not consistent with the modeling assumptions.

Jacobs (2010) through his study reiterates that developing a comprehensible approach to model validation is one of the main challenges in economic capital modelling among financial institutions. Advancements in regulatory standards in the form of Basel II, swift financial innovations and the recent financial crises have added further complications. The author surveys several practices in validating economic capital models, including both quantitative and qualitative approaches, and discusses regulatory expectations and concerns regarding the above process. The author also illustrates several of these approaches like benchmarking testing for predictive accuracy and , sensitivity analysis with the help of data from major banking institutions' loss experience (from regulatory reports), and estimates and compares alternative established frameworks for risk aggregation. Results of the study indicate and suggest that practitioners might look at implementing a simple non-parametric methodology in order to quantify integrated risk, as it was found to be more conservative and more stable than the other models, through a non- parametric bootstrap experiment.

Feng, Li, Gao, and Hua (2012), in their study suggest a combination model for estimation of operational risk. The authors argue that in the widely used loss distribution approach of operational risk estimation, the form of frequency distribution does not significantly impact risk analysis, while the selection of model in terms of severity usually has a huge impact on operational risk measures and that generally, different heavy-tailed distributions, which have their own characteristics, are used to quantify operational risk. To minimize the uncertainty of the operational risk model and to integrate characteristics of different heavy-tailed distributions, the authors propose a combination model to estimate operational risk in this paper. The model is built in three stages. At the outset, operational risk is estimated by using different heavy-tailed distributions in the loss distribution approach framework. Second, the weights are arrived at, according to certain criteria, while the present study uses p-values of the Kolmogorov–Smirnov goodness-of-fit test to decide the weight of each operational risk.

Lastly, the results of the previous two phases are added in an integrated estimation to obtain the final result. The authors use a linear combination model to assess operational risk capital of Chinese banks and then match the results obtained using the combination model with those obtained from the basic indicator approach. Empirical analysis by the authors showed that the combination approach allows capital to be allocated more efficiently than the standard approach.

Figini et al. (2010) argue that as per the proposals of the Basel Committee, banks are permitted to apply statistical approaches for the allocation and computation of their capital charges for credit risk, market risk, and operational risk. The authors opine that internal loss data alone does not contribute to accurate capital charges in risk management, more so, for high-severity and low-frequency events. The writers also point out that banks generally use external loss data to supplement the evidence present for more accurate risk estimates. The authors state that rigorous statistical techniques and approaches are necessary to bring comparisons between internal and external data and also to ensure that combining both the databases gives unbiased estimates.

McCormack et al (2013) construct a risk quantification model to get an estimation and mitigation of potential extreme losses through usage of capital charges to assess operational risk. The authors also compare the variations of operational risk capital charges under different approaches namely the Basic Indicator Approach, the Standardized Approach, and the Advanced Measurement Approach using a case bank. Findings of the study indicate that it is better to adopt the Advanced Measurement Approach for estimation of capital charge for operational risk, as it is the lowest under AMA. As a result, its available capital increases which can be used to allocate more funds to operations and decrease the capital costs.

McCormack et al (2014) further focus on the efficient management of operational risk with "the application of scenario analysis, loss data, business environment internal control factors and modelling approaches to obtain a better insight into the firm's forward-looking risk profile, and, through scenario analysis, the risks that pose the biggest threat to a firm's ability in meeting its business objectives". The study highlights the issues that need attention when migrating from the standardised approach to the more sophisticated advanced measurement approach.

Shi, Young, and Cao (2015) develop and propose a practical framework to quantify model risk, based on extensive research and industry practice experiences. The framework addresses the challenges faced in the quantification of financial model risk and aggregate model risk. This study assumes significance in the context of financial institutions across geographies significantly depending on various kinds of models for their regular business activities like hedging, business planning, trading accounts, budgeting, performance reporting, stress testing, risk management etc. , Hence a bad design or implementation of models can make financial institutions and the financial system vulnerable to considerable financial risk.

V. Operational Risk Measurement

Dube and Yatin (2004) in their study opined that operational risk and its quantification have become increasingly important topics for financial institutions and banks during the past few years since The Basel Committee on Banking Supervision released a consultative document that included a regulatory capital charge for operational risk. However, the complexity of the concept of "operational risk" has led to recurring discussions. In this study, the authors propose an approach to quantify operational risk using the Loss Distribution Approach (LDA), which is a more rigorous and potentially more accurate approach, for which, more institutions will be striving in the coming future. The study demonstrated a basic quantitative interpretation of LDA, providing a generalized approach, focusing on numerical measurement of operational risk.

Chapelle et al. (2004) review the rules of Basel II regarding the treatment of operational risk, and focus on four aspects of operational risk management, namely, Incident Reporting, Dashboards, KPIs, KRIs and RCSA.

Dutta and Perry (2006) noted in their study that operational risk is being accepted as a pivotal risk component for financial institutions as demonstrated by the huge sums of capital that are allotted to allay this risk. They acknowledge that risk measurement is of great concern in the spheres of capital allocation, hedging, and new product development for risk mitigation. The authors carried out a comprehensive evaluation of popularly adopted methods and introduced new techniques of operational risk measurement with respect to several criteria. The results of the study indicated that the newly introduced techniques were superior and consistently performed better than the other models tested by the authors.

J. Davies, Finlay, McLenaghen, and Wilson (2006) noted that among other operational risk management and measurement tools such as loss data, risk-and-control self-assessments, performance measurement and capital allocation, key risk indicators (KRIs) are one of the important items on an organisation's to-do lists, along with scenario analysis. The authors opine that there are emerging best practices for KRI programmes and that investment in KRI programmes will confer many benefits, such as the ability to convey risk appetite, optimise return and risk, and improve the possibility of achieving primary business objectives through efficient operational risk management. The authors, in their work, discuss the basic elements in "identifying, specifying, selecting and implementing indicators", along with how to track and report them, in combination with other valuable operational risk management information, to create powerful management reporting. They also examine the potential for advanced applications of KRIs, the potential for composite indicators along with KRI benchmarking.

Gao, Li, Chen, and Xu (2006) carried out a study on operational risk assessment using the public reported operational loss data of Chinese commercial banks from 1997 to 2005. The authors simulated the operational loss distribution and found that the loss frequency can be viewed as Poisson distribution and that the logarithm of loss was a normal distribution. Aggregated loss distributions and operational Value-at-Risks (OpVaR) were calculated by Monte Carlo Simulation by the authors in accordance with the confidence level required by Basel II.

Iyer (2006) states that "KRI is not a measure of risk, it is an indicator of riskiness". Dev Ashish (2007) acknowledges the growing popularity of Risk & Control Self-Assessment (RCSA) as an operational risk management tool. He notes that RCSA is now being used as a means of assessing the effectiveness of the risk management framework of a bank from an operational risk perspective. Kumar Vijay T. (2008) note that, RCSA is a process by which operational risks and the effectiveness of controls are evaluated to ensure that all business objectives would be accomplished.

Wood (2008) promotes the use of RCSA and KRI approaches as they are more objective and, offer the necessary focus for corrective action, resulting in genuine control of operational risks rather than just measuring it, and hence are more effective tools.

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(Rippel and Teply (2011)) conducted a study on operational risk measurement techniques and on economic capital estimation methods. They analysed data from a Central European bank using different approaches. Multiple statistical concepts such as the Loss Distribution Approach and the Extreme Value Theory, including scenario analysis method, were considered. Plausible loss events were defined in a particular scenario and were combined with the original data sample and the impact on capital charge estimates as well as on the financial institution was assessed. The authors assessed the most relevant statistical method to measure and model operational loss data distribution and the effect of hypothetical plausible events on the financial institution. The g&h distribution was valued to be the most suitable one for operational risk modeling. The authors concluded that the method relying on the merging of scenario analysis and historical loss events modeling offered reasonable capital estimates and allowed the measurement of the impact of even extreme events on banking operations.

Šoško (2013) pens a detailed review of the precise problems that banks face when defining and implementing models for computation of capital requirements for operational risk. Measurement and formal regulation of this risk is very different from others prevalent in banks, as it mainly deals with events whose probability of occurrence is small, but the damage they can cause, has enormous magnitude. Efficient management of operational risk mainly relies on both qualitative and quantitative aspects of risk assessment, resistance of these measures, taking into account the events of low frequency and high intensity and sensitivity of the regulatory capital requirements on operational risk, as well as reporting standards. The aim is to point out the fact that although the set of statistical tools and related literature for operational risk modeling are plenty, during their implementation banks are facing numerous problems. Based on results obtained from secondary research, applying description, comparison, classification, analysis and synthesis methods, there are many problems that banks face when trying to comply with the prescribed qualitative and quantitative requirements for modeling operational risk.

VI. Operational Risk Management Practices

Elliott, Letza, McGuinness, and Smallman (2000) carried out a study wherein they argued that operational risk is a culmination of organisations and the context in which they operate, but

predominantly of governance and regulations. They questioned the efficacy of current standards of governance in this context. The authors reviewed the development of the London Stock Exchange's Combined Code for Corporate Governance, through Turnbull committees' reports, identifying a shift in importance from a shareholder to a stakeholder perspective, and again backwards. The authors also demonstrated how the implementation of Turnbull might influence risk management in organisations, from both public as well as private sectors. The study is concluded with the thought that "the Turnbull Report might mark a turning point, but that this is only a first step. The full effect of the Combined Code will only be felt if the recommendations of the Turnbull Committee are implemented effectively".

Blacker (2000) carried out a study that extended the risk mitigation phase of an established risk management model by using well-established decision-making theories. The author proposed a model on mitigation of operational risks in British retail banks. The results of a case study were discussed to enable an elaborate and a detailed framework for risk mitigation. The study presented an illustrative example of an operational risk problem of pensions mis-selling, and its mitigation.

Tripe (2000) studied the approaches used in the pricing of operational risk and the differences between operational risk pricing and pricing of other risks in banking in New Zealand. Non – interest expense is used to determine operational risk capital requirements. Cost to assets ratio and Cost to income ratio are used for computing operational risk capital requirement and thereby the operational risk exposures of the banks. The study also lists the practical difficulties encountered in calculation of operational risk pricing.

Bauser and Lyser (2002) analyze risk management strategies of a bank funded with deposits and equity in a one period model. The bank's need for risk management stems from deposits that could further lead to liquidation costs. A hedging strategy to maximize the value of equity is derived. The authors "identify conditions under which well-known results such as complete hedging, maximal speculation or irrelevance of the hedging decision are obtained. The initial debt ratio, the size of the liquidation costs, regulatory restrictions, the volatility of the risky asset and the spread between the riskless interest rate and the deposit rate are shown to be the important parameters that drive the bank's hedging decision". The authors further extend the proposed basic model to include counterparty risk constraints on the forward contract. (Bauer & Ryser, 2004)

Ebnother, Vanini, McNeil, and Antolinez (2003) undertook a study that contributes to debates on operational risk management from a practitioner's point of view by considering a number of issues of operational risk from a case study perspective. The case study was defined for a bank's production unit and factors in self-assessment as well as historical data. The results of the study indicate that if operational risk is modelled using well-defined and specific objects, all ambiguity associated is dispelled even though a different methodology and statistical techniques are used. A significant input from a practitioner's perspective in the study is that not all processes of a financial institution need to be equally considered for the purpose of precisely defining operational risk exposure. The authors recommend that operational risk management can focus on pivotal issues – choosing relevant processes considerably decreases the costs of defining and designing the workflow items. To meet this objective, the authors construct the Risk Selection Curve (RiSC), which singles out the related workflows required to estimate the risk figures. The findings of the study highlight that the relevance and significance of the risk factors is dependent non-linearly on the confidence level used in measuring risk and that while for quality management all factors definitely matter, fraud and system failure have a non-reliable impact on risk figures. Finally, the authors propose a methodology that is able to link risk measurement to the needs of risk management.

Consiglio and Zenois (2003), Holmes (2003) and Giraud (2005) attribute well known loss events to the lack of operational risk management. They contend that management of operational risk drives better behaviour amongst firms.

Bolton and Berkey (2005) maintain that the Basel Committee's paper on Sound Practices for management of operational risk provides a remarkable outline for formulating an operational risk management framework that offers tangible benefits that withstand the challenges of operational risk modeling. The Basel II has defined the use of internal data, external data, scenario analysis, and Business Environment and Internal Control Factors (BEICFs) as elements of estimation of operational risk under AMA of which Scenario Analysis and Business Environment and Internal Control Factors are the qualitative methods that can meet AMA compliance.

Cindy B Levi et al. (2006) have analysed 350 events involving large risk at financial institutions of Europe and North America and found that the decrease in market capitalisation was roughly

equal to the amount of financial loss in the short term. After a lapse of 120 days, the decrease was almost approximately 12 times the reported financial loss. Severe losses were noticed in cases involving misappropriations, frauds in loans, unethical sales practices, trust violations and non-compliance of regulatory standards. The authors opine that traditional methods need to be challenged for managing operational risk as it is far less predictable as loss events of the past do not give great insights into the future losses. They suggest that banks should simultaneously focus on their business practices, risks embedded in their operations, organizational structures that ensure reliability, consistency and universal adherence. They also emphasize the need to interact with external stakeholders and tailor the risk mitigation process incorporating their risk perceptions. The authors recommend three focal points for a tight grip on business practices – new risks, evaluation of routine business practices and supporting culture around the practices. They also suggest that banks need to develop and deploy a methodology that aims at reducing costs as well as operational risk, with a trade off when necessary. A leading bank was found to merge its lean - Six Sigma methodology with measures to reduce operational risk.

Helbok and Wagner (2006) carried out a study motivated by the growing importance of operational risk management and adequate reporting for enhancing market discipline. They investigate operational risk disclosure practices in banks from the period 1998 to 2001. The results indicated that though operational risk reporting was not a compulsion at that point in time, disclosure increased in content and extent. In agreement with arguments emanating from the theory on corporate finance, empirical evidence indicated that "banks with a lower equity/assets ratio and/or profitability ratio gave greater importance to disclosing their assessment and management of operational risks, whereas those with higher ratios chose a lower disclosure stance".

Supatgiat, Kenyon, and Heusler (2006) conducted a study that emphasized operational risk quantification owing its importance to the new Basel II regulations. The authors opined that "the present methods relying on observation of losses and their magnitudes to quantify operational risk do not retain the cause-to-effect relationship that shows how operational risk can be reduced, managed, and controlled". They introduced a cause- to-effect operational-risk modeling methodology that enables operational risk to be reduced, managed, and controlled. The methodology involved the development of a decomposition algorithm to reduce the complexity of large-scale models. The methodology is demonstrated with an illustration, which

the authors maintain, is inspired by the settlement process of an inter-bank financial clearing house.

The need for operational risk management is extensively acknowledged by institutions worldwide. The major areas of concern in operational risk management include operational risk definition, its measurement and formalisation in theory culture. There is a strong belief that efficient operational risk management framework strengthens the internal controls of the organization. Internal audit plays a vital role in the complete process of managing operational risk within organisations (Laviada, 2007).

Jim Ryan and David Shu (2007) analyse the global survey on operational risk management practices and perceive maturity in foundational activities, such as loss event collection and risk control self-assessments (RCSA), but observe a state of immaturity for scenario analysis, key risk indicators and capital modelling, indicating widening popularity of RCSA as an Operational Risk management technique.

While the series of recent incidents of catastrophic business failures and Basel II requirements of capital charge for operational risk have increased awareness about the operational risk, it has raised a concern on its measurement as well as its management. The study analysed the reasons for an objective and effective management of operational risk and a note of the existing methods for measuring and modelling it. Through a survey to gauge the preparedness of Indian banks in managing such risk, the authors find that the Indian banking sector is still in its preparatory stage and is short of implementing a sound operational risk management system as it is wanting in transfer of risk and its quantification (Rao and Ghosh (2008)).

Breden (2008) explores the status quo of operational risk management practice in financial institutions. The author describes the characteristic features that distinguish operational risk from other kinds of risk, the key elements in the contemporary forward-looking, proactive, operational risk management framework**.** The author elaborates on the foundations of an effective risk monitoring system, the techniques for monitoring the operational risk environment, monitoring control effectiveness and reporting structures.

Brown, Goetzmann, Liang, and Schwarz (2008) through their study examined the value of mandatory disclosure through the SEC requirement which made major hedge funds to register

as investment advisors and file Form ADV disclosures. The authors found that leverage and ownership structures suggested that lenders and equity investors were aware of operational risk and that operational risk does not mediate flow-performance relationships. The findings also point that the investors either lack this information or consider it as irrelevant. The findings also suggest that regulators should be answerable for the endogenous production of information and the marginal benefit of disclosure to different stakeholders.

The BIS had undertaken an operational loss data collection exercise in 2008 from banks across the World. Information about all the four components of AMA and the banks' operational risk management practices was also collected. 121 banks of 17 countries that were grouped into Australia, Europe, Japan, North America and Brazil/India regions took part in the survey. The key findings of the study based on internal loss data were

- Among the business lines, Retail Banking reported highest loss frequency and total loss amount followed by Retail Brokerage.
- Among the event types, the highest frequency of losses were reported in Execution, Delivery, and Process Management, followed by External Fraud. The event type that had highest annual loss amount was Clients, Products, and Business Practices. Few losses were stated for Business Disruption and System Failures and Damage to Physical Assets.
- Recoveries of 2.1% of losses were reported from Insurance for small amount of losses.

The external loss database comprises of operational losses faced by other banks. It helps a bank to analyse the applicability of a particular loss to their context and circumstances. It was revealed that most of the banks used the external loss data for calculation of operational risk capital. The major findings based on External Loss data were

- External loss data was used as input to scenario analysis by 86% of AMA banks; as a tool for managing risk by 71%, and to a smaller extent as an input into the AMA model by 29% of AMA banks. 26% of the banks used it as an input for BEICFs tools. It was also observed that none of the AMA-compliant banks relied exclusively on external data for AMA calculation.
- About 45% of AMA banks used external loss data primarily to estimate severity of tail Events i.e. low frequency/ high severity.

- External data is used by 22% of AMA banks to estimate parameters of frequency distribution.
- One of the serious concerns before the banks is scaling of external loss data. The results indicate that only 21% of AMA-compliant banks are able to scale external data, with the rest using unscaled external loss data in their AMA models. Revenue or assets are normally used as the scaling factors.

The key findings pertaining to scenario data were

- 65 of the 121 banks surveyed responded with a total of 9,687 scenarios.
- Among the business lines, Retail Banking had 28% of scenarios
- Among the event types, in Execution, Delivery, and Process Management had the highest proportion of scenarios at 29% followed by Clients, Products, and Business Practices at 20%.
- From the information gathered, the expected annual frequency of operational losses surpassing €88 million for the typical bank was 1-in-100 years and that of losses exceeding €194 million was 1-in-1000 years.

Few of the findings of the study with reference to Business Environment and Internal Control Factors were

- The most common BEICFs tools used by banks for risk management are RCSAs (by 95% of the banks), audit results (by 88%) and KRIs/KPIs (by around 81%).
- One of the challenges for banks implementing AMA is quantification of the effect of BEICF on capital calculation. Most AMA banks (69%) used BEICFs as an indirect input to risk quantification. 7% of banks used it as a direct input into the model and another 7% used it as an ex-post adjustment to AMA capital.
- RCSAs are updated by 43% of AMA banks on an annual basis, by 26% AMA banks on a quarterly to semi-annual basis and by 24% banks semi-annually to annually.
- KRIs and KPIs are updated typically on a monthly to quarterly basis by 52% of AMA banks.
- Audit scores or findings are reviewed most of the times when triggered.

Few significant findings pertaining to operational risk capital calculation are:

- The operational risk capital estimates of AMA banks were lower than those of non-AMA banks.
- AMA banks have a higher frequency and severity of losses than non- AMA banks, even after the data are scaled by exposure indicators.
- The typical AMA bank's ratio of operational risk capital relative to its gross income is lower than the 15% alpha used in the Basic Indicator Approach and the specified range of betas (12%-18%) used in The Standardized Approach.
- Expected losses account for nearly 11% of operational risk capital at the typical participating AMA bank.

Bodla and Verma (2008) carried out a study on the implementation of the risk management framework by commercial banks in India , through a primary survey, following the guidelines issued by RBI on operational risk management on October 15, 2005. The results showed that the risk management and the operational risk management framework of banks in India are on the right path, irrespective of sector and size of bank and that they are based on the RBI's guidelines issued in this regard. The findings of the study indicated that many banks have established risk management committees for management of various risks, and particularly to manage operational risk, many banks have developed an operational risk management framework as specified by the Basel Accords. The study also reinstated that the 'board of directors' and 'operational risk management committees' are accountable for the management of operational risk in banks, and that the banks in India are adopting the Basic Indicator Approach (BIA) for operational risk capital charge calculation.

Hain (2009) through his study gave an overview of the important rewards in managing and reporting operational risk for internal as well as external risk transparency. The author showed that methods from insurance companies and outside stakeholders are analysed and taken as inspiration for handling firms' internal obstacles. The author focused on risk management, possible incentive schemes and organisational architecture to strengthen internal reporting. Non-monetary and monetary motivational elements and sanctions, and the level of monitoring associated with the place of origin of risk are discussed. It was demonstrated by the study that these elements have to be balanced for the incentive mechanism to work.

Chen and Liu (2010) carried out a study that analysed the trends in progress of operational risk and proposed the operational risk management framework for commercial banks based on McKinsey 7S Model in Internet World to enhance the effectiveness of operation risk management with Strategy as a core, Structure and Systems as foundation, Staff, Skills, Style and Shared Values as driving force.

Mehra (2011) studied the range of operational risk management practices of Indian Banks in necessary for achievement of Advanced Measurement Approach and compares them with AMA compliant banks globally. The study also investigates the influence of size and ownership of banks on the operational risk management practices. The study indicates increased awareness and importance given to operational risk and its management by Indian banks. "The study concludes that the practices adopted by small and average sized public sector and old private sector banks were noted to be behind those of new private sector banks in usage of BEICFs (RCSA, KRIs), usage of scenarios, updating of these indicators and collection and usage of external loss data".

Chernobai, Jorion, and Yu (2012) have studied the operational losses of U.S. Financial Institutions from 1980 to 2005 and traced that operational losses mostly originated from failure of internal controls. A high correlation between operational and credit risks was observed among the banks studied. The study also found that the CEOs of banks that reported large losses had more stock options and bonuses compared to their salaries. The study emphasises the contribution of corporate governance and appropriate incentives in operational risk mitigation.

Young (2012) carried out a study that provides insight into the application of key risk indicators as an operational risk management tool by banks in South Africa and indicates their level of preparedness to comply with the criteria. The results of a survey that involved junior and middle management indicated that banks, in general, are not appropriately primed to implement a key risk indicator management process. The author concluded that there is a general lack of understanding of the underlying theory and the concept of key risk indicators and that the advantages of using key risk indicators are not fully exploited."

B. Davies (2013) reviewed the reporting processes that go into the communication of financial performance, balance sheet and the risk profile of the bank. The study identifies

that a far larger extent of integration is required among different reports to facilitate the board to fulfil its responsibilities towards the shareholders and the regulators. The study suggests that reporting to the board must integrate reporting on business strategy, financial and regulatory objectives. This ensures that the risk appetite of the bank is conserved while ensuring the liquidity and the availability of capital to tide over unfavourable circumstances. The author recommends an integrated reporting process that needs to incorporate – business plan; capital & liquidity adequacy; financial & budget projections. The study concluded that a much greater extent of coherence and integration between different reports is called for to help the board in execution of its strategic responsibilities to shareholders and governance responsibilities to regulators and shareholders. The study also looked at a number of risk issues that pose challenges to bank boards with implications both for board composition and for the structure and remit of board committees. The author opines that there is ample scope to recognise incentive structures throughout the bank as a major risk driver, and can be addressed by replacing board remuneration committees that look at senior executive pay structures, with board incentives committees that look through the whole organisation and its agencies, supported by evidential reporting structures, to determine whether the incentives in remuneration structures do indeed incentivise the right behaviours.

Prokop and Pfeifer (2013) study the existing state of affairs of operational risk management in German insurance companies with regard to strategies formulated, processes implemented and instruments adopted. The study also offers insights into incumbent risk managers' perspectives on present and future regulation of the risk management process adopted. The findings contribute to the current discussions on the national implementation and interpretation of the European Solvency II directive by emphasizing on the similarities and differences in dealing with operational risk within the German insurance sector. The findings are bound to be useful to risk managers when evaluating the adequacy of their own company's risk management strategies, instruments and processes.

McCormack, Sheen, and Umande (2014) study focuses on operational risk measurement and scenario analysis for better risk management and justifies the application of models for better risk management and business decision making and not for reporting. The study emphasizes the need for simple and transparent models, the objectives of a good

Operational Risk Management Framework and the need for a continuous development of operational risk management.

VII. Risk and Financial Performance

Robert S. Dunnett (2005) carried out a study on the consequences of operational risk apart from the actual loss. The author noted that when crises occur, banks must deal with not only the original event but also its impact on shareholders. They stated that banks generally calculate their operational risk cover by assessing the probability that a particular event might occur and the resulting financial loss. The author argues that decrease in market value in response to an operational crisis is usually far greater than the actual financial loss caused by the event. The study analysed operational crises at European and North American institutions where actual financial loss was greater than $1 million (the sample's average actual loss being $65 million). In the short run, the decline in shareholder value was almost equal to the financial loss, on an average. After a period of 120 working days, however, the drop in market value rocketed to 12 times the actual financial loss, pulling down almost 2 percent, on an average, of a bank's total returns to shareholders.

Cummins etal.(2006) conducted an event study analysis on the impact of operational loss events on the market values of banks and insurance companies. The findings suggested a strong and statistically significant negative stock price reaction to the announcements pertaining to operational losses. It has been observed through the study that the magnitude of market value loss is far greater than the operational loss reported demonstrating the huge adverse impact of such losses on the stock performance. The response of the market values were larger for insurance companies than banks.

Kosmidou etal.(2006) studied the performances of many UK small and large banks. The banks were chosen on the basis of several parameters like asset quality, liquidity, capital adequacy and profitability. Among the three pillars of Basel II, the first pillar of minimum capital requirement prescribes to set minimum capital standards which elaborate on both qualitative and quantitative risk management requirements. While, the second pillar associated with supervision focuses on the control of environment and sufficiency of mechanisms, the third is concerned with the financial institutions' disclosure related to the

management of risk procedures. The authors opine that operational risk management for the banking industry is not only to comply and abide by the laws and regulations, but also to reflect the rising trend in the banking sector's need for operational risk management. The nature of operational risk is markedly different from that of other risks. While credit and market risks are associated with specific business activities, operational risk management is required to connect different business areas. The authors state that operational risk may be divided into different kinds of operational risk losses based on their causes: "1. internal fraud, 2. external fraud, 3. hiring practices and workplace safety, 4. customers, products, and business behaviour, 5. personnel and asset losses, 6. operating interruption and system shut down, and 7. execution, delivery, and operation process management".

Wei (2006) and Cummins J D, Lewis C M and Wei R (2006) observed that decline in market value due to announcement of operational loss events were of a much greater magnitude than the operational losses that caused them.

Chapelle, Crama, Hübner, and Peters (2008) study the implications of the Advanced Measurement Approach (AMA) for the assessment of operational risk. The authors develop a procedure that answers the major issues encountered by banks in the implementation of the AMA, through a case study using "a matrix of two selected business lines and two event types of a large financial institution". For each cell, the authors use two truncated distributions functions, one for "normal" losses and the other for the "extreme" losses. They also propose a method to include external data in the framework. The authors also estimate the impact of operational risk management on firm profitability, through an adapted measure of risk-adjusted return on capital (RAROC). The results indicate that significant savings can be gained by adopting active management techniques.

Moosa and Silvapulle (2012), in their study, performed an analysis on 54 operational loss events experienced by eight Australian banks during the period 1990–2007. Event studies conducted showed that the stock price and market value of the announcing bank are adversely affected by the declaration of operational losses. Empirical analysis also showed that there is no systematic relation between operational losses and bank characteristics such as size and leverage. The results also demonstrated that while the frequency of an event of a certain type is independent from the underlying business line, there is an association between the loss amount and the business line. The findings also suggested that a drop in

market value vis-à-vis the loss amount is independent of the type of the underlying loss event.

Yang (2012) carried out a study that characterized the production process of commercial banks as three components- activities associated with service , investment and risk management. The performance of these three components was assessed in terms of their service efficiency, investment efficiency, and risk management efficiency. The author studied data from 36 Taiwanese commercial banks and demonstrated how all the efficiency indices can be estimated. The major empirical findings of the study were that the correlation coefficients between each pair of efficiency indices were positive, indicating that an effort in one activity for efficiency improvement could also lead to improved performance in other activities. The author concluded that the non-performing loan ratio can negatively influence efficiency.

Ongore and Kusa (2013) conducted studies on moderating effect of ownership structure on bank performance through linear multiple regression model. Generalized Least Square on panel data was used for estimation of the parameters. The findings revealed that "bank specific factors significantly affect the performance of commercial banks in Kenya, except for liquidity variable". However, the effect of macroeconomic variables was inconclusive at 5% significance level. Moreover, the moderating role of ownership identity on the performance of commercial banks was also found to be insignificant. The authors concluded that the financial performance of commercial banks in Kenya are mainly governed by the board and management decisions, and that the macroeconomic factors do not have a significant contribution to the financial performance. ″

Ozdemir and Cubukgil (2014) in their work examine diverse and alternative strategies and dynamics of the relative relationship between the Regulatory capital (RC) and Economic Capital (EC) as Financial Institutions strive to maximise return on equity (ROE). The study shows that EC stays relevant even in scenarios where RC requirements are higher. Under these circumstances FIs are motivated to 'dial up' economic risk by expanding businesses that require more EC than RC or by divesting businesses needing more RC than EC in order to increase ROE. It is explicitly demonstrated that dialling up economic risk increases return on EC, increasing ROE. As these opportunities are arbitraged away over time, EC

and RC requirements will tend to converge. These strategies, while enhancing ROE, come at an additional economic cost. The authors suggest that "while improving ROE in the short run, low return on EC business may need to be acquired or high return on EC business may need to be divested. The higher the RC relative to EC on aggregate, the higher the potential economic cost. Both the FIs and regulators should prefer EC being the binding constraint on aggregate".

Shang et al (2014) designed a set of corporate governance assessment indices for investigating into the intermediary role of corporate governance in the relationship between firm performance and risk of listed companies of Taiwan based on data from 2008 to 2012. Their results demonstrate that "corporate governance has a suppressed mediating effect on the relationship between firm performance and risk both during and after the financial crisis. Moreover, especially during a financial crisis, corporate governance has a negative moderating effect on the relationship between firm performance and risk. Hence, it acts as a risk buffer to protect companies". The empirical results also point that listed companies with higher levels of corporate governance report high firm performance and low firm risk in Taiwan. The authors recommend that decision makers consider both value creation and risk control perspectives while formulating corporate governance strategies.

Çekrezi, Shanini, Saadaoui, and Mekkaoui (2015) investigate into the factors influencing the commercial banks' performance in Albenia. A sample of 16 commercial banks operating in Albenia was studied. The study included cross sectional time series data from 2010 – 2013 and these banks had both foreign as well as domestic capital. The author uses the Return on Assets (ROA) to measure the performance of banks and studies the internal factors – Size of the bank, Capital Adequacy, Liquidity and Bank Age and their influence on bank performance.

Huey-Yeh Lin & Hsiao-Yi Chang (2015) investigated if financial holdings management improved the operational performance of Taiwanese banks. A total of 30 Taiwanese were studied by dividing them into "financial holding subsidiary banks" and "independent banks without financial holdings" according to their operational method. The study also investigated if the impact of risk management factors on the operational performance of

banks differed between the two categories. The empirical results demonstrated that the banks were able to enhance their operational performance by managing risks. The results further indicated that the risk management factors influenced their operational performance and the influence varied between the two operational methods. Many operational performance indicators demonstrated that financial holding subsidiary banks performed better than independent banks.

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Theoretical Framework

The extensive review of literature has underpinned the growing incidence of operational risk and the importance of operational risk management among banks in India. Operational risk management encapsulates a wide array of methods and approaches that aim at reducing average losses and avoiding major losses. The causal definition of operational risk given by the Basel Committee forms the basis for the identification and quantification of operational risk among banks in terms of people risk, process risk, system risk and external events risk. On these lines items comprising each category of risk under operational risk were identified from earlier literature. The items recognised under people risk were - Incompetence, Negligence, Human error, Low morale, Lack of Training, Employee Fraud, Strikes, Adaptability, Platform, Variance etc (Jacobus Young, 2001). The items under process risk are Errors in procedures. Errors in execution, Documentation errors, Product complexity, security risks etc. Technology risk was evaluated through items - Hacking, System failures, Fraud, Programming Errors, Telecommunication failure, System obsolescence (Crouhy, 2000). External events risk items were External Criminal activities, domestic political uncertainty, Regulatory compliance, Legal actions, Business

Environment changes, Strikes, Bank reputation, money laundering (Jacobus Young, 2001).The operational risk was them computed as a sum of all the items captured. The study probed into the impact of each one of the causal factors on operational risk to see if each factor had a significant impact on operational risk.

Based on the conceptual relation between risk and firm performance, the study seeks to estimate the impact of operational risk on bank profitability through an adapted measure of Risk Adjusted Return on Capital (RAROC). Further, this relationship is expected to be mediated by operational risk capital. The role of operational risk capital in the relationship between operational risk and profitability was examined through mediation analysis by extending Millar's (2012) study on operational risk capital of banks. The items contributing to the operational risk were summed up and the impact of operational risk on profitability of banks was studied. According to Baron & Kenny (1986), "a given variable may be said to function as a mediator to the extent that it accounts for the relation between the predictor and the criterion". In addition, the independent variable is said to influence the dependent variable indirectly through mediating variable (Figure below).

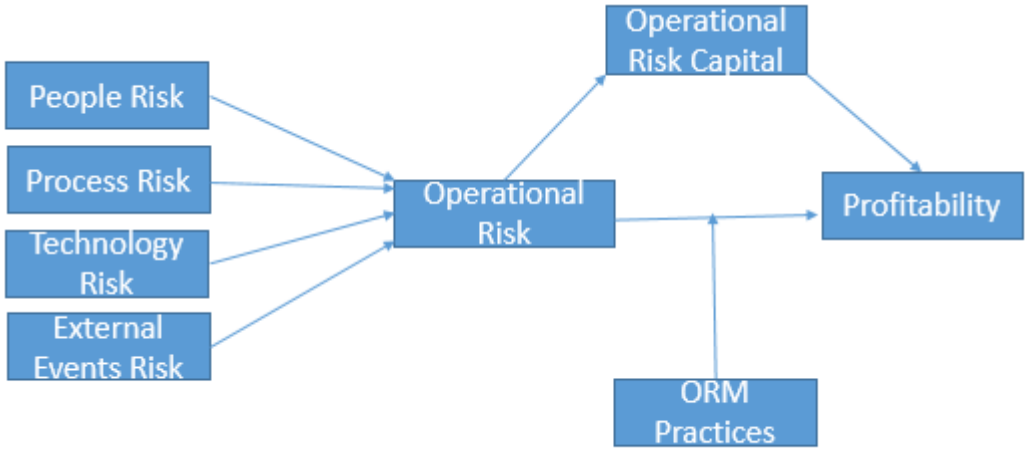

Figure: Conceptual Framework

Subsequently, the potential intermediary role of operational risk management in the relationship between operational risk and firm profitability was examined through moderation analysis. The study investigates the influence of operational risk management practices as a moderator on the relationship between operational risk and bank profitability.

This is a modest attempt made by the researcher drawing from a similar study by Chang et al (2015) that examined the role of corporate governance on the relationship between risk and

profitability of firms and a study by Agnes Koomos(2011) in which Operational risk management practices was used as a moderating variable between critical success factors and competitive advantage of banks in Ghana.

An assessment of operational risk management practices were undertaken, and a set of operational risk management assessment measures were developed based on empirical evidence. Operational risk management principles, governance, risk management environment and role of disclosure were assessed to arrive at a summated score for operational risk management practices. As per Baron & Kenny (1986) moderator is "a qualitative (e.g., sex, race, class) or quantitative (e.g., level of reward) variable that affects the direction and/or strength of the relation between an independent or predictor variables and a dependent or criterion variable. A moderator can be any demographic or categorical or any metric variable which influences the relationship between two variables". An operational risk index was constructed based on a similar study on credit risk by Arora & Kumar (2014).

The nature of variables used in the study are described in table 22. Table 23 summarizes the variables.

Table 22: Description of nature of variables of the study

Variable	Description	Variable Type
Operational Risk	Risk of loss from people, process, technology, external events	Independent variable
Operational Risk Management Practices	Practices aimed at maintaining a sound operational risk management framework in the bank	Moderating Variable
Operational Risk Capital	Capital required to meet unexpected operational losses	Mediating Variable
Risk Adjusted Return on Capital for operational Risk	Performance measure that expresses return of an investment adjusted for its risk	Dependent Variable

Table 23: Variables of the study

Construct	Components	Variable	Earlier Studies
Operational Risk	People Risk Factors	Incompetence, Negligence, Human error, Low morale, Lack of Training, Employee Fraud, Strikes, Adaptability, Platform, Variance	Katz(1995), Kingsley (1998), Donahoe(1999), Crouhy et al (2000) Jacobus Young (2001), study by RMAHQ
	Process Risk Factors	Errors in procedures. Errors in execution, Documentation errors, Product complexity, security risks	Davies(1998), Crouhy et al (1998, 2000), Jacobus Young (2001), study by RMAHQ
	Technology Risk Factors	Hacking, System failures, Fraud, Programming Errors, Telecommunication failure, System obsolescence	Crouhy et al (2000), Wilson (2000), Jacobus Young (2001), study by RMAHQ
	External Events Risk Factors	External Criminal activities, domestic political uncertainty, Regulatory compliance, Legal actions, Business Environment changes, Strikes, Bank reputation, money laundering	Rachlin (1998), PwC(1999), Jacobus Young (2001), study by RMAHQ,
Operational Risk Management Practices	Operational Risk Management Principles	Risk culture, Risk management standards, ethics, operational risk training and effectiveness, understanding risk, operational risk definition and operational risk in strategy formulation	Usha Janaki Raman(2008), Basel guidelines (2011), Agnes Koomos(2011)
	Governance	operational risk policies, post audit policies, best practices policy, organisation structure, operational risk appetite, resources for operational risk management	Basel guidelines(2011)
	Operational Risk Management Environment	Risk Identification & Assessment; Monitoring & Reporting; Risk Control & Mitigation; Business Resiliency & Continuity	Usha Janakiraman (2008), Basel guidelines(2011)

	Operational Risk Disclosure	OR disclosure policy, OR disclosure assessment, and disclosure	Basel guidelines(2011)
Operational Risk Capital	Operational Risk Capital	Operational Risk Capital	Millar (2012)
Profitability	RAROCO	12 % of net ROE	Chapelle (2008)

Research Gap

The extensive review of literature undertaken has highlighted the gap that could be summarised as follows.

- It is found that a majority of the studies focused on risk management practices in banks belong to foreign countries. Furthermore, those concentrating on Indian banking provide conceptual framework. Very few bank-specific studies were conducted in India.
- Though Basel II Norms were implemented worldwide, it could not avert significant operational losses. The reason for this could be the gap between Basel Standards and its implementation. There are very few studies which foray into this aspect.
- Most of the studies on Operational Risk Management focus on measurement on Operational Risk while ignoring the other elements of Operational Risk Management.
- Most of the studies discuss the Advanced Measurement Approach and estimating losses using VaR and OpVar, where in practice in India, most of the banks are still on the path of migration to The Standardized Approach.
- Very few studies measure the impact of operational risk on profitability of Indian banks
- Very few studies look into the mediating effect of operational risk capital on the relation between bank's operational risk and profitability.
- Very few studies look into the moderating effect of operational risk management practices on the relationship between bank's operational risk and profitability.

The above identified research gap has paved way for the following research questions that could be answered through the study.

Research Questions

- What are the critical factors influencing operational risk?
- Are the operational risk management practices same across public and private sector banks?
- How do different banks fare on their operational risk practices?
- How do operational risk, operational risk capital and operational risk management practices affect profitability of banks?
- Are both public and private sector banks sufficiently sharing information of operational losses with its stakeholders?
- What are the trends observed in operational risk capital charge across banks?

The present chapter summarises the literature on several aspects of operational risk that has been reviewed, the theoretical framework of the study, the gap in the research on operational risk and its management and the research questions that were formulated on the basis of research gap.

CHAPTER V

RESEARCH METHODOLOGY

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The current chapter discusses the methodology adopted in the study. It covers the research objectives, research hypotheses, research design, target population, sampling technique, sample size, data collection methods and procedures, justification for sample size, profile of the respondents, survey instrument, and methods of data analysis. Sampling design section includes sampling method, sampling technique, sample size and justification for the sample size and techniques. The questionnaire section discusses the scales used in the study to measure the factors influencing operational risk, the operational risk management practices adopted by the banks as well as other related constructs of the study. Data collection procedure section discusses the steps followed to collect the data. Finally, data analysis section presents statistical tools and techniques used in the study and justification for the same.

Based on the review of literature presented in the previous chapter, the research gap identified and the ensuing research questions on operational risk and its management among banks in India, the following research objectives were formulated.

Research Objectives

1. To examine the critical factors influencing operational risk among public and private sector banks and develop a suitable model
2. To examine if there is difference between operational risk management practices across public and private sector banks
3. To examine if operational risk capital affects profitability of public and private sector banks
4. To examine if operational risk affects profitability of banks
5. To examine the impact of operational risk management practices on profitability of banks.
6. To arrive at an Operational Risk Index based on the operational risk management practices of banks
7. To examine difference between operational risk disclosure practices followed by banks
8. To identify the trends in operational risk capital across public and private sector banks

Research Hypotheses

Based on the research objectives, the following research hypotheses were formulated. The hypotheses were formulated based on three dimensions- 1. The determinants of operational risk; 2. Operational Risk Management Practices and 3. The impact of operational risk on bank profitability.

- H1: There is significant contribution of firm specific factors to operational risk
    - H1a: There is significant contribution of people related factors to operational risk
    - H1b : There is significant contribution of process related factors to operational risk
    - H1c: There is significant contribution of technology related factors to operational risk

- H2: : There is significant contribution of external factors to operational risk
    - H2a : There is significant contribution of external event related factors to operational risk

- H3 : There is significant difference between public and private sector banks in terms of Operational Risk Management Practices
    - H3a : There is significant difference between public and private sector banks in terms of Operational Risk Management Principles
    - H3b : There is significant difference between public and private sector banks in terms of Governance
    - H3c : There is significant difference between public and private sector banks in terms of Operational Risk Management Environment
        - H3c1: There is significant difference between public and private sector banks in terms of Risk Identification & Assessment
        - H3c2: There is significant difference between public and private sector banks in terms of Monitoring & Reporting
        - H3c3: There is significant difference between public and private sector banks in terms of Risk Control & Mitigation

        - H3c4: There is significant difference between public and private sector banks in terms of Business Resiliency & Continuity
    - H3d: There is significant difference between public and private sector banks in terms of Role of Operational Risk Disclosure to its stakeholders
- H4:There is significant difference between public and private sector banks in terms of ORM Index scores
- H5: There is significant relationship between operational risk and profitability of banks
- H6: Operational Risk Capital mediates the relationship between operational risk and profitability of banks
- H7:Operational risk management practices moderate the relationship between operational risk and profitability of banks

Research Design

The approach adopted in the study is descriptive and empirical. The study is based on the premise that lines of business offer the first line of defence, independent risk management function constitutes the second line of defence and the internal audit provides the third line of defence in the operational risk framework(Trudell, 2014). Hence the study is a comprehensive one involving respondents from each line of defence i.e. the branch managers from the lines of business(first line), the risk managers from the risk management function(second line) and the internal auditors from the third line of defence.

The study explores the key drivers of operational risk among public and private sector banks in India by developing a measurement scale based on the causal definition given by the Basel Committee on Banking Supervision in its Basel II Accord. The study also examines the operational risk management practices adopted by various public and private sector banks through a scale developed based on the eleven principles of sound practices of operational risk management proposed in the Basel II Accord.

The study also investigates the relationship between the operational risk of a bank and its profitability. Further, the study explores the mediating role of operational risk capital and the moderating role of operational risk management practices on the relationship between operational risk and bank profitability. Thus the study is both descriptive and explorative in

nature. Both qualitative and quantitative data was collected for the study as it enables a better understanding of the research problem. Combining the two forms of data can confer many advantages. The qualitative data can be utilised to judge the validity of quantitative findings. Quantitative data can help develop qualitative sample or interpret findings from the qualitative data(Fetters, Curry, & Creswell, 2013). The purpose of exploratory research design is to discover the different aspects of the study (Kothari, 2009). The study explores the mediating and moderating interactions of operational risk capital and management practices on the relationship between a bank's operational risk and its profitability. Additionally, the study describes the state of operational risk. operational risk capital, the risk management practices and the profitability of the select banks in the Indian context making the study a descriptive study(Kothari, 2009).

A total of sixteen hypotheses comprising of seven main hypotheses and twelve sub hypotheses were proposed for the study. The study on causes of operational risk comprised of four latent constructs namely people factors, process factors, technological factor and external event factors. The study on operational risk management practices comprised of four latent constructs namely risk management principles, governance, risk management environment and disclosures. Risk management environment further has four sub constructs namely Identification and assessment, monitoring and reporting, control and mitigation, and business resiliency and continuity. Primary data in the form of responses for the above constructs were collected through a structured questionnaire.

Population of the Study

The population of the study consists of the public and private sector banks in India. For the study the private sector banks have been categorised into Private **Indian** and **Private Foreign** banks. As per the RBI, the number of private Indian banks is 25 and the number of private foreign banks is 43, while the number of public sector banks is 27.

Target Population

The target population of the study comprises of 12 public, 6 Private Indian sector banks and 5 Private Foreign sector banks headquartered in Mumbai, Bengaluru and Hyderabad. Among the public sector banks, all the banks headquartered in Hyderabad and Bengaluru, three in each city, were studied, based on the total assets. Among the seven public sector banks in Mumbai, six were chosen as they featured among the top 10 banks in India based on total assets of the

bank. Among the private sector Indian banks, top 6 were chosen for the study based on total assets of the bank. Among the private foreign banks, 5 top banks were chosen. Table 24 represents the sample of banks chosen for the study.

Table 24: Sector wise sample of banks

City	Public	Private Indian	Private Foreign
Mumbai	6	6	5
Bengaluru	3	---	---
Hyderabad	3	---	---
Sub-Total	**12**	**6**	**5**
Total			**23**

Sampling technique

The study is divided into two levels, one comprising of a study on the branch managers to examine the critical factors leading to operational risk and the other, a study on the operational risk managers to examine the operational risk management practices adopted by the banks. Since the population is finite and the list of banks and the branch information is available, probability method of stratified sampling is adopted for the study.

A probability sample is a sample in which each individual sample element has a known chance or probability of being selected for inclusion in the study i.e an equal chance. Selection or exclusion from the sample is not affected by any factor other than pure chance.

Stratified sampling

The sample is formed by taking proportions from each strata of the population so that it conforms to the pattern in the population. Strata indicates divisions of population. This sampling technique draws simple random samples from each of the several subgroups or strata into which the population is divided. This method reduces sampling error and improves precision without an increase in sample size. At times, the population to be sampled contains mutually exclusive and clearly distinguishable subgroups or strata that differ greatly from one another with respect to some characteristic of interest, while the elements within the stratum are homogenous, as in the present case of study. Under such circumstances, a stratified sample

can be chosen by taking separate random samples from every stratum in the population. Usually, the sizes of the separate samples are proportional to the size of different strata. After stratifying the population, a simple random sample is drawn from each stratum(Burns, 2008).

Reasons for using stratification

1. Distinct subpopulation sampling frames require that subsamples be drawn independently.
2. When one or more subgroups are scheduled for more intensive analysis.
3. Variations in the forms of questions or forced choice answers may be required for some items necessitating separate analysis of those particular items for each subgroup.
4. Stratified sampling adds an extra element to random sampling by ensuring that each group or strata within the population are sampled randomly. It offers enhanced possibility of accuracy by ensuring all subgroups of the population are represented in the sample in the same proportions as they are in population(Burns, 2008).

For the purpose of the study, the population of banks has been divided into three strata – Public Sector Banks, Private Indian Banks and Private Foreign Banks that are headquartered in Mumbai Bengaluru and Hyderabad. From each of these strata, operational risk managers and branch managers were chosen randomly based on their proportion in the total population.

Table 25a: Sample of branch managers in Mumbai

Banks in Mumbai	No. of Branches	Sample
Public Sector Banks		
State Bank of India	284	30
Bank of Baroda	153	16
Bank of India	126	13
Union Bank	160	16
IDBI	97	10
Central Bank	98	10
Total Public Sector	918	95
Private Indian Banks		
ICICI	192	22
Axis	137	14
HDFC	192	20
Yes	68	7
IndusInd	38	4
Kotak Mahindra	26	3
Total Private Indian	653	70

Foreign Private		
Standard Chartered	18	2
HSBC	12	2
Bank of America	1	1
Citi Bank	1	1
JP Morgan Chase	1	1
Total Foreign Private	33	7
Total – Mumbai		172

Table 25b: Sample of branch managers in Hyderabad

Banks in Hyderabad	No. of Branches	Sample
Public Sector Banks		
SBI	176	36
SBH	137	28
Andhra Bank	128	24
Punjab National Bank	31	6
Bank of Baroda	32	6
Total Public Sector		100
Private Indian Banks		
ICICI	52	8
HDFC	74	8
Total Private Indian		16
Total – Hyderabad		116

Table 25c: Sample of branch managers in Bengaluru

Banks in Bengaluru	No. of Branches	Sample
Public Sector Banks		
Vijaya Bank	106	20
Canara Bank	221	44
State Bank of Mysore	155	30
SBI	287	22
Total Banks		116

Sample Size

The study comprises of a sample of 23 banks in India, 404 branch managers and 97 risk managers. The sample was chosen proportionately from the population. According to Hair, Black, Babin, and Anderson (2010) the size of the sample should be determined based on the number of attributes of the study, and suggested that there should be at least five subjects for each attribute.

The study is conducted at two levels, i) Branch Managers and ii) Risk Managers. In the study on branch managers, there are 39 observed variables influencing operational risk among banks. Thus, there should be at least 195 subjects (branch managers) to meet the specified criteria. The sample chosen (404) exceeded the specified criteria. The second level study on the risk managers comprised 44 observed variables. However, as the head offices of each bank had a maximum of 3-4 managers dealing with operational risk, the sample of 97 risk managers was chosen from 23 banks proportionately.

Criteria for Selection of respondents: Banking Personnel in the cadre of branch managers and risk managers were chosen randomly from the database of bank branches and risk managers.

Depending on the number of branches of each bank in the city, the sample was chosen as a particular proportion of the population. Initially the proportion of the sample was chosen as 25% from each of the cities -Mumbai, Bengaluru and Hyderabad. However as it was difficult to obtain expected responses due to the profile of the respondents, the proportion was revised to 10% from Mumbai, and 20% each from Bengaluru and Hyderabad. The following tables 25 and 26 represent the population (number of branches) and the sample (proportion) chosen from each city.

Sample size of Risk Managers

A list of the Risk Managers, Operational Risk Managers, and Auditors from the head-offices of banks was obtained. From each bank, personnel at the level of Chief Managers and Assistant General Managers, who primarily deal with operational risk were contacted and the questionnaires administered.

Table 26: Sample of risk managers selected for the study

Cities	No. of respondents
Mumbai	66
Hyderabad	15
Bengaluru	16
Total	**97**

Profile of the Respondents

The following section presents the characteristics of the respondents of risk managers like gender, years of experience, sector etc. The classification is represented in table 27.

Table 27: Classification of characteristics of risk managers

Variable- Risk Managers	**Category**	**Frequency**	**Percentage**
Gender	Female	8	8.25
	Male	89	91.75
Experience(Years)	0-10	37	38.14
	11-20	43	44.33
	21-30	11	11.34
	>30	6	6.19
Sector type	Public sector	62	63.92
	Private Indian	24	24.74
	Private Foreign	11	11.34

Similarly the profile of the branch managers is represented in table 28.

Table 28: Characteristics of the branch managers

Variable- Branch Managers	**Category**	**Frequency**	**Percentage**
Gender	Female	54	13.36
	Male	350	86.63
Experience(Years)	0-10	105	25.99
	11-20	243	60.15
	21-30	53	13.12
	>30	3	0.74

Sector type	Public sector	307	4.95
	Private Indian	77	19.05
	Private Foreign	20	75.99

Data Collection

The study used both online and offline methods for collecting the data. Responses from branch managers, risk managers and auditors in Hyderabad were collected through offline survey method. Both online and offline survey methods was used to collect responses from Bengaluru and Hyderabad. A pilot study was collected in Hyderabad with a sample size of 100 branch managers and 16 risk managers and auditors. The questionnaire was discussed with experts from the field and their suggestions incorporated before administering the questionnaire. The total valid sample size of the study was 404 branch managers and 97 risk managers of banks headquartered in Mumbai, Bengaluru and Hyderabad.

Survey Instrument

A structured questionnaire was used for the study. The instrument for the branch managers comprised of 39 items and four items were used to measure overall operational risk. These items were used to examine the critical factors that caused operational risk among banks. Four latent constructs – people factors, process factors, technology factors and external events - were used to elicit factors leading to operational risk among banks. These constructs were based on the causal definition of operational risk given by the Basel Committee. All the items were measured on a five point Likert scale.

The latent construct, people factors was measured using seven items ranging from staff incompetence to fraudulent activities by employees. The latent construct, technology factors was measured using eight items spanning from technology failure to hacking over the network. Fourteen items were used to track external events construct, leading to operational risk. The five point Likert scale captured responses ranging from 1- to a negligible extent to 5- a very large extent. The latent construct process factors were captured with the help of items covering model risk, transaction risk etc. The transaction risk was measured on a five point Likert scale that varied from 1-very low to 5-very high.

The survey instrument for the risk managers comprised of two parts. The first part, was the questionnaire used for assessing the critical factors influencing the operational risk. The second part of the questionnaire consisted of 44 items that captured the operational risk management practices followed by banks. These items were based on the eleven principles proposed in Basel II accord. They were segregated into four latent constructs namely – operational risk management principles, governance, operational risk management environment and operational risk disclosure. These items were also measured on a five point Likert scale. The responses on the Likert scale ranged from 1- Strongly Disagree to 5- Strongly Agree. Apart from these 44 items, the questionnaire included a few multiple choice questions querying the types of tools used for assessment of operational risk, the contents of reports etc, The tools used were to be rated on a five point scale based on the frequency of their usage – 1- rarely, 2- occassionally, 3- never, 4- most of the times and 5-all the times. A few open ended questions were also used to elicit information pertaining to the current scenario of operational risk management and the challenges faced in implementation of an effective operational risk management system.

Methods of data analysis

Statistical packages such as MS Excel, Statistical Package for Social Sciences (SPSS 21) and Analysis of Moment Structures (Amos 21) were used for analysing the data. Descriptive statistics, exploratory and confirmatory factor analysis, Analysis of variance, Mediation and Moderation were used for data analysis.

Descriptive statistics

Descriptive statistics were used to examine the respondents' profile in terms of years of experience, designation and departments. The study reported frequency distributions of these items.

Factor Analysis

Exploratory Factor Analysis (EFA)

Factor analysis is a statistical approach that analyses relationships among a huge number of variables and explains the variables in terms of their common underlying dimensions i.e. factors The goal is to "find a way of condensing the information contained in a number of original variables into a smaller set of variates or factors, with minimal loss of

information"(Hair, 2009). Thus, it offers a clear view of the data as well as the possibility of using the output in subsequent analysis ((Field, 2009). Principal component analysis, one of the most commonly used extraction methods has been used for this study, as it attempts to summarize most of the original information in a minimum number of factors for prediction purposes. Other criterion as, Eigen value > 1 as a criteria for determining the number of extracted factor and Promax rotation has been used to extract the factors. The following criteria have been used to determine the factor structure as suggested by Hair & Black(2009) : (i) the loading for each item on a factor is more than or equal to ±0.40; and (b) the items which are having cross loadings were excluded if the difference between the loadings is less than 0.20. The sample comprising of the branch managers was used for Exploratory Factor Analysis to explore the underlying pattern of critical factors influencing operational risk among banks in India.

Confirmatory Factor Analysis (CFA)

CFA was used to examine the relationships between the manifest variables and the latent variables (Byrne, 2001). CFA was used to confirm the underlying pattern of factors influencing operational risk. Also, the CFA was used for validating the conceptual and the structural models which included the latent construct people factors, process factors, technological factors and external events.

A measurement model that identifies the relationship between the latent and the manifest variables was developed using the CFA approach. Following extensive review of literature, a theoretical model was developed, causal path diagram was specified and the number of indicators of the measurement model is discussed in the chapter subsequently. The following goodness of fit criteria was used to evaluate the models. The fit indices can be categorised as absolute (table 29), incremental (table 30) and parsimonious fit measures. (Hair, Black, Babin, Anderson, & Tatham, 2006).

Absolute fit measures

Absolute fit measures determine how well the model fits the sample data for measurement models. The overall fit was determined by following standard criteria

Table 29: Absolute Fit Measures

Parameters	Standard
The ratio of $\chi 2$ to degrees of freedom ($\chi 2$ /df)	2 to 5

Goodness-of-Fit Index (GFI)	> .90
Root Mean Square Error of Approximation (RMSEA)	≤ .08

Incremental fit measures

Incremental fit measures are used to compare the proposed and baseline models. The incremental fit was determined through the following standard criteria

Table 30: Incremental Fit Measures

Parameters	Standard
Adjusted Goodness-of-Fit Index (AGFI)	> .9
Tucker-Lewis Index (TLI)/NonNormed Fit Index (NNFI)	> .9
Normed Fit Index (NFI)	> .9
Comparative Fit Index (CFI)	> .9

Parsimonious fit measures

Parsimonious fit measures are used to analyse the model fit when the data is over fitting with large number of coefficients. In general, Parsimonious Normed Fit Index (PNFI) and Parsimonious Goodness-of-Fit Index (PGFI) are used to assess the fit criteria. The values for both PNFI and PGFI ranges from 0 to 1 and a greater value indicates that parsimonious fit is achieved.

In this study, based on the model fit index the results of measurement models were interpreted. Finally, reliability and validity of a model was tested by comparing with the following standards.

- Construct reliability should be greater than or equal to .7.
- Face or content validity has to be ensured with experts at the time of developing a questionnaire
- Convergent validity has to be ensured with average variance extracted (AVE) ≥ .5, factor loadings ≥ .7 and Construct reliability.
- Nomological validity has to be ensured with significant correlations between the constructs.
- Discriminant validity has to be ensured by checking AVE > squared inter-construct correlations and

- Construct validity has to be ensured with convergent, discriminant and nomological validity(Hair et al., 2006).

Comparing means

Analysis of Variance (ANOVA) was used to compare means of different groups i.e. public, Private Indian and Private Foreign banks as there were more than two groups in the study . The results of analysis of variance were interpreted based on the homogeneity test of equality of variances (Levene's test). These tests were performed for comparing means of risk management principles, governance, risk management environment and disclosures. Tukey post hoc tests were conducted for multiple comparisons when ANOVA results showed that means are significant.

Moderation analysis

Moderation and mediation analyses were performed to study the interaction effects among the variables under study. The study examined the role played by operational risk management practices in moderating the relationship between operational risk and profitability of banks in India. Process macro developed by **Andrew F Hayes** was used test the moderation effect in SPSS.

Mediation analysis

The study also examined the role played by operational risk capital in mediating the relationship between operational risk and profitability among banks. The mediation effect was also examined using the Process macro developed by **Andrew F Hayes** in SPSS.

This chapter presented the methodology of the study. the Research design, population, target population, sample chosen, sampling technique, sample size, justification for the sample, data collection methods, respondents' profile and methods of data analysis. The next chapter presents the results of the study.

CHAPTER VI

RESULTS AND DISCUSSION

CHAPTER VI
RESULTS AND DISCUSSION

The current chapter presents the results of data analysis. The study made use of descriptive statistics, exploratory factor analysis, and confirmatory factor analysis to develop and validate a measurement scale for assessing the critical factors influencing operational risk among banks in India. A comparison of operational risk management practices across sectors is presented using ANOVA. The study also undertakes examining the relationship between operational risk and profitability of banks in the presence of mediating (operational risk capital) and moderating variables (operational risk management practices) and the results are discussed.

Sample Demographics

As the study was conducted at two levels, that of risk managers and the branch managers, their demographic characteristics are described in this section.

Risk manager demographic characteristics

The sample of risk managers consists of about 8% female and about 92% male managers. It consists of about 38% in the experience band of 0 to 10 years, about 44% in the experience category of 11-20 years, about 11% in the experience category of 21-30 years and the remaining about 6% in the category of experience greater than 30 years. Of the chosen sample, about 64%

represent the public sector, about 25% represent the Indian private sector and the remaining 11% represent the foreign private sector. Table 31 presents a summary.

Table 31: Demographic characteristics of risk managers

Risk Managers	Category	Frequency	Percentage
Gender	Female	8	8.25
	Male	89	91.75
Experience(Years)	0-10	37	38.14
	11-20	43	44.33
	21-30	11	11.34
	>30	6	6.19
Sector type	Public sector	62	63.92
	Private Indian	24	24.74
	Private Foreign	11	11.34

The following charts represent the classification of the risk managers on the basis of gender (figure 4), experience (figure 5) and sector (figure 6).

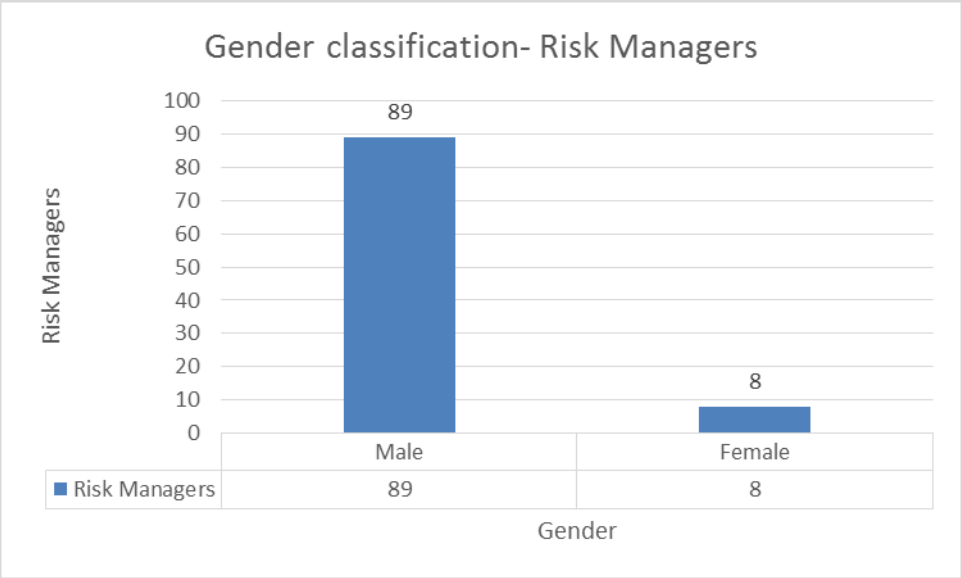

Figure 4: Classification of risk managers on the basis of gender

Figure 5: Classification of risk managers on the basis of years of experience

Figure 6: Classification of risk managers on the basis of sector

Branch manager demographic characteristics

The sample of branch managers consists of about 13% female and about 87% male managers. It consists of about 26% in the experience band of 0 to 10 years, about 60% in the experience category of 11-20 years, about 13% in the experience category of 21-30 years and the remaining about 1% in the category of experience greater than 30 years. Of the chosen sample, about 76% represent public sector, about 19% represent the Indian private sector and the remaining 5% represent the foreign private sector. Table 32 summarises the characteristics of branch managers.

Table 32: Demographic characteristics of branch managers

Branch Managers	Category	Frequency	Percentage
Gender	Female	54	13.36
	Male	350	86.63
Experience(Years)	0-10	105	25.99
	11-20	243	60.15
	21-30	53	13.12
	>30	3	0.74
Sector type	Public sector	307	75.99
	Private Indian	77	19.05
	Private Foreign	20	4.95

The following charts represent the classification of the branch managers on the basis of gender (figure 7), experience (figure 8) and sector (figure 9)

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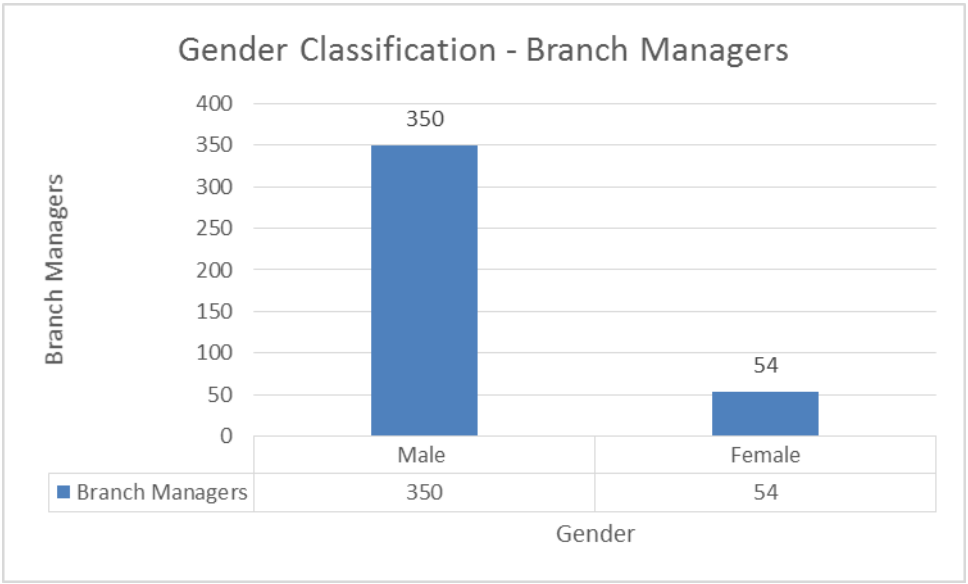

Figure 7: Classification of branch managers on the basis of gender

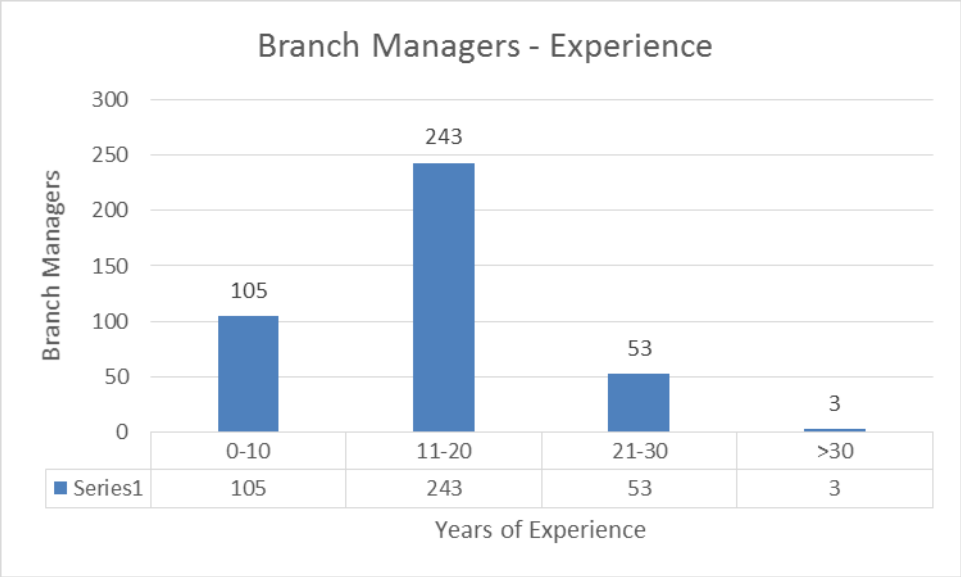

Figure 8: Classification of branch managers on the basis of years of experience

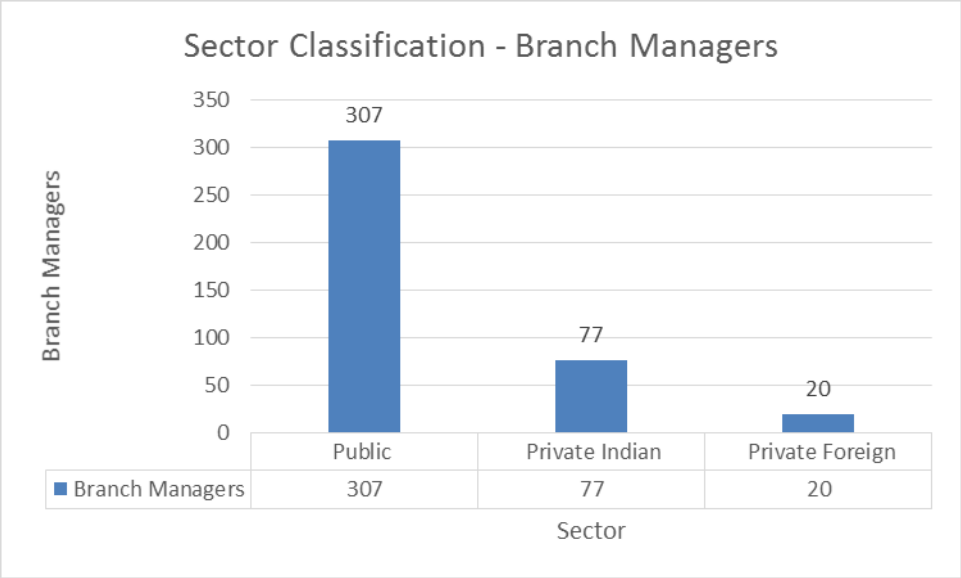

Figure 9: Classification of branch managers on the basis of sector

Characteristics of the data

The data collected for the study was tested for normality and outliers. As the questions require responses on a scale of 1 to 5, the data did not have any outliers. Table 33 presents a summary of descriptive statistics of the constructs – people factors, system factors, process factors and external events.

Construct	Minimum	Maximum	Mean	SD	Skewness	SE	Kurtosis	SE
People Factors	1	5	3.76	0.91	-.807	.12	0.01	.24

System Factors	1	5	3.01	0.92	.064	.12	0.56	.24
Process Factors	1	5	3.02	0.96	.704	.12	0.68	.24
External Events	1	5	3.06	1.06	-0.09	.12	0.17	.24

Table 33: Descriptive Statistics of the constructsf

Negative skewness values indicate that data is "skewed left and positive values for the skewness indicate that data is skewed right. In skewed left, left tail is long relative to the right tail and in skewed right, right tail is long relative to the left tail. In addition, a positive kurtosis indicates a "heavy-tailed" distribution".

The following figure 10 indicates the normal probability curve for the dependent variable operational risk and the independent variables i.e. constructs people factors, system factors, process factors and external events. The descriptive statistics and the normal probability curve support the assumption that the data is approximately normal and permit the parametric tests to be conducted on the sample data.

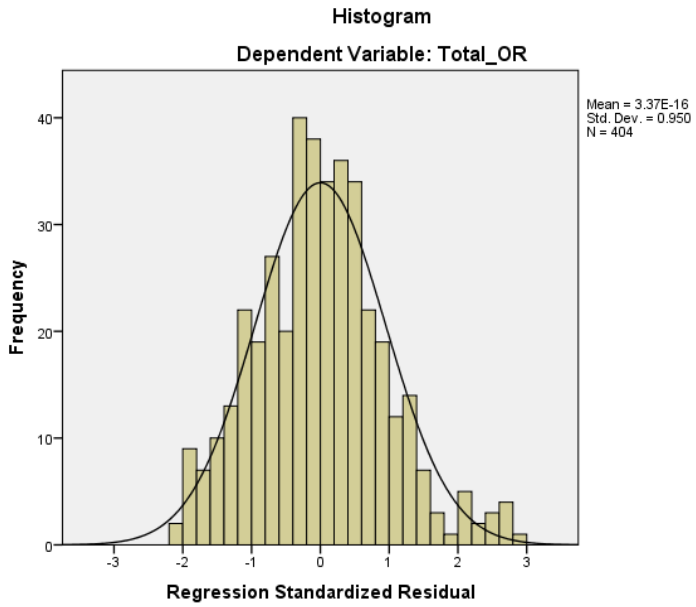

Figure 10: Normal Probability curve

The multivariate statistical techniques such as exploratory factor analysis and confirmatory factor analysis have the basic assumption of linearity of relationships among the constructs of the study. Thus, the study assumed that the relationships are linear(Field, 2009). There were no outliers in the sample. Thus, the study is based on the assumption that the data is normal with linear relationships among the constructs and is free from outliers.

Development of measurement scale

A scale was developed by combining several statements to measure the latent constructs people risk, process risk, technology risk, external event risk and operational risk. The scale was generated after reviewing the literature, the BASEL guidelines on operational risk and a few consultancy reports. 39 items have been identified under the above mentioned constructs.

Pilot Study

A pilot study was undertaken to pre-test the scale. The study involved a sample of 100, involving branch managers, internal auditors and operational risk managers among banks in Hyderabad. They were also asked to review the questionnaire and provide feedback. On the basis of the experts' feedback and the pretesting of the questionnaire, some of the items have been dropped. This also ascertained the face or content validity of the scale. Nine items were removed from the scale – People Incompetence, Counterparty claims, Money Laundering, External environment anticipated changes, Reputation deterioration in the minds of customer, Reputation deterioration in the minds of shareholders, Operational Support, Model assumptions, backup and disaster recovery. .

The reliability of the instrument had to be established since without reliability, research results using the instrument would not be replicable, replicability being fundamental to the scientific method. Reliability is estimated in one of the following ways.

Internal consistency

Reliability is an estimation based on the correlation among the variables comprising the set. A scale's reliability is a measure of the commonness of a set of items that measure a particular construct. It measures the consistency of presentation between test items by computing the coefficient of correlation. The more the test items inter-correlate, the higher is the internal reliability i.e., all the items in the test are measuring the same characteristic.

Cronbach Alpha test was used to assess the internal reliability. Alpha is zero when the true score is not measured at all and there is only an error component. Alpha is one when all items measure only the true score and there is no error component. Cronbach's alpha is the percent of variance the observed scale would explain in the hypothetical true scale. It can be interpreted as the correlation of the observed scale with all possible other scales measuring the same thing

and using the same number of items. An alpha of 0.8 or above is regarded as highly acceptable for assuming homogeneity of items, while 0.7 is the limit of acceptability.

The "Cronbach's Alpha if Item Deleted," is the estimated value of alpha if the given item were removed from the model. Items can be dropped where the alpha if deleted is higher than the overall alpha as another way to improve the alpha level. The item-total correlation is the Pearson correlation of the item with the total of scores on all other items.

Split-half reliability

Estimation of reliability using this method is based on the correlation of two equivalent forms of the scale. It is a measure of reliability obtained from correlating usually the odd-even items on a test. It involves administering two equivalent sets of items measuring the same thing in the "same instrument to the same people. The values obtained in one half are correlated with the values obtained on the other half. Split half reliability in SPSS generates four coefficients - Cronbach's alpha for each form, the Spearman-Brown coefficient, the Guttman split-half coefficient, and the Pearson correlation between the two forms.

Spearman-Brown split-half reliability coefficient is a form of split-halves reliability measure. "It is used to estimate full test reliability based on split-half reliability measures. A value of .80 or high is considered for adequate reliability and .90 or higher for good reliability. The Pearson correlation of split forms estimates the half-test reliability of an instrument or scale. The Spearman-Brown "prophecy formula" predicts the full-test reliability, based on half-test correlations. This coefficient will be higher than the half-test reliability coefficient. In SPSS, two Spearman-Brown split-half reliability coefficients appear in the "Reliability Statistics" portion of the output, (1) "Equal length" gives the estimate of the reliability if both halves had equal numbers of items, and (2) "Unequal length" gives the reliability estimate assuming unequal numbers". Guttman split-half reliability coefficient is an adaptation of the Spearman-Brown coefficient, but one which does not require equal variances between the two split forms. The best split will be that in which each half contains highly inter-correlated items. The study has used both internal consistency and split half reliability to determine the reliability.

Reliability using Internal Consistency

Internal consistency of the developed scale was determined by using reliability test. SPSS 21.0 software package was used for the data analysis. The value of Cronbach's alpha was .95 which demonstrated good internal consistency as against the minimum alpha value of .70 being acceptable for using the scale for further analysis (Hair et al., 2006) The value of Cronbach's alpha has also been examined if an item is deleted to know the impact of the items on overall alpha value (Table 34). The results indicated that the deletion of the items doesn't increase the overall scale alpha value.

Table 34: Cronbach's Alpha for internal consistency

Item-Total Statistics				
	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted"
P1	90.58	776.63	.71	.95
P2	90.86	782.48	.59	.95
P3	90.77	783.99	.55	.95
P4	90.86	779.92	.59	.95
P5	90.87	788.37	.52	.95
P6	90.94	785.77	.55	.95
P7	91.40	787.59	.63	.95
P8	90.91	782.74	.71	.95
P9	90.92	782.53	.63	.95
P10	91.38	768.35	.77	.95
P11	90.72	789.73	.48	.95
P12	91.41	764.12	.77	.95
P13	91.48	763.26	.78	.95
T1	91.53	769.34	.75	.95
T2	91.23	764.01	.80	.95
T3	91.59	764.00	.81	.95
T4	90.96	781.77	.66	.95
EE1	91.38	771.53	.73	.95
EE2	91.19	783.14	.64	.95

EE3	91.29	767.52	.78	.95
EE4	91.34	776.04	.68	.95
EE5	90.74	784.29	.62	.95
EE6	91.32	796.22	.54	.95
EE7	91.44	781.70	.72	.95
EE8	91.45	778.02	.73	.95
EE9	91.43	775.70	.72	.95
EE10	91.26	781.87	.66	.95
EE11	91.05	776.93	.69	.95
EE12	91.36	778.92	.71	.95
EE13	91.25	772.10	.78	.95
EE14	91.37	779.14	.72	.95
PR1	92.32	833.61	-.21	.96
PR2	91.85	841.28	-.35	.96
PR3	92.06	837.00	-.31	.96
PR4	91.56	834.16	-.16	.96
PR5	91.36	778.55	.74	.95
PR6	91.12	774.06	.72	.95
PR7	90.60	795.55	.42	.95
PR8	90.41	812.93	.23	.96

Split-half Reliability

Table 35: Split-half Reliability

Case Processing Summary			
		N	%
Cases	Valid	100	100.0
	Excluded[a]	0	.0
	Total	100	100.0
a. Listwise deletion based on all variables in the procedure.			

Reliability Statistics			
Cronbach's Alpha	Part 1	Value	.949
		N of Items	20[a]
	Part 2	Value	.873
		N of Items	19[b]
	Total N of Items		39

Correlation Between Forms		.912
Spearman-Brown Coefficient	Equal Length	.954
	Unequal Length	.954
Guttman Split-Half Coefficient		.907
a. The items are: P12, P1, P2, P3, P4, P5, P6, T1, T2, T3, EE1, EE2, EE3, EE4, P13, EE8, EE5, T4, EE6, EE7.		
b. The items are: EE7, EEvnts_CounterpartyClaims, P7, EEvnts_MoneyLaundering, P8, EEvnts_AnticipatedChngs, P9, EEvnts_ReputnDeteriorationCust, EEvnts_ReputnDeteriorationSharehldr, P10, EE9, Pro_OperlManualSupport, Pro_ORModelAssumptns, P11, Pro_AbsenceBackUpPln, Pro_AbsenceDisasterRecoveryPln, PR1, PR2, PR3, PR4.		

Cronbach alpha of 0.949 and 0.873, the Spearman Brown coefficient of 0.954 and a Guttman split half coefficient of 0.907 indicate that the scale adopted has a good reliability (table 35).

Hence, based on the reliability of the scale used in the pilot study, the same scale was adopted to carry out the main study.

Validity

Content Validity

The content validity reflects the degree to which the content of the scale reflects the intended content that needs to be investigated. It portrays the representativeness or the sampling adequacy of the content of the measuring scale or instrument and is usually determined on the basis of expert judgement(Burns, 2008). The content validity of the scale was evaluated in the pilot study through interaction with subject experts and professors in risk management, operational risk managers, and branch managers. Subsequently, the items were modified to make statements easier and simpler to respondents thereby establishing content validity.

Construct Validity

"Construct validity involves relating a theoretical concept to a specific measuring scale". It tests if the scale of measurement has captured the concept as it was theorized. "It indicates the qualities that an assessment measures, in other words, the concepts or constructs that account for variability on the assessment". Procedures such as Cronbach reliability coefficients (that establishes that items demonstrate good agreements with one another) and factor analysis (that

shows that one large common factor or one underlying construct is being measured) can be used to infer construct validity.

Exploratory factor analysis was performed for establishing the construct validity of the measurement scale. It brings inter-correlated variables together under more general, underlying variables. Factor analysis aims to "reduce the dimensionality of the original space and to give an interpretation to the new space, spanned by a reduced number of new dimensions which are supported to underlie the old ones". Thus it gives the possibility of gaining a clear view of the data and using the output in further analysis (Field, 2009). Principal component analysis, which is one of the most commonly used extraction methods was used for this study, as it seeks to summarize most of the original information into least number of factors for forecast purposes. The principal component analysis takes into consideration, the total variance and extracts factors that have small amount of unique variance (Hair, 2009).

The most frequently used method for extracting the number of factors is the latent root criterion or the Eigen value. With component analysis, each variable contributes a value of 1 to the total Eigen value. Hence, only the factors that have latent roots or Eigen values of greater than 1 are deemed significant. All factors that have latent roots less than 1 are disregarded as they are considered insignificant. Using the Eigen value for setting a cut-off for factor extraction is most reliable when the number of variables of study is between 20 and 50. Therefore, Eigen value >1 was used as one of the criteria for determining the number of extracted factors. Another method called the Scree test criterion was also used to specify the number of factors to extract. The scree test is obtained by plotting latent roots against the number of factors specified by the order of their extraction. The shape of the curve that is obtained is used to identify the cut-off point. Figure 11 identifies the thirty factors extracted in the study.

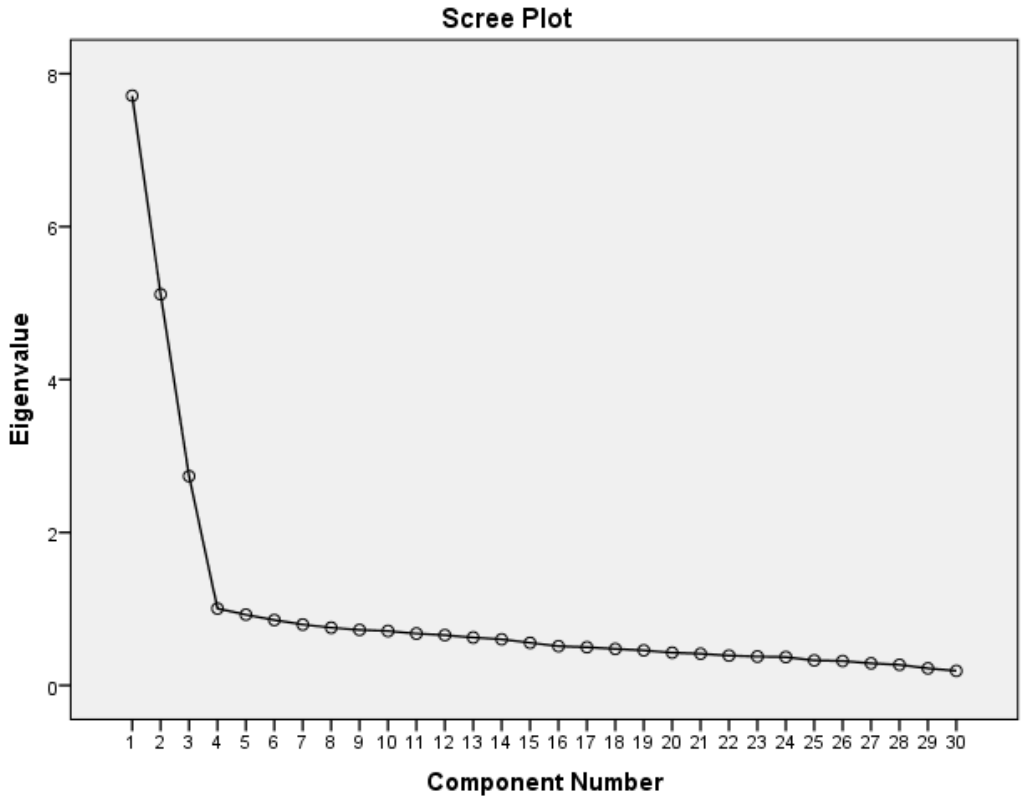

Figure 11: Scree plot

Beginning with the first factor, the plot slopes downward steeply and from there gradually becomes a straight line. The point at which the curve starts to flatten indicates the maximum number of factors to extract. In the present study, four factors would qualify for extraction.
Other criteria that were to determine the factor structure as suggested by Hair et al. (2009) - (a) the loading for each item on a factor should be more than or equal to ±0.40; and (b) the items which are having cross loadings should be excluded if the difference between the loadings is less than 0.20. Nine items that did meet the above mentioned criteria were dropped from further analysis.

Kaiser-Meyer-Olkin (KMO) and Bartlett's test of sphericity

The KMO Measure of Sampling Adequacy is a measure that quantifies the extent of inter-correlations amidst the variables and the appropriateness of factor analysis. KMO value varies from 0 to 1. The value 0 indicates that factor analysis is likely to be inappropriate(Hair, 2009). Kaiser (1974) recommends the value above 0.5 as acceptable. In the present study, KMO measure is 0.918, which can be treated as a good value.

The Bartlett's test of sphericity uses the correlation matrix to determine the appropriateness of factor analysis It provides statistical significance that the correlation matrix has significant correlations at least among some of the variables(Hair, 2009). Bartlett's measure tests the null hypothesis that the original correlation matrix is an identity matrix, thus there are as many factors as the items, and hence for doing the factor analysis, the test should be significant. (Hair, Anderson, Tatham, & Black, 1998). Bartlett's test for the present study is highly significant (p = .000), indicating that factor analysis is appropriate.

The results for KMO and Bartlett's test has been exhibited in Table 36.

Table 36: KMO and Bartlett's test

KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.918
Bartlett's Test of Sphericity	Approx. Chi-Square	5720.682
	df	435
	Sig.	.000

Factor Rotation: PROMAX rotation of oblique rotation was used to extract the factors. It is more realistic as the "theoretically important underlying dimensions are not assumed to be uncorrelated with each other". The Principal Component Analysis with Promax rotation resulted in four constructs, the same as the number of constructs that were taken initially at the time of scale development, thus establishing the construct validity. Total cumulative variance explained by these four factors was 57.23 per cent. Thus after the exploratory factor analysis, the final scale comprised of 30 items which were grouped under four constructs.

Among the output of factor loading which shows the correlation between the item and the factor - the values .40 or greater are considered. For each variable, highest loading for that variable on any factor was noted. The factor loadings are presented in table 37.

Table 37: Factor loadings **(**Pattern Matrix[a])

	Component			
	PeopleFactors	ExtlEventFactors	ProcessFactors	TechnologyFactors
P1	.770			
P2	.758			
P3	.735			
P4	.774			
P5	.730			

P6	.721			
P7	.819			
P8	.772			
P9	.761			
P10	.810			
P11	.597			
P12	.579			
P13	.838			
EE1		.545		
EE2		.632		
EE3		.563		
EE4		.650		
EE5		.684		
EE6		.797		
EE7		.617		
EE8		.689		
EE9		.477		
PR1			.790	
PR2			.692	
PR3			.891	
PR4			.886	
T1				.464
T2				.458
T3				.641
T4				.780
Extraction Method: Principal Component Analysis. Rotation Method: Promax with Kaiser Normalization.[a] a. Rotation converged in 5 iterations				

Communality values represent the amount of variance shared by any item with all other items. The following table 38 depicts the communalities of the items.

Table 38: Communalities of Items

Communalities		
	Initial	Extraction
P1	1.000	.597
P2	1.000	.585
P3	1.000	.551
P4	1.000	.598
P5	1.000	.601
P6	1.000	.538

T1	1.000	.522
T2	1.000	.461
T3	1.000	.562
EE1	1.000	.657
EE2	1.000	.411
EE3	1.000	.434
EE4	1.000	.458
P13	1.000	.696
EE5	1.000	.401
T4	1.000	.579
EE6	1.000	.496
EE7	1.000	.421
P7	1.000	.665
P8	1.000	.588
P9	1.000	.568
P10	1.000	.666
EE8	1.000	.457
EE9	1.000	.414
P11	1.000	.407
PR1	1.000	.648
PR2	1.000	.598
PR3	1.000	.802
PR4	1.000	.794
P12	1.000	.395
Extraction Method: Principal Component Analysis.		

The total variance explained table (table 34) depicts that the first four factors explain 55.23% of the total variance with factor 1 accounting for 25.7%, factor 2 accounting for 17.05%, factor 3 accounting for 9.12% and factor 4 explaining 3.35% of variance respectively.

Table 39: Total variance explained table

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	7.712	25.707	25.707	7.712	25.707	25.707
2	5.115	17.049	42.756	5.115	17.049	42.756
3	2.736	9.120	51.876	2.736	9.120	51.876
4	1.005	3.352	55.228	1.005	3.352	55.228
5	.925	3.083	58.310			
6	.855	2.849	61.160			
7	.796	2.654	63.813			
8	.755	2.516	66.329			

9	.725	2.418	68.747			
10	.711	2.370	71.117			
11	.678	2.260	73.377			
12	.657	2.191	75.568			
13	.627	2.089	77.656			
14	.602	2.008	79.664			
15	.557	1.857	81.522			
16	.512	1.707	83.229			
17	.499	1.663	84.892			
18	.477	1.591	86.483			
19	.458	1.527	88.010			
20	.427	1.425	89.435			
21	.414	1.379	90.814			
22	.390	1.301	92.114			
23	.377	1.257	93.371			
24	.371	1.237	94.608			
25	.327	1.091	95.700			
26	.319	1.064	96.764			
27	.289	.964	97.728			
28	.269	.898	98.625			
29	.223	.742	99.367			
30	.190	.633	100.000			

Reliability & Validity of the scale

The factor wise internal consistency of the four constructs in the study ranged from 0.738 to 0.861 and were good as they were greater than the acceptable criterion of 0.7. The construct wise Cronbach alphas are presented in Table 35. The construct reliability of these constructs ranges from 0.729 to 0.944 (Table 40).

Factor	Cronbach Alpha	CR	AVE
People	0.755	0.944	0.519
Technology	0.755	0.729	0.508
Process	0.738	0.803	0.581

External Events	0.861	0.847	0.536

Table 40: Construct wise reliability and internal consistency

Confirmatory Factor Analysis

The following model in Figure 12 was developed through confirmatory factor analysis. The model depicts the determinants of operational risk among banks with the main causal factors of risk.

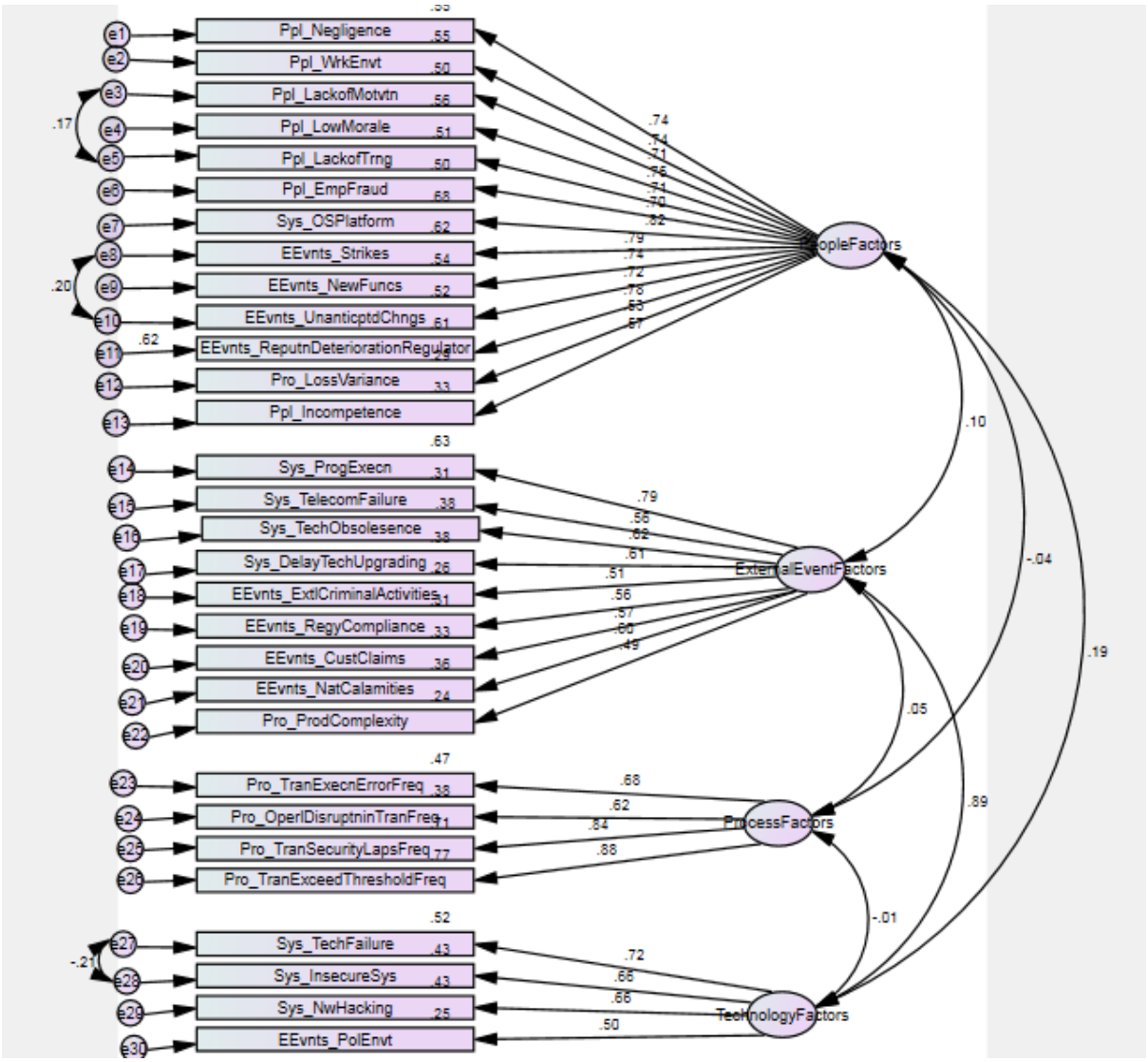

Figure 12: Measurement model of operational risk and its determinants

The results of the confirmatory factor analysis are discussed below in Table 41. The model fit indices indicate the overall fit and that the measurement model is reliable.

Table 41. Model fit summary

	Model's values	Standard
CMIN/DF	2.070	<5
P	.000	Significant
GFI	.88	>0.9
CFI	.92	>0.8
RMR	.07	<.09
RMSEA	.052	0.05 to 1- Moderate

GFI-Goodness of fit, RMSEA-Root mean square error of approximation; CFI - Comparative Fit Index.

Convergent validity

The estimates of the standardized loading were more than 0.6 for most of the scale items and Average Variance Extracted (AVE) was greater than 0.5 and the Composite Reliability is greater than 0.7, thus ensuring convergent validity. Thus the scale developed for the study has content, convergent and construct validity.

The following section tests the hypotheses related to the factors contributing significantly to operational risk.

Research Hypotheses

To test the hypothesis empirically, the responses that were falling under the four latent constructs were mapped to the operational risk scores to evaluate whether each of the four factors – people factors, process factors, technology factors and external events - were contributing significantly to operational risk.

H1: There is significant contribution of firm specific factors to operational risk

The above hypothesis is further broken down into 3 sub-hypotheses.

- **H1a: There is significant contribution of people related factors to operational risk**

The first sub-hypotheses tries to examine if people related factors affect operational risk significantly. Thirteen items that measured the latent construct people risk factors were taken into consideration to measure the impact of people risk on operational risk (shown in Figure 13). The items that measured people risk factors were Incompetence of staff, negligence of

staff, lack of motivation, low morale, work environment, Lack of training, employee frauds, Strikes, platform, dealing with unanticipated changes, new functions, perception of reputation, variance treatment.

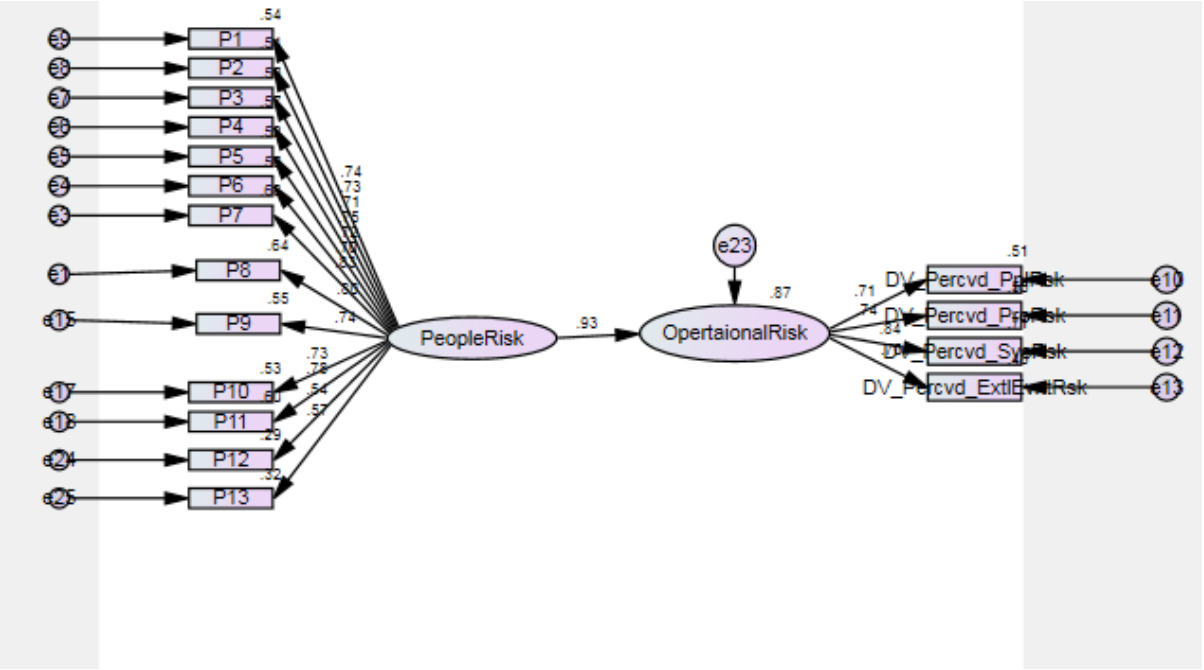

Figure 13: Impact of people risk on operational risk

Table 42: Impact of people risk on operational risk

			Estimate	S.E.	C.R.	P
OpertaionalRisk	<---	PeopleRisk	.778	.053	14.618	***

From table 42, as the P value is significant, the research hypothesis**, H1a** which states that there is significant contribution of people related factors towards operational risk is **supported**.

The regression weights for the above model are given in the following table 43**.**

Table 43: Regression weights of people risk on operational risk

			Estimate	S.E.	C.R.	P
OpertaionalRisk	<---	PeopleRisk	.778	.053	14.618	***
P7	<---	PeopleRisk	1.000			
P13	<---	PeopleRisk	1.123	.059	19.176	***
P6	<---	PeopleRisk	.809	.052	15.500	***
P5	<---	PeopleRisk	.824	.052	15.927	***
P4	<---	PeopleRisk	.871	.051	16.932	***

			Estimate	S.E.	C.R.	P
P3	<---	PeopleRisk	.778	.050	15.614	***
P2	<---	PeopleRisk	.836	.051	16.312	***
P1	<---	PeopleRisk	.722	.044	16.469	***
DV_Percvd_PplRsk	<---	Opertaional Risk	1.000			
DV_Percvd_ProRsk	<---	Opertaional Risk	1.070	.076	14.140	***
DV_Percvd_SysRsk	<---	Opertaional Risk	1.317	.083	15.901	***
DV_Percvd_ExtlEvntRsk	<---	Opertaional Risk	.947	.071	13.258	***
P8	<---	PeopleRisk	.790	.048	16.523	***
P9	<---	PeopleRisk	.829	.051	16.219	***
P10	<---	PeopleRisk	.966	.055	17.584	***
P11	<---	PeopleRisk	.594	.053	11.223	***
P12	<---	PeopleRisk	.778	.065	11.921	***

- **H1b : There is significant contribution of process related factors to operational risk**

The second sub-hypotheses tries to examine if process related factors affect operational risk significantly. Four items that measured the latent construct process risk factors, namely frequency of transaction execution error, operational disruptions, transaction security lapse and transactions exceeding thresholds, were taken into consideration to measure the contribution of process risk towards operational risk (shown if Figure 14).

Figure 14: Impact of process risk on operational risk

Table 44: Impact of Process Risk on Operational Risk

			Estimate	S.E	C.R	P
Operational Risk	<---	ProcessFactors	.062	0.044	1.408	.159

From table 44, as the P value is insignificant, the research hypothesis**, H1b** which states that there is significant contribution of process related factors to operational risk is **not supported.** The regression weights for the above model are given in the following table 45.

Table 45: Regression weights of process risk on operational risk

			Estimate	S.E.	C.R.	P
OperationalRisk	<---	ProcessFactors	.062	.044	1.408	.159
PR4	<---	ProcessFactors	1.000			
PR3	<---	ProcessFactors	.918	.050	18.547	***
PR2	<---	ProcessFactors	.431	.034	12.744	***
PR1	<---	ProcessFactors	.452	.031	14.741	***
DV_Percvd_PplRsk	<---	OperationalRisk	1.000			
DV_Percvd_ProRsk	<---	OperationalRisk	1.124	.086	13.035	***
DV_Percvd_SysRsk	<---	OperationalRisk	1.330	.097	13.691	***
DV_Percvd_ExtlEvntRsk	<---	OperationalRisk	1.000	.080	12.422	***

- **H1c: There is significant contribution of technology related factors to operational risk**

The third sub-hypotheses tries to examine if technology related factors affect operational risk significantly. Four items that measured the latent construct technology risk factors, namely Technology Failure, Insecure Systems, Network Hacking and Program Execution, were taken into consideration to measure the contribution of technology risk towards operational risk (shown in Figure 15).

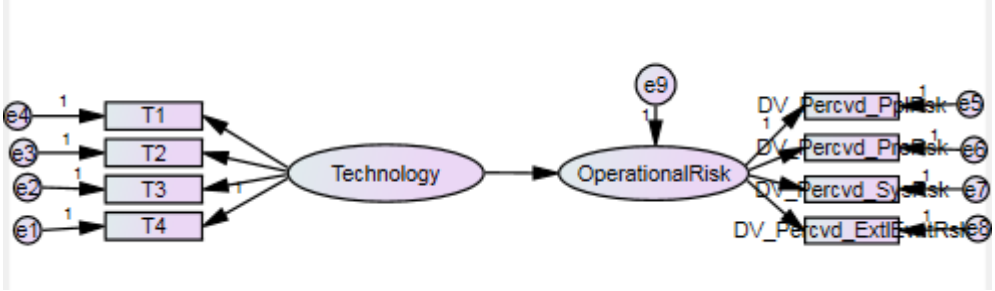

Figure 15: Impact of technological risk on operational risk

Table 46: Impact of Technology Risk on Operational Risk

			Estimate	S.E.	C.R.	P
Operational Risk	<---	Technology	.229	.116	1.979	.048

As the P value is significant, the research hypothesis**, H1c** which states that there is significant contribution of technology related factors to operational risk is **supported** (Table 46).

The regression weights for the above model are given in the following Table 47**.**

Table 47: Regression weights of technology risk on operational risk

			Estimate	S.E.	C.R.	P
OperationalRisk	<---	Technology	.229	.116	1.979	.048
T4	<---	Technology	1.000			
T3	<---	Technology	1.459	.188	7.767	***
T2	<---	Technology	1.228	.169	7.273	***
T1	<---	Technology	1.341	.174	7.695	***
DV_Percvd_PplRsk	<---	OperationalRisk	1.000			
DV_Percvd_ProRsk	<---	OperationalRisk	1.116	.086	13.027	***
DV_Percvd_SysRsk	<---	OperationalRisk	1.333	.097	13.764	***
DV_Percvd_ExtlEvntRs	<---	OperationalRisk	.995	.080	12.425	***

H2: There is significant contribution of external factors to operational risk

The hypothesis tries to examine the impact of factors that are external to a firm on the operational risk.

- **H2a : There is significant contribution of external events on operational risk**

The sub-hypotheses tries to examine if external events affect operational risk significantly. Nine items that measured the latent construct external events, namely External Criminal Activities, Regulatory Compliance, Customer Claims, Natural calamities, Telecom Failure, Execution, Reputation Deterioration in shareholders, Reputation Deterioration in customers and Money Laundering were taken into consideration to measure the impact of external event risk on operational risk as shown in Figure 16.

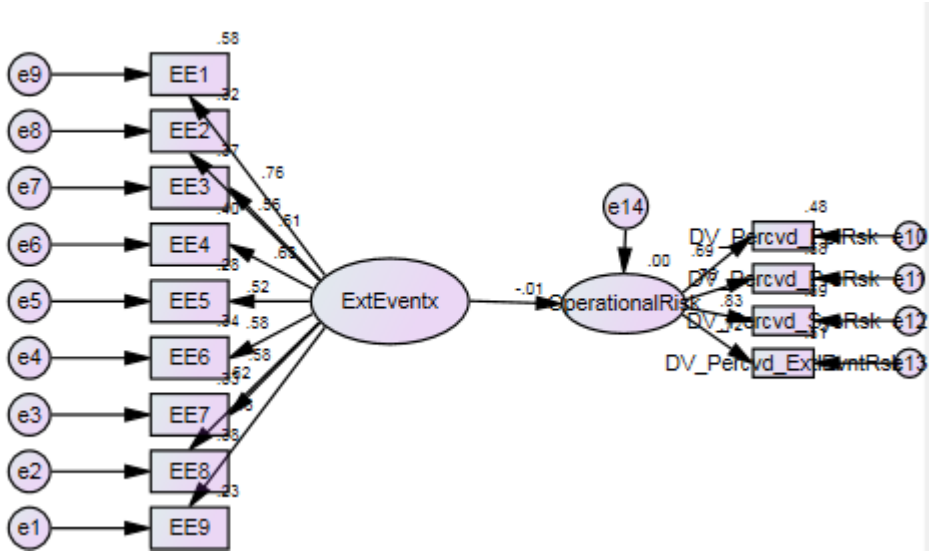

Figure 16: Impact of external events on operational risk

Table 48: Impact of external events on operational risk

	Estimate	S.E.	C.R.	P	Label
OperationalRisk <--- ExtEventx	-.029	.119	-.242	.809	

From tale 48, as the P value is insignificant, the research hypothesis**, H2a** which states that there is significant contribution of external events to operational risk is **not supported**.

The following table 49 presents the regression weights of the above model.

Table 49: Regression weights of external events on operational risk

			Estimate	S.E.	C.R.	P	Label
OperationalRisk	<---	ExtEvents	-.029	.119	-.242	.809	
EE9	<---	ExtEvents	1.000				
EE8	<---	ExtEvents	1.349	.166	8.119	***	
EE7	<---	ExtEvents	1.267	.162	7.846	***	
EE6	<---	ExtEvents	1.212	.154	7.879	***	

			Estimate	S.E.	C.R.	P	Label
EE5	<---	ExtEvents	1.100	.148	7.437	***	
EE4	<---	ExtEvents	1.506	.183	8.219	***	
EE3	<---	ExtEvents	1.275	.157	8.097	***	
EE2	<---	ExtEvents	1.200	.155	7.752	***	
EE1	<---	ExtEvents	1.426	.160	8.926	***	
DV_Percvd_PplRsk	<---	OperationalRisk	1.000				
DV_Percvd_ProRsk	<---	OperationalRisk	1.120	.086	13.033	***	
DV_Percvd_SysRsk	<---	OperationalRisk	1.330	.097	13.712	***	
DV_Percvd_ExtlEvntRsk	<---	OperationalRisk	.998	.080	12.428	***	

The above set of hypotheses evaluate if the determinants of operational risk have a significant impact on it.

A summary of the findings of the above hypotheses is presented in the following table 50.

Table 50: Summary of findings

S.No	Hypothesis	Result
1	H1a- There is a significant contribution of people related factors to operational risk	Supported
2	H1b- There is a significant contribution of process related factors to operational risk	Not Supported
3	H1c - There is a significant contribution of technology related factors to operational risk	Supported
4	H2a- There is a significant contribution of external event related factors to operational risk	Not Supported

The subsequent section of hypotheses deal with operational risk management practices among Public, Indian Private and Foreign Private banks. The means of these sectors of banks are compared using ANOVA and the results presented.

- **H3 : There is significant difference between public, Indian Private and Foreign Private sector banks in terms of Operational Risk Management Practices**

As per the Basel II regulatory guidelines on management of operational risk, there are four latent constructs underlying the Operational Risk Management Practices in banks. They are – Operational Risk Management Principles, Governance, Operational Risk Management Environment and Operational Risk Disclosure. Means of each one of these constructs are compared to identify if there is a difference in terms of their means among the banking sectors. The present section describes the hypotheses formulated to measure the differences, if any, among the public, Indian Private and Foreign Private banks. The main hypotheses have been broken further into sub-hypothesis.

- **H3a : There is significant difference public, Indian Private and Foreign Private sector banks in terms of Operational Risk Management Principles**

The latent construct operational risk management principles was measured by a combination of items – Risk culture, Risk management standards, ethics, operational risk training and effectiveness, understanding risk, operational risk definition and operational risk in strategy formulation- drawn based on the principles of Basel II as formulated by the Basel Committee.

After measuring the operational risk management principles, their means were compared across the three sectors, namely public. Indian Private and Foreign Private sectors using one-way ANOVA. It is a hypothesis testing procedure that is used to determine if mean differences exist for two or more samples. The results are presented in the following tables. Table 51 provides the descriptive statistics. It provides the means of ORM principles for each sector type.

Table 51: Descriptive Statistics

Descriptives							
ORM_Principles							
	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean	Minimum	Maximum

					Lower Bound	Upper Bound		
Public Sector	62	4.2944	.40114	.05094	4.1925	4.3962	2.88	4.88
Private Indian	24	4.2240	.26318	.05372	4.1128	4.3351	3.88	4.88
Private Foreign	11	4.1477	.19218	.05794	4.0186	4.2768	3.88	4.50
Total	97	4.2603	.35386	.03593	4.1890	4.3316	2.88	4.88

The test of homogeneity of variances table (Table 52) helps us to check that the homogeneity assumption has not been violated. Levene's test suggests that the value of .039 is significant and hence homogeneity of variances cannot be accepted and the variances are significantly different.

Table 52: Homogeneity of variances

Test of Homogeneity of Variances			
ORM_Principles			
Levene Statistic	df1	df2	Sig.
3.362	2	94	.039

The following table is the main ANOVA table (table 53). The table shows an F value of 0.970 at (2, 94) degrees of freedom and a corresponding p value of 0.383.

Table 53**:** Comparison of means for operational risk management principles

ANOVA					
ORM_Principles					
	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	.243	2	.121	.970	.383
Within Groups	11.778	94	.125		
Total	12.021	96			

The results of ANOVA table indicate an insignificant p value of 0.383 (which is not less than 0.05) at 5% level of significance. As the p value is not significant, the hypothesis **H3a** that there is significant difference between public, Indian Private and Foreign Private sector banks in terms of Operational Risk Management Principles is **not supported**.

- **H3b : There is significant difference between public, Indian Private and Foreign Private sector banks in terms of Governance**

The latent construct governance was measured by a combination of items –operational risk policies, post audit policies, best practices policy, organisation structure, operational risk appetite, resources for operational risk management- drawn based on the principles of Basel II as formulated by the Basel Committee.

After measuring governance, their means were compared across the three sectors, namely public. Indian Private and Foreign Private sectors using one-way ANOVA. The results are presented in the following tables. Table 54 provides the descriptive statistics. It provides the means of governance for each sector type.

Table 54: Descriptive Statistics

Descriptives								
Governance								
	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
Public Sector	62	4.2604	.39444	.05009	4.1602	4.3605	3.43	5.00
Private Indian	24	4.0357	.28957	.05911	3.9134	4.1580	3.71	4.57
Private Foreign	11	4.0519	.22381	.06748	3.9016	4.2023	3.71	4.29
Total	97	4.1811	.36800	.03736	4.1070	4.2553	3.43	5.00

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The Levene's test (Table 55) suggests that the value of .178 is not significant and hence homogeneity of variances can be accepted and the variances are not significantly different.

Table 55: Homogeneity of variances

Test of Homogeneity of Variances			
Governance			
Levene Statistic	df1	df2	Sig.

1.756	2	94	.178

The following table is the main ANOVA table (table 56). The table shows an F value of 4.260 at (2, 94) degrees of freedom and a corresponding p value of 0.017.

Table 56: Comparison of means for governance

ANOVA					
Governance					
	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	1.080	2	.540	4.260	.017
Within Groups	11.920	94	.127		
Total	13.001	96			

The results of ANOVA table indicate a significant p value of 0.017 (which is less than 0.05) at 5% level of significance. As the p value is significant, the hypothesis, **H3b** that there is significant difference between public, Indian Private and Foreign Private sector banks in terms of governance is **supported**.

The following table, Table 57, reports the Tukey post hoc test (equal variances assumed). The test determines where significant differences lie. The results of the Tukey post hoc tests indicate that the highest difference in governance (0.22465) lies between the public sector and the private Indian banking sector banks and there is least difference (0.01623) between private Foreign and private Indian banks in their mean governance values. In addition, the p value of 0.027(at 5% level of significance) between public and private Indian banks indicates that there is significant difference between them in their governance. The p value of 0.179 (at 5% level of significance) between public and private foreign banks indicates that there is no significant difference between them in their governance. The p value of 0.991 between Private Indian and private foreign banks indicates that there is no significant difference between them in their governance.

Table 57**:** Post Hoc Tests

Multiple Comparisons					
Dependent Variable: Governance					
Tukey HSD					
(I) Sector	(J) Sector			Sig.	95% Confidence Interval

		Mean Difference (I-J)	Std. Error		Lower Bound	Upper Bound
Public Sector	Private Indian	.22465*	.08561	.027	.0208	.4285
	Private Foreign	.20842	.11651	.179	-.0690	.4859
Private Indian	Public Sector	-.22465*	.08561	.027	-.4285	-.0208
	Private Foreign	-.01623	.12966	.991	-.3250	.2925
Private Foreign	Public Sector	-.20842	.11651	.179	-.4859	.0690
	Private Indian	.01623	.12966	.991	-.2925	.3250
*. The mean difference is significant at the 0.05 level.						

The overall interpretation is that public sector banks are better in governance and the hypothesis **H3b** that there is significant difference between public, Indian Private and Foreign Private sector banks in terms of Governance **is supported**.

The following section tests for difference between the three sectors in terms of their operational risk management environment. This construct is measured in terms of Risk Identification & Assessment, Monitoring & Reporting, Risk Control & Mitigation and Business Resiliency & Continuity

- **H3c : There is significant difference between public, Indian Private and Foreign Private sector banks in terms of Operational Risk Management Environment**

The above hypothesis is further divided into the following sub-hypotheses.

- **H3c1: There is significant difference between public, Indian Private and Foreign Private sector banks in terms of Risk Identification & Assessment**

Risk identification and assessment are measured through inclusion of operational risk in internal pricing and performance measurement, impact of new products on operational risk, and updating of operational risk with product changes.

After measuring in terms of risk identification and assessment, their means were compared across the three sectors, namely public. Indian Private and Foreign Private sectors using one-way ANOVA. The results are presented in the following tables. Table 58 provides the descriptive statistics. It provides the means of risk identification and assessment for each sector type.

Table 58: Descriptive Statistics

Descriptives								
Idenfcn_Assessment								
	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
Public Sector	62	4.2298	.47109	.05983	4.1102	4.3495	2.50	5.00
Private Indian	24	3.9375	.51208	.10453	3.7213	4.1537	3.00	4.75
Private Foreign	11	4.3409	.39167	.11809	4.0778	4.6040	3.75	5.00
Total	97	4.1701	.48887	.04964	4.0716	4.2686	2.50	5.00

The Levene's test (Table 59) suggests that the value of 0,579 is not significant and hence homogeneity of variances can be accepted and the variances are not significantly different.

Table 59: Homogeneity of variances

Test of Homogeneity of Variances			
Idenfcn_Assessment			
Levene Statistic	df1	df2	Sig.
.549	2	94	.579

The following table is the main ANOVA table (table 55). The table shows an F value of 4.100 at (2, 94) degrees of freedom and a corresponding p value of 0.020.

Table 60: Comparison of means for risk identification and assessment

ANOVA					
Idenfcn_Assessment					
	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	1.841	2	.920	4.100	.020
Within Groups	21.103	94	.224		

Total	22.943	96			

The results of ANOVA table indicate a significant p value of 0.020(which is less than 0.05) at 5% level of significance. As the p value is significant, the hypothesis, **H3c1** that there is significant difference between public, Indian Private and Foreign Private sector banks in terms of risk identification and assessment is **supported**.

The following table, Table 61, reports the Tukey post hoc test (equal variances assumed). The test determines where significant differences lie. The results of the Tukey post hoc tests indicate that the highest difference in risk identification and assessment (0.40341) lies between the private foreign and the private Indian banking sector banks and there is least difference (0.11107) between private Foreign and public sector banks in their mean risk identification and assessment values. In addition, the p value of 0.032 between public and private Indian banks indicates that there is significant difference between them in their risk identification and assessment. The p value of 0.754, at 5% level of significance, between public and private foreign banks indicates that there is no significant difference between them in their risk identification and assessment. The p value of 0.055 between Private Indian and private foreign banks indicates that there is no significant difference between them in their risk identification and assessment.

Table 61: Post Hoc Tests

Multiple Comparisons						
Dependent Variable: Idenfcn_Assessment						
Tukey HSD						
(I) Sector	(J) Sector	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
Public Sector	Private Indian	.29234*	.11391	.032	.0211	.5636
	Private Foreign	-.11107	.15501	.754	-.4802	.2581
Private Indian	Public Sector	-.29234*	.11391	.032	-.5636	-.0211

	Private Foreign	-.40341	.17252	.055	-.8142	.0074
Private Foreign	Public Sector	.11107	.15501	.754	-.2581	.4802
	Private Indian	.40341	.17252	.055	-.0074	.8142
*. The mean difference is significant at the 0.05 level.						

The overall interpretation is that private foreign banks are ahead in risk identification and assessment, and the hypothesis **H3c1** that there is significant difference between public, Indian Private and Foreign Private sector banks in terms of risk identification and assessment **is supported**.

- **H3c2: There is significant difference between public, Indian Private and Foreign Private sector banks in terms of Monitoring and Reporting**

Monitoring and Reporting is measured by assessing the operational risk reporting environment. After assessing Monitoring and Reporting, their means were compared across the three sectors, namely public. Indian Private and Foreign Private sectors using one-way ANOVA. The results are presented in the following tables. Table 62 provides the descriptive statistics. It provides the means of Monitoring and Reporting for each sector type.

Table 62: Descriptive Statistics

Descriptives								
Monitoring_reporting								
	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
Public Sector	62	4.2581	.72282	.09180	4.0745	4.4416	2.00	5.00
Private Indian	24	4.0833	.82970	.16936	3.7330	4.4337	3.00	5.00
Private Foreign	11	4.2727	.90453	.27273	3.6651	4.8804	3.00	5.00
Total	97	4.2165	.76685	.07786	4.0619	4.3710	2.00	5.00

The Levene's test (Table 63) suggests that the value of 0,283 is not significant and hence homogeneity of variances can be accepted and the variances are not significantly different.

Table 63: Homogeneity of variances

Test of Homogeneity of Variances

Monitoring_reporting

Levene Statistic	df1	df2	Sig.
1.280	2	94	.283

The following table is the main ANOVA table (table 64). The table shows an F value of 0.477 at (2, 94) degrees of freedom and a corresponding p value of 0.622.

Table 64: Comparison of means for monitoring and reporting

ANOVA

Monitoring_reporting

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	.567	2	.284	.477	.622
Within Groups	55.886	94	.595		
Total	56.454	96			

The results of ANOVA table indicate a insignificant p value of 0.622(which is not less than 0.05) at 5% level of significance. As the p value is not significant, the hypothesis, **H3c2** that there is significant difference between public, Indian Private and Foreign Private sector banks in terms of risk monitoring and reporting is **not supported**.

- **H3c3: There is significant difference between public, Indian Private and Foreign Private sector banks in terms of Risk Control and Mitigation**

Risk control and mitigation is measured by assessing the weightages accorded to internal control environment, communication, monitoring activities, segregation of duties, outsourcing and risk transfer. After assessing Risk control and mitigation, their means were compared across the three sectors, namely public. Indian Private and Foreign Private sectors using one-way ANOVA. The results are presented in the following tables. Table 65 provides the descriptive statistics. It provides the means of Risk control and mitigation for each sector type.

Table 65: Descriptive Statistics

Descriptives								
Control_Mitigation								
	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
Public Sector	62	4.1272	.53034	.06735	3.9926	4.2619	2.22	5.00
Private Indian	24	4.0139	.28622	.05843	3.8930	4.1348	3.44	4.44
Private Foreign	11	4.1010	.21346	.06436	3.9576	4.2444	3.56	4.33
Total	97	4.0962	.45322	.04602	4.0049	4.1876	2.22	5.00

Levene's test suggests that the value of .044 is significant and hence homogeneity of variances cannot be accepted and the variances are significantly different (table 66).

Table 66: Homogeneity of variances

Test of Homogeneity of Variances			
Control_Mitigation			
Levene Statistic	df1	df2	Sig.
3.227	2	94	.044

The following table is the main ANOVA table (table 67). The table shows an F value of 0.537 at (2, 94) degrees of freedom and a corresponding p value of 0.587.

Table 67: Comparison of means for control and mitigation

ANOVA					
Control_Mitigation					
	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	.223	2	.111	.537	.587
Within Groups	19.497	94	.207		
Total	19.719	96			

The results of ANOVA table indicate an insignificant p value of 0.587 (which is. not less than 0.05) at 5% level of significance. As the p value is not significant, the hypothesis, **H3c3** that there is significant difference between public, Indian Private and Foreign Private sector banks in terms of risk control and mitigation is **not supported.**

- **H3c4: There is significant difference between public, Indian Private and Foreign Private sector banks in terms of Business Resiliency & Continuity**

Business Resiliency & Continuity is measured by assessing business continuity policy, scenario, recovery strategies, continuity management awareness program, crisis management program, contingency and OR strategy alignment, business resiliency continuity. After assessing Business Resiliency & Continuity, their means were compared across the three sectors, namely public. Indian Private and Foreign Private sectors using one-way ANOVA. The results are presented in the following tables. Table 68 provides the descriptive statistics. It provides the means of Business Resiliency & Continuity for each sector type.

Table 68: Descriptive Statistics

Descriptives								
BusnsResiliency_Continuity								
	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
Public Sector	62	4.2488	.56610	.07189	4.1051	4.3926	2.71	5.00
Private Indian	24	3.9702	.45950	.09380	3.7762	4.1643	3.00	4.86
Private Foreign	11	4.0649	.36902	.11126	3.8170	4.3128	3.43	4.71
Total	97	4.1591	.53248	.05407	4.0517	4.2664	2.71	5.00

The Levene's test (Table 69) suggests that the value of 0,279 is not significant and hence homogeneity of variances can be accepted and the variances are not significantly different.

Table 69: Homogeneity of variances

Test of Homogeneity of Variances			
BusnsResiliency_Continuity			
Levene Statistic	df1	df2	Sig.
1.296	2	94	.279

The following table is the main ANOVA table (table 70). The table shows an F value of 2.650 at (2, 94) degrees of freedom and a corresponding p value of 0.076

Table 70: Comparison of means for business resiliency and continuity.

ANOVA					
BusnsResiliency_Continuity					
	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	1.453	2	.726	2.650	.076
Within Groups	25.766	94	.274		
Total	27.219	96			

The results of ANOVA table indicate an insignificant p value of 0.076 (which is. not less than 0.05) at 5% level of significance. As the p value is not significant, the hypothesis, **H3c4** that there is significant difference between public, Indian Private and Foreign Private sector banks in terms of business resiliency and continuity is **not supported.**

- **H3d: There is significant difference between public, Indian Private and Foreign Private sector banks in terms of Role of Operational Risk Disclosure to its stakeholders**

Operational risk disclosure is measured by assessing OR disclosure policy, OR disclosure assessment, and disclosure. After assessing Operational risk disclosure their means were compared across the three sectors, namely public. Indian Private and Foreign Private sectors using one-way ANOVA. The results are presented in the following tables. Table 71 provides the descriptive statistics. It provides the means of operational disclosure for each sector type.

Table 71**:** Descriptive Statistics

Descriptives
Disclosure

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
Public Sector	62	4.4355	.58390	.07416	4.2872	4.5838	2.67	5.00
Private Indian	24	4.1528	.39292	.08020	3.9869	4.3187	3.33	4.67
Private Foreign	11	4.3939	.49031	.14783	4.0645	4.7233	3.67	5.00
Total	97	4.3608	.54150	.05498	4.2517	4.4700	2.67	5.00

The Levene's test (Table 72) suggests that the value of 0,270 is not significant and hence homogeneity of variances can be accepted and the variances are not significantly different.

Table 72: Homogeneity of variances

Test of Homogeneity of Variances			
Disclosure			
Levene Statistic	df1	df2	Sig.
1.326	2	94	.270

The following table is the main ANOVA table (table 73). The table shows an F value of 2.453 at (2, 94) degrees of freedom and a corresponding p value of 0.091 at 5% level of significance.

Table 73: Comparison of means for disclosure

ANOVA					
Disclosure					
	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	1.396	2	.698	2.453	.091
Within Groups	26.752	94	.285		
Total	28.149	96			

The results of ANOVA table indicate an insignificant p value of 0.091 (which is. not less than 0.05) at 5% level of significance and an F value of 2.453. As the p value is not significant, the

hypothesis, **H3d** that there is significant difference between public, Indian Private and Foreign Private sector banks in terms of operational risk disclosure is **not supported.**

- **H4:There is significant difference between public, Indian Private and Foreign Private sector banks in their ORM Index scores**

Operational risk index was computed by adding the scores of operational risk management principles, governance, operational risk management environment and disclosure. The operational risk index scores for different banks of the study are presented in table 74

Table 74: Operational Risk Index scores of banks under study

Bank	ORM Index
Public Sector Banks	
Central Bank of India	0.838
Andhra Bank	0.879
Bank of Baroda	0.857
Bank of India	0.899
Canara Bank	0.872
IDBI	0.841
State Bank of Hyderabad	0.799
State Bank of India	0.856
State Bank of Mysore	0.887
Union Bank of India	0.830
Vijaya Bank	0.856
Private Indian Banks	
Axis	0.814
HDFC	0.790
ICICI	0.8
IndusInd	0.889
Kotak Mahindra	0.769
Yes Bank	0.776
Private Foreign Banks	
Bank Of America	0.805
CitiBank	0.817
HSBC	0.820
JP Morgan	0.820
Standard Chartered Bank	0.861

After assessing Operational risk index their means were compared across the three sectors, namely public. Indian Private and Foreign Private sectors using one-way ANOVA. The results are presented in the following tables. Table 75 provides the descriptive statistics. It provides the means of operational disclosure for each sector type

Table 75**:** Descriptive Statistics

Descriptives								
ORM_Index								
	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
Public	11	.855917	.0284682	.0085835	.836791	.875042	.7992	.8991
Private Indian	6	.806553	.0434493	.0177381	.760955	.852150	.7692	.8889
Private Foreign	5	.824957	.0214051	.0095726	.798379	.851535	.8051	.8615
Total	22	.835417	.0375086	.0079969	.818787	.852048	.7692	.8991

The Levene's test (Table 76) suggests that the value of 0.462 is not significant and hence homogeneity of variances can be accepted and the variances are not significantly different.

Table 76: Homogeneity of variances

Test of Homogeneity of Variances			
ORM_Index			
Levene Statistic	df1	df2	Sig.
.804	2	19	.462

The following table is the main ANOVA table (table 77). The table shows an F value of 4.985 at (2, 94) degrees of freedom and a corresponding p value of 0.018.

Table 77: Comparison of means for disclosure

ANOVA					
ORM_Index					
	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	.010	2	.005	4.985	.018
Within Groups	.019	19	.001		

Total	.030	21			

The results of ANOVA table indicate a significant p value of 0.018 at 5% level of significance (which is less than 0.05) and an F value of 4.985. As the p value is significant, the hypothesis, **H4** that there is significant difference between public, Indian Private and Foreign Private sector banks in their operational risk index is **supported**.

The following table, Table 78, reports the Tukey post hoc test (equal variances assumed). The test determines where significant differences lie. The results of the Tukey post hoc tests indicate that the highest difference in operational risk index scores lies between the public and the private Indian banking sector banks .(0493639) and there is least difference (.0184046) between private foreign and private Indian sector banks in their mean operational risk index values. In addition, the p value of 0.017 between public and private Indian banks indicates that there is significant difference between them in their operational risk index. The p value of 0.197 (at 5% level of significance) between public and private foreign banks indicates that there is no significant difference between them in their risk index scores. The p value of 0.615 between Private Indian and private foreign banks indicates that there is no significant difference between them in their operational risk index.

Table 78: Post Hoc Tests

Multiple Comparisons						
Dependent Variable: ORM_Index						
Tukey HSD						
(I) Sector	(J) Sector	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
Public	Private Indian	.0493639*	.0162073	.017	.008190	.090538
	Private Foreign	.0309593	.0172241	.197	-.012798	.074716
Private Indian	Public	-.0493639*	.0162073	.017	-.090538	-.008190
	Private Foreign	-.0184046	.0193372	.615	-.067530	.030721
	Public	-.0309593	.0172241	.197	-.074716	.012798

Private Foreign	Private Indian	.0184046	.0193372	.615	-.030721	.067530
*. The mean difference is significant at the 0.05 level.						

The overall interpretation is that public sector banks are ahead in operational risk index scores, followed by the private Indian sector and private foreign sector banks, and the hypothesis **H4** that there is significant difference between public, Indian Private and Foreign Private sector banks in terms of operational risk index **is supported**.

The following table 79 of Homogeneous subsets reveals a same pattern with private Indian and private foreign banks in the same subset and public sector banks in a different subset.

Table 79: Homogeneous subsets

ORM_Index			
Tukey HSD[a,b]			
Sector	N	Subset for alpha = 0.05	
		1	2
Private Indian	6	.806553	
Private Foreign	5	.824957	
Public	11		.855917
Sig.		.559	.211
Means for groups in homogeneous subsets are displayed.			
a. Uses Harmonic Mean Sample Size = 6.556.			
b. The group sizes are unequal. The harmonic mean of the group sizes is used. Type I error levels are not guaranteed.			

The table 80 below presents a summary of the hypotheses tested by the study using ANOVA.

Table 80: Results of hypotheses tested using ANOVA

Hypotheses	Description	Result
H3a	There is significant difference public, Indian Private and Foreign Private sector banks in terms of Operational Risk Management Principles	Not supported

H3b	There is significant difference between public, Indian Private and Foreign Private sector banks in terms of Governance	Supported
H3c1	There is significant difference between public, Indian Private and Foreign Private sector banks in terms of Risk Identification & Assessment	Supported
H3c2	There is significant difference between public, Indian Private and Foreign Private sector banks in terms of Monitoring and Reporting	Not supported
H3c3	There is significant difference between public, Indian Private and Foreign Private sector banks in terms of Risk Control and Mitigation	Not supported
H3c4	There is significant difference between public, Indian Private and Foreign Private sector banks in terms of Business Resiliency & Continuity	Not supported
H3d	There is significant difference between public, Indian Private and Foreign Private sector banks in terms of Role of Operational Risk Disclosure to its stakeholders	Not supported
H4	There is significant difference between public, Indian Private and Foreign Private sector banks in their ORM Index scores	Supported

- **H5: There is significant relationship between operational risk and profitability of banks**
- **H6: Operational Risk Capital mediates the relationship between operational risk and profitability of banks**

To test the above hypothesis for the presence of a significant relationship between operational risk and profitability, PROCESS macro (Hayes, 2012) was used. It is a plugin that can be added to SPSS and is used to test the interaction i.e. the mediation and moderation effects among constructs used in the study- operational risk and profitability.

"A given variable may be said to function as a mediator to the extent that it accounts for the relation between the predictor and the criterion" according to Baron and Kenny (1986). Independent variable influences the dependent variable indirectly through a mediating variable. The study has chosen operational risk capital as a mediating variable between operational risk and profitability. Sector was used as the control variable for the mediation in the study. The values for operational risk capital

The items contributing to the operational risk were summed up and the impact of operational risk on profitability of banks was studied. A modified measure of risk known as the "operational "Risk Adjusted Return on Capital(RAROCO) was used to measure the profitability of banks, using analogies with credit and market risk modelling (Ariane Chapelle et al, 2008).

RAROC is "a measure of performance that expresses the return on an investment, adjusted for the risk and related to economic capital used when undertaking the investment".

$$RAROC = \frac{Revenues - Expected\ Losses}{Economic\ Capital}$$

To obtain a RAROC measurement that is adapted to operational risk, i) expected losses because of operational events, ii) revenues earned by taking operational risks and iii) economic capital required to cover unexpected operational losses need to be identified. However, the estimation of revenues generated by taking operational risks is a complex challenge. According to Chapelle (2008), the operational revenues of a bank are null. Adopting a less restrictive view suggested by Chapelle et al (2008), a proportion of the revenues of the banks generated by operations are taken as counterpart for operational risk. Banks therefore, apply a mark-up to the price of the operations carried out, in order to get rewarded for the operational risk that arises on account of doing business. This mark-up can be equated to the gross operating margin of the bank. Hence, the "operational" RAROC (RAROCO) for a business line can be computed as,

$$RAROCO(i) = \frac{GI_{op}(i) - EL_{op}(i)}{Economic\ Capital\ _{op}(i)}$$

where $GI_{op}(i) = \lambda_i \times GI(i)$ and GI(i) is the gross income of business line i and λ_i is the "mark-up for operational risks charged by the business line I".

To quantify the operational revenues, two approaches as suggested by Chapelle (2008) can be used. The first approach considers that a part of the revenues of a bank are earned by operations and hence are a counterpart to operational risk. To measure the operational revenues an assumption is made that "a ratio between expected operational losses and operational revenues is similar to the average cost/revenue ratio in the business line, i.e. the gross operating margin".

The second approach considers the "minimum level of revenue needed in a business line to reach a RAROCO threshold. A common RAROC threshold in banking is 18%, which roughly corresponds to 12% of net Return on Equity (ROE), after taking into account tax deductibility as RAROC is a gross return measure". Therefore, the present study represents RAROCO as 12% of net ROE of banks under study (Chapelle, 2008).

Mediation can be tested through a series of following steps(Baron and Kenny (1986)),
Step 1: x variable predicts y-→ Path c i.e. Operational risk affects profitability
Step 2: x variable predicts m → Path a i.e. operational risk affects operational risk capital
Step 3: x and m together predict y. Operational risk and operational risk capital together affect profitability. This is further tested as,
variable m predicts y→ Path b i.e. operational risk capital affects profitability
x variable no longer predicts y → Path c' i.e. operational risk no longer affects profitability
Mediation is said to exist when path c is different from path c'. The following figure 17 represents mediation model of the study.

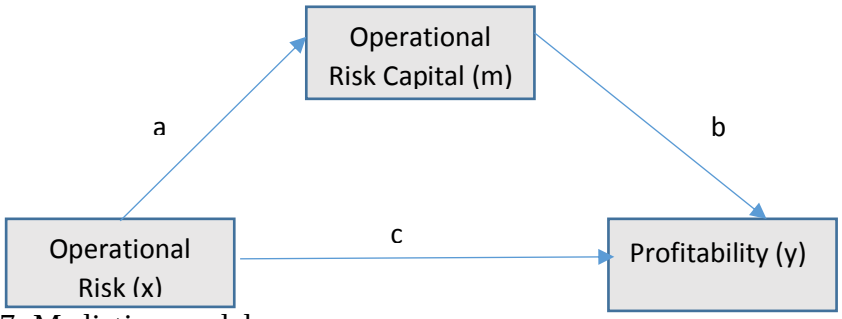

Figure 17: Mediation model

```
Run MATRIX procedure:

************** PROCESS Procedure for SPSS Release 2.15 *******************

          Written by Andrew F. Hayes, Ph.D.       www.afhayes.com
    Documentation available in Hayes (2013). www.guilford.com/p/hayes3

**************************************************************************
Model = 4
    Y = ProftCat
    X = OpRskCal
    M = ORCapCat

Statistical Controls:
CONTROL= Sector

Sample size
         97

**************************************************************************
Outcome: ORCapCat -→  Mediator

Model Summary
      R       R-sq        MSE          F         df1         df2          p
.1202       .0145       .3379       .6893      2.0000     94.0000      .5045

Model
              coeff         se          t          p       LLCI       ULCI
constant       .6690      .1515     4.4149      .0000      .3681      .9699
OpRskCal      -.1013      .0864    -1.1718      .2442     -.2729      .0703
Sector        -.0177      .0879     -.2012      .8410     -.1923      .1569
```

The above section of the output predicts the effect of operational risk on operational risk capital i.e. the effect of x variable on the mediating variable m i.e. path 'a'. As the p value at 5% level of significance, 0.5045 is greater than 0.05, the prediction is not significant. In other words, operational risk does not influence operational risk capital.

```
**************************************************************************
Outcome: ProftCat

Model Summary
```

```
    R       R-sq        MSE          F         df1         df2          p
    .6558       .4300       .1101    23.3902     3.0000    93.0000       .0000

Model
              coeff         se          t          p       LLCI       ULCI
constant     1.6231      .0950    17.0801      .0000     1.4344     1.8118
ORCapCatM      .0339      .0589      .5760      .5660      -.0830      .1508
OpRskCalX     -.4081      .0497    -8.2145      .0000      -.5068     -.3095
Sector       -.0739      .0502    -1.4726      .1442      -.1736      .0258
```

The above section of the output predicts x and m together predicting y i.e. the operational risk and operational risk capital influencing profitability. The output indicates that, in this study, both these variables explain 43% of the influence (R^2) and that the p value is significant at 5% level of significance.

The second line of the model represents the effect of operational risk capital on firm profitability i.e. the effect of mediating variable, m on the variable y i.e. path 'b'. As the p value is insignificant, at 5% level of significance, it can be said that there is no influence of operational risk capital on profitability. However, the third line in the model denotes the impact of operational risk on profitability. This is significant at 5% level of significance, indicating that operational risk influences profitability significantly. A negative coefficient of -0.4081 indicates that there is a significant negative relationship between operational risk and profitability. For every one unit of operational risk, the profitability of banks is going to decrease by 0.41 units. Hence the hypothesis, **H5** that there is significant relationship between operational risk and profitability of banks **is supported.**

```
************************** TOTAL EFFECT MODEL ****************************
Outcome: ProftCat

Model Summary
     R       R-sq        MSE          F         df1         df2          p
    .6542       .4280       .1093    35.1694     2.0000    94.0000       .0000

Model
              coeff         se          t          p       LLCI       ULCI
constant     1.6458      .0862    19.0978      .0000     1.4747     1.8169
OpRskCal      -.4116      .0492    -8.3738      .0000      -.5092     -.3140
Sector       -.0745      .0500    -1.4902      .1395      -.1738      .0248
```

This section of the output predicts the influence of the x variable i.e. operational risk on y variable i.e. the profitability. The results indicate that operational risk capital explains 42.8% of the influence on profitability. The p value is significant at 5% level of significance and the negative coefficient indicates that there is a significant negative relationship between

operational risk and profitability. For every one unit of operational risk, the profitability of banks is going to decrease by 0.41 units.

```
***************** TOTAL, DIRECT, AND INDIRECT EFFECTS ********************

Total effect of X on Y
     Effect         SE          t          p       LLCI       ULCI
     -.4116      .0492    -8.3738      .0000     -.5092     -.3140

Direct effect of X on Y
     Effect         SE          t          p       LLCI       ULCI
     -.4081      .0497    -8.2145      .0000     -.5068     -.3095

Indirect effect of X on Y
             Effect    Boot SE   BootLLCI   BootULCI
ORCapCat     -.0034      .0076     -.0269      .0055

Partially standardized indirect effect of X on Y
             Effect    Boot SE   BootLLCI   BootULCI
ORCapCat     -.0079      .0178     -.0644      .0139

Completely standardized indirect effect of X on Y
             Effect    Boot SE   BootLLCI   BootULCI
ORCapCat     -.0055      .0121     -.0456      .0091

Ratio of indirect to total effect of X on Y
             Effect    Boot SE   BootLLCI   BootULCI
ORCapCat      .0083      .0187     -.0145      .0670

Ratio of indirect to direct effect of X on Y
             Effect    Boot SE   BootLLCI   BootULCI
ORCapCat      .0084      .0191     -.0143      .0718

Normal theory tests for indirect effect
     Effect         se          Z          p
     -.0034      .0084     -.4104      .6815

******************** ANALYSIS NOTES AND WARNINGS ************************

Number of bootstrap samples for bias corrected bootstrap confidence
intervals:
     5000

Level of confidence for all confidence intervals in output:
    95.00

NOTE: Some cases were deleted due to missing data.  The number of such
cases was:
  1

------ END MATRIX -----
```

The result for direct effect of X and Y and the total effect of X on Y indicate that there is a significant direct and negative relationship between operational risk and profitability. The

direct effect indicated that for every unit increase in operational risk, the profitability among banks decreases by 0.4081 units.

If the class interval for a*b does not include zero, then mediation is said to have occurred. As the class interval for indirect effect of X on Y from the study is ranges from -.0269 to .0055 and includes zero, no mediation effect can be said to exist between operational risk and profitability. Hence, the hypothesis **H6** that Operational Risk Capital mediates the relationship between operational risk and profitability of banks is not **supported.**

- **H7:Operational risk management practices moderate the relationship between operational risk and profitability of banks**

Baron & Kenny (1986) defined moderator as "a qualitative (e.g., sex, race, class) or quantitative (e.g., level of reward) variable that affects the direction and/or strength of the relation between an independent or predictor variables and a dependent or criterion variable". It can be said that moderator can be any demographic or categorical or any metric variable which influences the relationship between the two variables. Operational risk management practices was chosen as a moderator to test its extent of influence on the relationship between operational risk and banks' profitability. Sector was used as the control variable for the mediation in the study. The moderation model is represented in Figure 18.

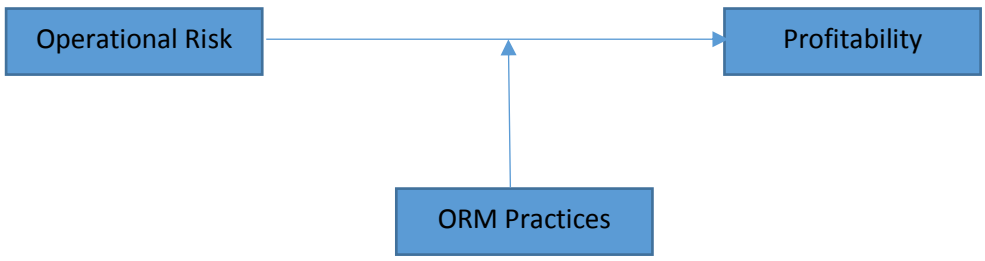

Figure 18: Moderation model of the study

```
Run MATRIX procedure:

************** PROCESS Procedure for SPSS Release 2.15 ******************

        Written by Andrew F. Hayes, Ph.D.       www.afhayes.com
    Documentation available in Hayes (2013). www.guilford.com/p/hayes3
```

```
**************************************************************************
Model = 1
    Y = ProftCat
    X = OpRskCal
    M = TotORM

Statistical Controls:
CONTROL= Sector

Sample size
         97

**************************************************************************
Outcome: ProftCat

Model Summary
  R       R-sq        MSE          F         df1         df2          p
.7601      .5778      .0824    14.3015      4.0000     92.0000      .0000

Model
              coeff         se          t          p       LLCI       ULCI
constant     1.0136      .0274    36.9666      .0000      .9591     1.0680
TotORM        .3831      .1022     3.7475      .0003      .1801      .5862
OpRskCal     -.1439      .0476    -3.0239      .0032     -.2384     -.0494
int_1        -.2293      .0976    -2.3508      .0209     -.4231     -.0356
Sector       -.0957      .0667    -1.4343      .1549     -.2281      .0368

Product terms key:

 int_1    OpRskCal     X      TotORM

R-square increase due to interaction(s):
         R2-chng           F         df1         df2           p
int_1      .0387      5.5261      1.0000     92.0000      .0209
```

The empirical results suggest that operational risk management practices has a negative moderating effect on the relationship between operational risk and bank profitability. This is possibly because operational risk management practices reduce firm risk thereby weakening the relationship between operational risk and bank profitability and resulting in a negative moderating effect. The above output indicates that the ORM practices influence profitability significantly as the p value at 5% level of significance is .0003, which is less than 0.05. The output also indicates that operational risk has a significant negative influence on profitability as the p value, 0.0032 (which is less than 0.05) is significant at 5% level of significance. The interaction term int_1 indicates that the moderation is significant as the p value is 0.0209 and is significant at 5% level of significance. In other words, operational risk management practices significantly moderate the relationship between operational risk and bank profitability. It can be observed that moderation reduces the negative effect of operational risk capital on profitability. Hence the hypothesis, **H7** that operational risk management practices moderate the relationship between operational risk and profitability of banks is **supported.**

```
**************************************************************************

Conditional effect of X on Y at values of the moderator(s):
TotORM     Effect         se          t          p       LLCI       ULCI
-.5077     -.0275      .0725     -.3788      .7057     -.1715      .1166
.0000      -.1439      .0476     -3.0239      .0032     -.2384     -.0494
 .5077     -.2603      .0646    -4.0290       .0001     -.3886     -.1320
```

This section gives the effect for varying levels of operational risk management practices. For low ORM, b=-.0275, p is .7057 at 5% significance level, and is insignificant. Therefore there is no relationship between Operational Risk and Profitability. For medium ORM, b=-.1439, p= .0032, significant at 5% significance level i.e. every unit of Operational Risk contributes -.1439 to the profitability For high ORM, b=-.2603, p=.0001i.e. significant at 5% level of significance. Therefore every unit of operational risk has a lesser negative effect on profitability.

```
Values for quantitative moderators are the mean and plus/minus one SD from
mean.
Values for dichotomous moderators are the two values of the moderator.

********************** JOHNSON-NEYMAN TECHNIQUE **************************

Moderator value(s) defining Johnson-Neyman significance region(s)
      Value    % below    % above
     -.1742    10.3093    89.6907

Conditional effect of X on Y at values of the moderator (M)
     TotORM     Effect         se          t          p       LLCI
ULCI
    -1.0515      .0973      .1179      .8246      .4118     -.1370
.3315
     -.9515      .0743      .1091      .6814      .4974     -.1423
.2910
     -.8515      .0514      .1004      .5120      .6099     -.1480
.2507
     -.7515      .0285      .0919      .3097      .7575     -.1540
.2109
     -.6515      .0055      .0837      .0660      .9475     -.1606
.1717
     -.5515     -.0174      .0758     -.2296      .8189     -.1680
.1332
     -.4515     -.0403      .0685     -.5892      .5571     -.1763
.0956
     -.3515     -.0633      .0618    -1.0243      .3084     -.1860
.0594
     -.2515     -.0862      .0560    -1.5396      .1271     -.1974
.0250
     -.1742     -.1039      .0523    -1.9861      .0500     -.2079
.0000
     -.1515     -.1091      .0514    -2.1222      .0365     -.2113     -
.0070
     -.0515     -.1321      .0484    -2.7275      .0076     -.2282     -
.0359
```

```
      .0485     -.1550      .0473    -3.2788      .0015     -.2489     -
.0611
      .1485     -.1779      .0481    -3.6979      .0004     -.2735     -
.0824
      .2485     -.2009      .0509    -3.9499      .0002     -.3019     -
.0999
      .3485     -.2238      .0552    -4.0541      .0001     -.3334     -
.1142
      .4485     -.2467      .0608    -4.0569      .0001     -.3675     -
.1259
      .5485     -.2697      .0674    -4.0019      .0001     -.4035     -
.1358
      .6485     -.2926      .0746    -3.9195      .0002     -.4408     -
.1443
      .7485     -.3155      .0824    -3.8277      .0002     -.4792     -
.1518
      .8485     -.3385      .0906    -3.7358      .0003     -.5184     -
.1585
      .9485     -.3614      .0990    -3.6485      .0004     -.5581     -
.1647

************************************************************************

Data for visualizing conditional effect of X on Y
Paste text below into a SPSS syntax window and execute to produce plot.

DATA LIST FREE/OpRskCal TotORM ProftCat.
BEGIN DATA.

     -.7057     -.5077      .7931
      .0000     -.5077      .7737
      .7057     -.5077      .7543
     -.7057      .0000     1.0698
      .0000      .0000      .9682
      .7057      .0000      .8667
     -.7057      .5077     1.3464
      .0000      .5077     1.1627
      .7057      .5077      .9790

END DATA.
GRAPH/SCATTERPLOT=OpRskCal WITH ProftCat BY TotORM.

* Estimates are based on setting covariates to their sample means.

****************** ANALYSIS NOTES AND WARNINGS ************************

Level of confidence for all confidence intervals in output:
    95.00

NOTE: The following variables were mean centered prior to analysis:
 OpRskCal TotORM

NOTE: Some cases were deleted due to missing data.  The number of such
cases was:
  1

NOTE: All standard errors for continuous outcome models are based on the
HC3 estimator

------ END MATRIX -----
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A summary of the research hypotheses of the study is presented in the following table 81

Table 81: Summary of research hypotheses

S.No		Hypotheses	Supported / Not Supported	Earlier Findings
1	H1a	There is significant contribution of people related factors to operational risk	Supported	In accordance with Jacobus Young(2001), Agnes Koomos(2011)
2	H1b	There is significant contribution of process related factors to operational risk	Not Supported	Not in accordance with Jacobus Young(2001). In accordance with Agnes Koomos(2011)
3	H1c	There is significant contribution of technology related factors to operational risk	Supported	In accordance with Jacobus Young(2001), Agnes Koomos(2011)
4	H2a	There is significant contribution of external event related factors to operational risk	Not Supported	In accordance with Jacobus Young(2001)
5	H3a	There is significant difference between public and private sector banks in terms of Operational Risk Management Principles	Not Supported	
6	H3b	There is significant difference between public and private sector banks in terms of Governance	Supported	

7	H3c	There is significant difference between public and private sector banks in terms of Risk Management Environment	Not Supported
8	H3c1	There is significant difference between public and private sector banks in their Risk identification & assessment	Supported
9	H3c2	There is significant difference between public and private sector banks in their Risk monitoring & reporting	Not Supported
10	H3c3	There is significant difference between public and private sector banks in their Risk control & mitigation	Not Supported
11	H3c4	There is significant difference between public and private sector banks in their Business Resiliency & Continuity Plans	Not Supported
12	H3d	There is significant difference between public and private sector banks in terms of Operational Risk Disclosure	Not Supported
13	H4	There is significant difference between public and private sector banks in terms of ORM Index scores	Supported

14	H5	There is significant relationship between operational risk and profitability	Supported	In accordance with Chapelle (2008)
15	H6	Operational Risk Capital mediates the relationship between operational risk and profitability of banks	Not Supported	In accordance with Millar's (2012) study
16	H7	Operational risk management practices moderate the relationship between operational risk and profitability of banks	Supported	

Apart from testing the above hypotheses, the study also attempted to identify the trends in operational risk capital of the banks under study.

The following table 82 shows the operational risk capital of banks included in the study. The data is collected from 2009 t0 2015 and is segregated as operational risk capital for public, private Indian and private foreign banks. The information was collected from the web sites of respective banks as well as from RBI. Where the operational risk capital charge was not available, it was replaced by the average operational risk capital of that particular bank. The information collected was then analysed to denote the trends in operational risk among each sector of banks chosen for the study.

Table 82: Operational Risk Capital (in crores of rupees) of public sector banks

	2009	2010	2011	2012	2013	2014	2015
State Bank of India	884.00	1079.12	7793.36	7918.10	9581.05	10876.73	12113.96
Bank of Baroda	7875.22	9431.08	4075.84	1295.68	1638.27	1947.93	2266.86
Bank of India	884.00	1079.12	1318.73	1496.52	1684.00	1905.30	2115.73
Union Bank	1397.66	1397.66	1397.66	1397.66	1356.84	1356.86	1479.29
IDBI	1060.84	1060.84	1060.84	1060.84	887.45	1082.12	1212.95
Central Bank	947.53	947.53	947.53	685.35	1004.67	1004.70	1095.40

State Bank of Hyderabad	690.88	690.88	690.88	690.88	647.05	702.18	723.40
Andhra Bank	528.96	362.32	362.32	466.69	585.74	673.82	722.85
State Bank of Mysore	331.44	331.44	331.44	331.44	326.83	326.83	340.66
Vijaya Bank	194.72	209.60	246.90	302.58	345.81	279.99	380.35
Canara Bank	759.77	836.27	971.92	1201.45	1406.52	1557.28	1680.30

The following charts denote the trends observed in operational risk among public sector banks. Figure 19 represents the trends in operational risk capital of public sector banks in Mumbai namely the State Bank of India, Bank of Baroda, Bank of India, Union Bank, IDBI and the Central bank. The data spans from 2009 to 2015.

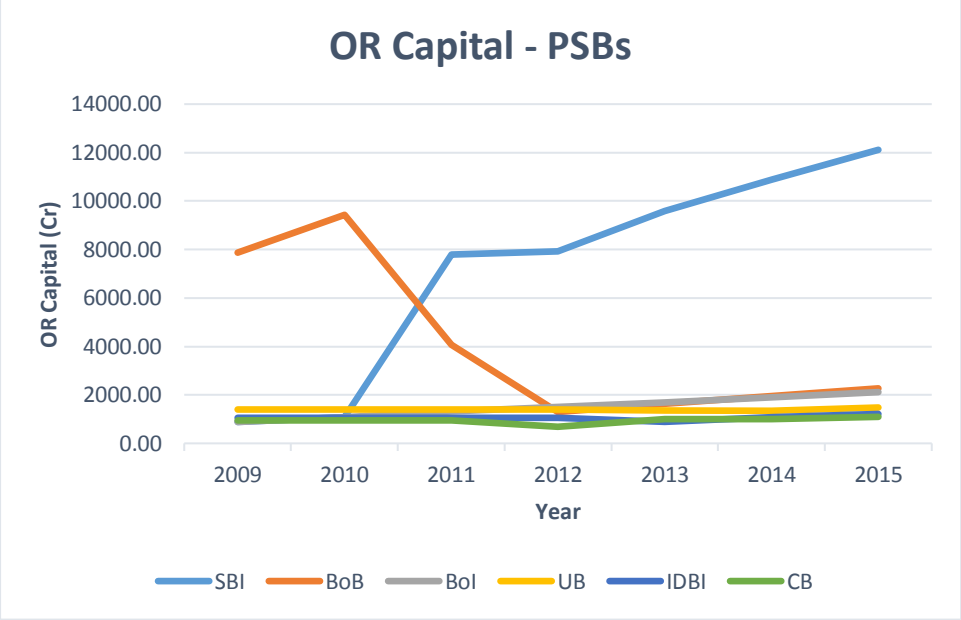

Figure 19: Operational risk capital of public sector banks

From the above chart, it can be concluded that among the public sector banks, State Bank of India has the highest operational risk capital which is steadily increasing year after year. This steep rise in its operational risk capital can be attributed to the large scale of operations of SBI and its size. It is noteworthy that among all the public sector banks, Bank of Baroda has been successful in reducing its operational risk capital. The operational risk capital of the other public sector banks i.e. Bank of India, Union Bank, IDBI and central Bank were more or less consistent albeit with a small increase.

Figure 20 represents the trends of operational risk capital among regional public sector banks of Telangana and Karnataka namely State Bank of Hyderabad, Andhra Bank, State Bank of Mysore, Vijaya Bank and Canara Bank. The operational risk data is collected from 2009 to 2015.

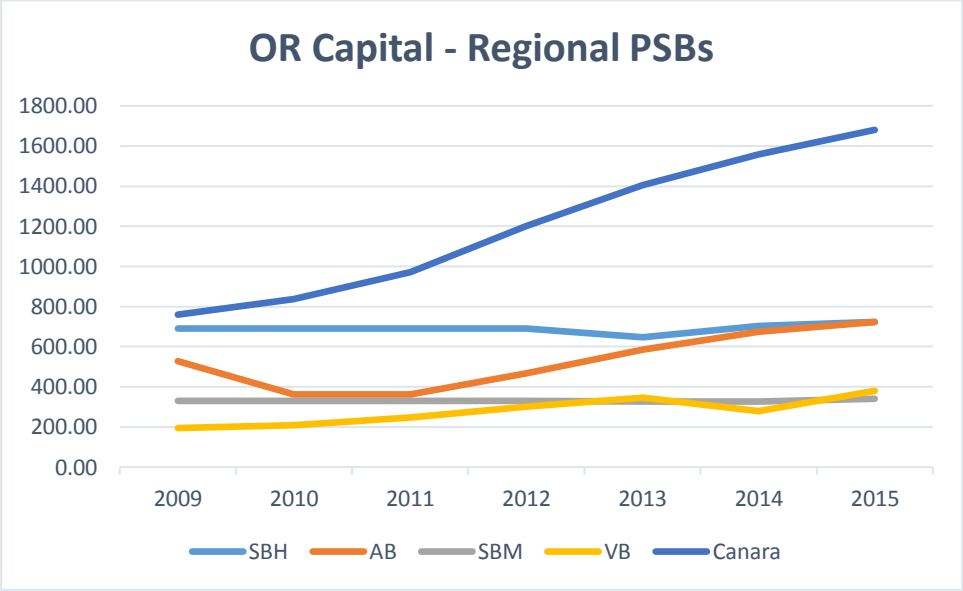

Figure 20: Operational risk capital of regional public sector banks

From the above chart, it can be concluded that among the regional public sector banks, Canara Bank has the highest operational risk capital which is steadily increasing year after year. This is followed by State Bank of Hyderabad, Andhra Bank, State Bank of Mysore and Vijaya Bank. The following table 83 denotes the operational risk capital of private Indian banks under study.

Table 83: Operational Risk Capital (in crores of rupees) of private Indian banks

	2009	2010	2011	2012	2013	2014	2015
ICICI	3,700.37	3,123.85	2749	2619	2625	2459	2114
Axis	2432.00	2000.20	1625.23	1289.52	961.72	656.09	431.46
IndusInd	707.00	551.80	420.29	309.86	551.00	551.00	707
Kotak Mahindra	1122.80	944.82	823.03	727.24	627.67	578.73	224.43
HDFC	3414.43	2810.09	2256.46	1892.68	1514.23	1175.01	806.11
Yes	569.98	426.90	310.24	220.77	154.50	92.03	60.76

Figure 21 represents the trends of operational risk capital among private Indian banks namely ICICI, Axis, IndusInd, Kotak Mahindra, HDFC and Yes bank. The operational risk data is collected from 2009 to 2015.

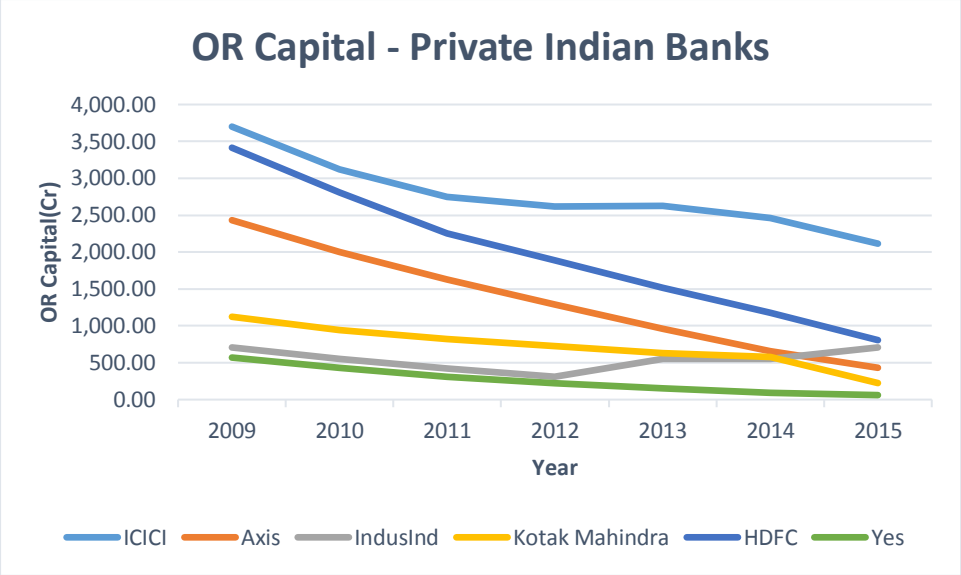

Figure 21: Operational risk capital of private Indian banks

From the above chart, it can be concluded that among the private Indian banks, ICICI has the highest operational risk capital. It can be noted from the above chart that the private Indian banks have been successful in reducing their operational risk capital every year, thereby increasing their chances of profitability. This can be attributed to their efficient risk management practices.

The following table 84 denotes the operational risk capital of private foreign banks under study.

Table 84: Operational Risk Capital (in crores of rupees) of private foreign banks

	2009	2010	2011	2012	2013	2014	2015
Bank of America	257.20	231.60	194.50	176.74	134.58	231.00	257.20
Citi Bank	1141.28	1037.27	1051.90	1231.54	1295.34	1246.60	1246.10
JP Morgan Chase	260.60	227.20	174.73	114.35	109.74	89.64	98.35
Standard Chartered	1200.16	1095.53	1034.29	989.40	926.34	749.61	574.08
HSBC	852.56	840.20	821.77	843.87	841.74	746.30	541.64

Figure 22 represents the trends of operational risk capital among private foreign banks namely Bank of America, Citi Bank, JP Morgan Chase, Standard Chartered and HSBC. The operational risk data is collected from 2009 to 2015.

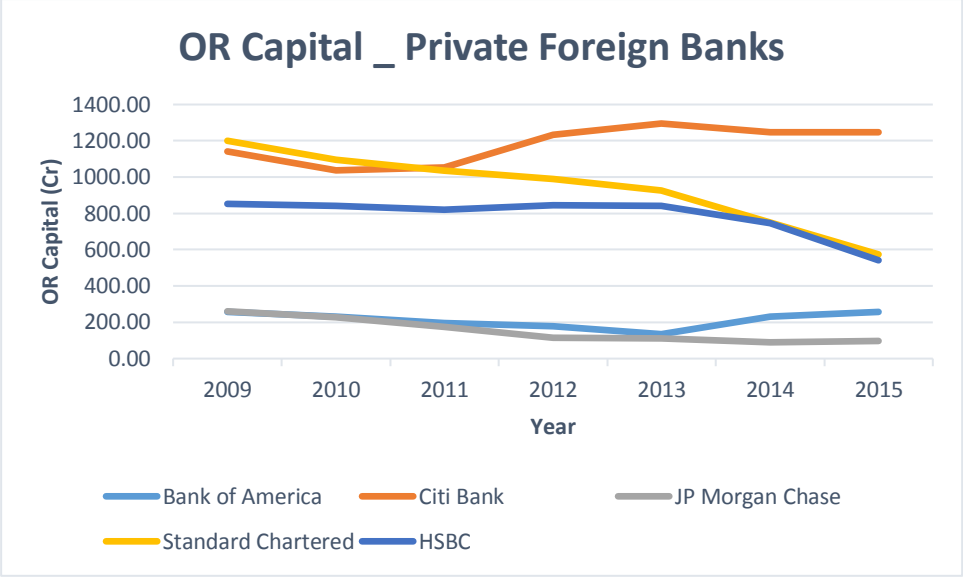

Figure 22: Operational risk capital of private foreign banks

From the above chart, it can be concluded that among the private foreign banks, Citi Bank has the highest operational risk capital. It can be noted from the above chart that few private foreign banks like Standard Chartered bank and HSBC have been successful in reducing their operational risk capital every year, thereby increasing their chances of profitability.

The present chapter summarises the results of the analysis. The results indicate that among the factors influencing operational risk, the people and technology factors have a significant impact. The results also suggest that there is no significant difference between public, Indian private and foreign banks in terms of their operational risk management practices indicating that the Basel norms on operational risk management are well adhered to. The results also indicate that there is a significant relationship between operational risk and profitability of banks, though the study finds operational risk capital is not very reflective of the operational risks that banks are exposed to. Finally the study concludes that operational risk management practices reduce the adverse impact of operational risk on bank profitability.

CHAPTER VII

CONCLUSION AND SUGGESTIONS

CHAPTER VII

CONCLUSION AND SUGGESTIONS

The major objective of the study is to investigate the major factors contributing to operational risk and its impact on the profitability of banks in India. The banks have been categorised into public, private Indian and private foreign banks. At the outset, the study identifies the factors contributing to operational risk as people risk, process risk, technology risk and external event risk. The study then examines the relationship between operational risk of a bank and its profitability. Additionally, the study also looks into the operational risk management practices of banks and also into the possible influence of these practices on the impact of operational risk on profitability. The influence of operational risk capital on the relation between operational risk and profitability has also been analysed.

The study was conducted at two levels. The study makes an attempt to measure the operational risk among banks through a scale developed for the same across public, private Indian and private foreign banks. For this purpose, the data was collected from a sample of 404 branch managers across Hyderabad, Bengaluru and Mumbai. The items that were used to measure the causal factors of operational risk were collected from the earlier literature and a summated scale was developed. There are very few studies on the factors influencing operational risk from the Indian context (no relevant literature on the determinants of operational risk was found in the Indian context).

A few of the items were sourced from theory based on their relevance in the context of the study. These items were grouped into four components following extraction by factor analysis. The components were grouped as people related, process related, technology related and external events related factors leading to operational risk. Initially 39 items were collected on several aspects of operational risk. Exploratory factor analysis was used to group items with similar loadings after eliminating items with cross loadings i.e. items that loaded onto more than component. A scale consisting of 30 items was obtained after the factor analysis. The scale so obtained was subjected to reliability and validity tests. The scale met the criteria of both reliability and validity. Additionally, the impact of each factor on operational risk was also measured using confirmatory factor analysis. The analysis indicated that people risk and technology risk have a significant impact on operational risk.

Operational Risk Management Practices

As per the Basel II regulatory guidelines on management of operational risk, there are four latent constructs underlying the Operational Risk Management Practices in banks. They are – Operational Risk Management Principles, Governance, Operational Risk Management Environment and Operational Risk Disclosure. Means of each one of these constructs are compared to identify if there is a difference in terms of their means among the banking sectors. The study pertaining to operational risk management practices was conducted on a sample of 97 risk managers across Hyderabad, Bengaluru and Mumbai. In addition, an Operational risk index was computed by adding the scores of operational risk management principles, governance, operational risk management environment and disclosure.

Impact of Operational Risk on Bank Profitability

Another dimension of the study focuses on the relationship between operational risk of banks and their profitability. The operational risk was taken as a measure of the summated scale from the survey of branch managers. The profitability was measured in terms of Risk Adjusted Return on Capital for Operational Risk (RAROCO) which was taken as 12% of Return on Equity, based on earlier literature (Ariane Chapelle et al, 2008). The data showed a significant and negative relationship between operational risk of banks and their profitability.

Interaction Effects

The study also examines the influence of operational risk capital on the relation between operational risk and firm profitability through mediation analysis using PROCESS macro. Operational risk capital was used as a mediating variable. This is a modest attempt by the researcher based on the theory. No literature evidence or support was found to this effect. The values for operational risk capital was collected from the websites of respective banks. The findings of the study suggest that the operational risk capital does not influence the relationship between operational risk and bank profitability. In other words, operational risk capital does not mediate the relationship between operational risk and profitability of banks under study.

The study also examines the operational risk management practices of select public, private Indian and private foreign banks. A scale developed on the basis of Basel guidelines on sound management of operational risk was used to measure the operational risk management practices among banks across different sectors. The scores so obtained were used to test if

implementation of operational risk management practices reduced the impact of operational risk on profitability of banks. This was tested through moderation analysis using PROCESS macro. The results of analysis indicate the presence of moderating effect of operational risk management practices on the relationship between operational risk and profitability. In other words, operational risk management practices indeed reduce the adverse effect of operational risk on firm profitability.

Demographics of Branch Managers

A sample of 404 branch managers was selected to identify the drivers of operational risk among banks across different sectors. A summary of the characteristics of the sample is presented. Of the sample of 404 branch managers, about 13% are female and about 87% are male managers. The sample consists of about 26% in the experience band of 0 to 10 years, about 60% in the experience category of 11-20 years, about 13% in the experience category of 21-30 years and the remaining about 1% in the category of experience greater than 30 years. Of the chosen sample, about 76% represent public sector, about 19% represent the Indian private sector and the remaining 5% represent the foreign private sector.

Demographics of Risk managers

A sample of 97 risk managers was chosen which consists of about 8% female and about 92% male managers. It consists of about 38% in the experience band of 0 to 10 years, about 44% in the experience category of 11-20 years, about 11% in the experience category of 21-30 years and the remaining about 6% in the category of experience greater than 30 years. Of the chosen sample, about 64% represent the public sector, about 25% represent the Indian private sector and the remaining 11% represent the foreign private sector.

The data collected for the study showed the following descriptive statistics. Since the survey instrument used a likert scale of 1 to 5, the minimum value was 1 and the maximum was 5. There were no outliers. The mean value for people related factors was 3.76, process related factors was 3.02, process related factors was 3.01 and external event factors was 3.06.

Causes of Operational Risk

The study found that the major causes of operational risk among the banks studied could be grouped as i. People risk – arising on account of factors related to staff working for the banks and other personnel associated with the operations of the bank; ii. Process risk – arising on account of the complexity of the processes implemented by the banks; iii. Technology risk – associated with the technology implementation and technological advancements in the banks and iv. External events risk – arising on account of external events. The findings indicated that there is significant impact of people risk and technology risk on operational risk among banks. In other words, people and technology risk contribute significantly to operational risk of banks. The results also suggested that process risk and external events risk do not contribute significantly to operational risk.

Following items that measured the latent construct people risk factors were taken into consideration to measure the impact of people risk on operational risk - incompetence of staff, negligence of staff, lack of motivation, low morale, work environment, Lack of training, employee frauds, Strikes, platform, dealing with unanticipated changes, new functions, perception of reputation, variance treatment. A significant P value suggested that there is significant contribution of people related factors or people risk towards operational risk.

Four items that measured the latent construct process risk factors, namely frequency of transaction execution error, operational disruptions, transaction security lapse and transactions exceeding thresholds, were taken into consideration to measure the contribution of process risk towards operational risk. As the P value obtained is insignificant, it can be said that there is no significant contribution of process related factors to operational risk.

Four items that measured the latent construct technology risk factors, namely Technology Failure, Insecure Systems, Network Hacking and Program Execution, were taken into consideration to measure the contribution of technology risk towards operational risk. As the P value obtained is significant, it can be stated that there is significant contribution of technology related factors to operational risk.

Nine items that measured the latent construct external events, namely External Criminal Activities, Regulatory Compliance, Customer Claims, Natural calamities, Telecom Failure, Execution, Reputation Deterioration in shareholders, Reputation Deterioration in customers and Money Laundering were taken into consideration to measure the impact of external event

risk on operational risk. An insignificant P value suggested that external event related factors don not contribute significantly to operational risk.

Operational Risk Management Practices

As per the Basel II regulatory guidelines on management of operational risk, the Operational Risk Management Practices in banks can be measured using four latent constructs. They are – Operational Risk Management Principles, Governance, Operational Risk Management Environment and Operational Risk Disclosure. Means of each one of these constructs are compared to identify if there is a difference in terms of their means among the banking sectors – public, private Indian and private foreign sectors.

The operational risk management principles was measured by a combination of items – Risk culture, Risk management standards, ethics, operational risk training and effectiveness, understanding risk, operational risk definition and operational risk in strategy formulation- based on the principles of Basel II as formulated by the Basel Committee. As the comparison of means across sectors indicated an insignificant p value, it can be concluded that there is no significant difference between public, Private Indian and Private Foreign sector banks in terms of Operational Risk Management Principles.

The latent construct governance was measured by a combination of items –operational risk policies, post audit policies, best practices policy, organisation structure, operational risk appetite, resources for operational risk management. As the comparison of means across sectors indicated a significant p value, it can be concluded that there is significant difference between public, Private Indian and Private Foreign sector banks in terms of governance. As the difference across sectors was significant, a post hoc Tukey test that determines where significant differences lie was performed. The results of the Tukey post hoc tests indicate that the highest difference in governance lies between the public sector and the private Indian banking sector banks and there is least difference between private Foreign and private Indian banks in their mean governance values.

The construct Operational risk management environment is measured in terms of Risk Identification & Assessment, Monitoring & Reporting, Risk Control & Mitigation and Business Resiliency & Continuity.

Risk identification and assessment are measured through inclusion of operational risk in internal pricing and performance measurement, impact of new products on operational risk, and updating of operational risk with product changes. As the comparison of means across sectors indicated a significant p value, it can be concluded that there is significant difference between public, Indian Private and Foreign Private sector banks in terms of risk identification and assessment. The results of the Tukey post hoc tests indicate that the highest difference in risk identification and assessment lies between the private foreign and the private Indian banking sector banks and there is least difference between private Foreign and public sector banks in their mean risk identification and assessment values.

Monitoring and Reporting is measured by assessing the operational risk reporting environment. The comparison of means indicate that there is no significant difference between public, Indian Private and Foreign Private sector banks in terms of risk monitoring and reporting as the p value is not significant.

Risk control and mitigation is measured by assessing the weightages accorded to internal control environment, communication, monitoring activities, segregation of duties, outsourcing and risk transfer. After assessing Risk control and mitigation, their means were compared across the three sectors, namely public. Indian Private and Foreign Private sectors. As the p value is not significant it can be concluded that there is no significant difference between public, Indian Private and Foreign Private sector banks in terms of risk control and mitigation.

Business Resiliency & Continuity is measured by assessing business continuity policy, scenario, recovery strategies, continuity management awareness program, crisis management program, contingency and OR strategy alignment, business resiliency continuity. After assessing Business Resiliency & Continuity, their means were compared across the three sectors, namely public. Indian Private and Foreign Private sectors. As the p value is not significant, it can be concluded that there is no significant difference between public, Indian Private and Foreign Private sector banks in terms of business resiliency and continuity.

Operational risk disclosure is measured by assessing OR disclosure policy, OR disclosure assessment, and disclosure. After assessing Operational risk disclosure their means were compared across the three sectors. As the p value is not significant, it can be concluded that

there is no significant difference between public, Indian Private and Foreign Private sector banks in terms of operational risk disclosure.

An operational risk index was computed by adding the scores of operational risk management principles, governance, operational risk management environment and disclosure and the means of operational risk indices were compared across sectors. As the p value is significant, it can be concluded that there is significant difference between public, Indian Private and Foreign Private sector banks in their operational risk index scores across sectors. The results of the Tukey post hoc tests indicate that the highest difference in operational risk index scores lies between the public and the private Indian banking sector banks, and there is least difference between private foreign and private Indian sector banks in their mean operational risk index values.

Impact of Operational Risk on Profitability

To test for the presence of a significant relationship between operational risk and profitability, PROCESS macro (Hayes, 2012)was used. It is a plugin that can be added to SPSS and is used to test the interaction i.e. the mediation and moderation effects among constructs used in the study- operational risk and profitability. The items contributing to the operational risk were summed up and the impact of operational risk on profitability of banks was studied. A modified measure of risk known as the "operational "Risk Adjusted Return on Capital (RAROCO) was used to measure the profitability of banks. The p value is significant indicating that operational risk influences profitability significantly. A negative coefficient indicates that there is a significant negative relationship between operational risk and profitability.

Examining the mediation effect of operational risk capital on the relation between operational risk and profitability shows that there is no mediation effect of operational risk capital on the relationship between operational risk and profitability of banks.

The empirical results also suggest that operational risk management practices has a negative moderating effect on the relationship between operational risk and bank profitability. This is possibly because operational risk management practices reduce firm risk thereby weakening the relationship between operational risk and bank profitability and resulting in a negative moderating effect. Hence it can be concluded that operational risk management practices moderate the relationship between operational risk and profitability of banks.

Details of hypotheses tested is presented in the following table 85.

Table 85: Summary of research hypotheses

S.No		Hypotheses	Supported / Not Supported
1	H1a	There is significant contribution of people related factors to operational risk	Supported
2	H1b	There is significant contribution of process related factors to operational risk	Not Supported
3	H1c	There is significant contribution of technology related factors to operational risk	Supported
4	H2a	There is significant contribution of external event related factors to operational risk	Not Supported
5	H3a	There is significant difference between public and private sector banks in terms of Operational Risk Management Principles	Not Supported
6	H3b	There is significant difference between public and private sector banks in terms of Governance	Supported
7	H3c	There is significant difference between public and private sector banks in terms of Risk Management Environment	Not Supported
8	H3c1	There is significant difference between public and private sector banks in their Risk identification & assessment	Supported
9	H3c2	There is significant difference between public and private sector banks in their Risk monitoring & reporting	Not Supported

10	H3c3	There is significant difference between public and private sector banks in their Risk control & mitigation	Not Supported
11	H3c4	There is significant difference between public and private sector banks in their Business Resiliency & Continuity Plans	Not Supported
12	H3d	There is significant difference between public and private sector banks in terms of Operational Risk Disclosure	Not Supported
13	H4	There is significant difference between public and private sector banks in terms of ORM Index scores	Supported
14	H5	There is significant relationship between operational risk and profitability	Supported
15	H6	Operational Risk Capital mediates the relationship between operational risk and profitability of banks	Not Supported
16	H7	Operational risk management practices moderate the relationship between operational risk and profitability of banks	Supported

Apart from testing the above hypotheses, the study also attempted to identify the trends in operational risk capital of the banks under study. It can be concluded that among the public sector banks, State Bank of India has the highest operational risk capital which is steadily increasing year after year. This steep rise in its operational risk capital can be attributed to the large scale of operations of SBI and its size. It is noteworthy that among all the public sector banks, Bank of Baroda has been successful in reducing its operational risk capital. The operational risk capital of the other public sector banks i.e. Bank of India, Union Bank, IDBI and central Bank were more or less consistent albeit with a small increase. It can also be concluded that among the regional public sector banks, Canara Bank has the highest operational risk capital which is steadily increasing year after year. This is followed by State

Bank of Hyderabad, Andhra Bank, State Bank of Mysore and Vijaya Bank. Among the private Indian banks, ICICI has the highest operational risk capital. It can be noted from the above chart that the private Indian banks have been successful in reducing their operational risk capital every year, thereby increasing their chances of profitability. This can be attributed to their efficient risk management practices. It can be stated that among the private foreign banks, Citi Bank has the highest operational risk capital. It can be noted that few private foreign banks like Standard Chartered bank and HSBC have been successful in reducing their operational risk capital every year, thereby increasing their chances of profitability

Other Findings:

- People are the major source of operational risk.
- Though all banks offer training to their employees on risk management, the training effectiveness is an issue of concern as the employees expressed their inability to implement because of huge volume of banking transactions.
- The staff at the clerical level are not aware of the implications of operational risk.
- Due to huge volume of business, the focus is on completing a transaction rather than doing it correctly. Risk culture should be imbibed into the system.
- Most of the banks do not report the operational losses to the head-offices immediately.
- Though banks have audits as part of internal control mechanism, they are not being done judiciously at all bank branches.

Suggestions

- The main onus of operational risk rests on people, process, technology and external events. Evidence suggests that most of the operational losses of large magnitude are tracked down to people. As the losses are a result of both intentional and unintentional activities, the system should be made fool-proof to eliminate unintentional errors.
- Though all banks offer training to their employees on risk management, the training effectiveness is an issue of concern as the employees expressed their inability to implement because of huge volume of banking transactions. Banks should focus on risk management training effectiveness.

- For banks that are part of financial conglomerates, the process of risk management must focus on exposures within the group and transactions as also group wide exposures to sectors and borrowers.
- While sound risk management policies are observed at the firm level there could be systemic risks over which individual banks have no control and this calls for risk management at the systemic level like ensuring financial stability by financial regulators and policy makers.
- Banks should take technology from the present core banking solution to the next level to build up appropriate Information System capability. This will ensure that risk management is of the highest order and banks will be equipped to meet the challenge inherent in a sophisticated financial system.
- The traditional methods for managing operational risk need to be challenged as the risk is not easily predictable as loss events of the past are not indicative of future losses.
- The banks need to focus simultaneously on their business practices, risks inherent in their operations, the organizational structures which confirm universal adherence, reliability and consistency.
- The operational risk management program can incorporate the risk perceptions of external stakeholders and shape the risk mitigation process.
- Three prong focus on new risks, routine business practice evaluation and a supporting risk culture would help in achieving a better monitoring and control of business practices.
- Banks have to develop and implement a methodology that targets reducing costs as well as operational risk, with a trade off if required. For example, merging lean - Six Sigma methodology with measures to reduce operational risk.
- Pricing of risk is critical. Banks tend to under-price risk when there is excess liquidity and a pressure to garner profits. Pricing below cost can be very risky and the risk cost is very often not captured adequately.
- "While credit, market and operational risk are significant risks and are captured in the capital framework under Pillar I of Basel II, other risks like the liquidity risk, reputation risk, strategic risk, concentration risks, and risks arising out of activities like securitisation, off balance sheet risks and valuation practices need to be recognised. Banks need to emphasize all these risks and set firm wide limits on the major risks relevant to the banks' activities. Banks should focus on robust stress testing. Compensation packages should also form part of risk management policies".

- "The recent financial crises have highlighted the importance of internal controls, good corporate governance and risk management. Some banks with strong risk management systems weathered the current crisis much better than many banks that had poor or inadequate risk management systems".

- While introduction of technology in banking has increased the speed and accuracy of service delivery, it has also increased banks' vulnerability to cyber frauds. Banks need to put in place appropriate control mechanisms to prevent such frauds.

Limitations and Scope for further research

The study has undertaken an extensive survey of banks in Hyderabad, Bengaluru and Mumbai to determine the causes of operational risk. However, operational loss data could not be collected due to the confidentiality of banks in sharing sensitive operational loss data. There are no publicly available operational loss databases in India. Availability of public operational loss databases would help immensely. Full fledge implementation of Cordex database might overcome this problem. In the Indian Context, academic research in Operational Risk Measurement and application of econometric tools like Extreme Value Theory and Peak Over Threshold is challenging because of unavailability of operational loss information.

Though operational risk is the second largest risk next only to credit risk, operational risk management is still in a very nascent stage in India. Most of the banks surveyed follow Basic Indicator Approach for Operational Risk Capital charge calculation which is a very primitive method. Most of the banks do not have an organised operational loss database.

Banks would move to organized operational loss databases by 2018-2019 by when AMA would come into force. AMA would reduce operational risk capital charges of banks significantly thereby increasing their profitability

The study covered only three major cities and hence a study that includes other cities that have bank headquarters across India can be undertaken. Econometric models can be developed for the prediction and forecast of operational losses.

To conclude, “Indian banking system which has shown resilience in withstanding the global crisis is well placed to meet the requirements of the rapid inclusive growth. Even in the new paradigm under Basel, the system is well placed in terms of capital and liquidity. Strong HR and sound risk management practices will stand the banks in good stead while they strive to meet the challenges of the next decade. It needs to be emphasized in the context of Basel II that no amount of capital can make a financial institution absolutely secure. The key issue is proper pricing of risks. Risk management should be integrated with the activity of risk taking – one need to structure one’s position according to the risks understood by him or her. Risks that are not understood well should be avoided”.

References

Aiuppa, T. A. (2001). A Synthesis Of Risk Management Within A Financial Framework. *Journal of Financial Education*, 16-27.

Alexander, C. (2005). The present and future of financial risk management. *Journal of Financial Econometrics, 3*(1), 3-25.

Allan, J., Booth, P., Verrall, R., & Walsh, D. (1998). The management of risks in banking. *British Actuarial Journal, 4*(04), 707-802.

Anghelache, G. V., & Olteanu, A. C. (2009). The Operational Risk–Comparative Analysis. *Theoretical and Applied Economics, 11*(11), 51.

Balthazar, L. (2006). *From Basel 1 to Basel 3*: Springer.

Baron, R. M., & Kenny, D. A. (1986). The moderator–mediator variable distinction in social psychological research: Conceptual, strategic, and statistical considerations. *Journal of personality and social psychology, 51*(6), 1173.

Basel, I. International Convergence of Capital Measurement and Capital Standards: a Revised Framework (June 2004). *Bank for International Settlements*.

Bauer, W., & Ryser, M. (2004). Risk management strategies for banks. *Journal of Banking & Finance, 28*(2), 331-352.

Bessis, J., & O'Kelly, B. (2015). *Risk management in banking*: John Wiley & Sons.

Blacker, K. (2000). Mitigating operational risk in british retail banks. *Risk Management, 2*(3), 23-33.

Bodla, B., & Verma, R. (2008). Operational risk management framework at banks in India. *The Icfai University Journal of Financial Risk Management, 4*, 63-85.

Bradstreet, D. (2006). *Financial Risk Management*: Tata McGraw-Hill.

Breden, D. (2008). Monitoring the operational risk environment effectively. *Journal of Risk Management in Financial Institutions, 1*(2), 156-164.

Brown, S., Goetzmann, W., Liang, B., & Schwarz, C. (2008). Mandatory disclosure and operational risk: Evidence from hedge fund registration. *The journal of finance, 63*(6), 2785-2815.

Brunner, M., Piacenza, F., Monti, F., & Bazzarello, D. (2009). Capital allocation for operational risk. *Journal of Risk Management in Financial Institutions, 2*(2), 165-174.

Bugalla, J., Kallman, J., Lindo, S., & Narvaez, K. (2012). The new model of governance and risk management for financial institutions. *Journal of Risk Management in Financial Institutions, 5*(2), 181-193.

Burns, R. B. B. a. R. A. (2008). *Business Research Methods and Statistics Using SPSS*. London: Sage.

Cagan, P. (2001). Seizing the Tail of the Dragon. *FOW/Operational Risk*, 18-23.

Çekrezi, A., Shanini, E., Saadaoui, M., & Mekkaoui, S. (2015). Factors affecting performance of commercial banks in Albania. *The European Proceedings of Social & Behavioral Sciences", eISSN*, 2357-1330.

Chapelle, A., Crama, Y., Hübner, G., & Peters, J.-P. (2008). Practical methods for measuring and managing operational risk in the financial sector: A clinical study. *Journal of Banking & Finance, 32*(6), 1049-1061.

Chen, J.-x., & Liu, W. (2010). *Research on Operational Risk Management Framework for Commercial Banks in Internet World-Based on McKinsey 7S Model.* Paper presented at the Internet Technology and Applications, 2010 International Conference on.

Chernobai, A., Jorion, P., & Yu, F. (2012). The determinants of operational risk in US financial institutions. *Journal of Financial and Quantitative Analysis, 46*(06), 1683-1725.

Chunxi, Z. (2010). *A research about commercial banks operational risk rating based on gray information.* Paper presented at the Information Management and Engineering (ICIME), 2010 The 2nd IEEE International Conference on.

Couto, G., & Bulhões, K. M. (2009). Basel II: operational risk measurement in the portuguese banking sector. *Portuguese Journal of Management Studies, 14*(3), 259-278.
Cowell, R. G., Verrall, R. J., & Yoon, Y. (2007). Modeling operational risk with Bayesian networks. *Journal of Risk and Insurance, 74*(4), 795-827.
Cvilikas, A., Kraujalis, Š., & Karpavičienė, E. (2006). The specifics of operational risk Assessment methodology recommended by Basel II. *Engineering Economics*(3 (48)), 7-17.
Davies, B. (2013). How do boards address risk management and oversight? *Journal of Risk Management in Financial Institutions, 6*(4), 352-365.
Davies, J., Finlay, M., McLenaghen, T., & Wilson, D. (2006). Key risk indicators–their role in operational risk management and measurement. *ARM and RiskBusiness International, Prague*, 1-32.
De Fontnouvelle, P., DeJesus-Rueff, V., Jordan, J. S., & Rosengren, E. S. (2006). Capital and risk: new evidence on implications of large operational losses. *Journal of Money, Credit and Banking*, 1819-1846.
Deshmukh, C. D. (1920). Central banking in India.
Dutta, K., & Perry, J. (2006). A tale of tails: an empirical analysis of loss distribution models for estimating operational risk capital.
Ebnother, S., Vanini, P., McNeil, A., & Antolinez, P. (2003). Operational risk: A practitioner's view. *Journal of Risk, 5*, 1-16.
Elliott, D., Letza, S., McGuinness, M., & Smallman, C. (2000). Governance, control and operational risk: the Turnbull effect. *Risk Management, 2*(3), 47-59.
Embrechts, P., Furrer, H., & Kaufmann, R. (2009). Different kinds of risk *Handbook of financial time series* (pp. 729-751): Springer.
Feng, J., Li, J., Gao, L., & Hua, Z. (2012). A combination model for operational risk estimation in a Chinese banking industry case. *The Journal of Operational Risk, 7*(2), 17.
Fetters, M. D., Curry, L. A., & Creswell, J. W. (2013). Achieving integration in mixed methods designs—principles and practices. *Health services research, 48*(6pt2), 2134-2156.
Fheili, M. I. (2011). Information technology at the forefront of operational risk: banks are at a greater risk. *The Journal of Operational Risk, 6*(2), 47.
Field, A. (2009). *Discovering statistics using SPSS*: Sage publications.
Flynn, G., & Butler, C. (2013). Lessons for the Irish Government on Basel II and accounting failures. *Journal of Risk Management in Financial Institutions, 6*(1), 23-36.
Frachot, A., Moudoulaud, O., & Roncalli, T. (2003). Loss distribution approach in practice. *The Basel handbook: A guide for financial practitioners*, 369-396.
Gao, L., Li, J., Chen, J., & Xu, W. (2006). *Assessment the operational risk for Chinese commercial banks.* Paper presented at the International Conference on Computational Science.
GÂRLIŞTE, M. A. S. (2013). OPERATIONAL RISK-DEFINITION AND REGULATIONS IN BANKING. *Review of Management & Economic Engineering, 12*(1).
Goodhart, C. (2001). Operational risk: Financial Markets Group.
Grody, A. D., & Hughes, P. J. (2008). Financial services in crisis: Operational risk management to the rescue! *Journal of Risk Management in Financial Institutions, 2*(1), 47-56.
Gupta, V. (2009). Strategic framework for managing forces of continuity and change in risk management of banks in India. *Global Journal of Flexible Systems Management, 10*(2), 35.
Hain, S. (2009). Managing operational risk: creating incentives for reporting and disclosing. *Journal of Risk Management in Financial Institutions, 2*(3), 284-300.
Hair, J. F. (2009). Multivariate data analysis.
Hair, J. F., Black, W. C., Babin, B. J., & Anderson, R. E. (2010). Multivariate data analysis: A global perspective. *Pearson Education International, New Jersey, NJ*.
Hair, J. F., Black, W. C., Babin, B. J., Anderson, R. E., & Tatham, R. L. (2006). Multivariate data analysis (Vol. 6): Upper Saddle River, NJ: Pearson Prentice Hall.
Hayes, A. F. (2012). PROCESS: A versatile computational tool for observed variable mediation, moderation, and conditional process modeling.

Helbok, G., & Wagner, C. (2006). Determinants of operational risk reporting in the banking industry. *Available at SSRN 425720*.

Herring, R. J. (2002). The Basel 2 approach to bank operational risk: Regulation on the wrong track. *The Journal of Risk Finance, 4*(1), 42-45.

Hull, J. (2012). *Risk Management and Financial Institutions,+ Web Site* (Vol. 733): John Wiley & Sons.

Jacobs, M. (2010). Validation of economic capital models: State of the practice, supervisory expectations and results from a bank study. *Journal of Risk Management in Financial Institutions, 3*(4), 334-365.

Kashyap, A., & Stein, J. (2004). iCyclical Implications of Basel II Capital Standards, j Federal Reserve Bank of Chicago. *Economic Perspectives, 1st Quarter, 18*.

Kothari, C. (2009). Research methodology: Methods and techniques New Delhi: New Age International Publishers: ISBN 978-81-224-15222-3.

Kühn, R., & Neu, P. (2003). Functional correlation approach to operational risk in banking organizations. *Physica A: Statistical Mechanics and its Applications, 322*, 650-666.

Lin, H.-Y., & Chang, H.-Y. ANALYSIS OF THE CORRELATION BETWEEN OPERATIONAL RISKS AND OPERATIONAL PERFORMANCE: RESULTS OBTAINED BY COMPARING INDEPENDENT BANKS WITH THE FINANCIAL HOLDING SUBSIDIARY BANKS.

Master, E. (2016). Banking Sector Analysis Report.

McConnell, P. (2008). People risk: Where are the boundaries? *Journal of Risk Management in Financial Institutions, 1*(4), 370-381.

McCormack, P., & Sheen, A. (2013). Operational risk: Back on the agenda. *Journal of Risk Management in Financial Institutions, 6*(4), 366-386.

McCormack, P., Sheen, A., & Umande, P. (2014). Managing operational risk: Moving towards the advanced measurement approach. *Journal of Risk Management in Financial Institutions, 7*(3), 239-256.

Mehra, Y. S. (2011). *Operational risk management in Indian Banks: impact of ownership and size on range of practices for implementation of advanced measurement approach.* Paper presented at the The Thirteenth Annual Conference on Money and Finance in the Indian Economy.

Millar, D. (2012). The BIS operational risk reviews: Let us not miss the chance of necessary change. *Journal of Risk Management in Financial Institutions, 5*(4), 359-362.

Mishra, N. (2014). *Modeling Credit and Operational Risks of Indian Companies as per Basel II norms.* (PhD), UoH, Hyderabad.

Monti, F., Brunner, M., Piacenza, F., & Bazzarello, D. (2010). Diversification effects in operational risk: A robust approach. *Journal of Risk Management in Financial Institutions, 3*(3), 243-258.

Moosa, I., & Silvapulle, P. (2012). An empirical analysis of the operational losses of Australian banks. *Accounting & Finance, 52*(1), 165-185.

Ozdemir, B., & Cubukgil, E. (2014). Managing differences in economic and regulatory capital: An examination of return of equity (ROE) maximising strategies. *Journal of Risk Management in Financial Institutions, 7*(4), 328-344.

Power, M. (2005). The invention of operational risk. *Review of International Political Economy, 12*(4), 577-599.

Prokop, J., & Pfeifer, D. (2013). How do you deal with operational risk? A survey of risk management practices in the German insurance sector. *Journal of Risk Management in Financial Institutions, 6*(4), 444-454.

Rao, D. T., & Ghosh, P. (2008). Preparedness of Indian Banks in managing operational risk. *Economic and Political Weekly*, 47-53.

RBI. Evolution of Banking in India.

Guidance note on management of operational risk (2005).

Guidelines on Advanced Measurement Approach (AMA) for Calculating Operational Risk Capital Charge (2011).

Introduction of Advanced Approaches of Basel II Framework in India – Time Schedule (July 2009).

Rippel, M., & Teply, P. (2011). Operational Risk-Scenario Analysis. *Prague Economic Papers, 1*, 23-39.
Robert S. Dunnett, C. B. L. A. P. S. (2005, 2005). Managing operational risk in banking. *The McKinsey Quarterly.* 1
Selma, M. R. B., Abdelghani, E., & Rajhi, M. T. (2013). Risk management tools practiced in Tunisian commercial banks. *Studies in Business and Economics, 8*(1), 55-78.
Shi, Y., Young, H. W., & Cao, R. (2015). On aggregate model risk management: Focus on stress testing. *Journal of Risk Management in Financial Institutions, 8*(2), 171-195.
Sironi, A., & Resti, A. (2007). *Risk management and shareholders' value in banking: from risk measurement models to capital allocation policies* (Vol. 417): John Wiley & Sons.
Skoglund, J., Erdman, D., & Chen, W. (2013). A mixed approach to risk aggregation using hierarchical copulas. *Journal of Risk Management in Financial Institutions, 6*(2), 188-205.
Šoško, G. B. (2013). PRACTICAL CHALLENGES IN DEFINING AND IMPLEMENTING MODEL FOR MEASUREMENT OF OPERATIONAL RISK CAPITAL REQUIREMENTS IN BANKING INDUSTRY. *Business Consultant/Poslovni Konsultant, 5*(31).
Supatgiat, C., Kenyon, C., & Heusler, L. (2006). Cause-to-effect operational-risk quantification and management. *Risk Management, 8*(1), 16-42.
Sverrisson, Á., Van Dijk, M., & Van Dijk, M. P. (2000). *Local economies in turmoil: the effects of deregulation and globalization*: Springer.
Teply, P., Sekhri, V., & Chalupka, R. (2010). Modeling Capital Requirements for Operational Risk in Emerging Markets' Banks. *Decision, 37*(1), 83.
Tripe, D. (2000). *Pricing operational risk.* Paper presented at the 13th Australasian Finance and Banking Conference, Sydney, December.
Trudell, C. (2014). Internal Audit's role in the risk assessment process at KeyCorp. *Journal of Risk Management in Financial Institutions, 7*(4), 370-374.
Vaughan, E. J. (1995). *Essentials of Insurance: A risk management perspective*: John Wiley & Sons Incorporated.
Whalen, C. (2008). An empirical approach to Basel II. *Journal of Risk Management in Financial Institutions, 1*(2), 133-145.
Xie, Y., Wu, Y.-w., & Hu, Y.-c. (2011). The Engineering of China Commercial Bank Operational Risk Measurement. *Systems Engineering Procedia, 1*, 330-336.
Yang, C.-C. (2012). Service, investment, and risk management performance in commercial banks. *The Service Industries Journal, 32*(12), 2005-2025.
Young, J. (2012). The use of Key Risk Indicators by banks as an operational risk management tool: A South African perspective.

Appendix 1

Basel Business Line Classification

Level 1	**Level 2**	**Activity Groups**
Corporate Finance	Corporate Finance	Mergers and acquisitions, underwriting, privatisations, securitisation, research, debt (government, high yield), equity, syndications, IPO, secondary private placements
	Government Finance	
	Merchant Banking	
	Advisory Services	
Trading & Sales	Sales	Fixed income, equity, foreign exchanges, credit products, funding, own position securities, lending and repos, brokerage, debt, prime brokerage and sale of Government bonds to retail investors.
	Market Making	
	Proprietary Positions	
	Treasury	
Payment and Settlement	External Clients	Payments and collections, inter-bank funds transfer (RTGS, NEFT, EFT, ECS etc.), clearing and settlement
Agency Services	Custody	Escrow, securities lending (customers) corporate actions, depository services
	Corporate Agency	Issuer and paying agents
	Corporate Trust	Debenture trustee

Asset Management	Discretionary Fund Management	Pooled, segregated, retail, institutional, closed, open, private equity
	Non-Discretionary Fund Management	Pooled, segregated, retail, institutional, closed, open
Retail Brokerage	Retail Brokerage	Execution and full service
Retail Banking	Retail Banking	Retail lending including trade finance, cash credit etc. as defined under Basel II and also covering non fund based and bill of exchange facilities to retail customers, housing loans, loans against shares, banking services, trust and estates, retaildeposits, intra bank fund transfer on behalf of retail customers.
	Private Banking	Private lending (personal loans) and private/bulk deposits, banking services, trust and estates, investment advice
	Card Services	Merchant/commercial/corporate cards, private labels and retail
Commercial Banking	Commercial Banking	Project finance, corporate loans, cash credit loans, real estate, export and import finance, trade finance, factoring, leasing, lending, guarantees including deferred payment and performance guarantees, LCs,

		bills of exchange, take-out finance, interbank lending other than in call money and notice money market.

Source: "Guidelines on Advanced Measurement Approach (AMA) for Calculating Operational Risk Capital Charge", Reserve Bank of India, April, 2011

Annexure 2

Loss event type classification

Loss Event Type Classification			
Category(Level 1)	Definition	Category (Level 2)	Category (Level3)
Internal Fraud	Losses due to acts of a type intended to defraud, misappropriate property or circumvent regulations, the law or company policy, excluding diversity / discrimination events, which involves at least one internal party.	Unauthorized activity	Transactions not reported (intentional)
			Transaction type unauthorized (monetary loss)
			Mismarking of position (intentional)
		Theft and Fraud	Fraud/ credit fraud /worthless deposits
			Theft / extortion / embezzlement / robbery
			Misappropriation of assets
			Malicious destruction of assets
			Forgery
			Check kiting
			Smuggling
			Account take-over / impersonation /etc
			Tax non-compliance /evasion (willful)
			Bribes/ kickbacks
			Insider trading (not on bank's account)
External Fraud	Losses due to acts of a type intended to defraud, misappropriate property or circumvent the law, by a third party	Theft and Fraud	Theft/ robbery
			Forgery
			Cheque Kiting
		Systems Security	Hacking damage
			Theft of information
Employment Practices and Workplace Safety	Losses arising from acts inconsistent with employment, health or safety laws or agreements, from	Employee Relations	Compensation, benefit, termination issues
			Organized labour activity

	payment of personal injury claims, or from diversity / discrimination events.	Environmental safety	General liability (Workplace accidents - slip & fall etc)
			Employee health & safety rules events
			Workers compensation
		Diversity and Discrimination	All discrimination types
Clients, Products & Business Practices	Losses arising from an unintentional or negligent failure to meet a professional obligation to specific clients (including fiduciary and suitability requirements), or from the nature or design of a product.	Suitability, Disclosure & Fiduciary	Fiduciary breaches / guideline violations
			Suitability / disclosure issues (KYC etc)
			Retail consumer disclosure violations
			Breach of privacy
			Aggressive sales
			Account churning
			Misuse of confidential information
			Lender Liability
		Improper Business or Market Practices	Antitrust Improper trade / market practices
			Market manipulation
			Insider trading
			Unlicensed activity
			Money laundering
		Product flaws	Product defects (unauthorized etc.)
			Model errors
		Selection, Sponsorship & Exposure	Failure to investigate client per guidelines
			Exceeding client exposure limits
		Advisory Activities	Disputes over performance of advisory activities
Damage to physical assets	Losses arising from loss or damage to physical assets from natural disasters or other events	Disasters and other events	Natural disaster losses
			Human losses from external sources

			(terrorism, vandalism)
Business disruption & system failures	Losses arising from disruption of business or system failures	Systems	Hardware
			Software
			Telecommunications
			Utility outrage / disruptions
Execution, Delivery & Process Management	Losses from failed transactions processing or process management, from relations with trade counterparties and vendors	Transaction Capture, Execution Maintenance	Miscommunication
			Data entry, maintenance or loading error
			Missed deadline or responsibility
			Model / system misoperation
			Accounting error / entity attribution error
			Other task misperformance
			Delivery failure
			Collateral management failure
			Reference data maintenance
		Monitoring and Reporting	Failed mandatory reporting obligation
			Inaccurate external report (loss incurred)
		Customer intake and documentation	Client permissions /disclaimers missing
			Legal documents missing / incomplete
		Customer client account management	Unapproved access given to accounts
			Incorrect client records (loss incurred)
			Negligent loss damage of client assets
		Trade Counterparties	Non client counterparty mis-performance

			Misc. non-client counterparty disputes
		Vendors & Suppliers	Outsourcing
			Vendor disputes

Annexure 3

Types of Risks : Some Key Risk Indicators (KRIs)

People	Internal control and corporate governance breakdown leading to financial losses, incompetence, internal/external fraud, theft: Employee theft and smuggling, insider and outsider trading, bribes, robbery, forgery, damage from computer hacking, etc.	1. Staff turnover rates 2. Number of documentation error 3. Staff training & experience level 4. Transaction and trade volumes
Process	Process execution: Management failure, product service complexity, delivery and process management, employment practices and workplace safety, delivery failure and vendor disputes, security failure, violation of employee health and safety rules, etc.	1. No. of fraudulent accounts rejected after Verification of documents as a percentage of total accounts sourced 2. No. of KYC discrepant cases as a percentage of total number of cases verified 3. No. of customer complaints received on account of mis-selling/aggressive selling as a percentage of total applications received
Technological systems	System failures caused by internal and external events: Programming error, loss of information data, failure of system to meet business requirement, internal telecommunication failure, IT crash caused by new application, etc.	1. preventive maintenance by number of hardware units 2. System downtime rate 3. Number of instances of network systems downtime 4. Backup failure rate 5. System failure retrieval time
External events	Political uncertainties: Damage to physical assets, fires, virus/mass diseases, terrorism, vandalism, riots, earthquakes, floods,	1. No of external attempted frauds 2. Number of hacking cases

	bankruptcy of supplier, transportation failures, etc.	

Source: “Guide to Optimal Operational Risk and Basel II”, Akkizidis, I.S and V. Bouchereau (2006), Auerbach Publications

Appendix 4

A Study on Operational Risk Management in Indian Banks

Respected Sir / Madam,
Greetings of the day. I, P.S.Subha Pradha, am a research scholar pursuing my PhD from University of Hyderabad on "Operational Risk Management in Indian Banks". As part of the research, I am undertaking a survey on "Determinants of Operational Risk" of banks to identify the critical factors influencing Operational Risk. The target respondents comprise the middle level management of banks. I request you to kindly fill in the following questionnaire as it will be very valuable for my research. The information provided by you will be kept confidential and would be used for academic purposes only. Thank you for your valuable time.

Please rate the following responses on a scale of 1 to 5 with

1 denoting **To a Negligible extent; 2 - To a Small Extent; 3 – Moderate extent; 4 - To a Large extent and 5 - To a Very Large extent**

	According to you,					
1	The extent to which the following people factors contribute to operational losses of the bank					
	Incompetence of staff	1	2	3	4	5
	Negligence of staff	1	2	3	4	5
	Work environment	1	2	3	4	5
	Lack of motivation	1	2	3	4	5
	Low Morale	1	2	3	4	5
	Lack of Training	1	2	3	4	5
	Fraudulent activities by employees	1	2	3	4	5
	Any Other _____					
2	The extent of operational losses the bank encounters because of					
	Systems or technology failure	1	2	3	4	5
	Insecure systems/transactions	1	2	3	4	5
	Hacking over the network	1	2	3	4	5
	Programming Errors or execution of programs	1	2	3	4	5
	Technical snags in communication channels (telecommunication failure)	1	2	3	4	5
	Technology becoming obsolete/outdated	1	2	3	4	5
	Delay in upgrading to new technology	1	2	3	4	5
	Operating System Platform	1	2	3	4	5
	Any other Systems/Technology related problem _____					
3	The extent to which the following external events lead to operational losses					
	Natural Calamities	1	2	3	4	5
	External criminal activities	1	2	3	4	5
	Domestic political environment/ uncertainty	1	2	3	4	5
	Regulatory compliance	1	2	3	4	5
	Claims from customers	1	2	3	4	5
	Claims from counterparties	1	2	3	4	5

	Strikes	1	2	3	4	5
	Money Laundering	1	2	3	4	5
	New functions of banks like outsourcing	1	2	3	4	5
	Anticipated changes in the external operating environment	1	2	3	4	5
	Unanticipated changes in the external operating environment	1	2	3	4	5
	Deterioration of bank's reputation in the minds of the Customer	1	2	3	4	5
	Deterioration of bank's reputation in the minds of the Shareholder	1	2	3	4	5
	Deterioration of bank's reputation as perceived by regulators	1	2	3	4	5
	Any other_____					
4	Extent to which complexity of financial products/services leads to transaction errors	1	2	3	4	5
5	Extent to which operational manual provides support for carrying transactions smoothly	1	2	3	4	5
6	Extent to which assumptions underlying operational risk models are realistic and accurate	1	2	3	4	5
	The difference between actual and predicted operational losses based on the operational risk model is	1	2	3	4	5
	Any other operational model problem _____					
7	The extent of occurrence of operational losses because of absence or inadequacy of a back-up plan	1	2	3	4	5
8	The extent of occurrence of operational losses because of absence or inadequacy of a disaster recovery plan	1	2	3	4	5
Please rate the following responses from **1 to 5 with 1** denoting **Very Low, 2 - Low, 3 - Moderate, 4 - High, 5 - Very High**						
9	The frequency of	**0 - 2 %**	**2 - 5 %**	**5 - 8 %**	**8 - 10 %**	**> 10 %**
	Execution errors in transactions in the bank per month					
	Operational disruptions in carrying out transactions per month					
	Security lapse encountered in transactions in a month					
	Transactions exceeding threshold limits					
	Any other transaction related issues_____					
10	Based on the current scenario,					
	Please rate the people risk that the bank is exposed to	1	2	3	4	5
	Please rate the process risk that the bank is exposed to	1	2	3	4	5
	Please rate the systems/technology risk that the bank is exposed to	1	2	3	4	5
	Please rate the risk due to external events that the bank is exposed to	1	2	3	4	5
11	Please rank the top 3 events that contribute most towards operational losses in the bank					
	[ ]Internal Fraud					
	[ ]External Fraud					
	[ ]Employment Practices and Workplace Safety					
	[ ]Clients, Products and Business Practices					
	[ ]Damage to Physical Assets					
	[ ]Business Disruption and System Failures					
	[ ]Execution, Delivery and Process Management					
12	Please rank the top 3 business lines that incur maximum operational losses					
	[ ]Corporate Finance					
	[ ]Trading and Sales					

	[ ]Payment and Settlement
	[ ]Agency Services
	[ ]Asset Management
	[ ]Retail Brokerage
	[ ]Retail Banking
	[ ]Commercial Banking
13	In your opinion, are there any other factors that can cause significant operational losses? Please specify.

Name: Sri/ Smt _____

Designation :_____ Department: _____

No. of years of banking experience: _____

Bank & Branch: _____

Nature of Banking: _____

Location: _____

Appendix 6

A Study on Operational Risk Management in Indian Banks

Respected Sir / Madam,
Greetings of the day. I, P.S.Subha Pradha, am a research scholar pursuing my PhD from University of Hyderabad on "Operational Risk Management in Indian Banks". As part of the research, I am undertaking a survey on "Operational Risk Management practices" of banks to identify the critical factors influencing Operational Risk and its Management. The target respondents comprise the top and middle level management of banks. I request you to kindly fill in the following questionnaire as it will be very valuable for my research. The information provided by you will be kept confidential and would be used for academic purposes only. Thank you for your valuable time.

Please rate the following responses on a scale of 1 to 5 with

1 denoting **To a Negligible extent; 2 - To a Small Extent; 3 - Cannot Say; 4 - To a Large extent and 5 - To a Very Large extent**

	According to you,					
1	The extent to which the following people factors contribute to operational losses of the bank					
	Incompetence of staff	1	2	3	4	5
	Negligence of staff	1	2	3	4	5
	Work environment	1	2	3	4	5
	Lack of motivation	1	2	3	4	5
	Low Morale	1	2	3	4	5
	Lack of Training	1	2	3	4	5
	Fraudulent activities by employees	1	2	3	4	5
	Any Other _____					
2	The extent of operational losses the bank encounters because of					
	Systems or technology failure	1	2	3	4	5
	Insecure systems/transactions	1	2	3	4	5
	Hacking over the network	1	2	3	4	5
	Programming Errors or execution of programs	1	2	3	4	5
	Technical snags in communication channels (telecommunication failure)	1	2	3	4	5

	Technology becoming obsolete/outdated	1	2	3	4	5
	Delay in upgrading to new technology	1	2	3	4	5
	Operating System Platform	1	2	3	4	5
	Any other Systems/Technology related problem _____					
3	The extent to which the following external events lead to operational losses					
	Natural Calamities	1	2	3	4	5
	External criminal activities	1	2	3	4	5
	Domestic political environment/ uncertainty	1	2	3	4	5
	Regulatory compliance	1	2	3	4	5
	Claims from customers	1	2	3	4	5
	Claims from counterparties	1	2	3	4	5
	Strikes	1	2	3	4	5
	Money Laundering	1	2	3	4	5
	New functions of banks like outsourcing	1	2	3	4	5
	Anticipated changes in the external operating environment	1	2	3	4	5
	Unanticipated changes in the external operating environment	1	2	3	4	5
	Deterioration of bank's reputation in the minds of the Customer	1	2	3	4	5
	Deterioration of bank's reputation in the minds of the Shareholder	1	2	3	4	5
	Deterioration of bank's reputation as perceived by regulators	1	2	3	4	5
	Any other_____					
4	Extent to which complexity of financial products/services leads to transaction errors	1	2	3	4	5
5	Extent to which operational manual provides support for carrying transactions smoothly	1	2	3	4	5
6	Extent to which assumptions underlying operational risk models are realistic and accurate	1	2	3	4	5
	The difference between actual and predicted operational losses based on the operational risk model is	1	2	3	4	5
	Any other operational model problem _____					
7	The extent of occurrence of operational losses because of absence or inadequacy of a back-up plan	1	2	3	4	5

8	The extent of occurrence of operational losses because of absence or inadequacy of a disaster recovery plan	1	2	3	4	5
Please rate the following responses from **1 to 5 with 1** denoting **Very Low, 2 - Low, 3 - Moderate, 4 - High, 5 - Very High**						
9	The frequency of	**0 - 2 %**	**2 - 5 %**	**5 - 8 %**	**8 - 10 %**	**> 10 %**
	Execution errors in transactions in the bank per month					
	Operational disruptions in carrying out transactions per month					
	Security lapse encountered in transactions in a month					
	Transactions exceeding threshold limits					
	Any other transaction related issues_____					
10	Based on the current scenario,					
	Please rate the people risk that the bank is exposed to	1	2	3	4	5
	Please rate the process risk that the bank is exposed to	1	2	3	4	5
	Please rate the systems/technology risk that the bank is exposed to	1	2	3	4	5
	Please rate the risk due to external events that the bank is exposed to	1	2	3	4	5
11	Please rank the top 3 events that contribute most towards operational losses in the bank					
	[ ]Internal Fraud					
	[ ]External Fraud					
	[ ]Employment Practices and Workplace Safety					
	[ ]Clients, Products and Business Practices					
	[ ]Damage to Physical Assets					
	[ ]Business Disruption and System Failures					
	[ ]Execution, Delivery and Process Management					
12	Please rank the top 3 business lines that incur maximum operational losses					
	[ ]Corporate Finance					
	[ ]Trading and Sales					
	[ ]Payment and Settlement					
	[ ]Agency Services					

	[ ]Asset Management					
	[ ]Retail Brokerage					
	[ ]Retail Banking					
	[ ]Commercial Banking					
13	In your opinion, are there any other factors that can cause significant operational losses? Please specify.					
Please rate the following responses on a scale of **1 to 5** with **1 - Strongly Disagree; 2 - Disagree; 3 - Neutral; 4 - Agree; 5 - Strongly Agree**						
14	The bank has strong set of values, beliefs, knowledge, understanding and attitude about risk	1	2	3	4	5
	The bank sets appropriate standards in risk management and rewards professional and responsible behaviour	1	2	3	4	5
15	The bank sets clear expectations of ethical values, acceptable business practices and prohibited conflicts	1	2	3	4	5
16	The bank ensures that every employee undergoes training to minimize operational risk across all levels in the bank	1	2	3	4	5
17	The bank has supporting processes to understand the nature and complexity of the risks in the bank products	1	2	3	4	5
18	The bank clearly defines operational risks and operational losses	1	2	3	4	5
19	The bank incorporates its operational risk assessment results into overall business strategy development processes	1	2	3	4	5
20	The bank has policies and procedures specific to operational risk management	1	2	3	4	5
21	The bank's operational risk policies are updated after independent audits	1	2	3	4	5
22	The bank's ORM policies are revised as per industry best practices	1	2	3	4	5
23	The bank has clear lines of management responsibility, accountability and reporting	1	2	3	4	5
24	The bank reviews and updates the levels of operational risk that it is willing to take & its level of risk aversion	1	2	3	4	5
25	The bank provides essential resources to manage operational risk	1	2	3	4	5
26	The bank has effective coordination and communication between operational risk management staff and staff managing credit, market and other risks	1	2	3	4	5
	The bank uses the following tools to identify and assess the operational risk					

27	Audit Findings	1	2	3	4	5
	Internal Loss Data Collection and Analysis	1	2	3	4	5
	External Loss Data Collection and Analysis	1	2	3	4	5
	Risk Control & Self-Assessment	1	2	3	4	5
	Business Process Mapping	1	2	3	4	5
	Risk and Performance Indicators	1	2	3	4	5
	Scenario Analysis	1	2	3	4	5
	Risk Measurement	1	2	3	4	5
	Causal Modelling	1	2	3	4	5
	Comparative Analysis	1	2	3	4	5
	Questionnaires	1	2	3	4	5
	Scorecards	1	2	3	4	5
	Any other _____					
28	The bank's internal pricing mechanisms take operational risk into consideration	1	2	3	4	5
	The bank's performance measurement mechanisms take operational risk into consideration	1	2	3	4	5
29	The bank has policies and procedures for review, approval and monitoring of new products/processes and their possible impact on operational risk	1	2	3	4	5
30	The bank's operational risk management control mechanism is updated with the changes to products/processes	1	2	3	4	5
31	The bank's operational risk reports are					
	Comprehensive	1	2	3	4	5
	Accurate	1	2	3	4	5
	Consistent	1	2	3	4	5
	Actionable	1	2	3	4	5
32	The reports are timely and reflect the risks involved along with the changes in the operating environment	1	2	3	4	5
33	The reports to the Board of Directors and Senior Management includes [ ]Results of monitoring activities [ ]Assessments of Framework by internal audit [ ]Reports for supervisory authorities					
34	Operational risk reports of the bank contain elements like [ ]Operational indicators, [ ]Internal financial indicators, [ ]Compliance indicators					

	[ ]External market information about events relevant to decision making					
35	Operational risk reports of the bank include [ ]breaches of the bank's risk appetite and tolerance statement, thresholds or limits [ ]details of recent significant internal operational risk events and losses [ ]relevant external events and any potential impact on the bank and operational risk capital					
36	The weightage the bank's internal control program attributes to the following (5 being maximum weightage)					
	Risk Assessment	1	2	3	4	5
	Control Environment	1	2	3	4	5
	Information and Communication	1	2	3	4	5
	Monitoring Activities	1	2	3	4	5
37	The bank segregates duties appropriately to avoid conflicts of interest	1	2	3	4	5
38	The bank ensures data and system integrity, security and availability	1	2	3	4	5
39	The bank understands operational risks associated with outsourcing	1	2	3	4	5
	The bank has policies and practices to manage risk in outsourcing activities	1	2	3	4	5
40	The bank transfers risk to third parties in cases where internal controls do not adequately address risk	1	2	3	4	5
41	The bank's business continuity plans consider					
	Complexity of its operations	1	2	3	4	5
	Likely scenarios to which the bank may be vulnerable	1	2	3	4	5
42	The bank's Continuity management incorporates					
	Business Impact Analysis	1	2	3	4	5
	Recovery strategies	1	2	3	4	5
	Testing, training and awareness programs	1	2	3	4	5
	Communication and crisis management programs	1	2	3	4	5
43	The bank periodically reviews continuity plans to ensure that contingency strategies are in line with current operations, risks and threats	1	2	3	4	5
44	The bank discloses its operational risk management framework allowing stakeholders to assess its effectiveness	1	2	3	4	5
45	The bank has a formal disclosure policy that determines the operational risk disclosures and the internal controls over the disclosure process	1	2	3	4	5
46	The bank assesses the appropriateness, verification and frequency of the disclosures	1	2	3	4	5

47	Please rate the importance assigned to each element of operational risk management process in the bank					
	Risk Identification	1	2	3	4	5
	Risk Measurement	1	2	3	4	5
	Risk Control & Mitigation	1	2	3	4	5
	Risk Transfer	1	2	3	4	5
	Others _____	1	2	3	4	5
48	The bank considers Operational Risk Management as an important and integral element of the overall risk management process	1	2	3	4	5
49	Your opinion on the current scenario and future direction of Operational Risk Management in Indian Banks					
50	What according to you are the challenges in implementation of effective Operational Risk Management?					

Name: Sri/ Smt _____

Designation :_____ Department: _____

No. of years of banking experience: _____

Bank & Branch: _____

Nature of Banking: _____

Location: _____

Thank You for your valuable contribution.

Appendix 7

Papers Presented/ Published

- Published a paper titled A Study on the Determinants of Operational Risk in Public Sector Banks, International Research Journal of Commerce & Behavioural Science, Vol 5, No 3, January 2016, ISSN 2251 1547

- Published a paper titled Operational Risk Management in Indian Banks – the changing Paradigm, International Research Journal of Economics & Business Studies, Vol 4, No 11, September 2015, ISSN 2251 1555

- Presented & Published a paper on Impact of Internationalization Prudential Regulations on Banking Strategies : A Case Study of ICICI Ltd at the international conference on "Global Business : Opportunities & Challenges" organized by Osmania University, March 27th – 29th, 2014, ISBN : 978-81-910003-0-14

- Presented & published a paper on A Comparative Study of LIC and Private Life Insurers in India at the national conference on Corporate Finance & Financial Services – Emerging Trends organized by University of Hyderabad, 14th to 16th February 2013, ISBN : 978-93-82829-42-3

- Presented & published a paper on Risk Management System in Banking in the national conference on Risk Management in Banking, Insurance & Financial Services, Institute of Public Enterprise ,Jan 30th & 31st , 2013, ISBN : 978-93-327-0139-7.

- Published a paper on Bancassurance: Convergence of Banking & Insurance in Business Vision, Volume 8,Number 3, July – Sep 2012 Sister Nivedita Foundation, ISSN 2231 - 5497.

- Published "Case Study on Anjani Portland Cement Ltd", in Business Views, Vol1, No. 1, Jun – Aug 2004

Appendix 8

Conferences / Workshops attended

- Attended an International Conference on "Global Business : Opportunities & Challenges" organized by Osmania University from 27th – 29th March, 2014

- Attended a 21 day "Refresher Course on Research Methodology" from University of Hyderabad from 23rd April – 13th May, 2014

- Attended a seven day workshop on "Computational Methods & Data Analysis in social Sciences" Osmania University, 19th – 25th March, 2014

- Attended a six day workshop on Research Methodology in Commerce and Management organized by Osmania University & ICSSR-SRC , 24th – 29th April, 2013

- Attended three day national conference on Corporate Finance & Financial Services – Emerging Trends organized by University of Hyderabad from 14th to 16th February 2013

- Attended a two day national conference on Risk Management in Banking, Insurance & Financial Services organized by Institute of Public Enterprise 0n Jan 30th and 31st,2013

- Attended Faculty Development Program on Case Study, Article Writing, Research Tools and Research Methodology organized by Vignan Bharti Institute of Technology, 13th & 14th November, 2009

- Attended Faculty Development Program on Knowledge Management and Inventive Thinking in the context of Current Business Trends organized by Wesley P.G College, 24th October, 2009