Controlling Operational Risk
Concepts and Practices

A Participant-Observer Research
on the Development of Concepts and Practices
in Controlling Operational Risk
in a Banking Environment

Promotiecommissie

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PROEFSCHRIFT

ter verkrijging van
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door

Alice Hendrika Adriana Johanna van den Tillaart
geboren op 29 december 1975
te Veghel

Dit proefschrift is goedgekeurd door

de promotoren
Prof. Dr. Ir. A. Bruggink

Prof. Dr. J.H.R. van de Poel

de referent
Prof. Dr. J. Bilderbeek

Voorwoord

Voor u ligt het resultaat van zo'n vier jaar worstelen met het onderwerp 'operationeel risico'. De interesse in wetenschappelijk onderzoek is gedurende mijn doctoraalstudie gegroeid en ik ben dan ook blij dat ik het lef heb gehad tegen Rabobank te zeggen dat dit was wat ik wilde. Nu is dan eindelijk het moment daar dat het voorwoord mag worden geschreven. Hiervoor wil ik terugvallen op de avonturen van Alice in Wonderland. Bij mijn afscheid van Control Rabobank Groep leerde Niek mij immers al dat mijn avonturen staan opgetekend in dat boek. Zo ook het promoveren, wat verrassend overeenkomt met de avonturen die Alice beleeft als ze als een pion haar weg probeert te vinden op een enorm schaakbord met als doel koningin te worden: het verhaal 'door het vergrootglas'.

Vol goede moed begon ik in augustus 1999 als 'pion' bij Control Rabobank Groep. Immers, onderzoek en praktijk wilde ik niet splitsen. Het onderwerp bleek een blanco vel papier zonder enige instructies hoe te beginnen en wat te doen. Ik ben dan ook erg veel dank verschuldigd aan de mensen die mij in deze cruciale eerste fase op weg hebben geholpen. Dan denk ik met name aan Willem van Duijn, die met veel enthousiasme en interesse mij wist te inspireren. In een later stadium heb ik ook van Marja Feddes enorm veel mogen leren en veel steun ondervonden om, ondanks alles, steeds maar weer door te gaan. Terugkijkend denk ik dat we samen veel hebben bereikt en ik vind het dan ook erg leuk dat je tijdens de ceremonie mijn paranimf wilde zijn.

Toch is niet te voorkomen dat je regelmatig wordt geconfronteerd met situaties, waar je geen raad mee weet. Ik heb dus ook veel dingen alléén moeten ervaren en uitzoeken en dat vond ik terug in het boek van Alice:

> *She very soon came to an open field, with a wood on the other side of it: it looked much darker than the other wood, and Alice felt a little timid about going into it. However, on second thoughts, she made up her mind to go on: "for I certainly won't go back," she thought to herself, "and this is the only way to the Eighth Square."*
> *"I know what you're thinking about", said* ***Tweedledum****; "but it isn't so, nohow."*

*"Contrariwise," continued **Tweedledee**, "if it was so, it might be; and if it were so, it would be; but as it isn't, it ain't. That's logic."*
*"I was thinking," **Alice** said very politely, "which is the best way out of this wood: it's getting so dark. Would you tell me, please?"*
But the fat little man only looked at each other and grinned.

[Lewis Carol]

Een aantal keren heb ik het beeld dat ik had van mijn onderzoek moeten bijstellen. Waar ik in 1999 begon met het idee om operationeel risico te gaan meten, ben ik gaandeweg het proces gaan ontdekken dat meten helemaal niet zo logisch is. De onderzoeksmethode die ik heb toegepast is op een natuurlijke wijze tot stand gekomen. Uiteindelijk doe je toch de dingen waar je goed in bent en die je echt interesseren. Mijn promotoren hebben mij ondersteund bij het kiezen van een onderzoeksmethode die niet gebruikelijk is binnen mijn vakgebied, maar wel het beste past bij mij: participant-observer. In het observeren van de wijze waarop de bankwereld omgaat met operationele risico's viel ik van de ene verbazing in de andere. Het lijkt allemaal zo logisch als je er middenin zit, maar als je vanaf een afstandje toekijkt is er best wat op aan te merken.

"Well, just then I was inventing a new way of getting over a gate – would you like to hear it?
*"Very much indeed," **Alice** said politely.*
*"I'll tell you how I came to think of it," said the **Knight**. "You see, I said to myself 'the only difficulty is with the feet: the head is high enough already.' Now, first I put my head on the top of the gate – then the head's high enough – then I stand on my head – then the feet are high enough, you see – then I'm over, you see."*
*"Yes, I suppose you'd be over when that was done," **Alice** said thoughtfully: "but don't you think it would be rather hard?"*
*"I haven't tried it yet," the **Knight** said, gravely; "so I can't tell you for certain – but I am afraid it would be a little hard."*

[Lewis Carol]

Ik ben de vele collega's van andere banken in binnen- en buitenland bijzonder dankbaar voor al die momenten waarop we samen hebben kunnen discussiëren over operationeel risico. Met bijzonder veel plezier denk ik terug aan de vergaderingen ergens op de wereld, die van 's ochtends vroeg tot 's avonds laat doorgingen, maar wel bleven boeien. We moesten het met elkaar eens zien te worden over het te bewandelen pad en dat bleek niet makkelijk. Ik zal geen namen noemen, omdat ik enerzijds niemand tekort wil doen en anderzijds geen vertrouwen wil beschamen. Jullie zijn onbewust object van onderzoek geweest en mogelijkerwijs herkennen jullie je in mijn bevindingen.

Zoals de pion Alice in 'door het vergrootglas' koningin wordt, zo kwam ook voor mij het einddoel in zicht.

> *"You've only a few yards to go," he said, "down the hill and over that little brook, and then you'll be a queen."*
> *A very few steps brought her to the edge of the brook. "The Eighth Square at last!" she cried as she bounded across, and threw herself down to rest on a lawn as soft as moss, with little flower-beds dotted about it here and there. "Oh, how glad I am to get here! And what is this on my head?" she exclaimed in a tone of dismay, as she put her hands up to something very heavy, that fitted tight all around her head.*
> *"But how can it have got there without my knowing it?" she said to herself, as she lifted it off, and sat it on her lap to make out what it possibly could be.*
> *It was a golden crown.*
> *"Well, this is grand!" said* ***Alice****. "I never expected I should be a Queen so soon!"*
>
> *[Lewis Carol]*

Voor u ligt het resultaat en ik kijk terug op een boeiende periode, die uiteindelijk sneller werd afgerond dan gedacht. Dat is zeker niet alleen mijn verdienste. Ik wil daarom van de gelegenheid gebruik maken een aantal mensen in het bijzonder te bedanken.

Allereerst mijn ouders, want als zij mij niet de ruimte hadden gegeven om te gaan studeren en op zoek te gaan naar wat ik kan en wat ik wil, was dit boek er nooit gekomen. Ook al was het voor jullie vaak moeilijk om te begrijpen wat ik precies deed, jullie steun en liefde was onvoorwaardelijk.

Mijn promotoren, de heren Bruggink, Van de Poel en Bilderbeek en de professoren die zitting hebben genomen in mijn promotiecommissie, de heren Bagchi, Boorsma, Hoogendoorn, Koopmans en Leenaars wil ik bedanken voor de tijd die in mij is geïnvesteerd. Doordat ik omgeven was met praktijkmensen waren juist de discussies met jullie voor mij cruciaal en ook bijzonder boeiend. Ik ben nooit helemaal gaan wennen aan het idee dat je door het doen van onderzoek in contact komt met interessante mensen in de top van het bedrijfsleven, die de tijd voor je nemen. Voor jullie is onderzoek altijd een hobby gebleven en ik hoop dat ik op jullie leeftijd hetzelfde kan zeggen.

Mijn collega's en leidinggevenden binnen Rabobank mag ik hier zeker niet vergeten. Ik denk dan in het bijzonder aan Niek Vogelaar en Hans Warmerdam, die me de tijd gaven om onderzoek te doen, ook al conflicteerde dit wel eens met Rabobank belangen. Hoewel ik jarenlang werkte op hetzelfde vakgebied als waarnaar ik onderzoek deed, denk ik toch dat de inhoud van dit boek voor jullie

lang een vraagteken is gebleven. Hier dan eindelijk de kans om te zien wat ik al die uren alleen thuis achter mijn laptopje heb zitten doen.
Ronald wil ik bedanken voor het becommentariëren van de eerste artikelen die ik publiceerde, wat op de Beaujolais borrel uitgebreid is gevierd...

Bij het zetten van de puntjes op de i heb ik kunnen leunen op de kennis, ervaring en interesse van René Doff en Wim van den Goorbergh. Jullie frisse blik op inhoud en taal heeft zeker bijgedragen aan de kwaliteit van dit boekwerk. David Wright en Vinod Patel hebben zich uitgeleefd op het Engels, waarvoor ik ze heel dankbaar ben. You really did me a huge favour, thanks a lot!

Voor de broodnodige uurtjes van ontspanning kon ik terugvallen op vrienden, familie, (oud)-collega's en de fanfare. Voor carnaval, Orangerie, Old Dutch of het leggen van een Kolonistje was altijd wel een gaatje vrij te maken en dat was ook nodig om het fanatisme, waarmee promoveren zo nu en dan gepaard gaat, in toom te houden.

Tenslotte, ook thuis op de bank ging het wel eens over de essentie van economisch vermogen, het nut van RAROC en de problematiek rondom operationele risico's en business risk. Ik kan niet anders zeggen dan dat ik daarvan intens heb genoten. René, je hebt niet alleen vanaf de zijlijn liefde en ondersteuning geboden. Je inhoudelijke bijdrage is ook overweldigend geweest. Ik hoop dat we elkaar blijven vinden om al die fundamentele discussies te voeren, die in de praktijk vaak onterecht terzijde worden geschoven.

's-Hertogenbosch, juni 2003
Alice van den Tillaart

Table of Contents

Chapter 1 Introduction: Research Question and Summary

The subject of this thesis is controlling 'operational risk' in banks. Operational risk is defined as the risk of losses resulting from inadequate or failed internal processes, people, systems, or from external events.[1] Within this very broad subject, we focus on the place of operational risk management within the *risk management* function of banks, and on the development of measurement concepts to determine the appropriate level of *capital* necessary for this particular risk type. The problem of operational risk management applies to many industries. We have chosen to restrict our research to the banking industry, due to the large role *banking regulation* has played in the development of measurement concepts.[2]

As an introduction on the subject of operational risk management, this chapter provides some background information on risk management practice within banks, the role of capital and the role of capital regulation. In general, risk management in banking can be divided into four broad areas: Balance Sheet Management, Risk Transfer, Measurement and Pricing, and Management Control. Section 1.1 introduces and describes these areas. Also, this section explains the Risk Management Process. Section 1.2 describes the role of equity in banking and explains why equity management and risk measurement are related. Section 1.3 includes a first introduction to the role of regulation in the banking industry, the unavoidable regulatory arbitrage, and the conversion of financial institutions.
After these introductory sections, the research question is formulated and explained. Section 1.5 provides a summary of the entire research. Chapter Two separately describes the methodological justifications of this research.

1.1 The Risk Management Concept in Banking

Banks are financial intermediaries, the main activities of which are taking deposits, making loans and transmitting payments.[3] Banking can also be defined as a business that makes a profit from acquiring money and providing credits and investments for its own account.[4] In the Netherlands, a bank used to be characterised as 'rentemargebedrijf' (interest rate margin company), transforming

amounts, maturity, and risks from the one's facing surplus to the one's facing shortage in the economy.[5]

The reason for the existence of banks is the monitoring costs of investors depositing their money with the bank. Investors are generally unable to monitor the 'financial health' of all individual debtors, so banks perform it on their behalf. Also, there are certain transaction costs involved in issuing a loan to debtors that cannot be borne by individual investors. The intermediation of banks in this process decreases the total monitoring costs and transaction costs.

The essence of banking can be summarised as making profit out of borrowing and lending money. Banks profit from different rates on the borrowing and lending markets for money, due to the transformation of maturity, liquidity, price/interest related risks, and credit risk. Banks can increase their profit by, for example, lending money for the long term and borrowing it for the short-term. This is called transformation of maturity. The transformation of maturity is most often accompanied by taking interest rate risk, as long-term rates are usually higher than short-term rates. Relevant for the rates of transactions is for example:

- ✓ *Credit Risk:* will the counterpart who borrows money from the bank be able to repay on the agreed date? A counterpart with a strong financial position and excellent management will have a lower probability of default than a counterpart with a weak financial position, inadequate management, or both.
- ✓ *Market Risk:* what are the expected changes in market rates on the buy and sell markets during the term of the transactions?
- ✓ *Interest Rate Risk:* how will the short-term and long-term interest rates develop compared to each other? Is there a chance that short-term rates will have risen dramatically at the refunding date?
- ✓ *Time to Maturity:* what will be the duration of the contract? A long-term contract implies higher credit, market, or interest rate risks.

For banks, managing these risks and being able to estimate their (financial) impact is necessary to distinguish oneself from competitors; to discover the most attractive clients; and hence to make the best financial results. As risks are the basis for pricing in banking, it is not surprising that risk management is a profession that is deeply rooted in the various departments of banks.

The earliest tools in risk management were aimed at interest rate risk management and liquidity management, but these tools were also used for credit risk management.[6] These risks were considered the only relevant risks at that time. Product innovation and changes in customers' demand introduced new risks. To

keep up with the industry and keep track of these new risks, risk management in banks has become a continuously developing area. Comparing the risk management function in banks to the risk management function in non-financial institutions, differences can be observed. In non-financial institutions, a flow of goods is combined with a flow of money in the opposite direction. Financial institutions only have flows of money.

Aspect	***Financial institutions***	***Non-financial institutions***
Goal	Make profit by taking risks Some defensive goals as well	Primarily defensive
Scope	Asset & Liability Management	Only financial assets
Relation with company strategy	Closely related to business strategy (financial processes are primary processes)	Large distance to business strategy, financial processes are supportive (difference between primary processes and financial processes)
Stage of risk measurement	Strongly developed	In a developmental phase
Risk analysis techniques	Focused on market value	Focused on nominal value

Table 1.1: Differences in Risk Management Function [7]

1.1.1 Four Areas of Risk Management

According to Vaughan and Vaughan, risk management can be split up into risk financing and risk control.[8] Another possible distinction is transfer, avoid, accept and reduce/control. As acceptance and avoidance do not require active risk management efforts, we will focus on the distinction between financing and control.[9]

Risk Management Type	***Risk Management Area***	***Examples***
Risk financing	Balance sheet management	Hedging, futures, securitisation
	Risk transfer	Insurance, alternative risk transfer
	Measurement and pricing	Fees and Commission
Risk control	Management control	Limit setting, budgeting, procedures, rating techniques

Table 1.2: Four Areas of Risk Management

Risk control focuses on minimising the risk of losses. *Risk financing* concentrates on arranging the availability of funds to meet losses arising from risks. We distinguish three methods to obtain funds: through the capital markets (balance sheet management), via insurance or alternative risk transfer, and by charging clients (pricing).

The various risk management areas deal with different parts of risk management (Figure 1.1). For example, the bank can choose to sell the complete risk at once

before any losses occur, or it can sell the possible damage only. At the other hand, the bank can also choose to measure the risk and charge the client to pay for it.

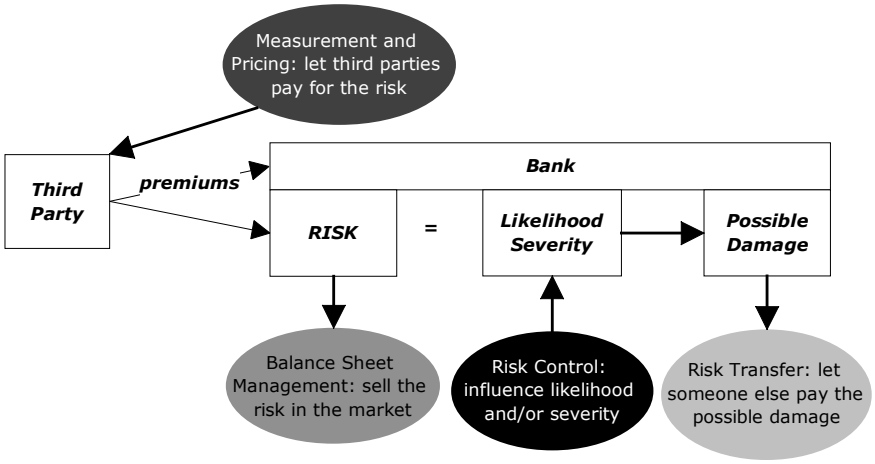

Figure 1.1: The Aspects of Risk Management

Balance Sheet Management

Managing the balance sheet or 'Asset-Liability Management' is an important activity in banking. For example, banks earn money via funding long-term assets with short-term liabilities and maintaining an interest-rate mismatch position. An important aspect of balance sheet management is asset securitisation. Banks can sell part of their assets in the market via Special Purpose Vehicles that issue bonds or other securities.

Asset-Liability Management focuses on quantitative management of interest and liquidity risks at the global level. The major areas of Asset-Liability Management include: (a) the measurement and monitoring of liquidity and interest rate risks, (b) the funding and control of the balance sheet constraints, and (c) the hedging programmes for both liquidity and interest rate risks.[10]

Risk Transfer

The best-known risk transfer method in banking is 'insurance'. Insurance is used to mitigate the loss resulting from for example fraud, liabilities, crime and damage to physical assets. Outsourcing activities and derivative structures can be other examples of risk transfer. Given the innovations in both risk transfer products and Asset-Liability Management, the two risk management areas are hard to separate.

Measurement and Pricing

Although this term might not be used explicitly in banking, we use this term to group those risk management techniques that use involvement of the client in the risk/return trade-off. An example of measurement and pricing is the incorporation of a credit risk charge in the tariff for retail loans. Clients with high credit risk must pay more than similar clients with low credit risk. If the bank takes more risk, it also wants higher returns. Risk modelling, like Value-at-Risk, is a widely applied tool for risk measurement and pricing. Also, credit rating techniques are frequently used.

Management Control

Management control can be defined as the process by which managers influence other members of the organisation to implement the organisation's strategy.[11] There are many different management control systems and definitions. Financial control and risk control are aspects of the concept of Management Control. A characteristic of management control is the *internal focus*. Management control uses the business strategy as a starting point for developing performance measures, setting limits, identifying strategic uncertainties and influencing the corporate culture. Chapter Six will describe and discuss the concept of Management Control more thoroughly.

1.1.2 Banking Risks

Banks face a wide spectrum of risks. There seems to be consensus about which risks banks face, but views differ on how to group these risks. A selection of banking risks is given below. This selection is derived from Bos[12] and Dutch Central Bank[13]. It can be argued whether all risks mentioned in this table can be labelled as 'risk'. For example, can reputational risk be regarded as a separate risk category, when damage to reputation will always be the effect of failures in other risk categories (e.g. unethical strategic decision, payment system going down, lending money to criminal organisations) and not a cause in itself?

	Basel Committee on Banking Supervision	***G – 30***	***Dutch Central Bank***
Financial or Speculative Risks	Credit risk Market risk Interest rate risk Liquidity risk Country risk	Credit risk Market risk	Credit risk Price risk Interest rate risk Liquidity risk Foreign exchange risk
Non-Financial or Pure Risks	Operational risk Legal risk Reputational risk	Operational risk Legal risk	Operational risk IT risk Legal & integrity risk Reputational risk Strategic risk

Table1.3: Banking Risks

However, Table 1.3 clearly distinguishes between financial/speculative risks and non-financial/pure risks. Banks often make this distinction for a couple of reasons:

- ✓ Banks can actively take a position in financial risks, but non-financial risks are more the effect of doing business rather than an active choice;
- ✓ Financial risks have both an upside and a downside potential. The bank takes the position to gain money from it, but runs the risk of losing money on it. There is financial compensation for risk taking. Non-financial risks only have a downside potential, the maximum profit is zero.

In the primary business of borrowing and lending, as explained before, speculation on risks is an essential element. However, this only applies to the financial risks, as banks can actively take positions in these risks. Therefore, financial risk management is part of a banks primary process, whereas non-financial risk management is not.

Although all these risks are mentioned as separate categories, there appears to be a substantial amount of overlap between risk areas. Also, it is argued that being exposed to different types of risk may result in diversification benefits. Therefore, it is important to analyse risks in an integrated way.

1.1.3 The Risk Management Process in Banking

Risk management is a continuous process that can be split up in six steps:[14]

1. Identification of all material 'natural' risk exposures;
2. Risk retention decision;
3. Measurement or quantification;
4. Monitoring and reporting;
5. Actions, processes, and systems to control the firm's remaining risk exposures and its tolerances;
6. Oversight, audit, tuning, and re-alignment of risk management as a continuous process.

Risks can only be managed if they are identified (step one) and if a proper tolerance level has been set (step two). Risk identification and the formulation of risk tolerance levels are often related to the business strategy and form an important part of the policies of an organisation. All identified risks that are unacceptable to the organisation should be transferred to third parties (e.g. insurance, Alternative Risk Transfer), hedged or controlled by means of control measures. Sometimes, risks can only be avoided by means of withdrawal from a certain business or market.

Measurement or quantification is the third step. In managing risks, it is important to gather information on the development of the risk exposures. Before information can be reported, an appropriate measurement methodology must be developed (step three). The measurement methodology includes the type of information required, the method to translate this information into a 'risk figure' and the underlying systems needed to implement the measurement methodology technically. As soon as the measurement method is implemented, management can start monitoring the risk exposures and compare them to the tolerance level set (step four). Excesses should lead to actions (step five).

The oversight function forms the last step of the risk management process. Internal and external audit report independently on the adequacy of measures taken and advise on possible improvements in the risk management process. Also, management continuously reviews the adequacy of internal control measures and monitors the risks.

In practice, various persons representing different roles will be involved in this risk management process. For example, line management plays an important role in implementing controls and improving processes, but will leave the measurement effort to a control or risk management department. Section 6.1 elaborates on the roles in bank's risk management process.

1.2 The Role of Equity

The role of equity or capital in a bank is to act as a buffer against future, unidentified, even relatively improbable losses, whilst still leaving the bank room to recover or organise an orderly winding down.[15] For management control pur-

poses, banks distinguish different concepts of equity:[i] accounting capital, regulatory capital and economic capital.[16] Accounting Capital is the equity amount on the balance sheet; Regulatory Capital is the minimum amount of equity a bank must hold as a result of capital regulation; and Economic Capital is the amount of equity needed as a buffer to cover unexpected losses resulting from risks. The latter two types of equity are minimum requirements. This section provides some background on the importance of equity management for banks and the relation to risk measurement.

1.2.1 Equity as a Business Constraint

Equity management has not always been an issue in banking. The market structure and the financial and economic regulation of the banking sector did not require active equity management until the late 1980s. In many countries, the banking industry could be characterised as an oligopolistic market, in which the oligopolists had incentives to co-operate and maintain prices above the level of perfect competition. This resulted in high margins and lack of incentives for banks to control bank performance. Perhaps even more important is the regulation of the banking sector. The public sector established a form of financial-economic supervision, which limited the freedom of banking organisations to operate, thereby sheltering banks from dynamic market forces. [17]

A number of factors have pushed banks to improve their equity efficiency: gradual deregulation of the industry (since the 1970s, starting with the collapse of the Bretton Woods agreement), more demanding shareholders, and increased experience at rating agencies in "knowing what to look for".[18]

In comparison to the early 1970s, banks now face global competition (mainly in the area of commercial banking and investment banking) resulting in lower margins, and are forced to hold a higher level of equity due to capital regulation. The bank should keep at least 8% of the risk-weighted assets as equity reserve of which 4% must be tier 1 equity. These changes have influenced the role of equity management. Equity has become a business constraint and managing bank equity effectively has become a potential competitive advantage.

Because equity has become a scarce resource for the bank, it must be efficiently employed. Equity that serves as a buffer to cover 'unidentified' losses, earns a

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[i] *In banking the term 'equity' is broader than in non-financial institutions. The banking regulator recognises three types of capital that can be used as a buffer for unexpected losses: tier 1, tier 2, and tier 3 capital. Only tier 1 capital can be called equity capital. Tier 2 capital contains revaluation reserves and subordinated loans with an original maturity of at least 5 years. The subordinated loans with an original maturity of 2-5 years are called 'tier 3' capital. The sum of tier 1, 2 and 3 is often referred to as 'capital'.*

lower return than equity that is invested in commercial activities, as it must be invested in risk-free activities.

1.2.2 Risk Measurement and Equity

As equity has become a business constraint in banking, it has become more important to be able to determine more precisely the level of equity needed (i.e. Economic Capital), given the type of business the bank is in. This requires an estimation of the "future, unidentified, even relatively improbable losses" the bank may face. Risk *measurement* aims for providing this estimate. The concept of Economic Capital is built on the identification of risks and the development of measurement methods to calculate the maximum losses resulting from these risks. Hence, risk measurement is one of the prerequisites of managing bank equity effectively, should decrease the extent of 'unidentified' risks, and should enable the bank to calculate the required equity cushion more precisely.

To obtain competitive advantage, at least one of the following propositions should apply:

- ✓ Risk measurement enables the bank to price risks more accurately. By doing so, the bank is properly compensated for the risks involved and the bank can exclude the clients with a risk profile that exceeds its tolerance level;
- ✓ Risk measurement enables the bank to lower the minimum required equity base, leading to an increase in investment opportunities.

As the minimum required equity base is dependent on regulation, the second benefit is more difficult to obtain than the first one. The current discussion on 'A New Capital Adequacy Framework' (also called Basel II) should be a step forward in enabling banks to make use of this competitive advantage.

The next section describes the Basel II framework in general. The details of the framework are included in Chapter Four. Chapter Six elaborates on risk measurement concepts developed to determine the amount of (economic) capital needed. As the banking industry uses the term 'capital' when referring to equity, we will use the term capital in the reminder of this thesis.

1.3 Banking Regulation

The most important goal of banking regulation is to guarantee the stability of the financial system and prevent the occurrence of a system crisis. Also, the protection of depositors is an important goal of banking regulation. Banking

regulation includes, for example, safeguarding healthy competition between banks; to guarantee the integrity of the financial sector; and the quality of payment products and systems.[19] To safeguard this stability, banks are subject to a regulatory regime. Besides a system of sanctions, regulators have formulated requirements with regard to the level of capital (solvency) and liquidity of banks, which is an important element of this research. Since 1988, the capital requirements have been based on a rough estimate of credit risk, adjusted with a charge for market risk in 1996. Other risks are implicitly included. As of 2007, the regulator wants to explicitly define a capital charge for operational risk as well. This explicit wish has urged the banking industry to come up with an adequate operational risk measurement method to calculate the operational risk capital charge. Section 1.3.1 introduces the Basel Committee on Banking Supervision, the Committee that has drafted the 1988 Capital Accord and has been working on a new 'Capital Adequacy Framework' during the period of this research.

1.3.1 Banking Regulation as a Control Model

Banking regulation can be described as a simple control model with the national regulator being the controlling entity and the bank being the entity controlled. The preconditions for effective control are:[20]

1. *With relation to the entity controlled, the controlling entity needs to specify a goal that is used as a guideline in controlling;*
2. *The controlling entity should have an adequate model of the entity controlled;*
3. *The controlling entity should have enough information about the conditions of the entity controlled and the environmental variables influencing these conditions;*
4. *The controlling entity should have a wide variety of control measures.*

The goal of the controlling entity is stated above as maintaining the stability of the financial sector. The regulator has different sources of information to perform its task: on-site visits, off-site analysis and information from the external auditor. Also, the number of control measures is large. The most radical measure is to withdraw the banking licence. One precondition for effective control is increasingly challenged: the ongoing mergers and acquisitions and the speed of technological innovations complicate the banking model. For regulators it becomes harder to keep track of the procedures and to be able to take the appropriate measures. Section 1.3.3 discusses the possibilities for and the impact of regulatory arbitrage on the effectiveness of control.

One of the elements that may stimulate banks to arbitrage regulation is unfair competition. The ongoing convergence of banks and non-bank financial institu-

tions may therefore also provide incentives for regulatory arbitrage. Therefore, this development is shortly outlined in Section 1.3.4.

1.3.2 Basel Committee on Banking Supervision

The Basel Committee on Banking Supervision is a committee of supervisors from the G10 countries plus Luxembourg. The Committee advises on banking regulation and was established in 1975. In 1988, the Committee published a first Basel Capital Accord, currently known as Basel I.[21] Although no one was obliged to adopt the rules the Committee drafted, the Accord has been translated into EU legislation and national legislation of all countries world-wide. According to the capital rules advised in Basel I, banks have to set aside an amount of buffer capital that equals 8% of risk weighted assets.[22] In 1996, the Accord was extended with a capital charge to cover unexpected losses from trading activities (market risk).
In 1998, the discussion on the Basel Capital Accord resumed. The developments in the industry urged the regulators to come up with more risk sensitive regulations that would be in line with industry developments and to guarantee a level playing field. Important elements of the new proposals are: refined credit risk charges; an explicit charge for operational risk; an extended role for the supervisor; and the use of market discipline. As the level playing field is an important goal of the new Capital Adequacy Framework, as the new accord is to be called, supervisory discretion of the different national regulators is of extreme importance.

The first draft of the new Basel proposals, released in June 1999, was ambitious in many respects. Besides the problems with supervisory discretion, as described above, the wish to incorporate an explicit charge for operational risk appeared to cause more problems than expected. In general, the move towards acknowledgement of internal models is a challenge for banking regulation:

- ✓ Requirements should be drafted carefully, to prevent creating a disadvantage for banks operating in certain (niche-)markets (the 'level playing field');
- ✓ For regulators, it is hard to keep track of the quantitative impact of its proposals and to maintain a grip on internal models developed by banks (third precondition of effective control). Banks can afford to hire the most intelligent people to develop the models, but the regulator has to keep up with them to be able to judge the models.[23]

The incorporation of internal models into the capital requirements can therefore be called a stress test on the control requirements in the relationship between regulator and bank as mentioned in the previous section. In order to reach these

ambitious goals, the regulators worked closely together with the banking industry.[24] Chapter Five describes the practical result in the area of operational risk. New models and the drafting of capital regulation happened simultaneously, as operational risk models were unavailable at the beginning of the regulatory discussion.

1.3.3 Regulatory Arbitrage

The first Capital Accord of 1988 was simple, but resulted in capital charges that were not an adequate reflection of the risks banks were exposed to. Therefore, the banking industry "exploited" the capital charge via means of regulatory arbitrage. The growth of regulatory arbitrage has forced the Basel Committee on Banking Supervision to redraft the 1988 Accord.

The essence of regulatory arbitrage is to find methods to avoid a regulatory burden without breaking the law. 'It is commonly suspected that innovation is driven by regulatory arbitrage – a desire to circumvent existing regulations in taxation and accounting, without necessarily breaking the law.'[25] Paradoxically, regulations intended to remove artificial competitive advantages can also create opportunities to gain competitive advantages. A legally based level playing field opens up new sources of competitive advantage, with some more able than others to creatively escape even harmonised regulatory restrictions. The rules of the 'level playing field' themselves become obstacles to some but not all. Regulation in effect becomes a further stimulus for innovative use of law both to defeat unwelcome regulation and to secure an advantage over competitors.[26]

The difficult position of the regulator can be illustrated with the use of Social Theory. In his book Social Theory and Social Structure, Merton describes bureaucratic structure and personality. As regulation and bureaucracy potentially are closely related, this theory may be useful in analysing the requirements to refrain from regulatory arbitrage.

Characteristics of bureaucracy [27]

1. *An effective bureaucracy demands reliability of response and strict devotion to regulations*
2. *Such devotion to the rules leads to their transformation into absolutes; they are no longer conceived as relative to a set of purposes*
3. *This interferes with ready adaptation under special conditions not clearly envisaged by those who drew up the general rules*
4. *Thus, the very elements which conduce toward efficiency in general produce inefficiency in specific instances*

The first characteristic of bureaucracy is important. Regulatory arbitrage is a sign that this first characteristic or requirement is not met. Banks search for methods to avoid the strong regulation. Apparently, they are not *devoted* to regulations. Many bank products are even developed purely for the purpose of reducing the capital requirements (e.g. derivatives). The avoidance of regulation becomes a goal in itself (characteristic 2). Banks neglect the objectives of the regulator (a less risky financial industry and better risk management) when they develop their products for regulatory arbitrage. Under special conditions (characteristic 3), they will certainly not adapt to the rules. The regulator has to refine the capital adequacy rules, to include the new products.
In the end, risk in the financial industry increased to reduce capital requirements. If the capital regulation is drafted inadequately, some institutions will benefit from it and disturb the level playing field. As it takes many years to refine a Basel Capital Accord, it is of huge importance that regulation is up to date and flexible enough to adapt to changes in the banking industry. General rules allow for the incorporation of new cases or risks. The Basel Committee and national regulators must continuously advise on the interpretation of these general rules in specific (new) situations that come across.

It can be concluded that the behaviour of banks makes it hard for regulators to present adequate rules. There will always be regulatory arbitrage to some extent and regulators should find a way to minimise the resulting damage. When capital requirements are unreasonable and/or substantially high, banks start searching for ways to avoid high capital charges through financial innovation.[28] These financial innovations may have a negative impact on the risk profile of banks. Whereas capital regulation aims for stability in the financial system, too burdensome capital regulation will lead to a decrease in the stability of the financial system. This effect is similar to the Laffer Curve on tax rates and tax revenues.[29]

> *The first Basel Capital Accord of 1988 led to higher capital levels in the banking industry, which was positive for the safety of the banking system. However, the Accord also resulted in financial products (among which derivatives and securitisation vehicles) developed to lower the capital requirements without diminishing risk to the same extent. This had a negative impact on the safety of the banking system. For banks, regulatory capital (solvency) is the most expensive form of capital, which has impact on pricing and Profit and Loss. A bank with a lower capital requirement is able to set better prices and make more profit, so as the capital charge can be of overriding importance. The possibilities for regulatory arbitrage under the Basel 1988 Capital Accord are numerous. Some examples are:* [30]

- ✓ *Removing from the banking book financial instruments for which the Basel capital standards assign too much capital relative to underlying economic risks, while retaining instruments for which the Basel standard is low;*
- ✓ *Re-engineering financial contracts to convert a bank's on-balance-sheet credit risk into a nearly-equivalent off-balance-sheet exposure having a lower capital requirement;*
- ✓ *For certain instruments (such as credit derivatives), shifting positions from the banking book (risk-weighted assets approach) to the trading book (models-based approach).*

The definition of regulatory arbitrage for banks can be 'the process whereby a financial institution reduces its regulatory capital requirement with little or no corresponding reduction in its overall levels of risk'. Regulation should only be drafted if the positive results are likely to outweigh the negative results. The Basel Committee should therefore carefully try the find the optimum level of capital requirements. Drafting capital regulation is a trade off: too high charges will result in an undesirable level of regulatory arbitrage, and too low charges will negatively affect the safety of the banking system.

1.3.4 Convergence

The market in which banks operate is a dynamic market. Two competitive forces from Porter's model urge banks to actively manage capital and request improvements of banking regulation: substitute products and new entrants.
Companies gain access to the capital markets directly via issuing shares, bonds, medium term notes or commercial paper. As a result, the demand for bank loans relatively decreases. Vogelaar marks this development as a completion of the capital market, which obtains a more central role in the financial world.[31] These developments make the 'unique' transformation function of banks less unique and they can be seen as substitutes for traditional banking products.

Besides the completion of financial markets, banks face competition of non-bank financial institutions (new entrants), like insurance companies and pension funds. These financial institutions also manage substantial amounts of money that should be invested in a profitable way.
As banks and non-bank financial institution become competitors, it is not surprising that banking regulators tend to co-operate more with colleagues regulating the insurance companies and pension funds. The capital charges imposed on banks should become comparable to the capital requirements imposed on insurers or pension funds. In the Netherlands, the banking regulator (De Neder-

landsche Bank) and the regulator for insurance companies and pension funds (Pensioen- en Verzekeringskamer) recently announced a full integration of financial supervision to be realised before January 2005.[32]

1.3.5 Conclusion

The previous sections could give the impression that absence of capital rules will result in a safer financial industry than the current system with all its regulatory arbitrage, but this is not true. An investigation by the Bank of International Settlements has shown that the amount of capital in the industry increased substantially after the introduction of the first Basel Capital Accord.[33]

Also, regulators provide an impulse to the development of risk management and measurement techniques, as they propose to penalise banks with higher capital requirements if these techniques are below standard. Still, the increased level of regulatory arbitrage pushed the Basel Committee on Banking Supervision to start the discussion on a new capital adequacy framework. In the end, regulatory arbitrage always is a 'lose/lose' scenario: banks are forced to hold capital levels that bear no relation to their economic risks and may actually be penalised for trying to reduce their economic risks, while regulators are faced with increasingly less meaningful capital ratios of different banks, that are not even comparable with each other.

This section outlined the complex environment the Basel Committee on Banking Supervision acts in. The Committee is drafting detailed capital rules to prevent putting certain banks undeservedly at a disadvantage. However, if capital rules become too specific, the damage as a result of regulatory arbitrage is likely to outweigh the advantages. Also, the rules might become too rigid to include new cases that might come up in the near future. Apart from these problems, the banking regulators must combine their efforts with supervisors of non-bank financial institutions. The ongoing convergence implies that banking regulators can only reach their objectives if all financial institutions obey the rules.

1.4 Research Question

The development of risk measurement concepts and practices, focusing on the incorporation of operational risk in risk management practice is the main theme of this research. The regulatory discussion within industry groups is an important source of information on how risk measurement concepts have evolved. The practical problems of implementing operational risk measurement concepts are also of interest for this research. In this introductory chapter, we have revealed the relations of this subject with the complex environment of risk management

and regulation. We want to elaborate on that using the following research question as a guide:

> *How do banks develop measurement concepts for the relatively new subject of 'operational risk' and how should these concepts be implemented into risk management practice?*

Some terms in this research question might need clarification.

- ✓ *Banks*
  A bank is defined as a financial intermediary, acquiring money to borrow and invest on its own account. We have chosen to restrict the research to banks instead of financial institutions in general or, even broader, companies. Some important considerations have been:
  1. The development of measurement methods appears to be partly dependent on regulation, developments in the market, or both. To give insight into a developmental process, it is important to focus on institutions that are subject to the same regulations and operate on one market.
  2. The research does not focus on the measurement method itself, but on the process to develop such a method. Although the outcomes of such a process may be applicable to any type of industry, the observations should be derived from one type of industry to ensure consistency and to ensure that circumstances are not mixed.
- ✓ *Operational risk*
  Operational risk is defined as the risk of losses resulting from inadequate or failed internal processes, people, systems, or from external events.[34] The research is restricted to operational risk, as measurement methods for this risk have not been established and there has been a world-wide discussion between large, internationally active banks on how to design such methods at the time the research was conducted.
- ✓ *Measurement*
  Measurement is defined as transforming 'something' into a single figure. It depends on the viewpoint one adopts with regard to the scope and application of measurement on how broad the concept of 'something' can be (as Chapter Three will show). This research focuses on the attempt to transform the concept of Operational Risk into a figure.
- ✓ *Control*
  In managing operational risk, a bank can choose either to finance the risk or to control it.[35] In the risk management process described in Section 1.1.3

(page 6) risk finance is a retention decision (step two) and risk control is step five. We have chosen to focus on risk control, as this requires most management effort.

The sub-questions derived from this research question are:

1. *What is risk measurement?*
   Two terms 'risk' and 'measurement' should be understood before the concept of 'Risk Measurement' can be studied. The research methodology for this sub-question is literature study. The focus lies on philosophical and fundamental viewpoints, instead of banking practice. Chapter Three discusses this question together with the next question:
2. *How can we expect risk measurement concepts to evolve?*
   Expectations will be based on the development of risk measurement methods during the last century. The research methodology for this sub-question is also the study of literature, focusing on (banking) practice and the structure of the discussions.
3. *How has the concept of Operational Risk Measurement evolved since 1999?*
   Participant-observer methodology is applied to understand the evolution of the concept of Operational Risk Measurement that took place in the banking industry from 1999 onwards. Chapter Two describes the details of this research methodology, Chapter Four reflects on the results of the participant-observer research.
4. *How does this fit our expectations based on past experiences?*
   The observations in the banking industry are translated back to the expectations drafted in Chapter Three (sub-question 2). This analytical interpretation of the observations is the subject of Chapter Five.
5. *What risk management area best fits the concept of Operational Risk?*
   We have identified four risk management areas in Section 1.1.1 (page 3). The participant-observations together with the study of literature are used to place the concept of Operational Risk within one of these risk management areas. Chapter Six answers this question and provides a theoretical overview of the relevant theory for this risk management area.
6. *How can the concept of Operational Risk be incorporated in this risk management area?*
   Research of the literature is used to gain insight in the accepted concepts and practices within the risk management area chosen and how operational risk could fit in. This analysis is the last part of Chapter Six.

1.5 Summary

The subject of this thesis is controlling operational risk in a banking environment. Operational risk is defined as 'the risk of losses resulting from inadequate or failed internal processes, people, systems, or from external events'. The definition already points out that this is a broad subject that affects the whole bank. We have chosen to focus on the place of operational risk within the risk management function of banks and on the development of measurement methods for determining the appropriate level of capital needed to cover potential losses resulting from this risk. The research method used is the participant-observer methodology. This implies that the researcher is both participating in the object of research and observing the object.
The research question that guided this research is: *How do banks develop measurement concepts for the relatively new subject of 'operational risk' and how should these concepts be implemented into risk management practice?* The reason to limit this research to banks, is the large role banking regulators have played in the development of risk measurement methods. We expect this role to continue in the future. To be able to answer this research question, six sub-questions have been formulated that form the basis of the research structure, as illustrated in Figure 1.2.

The first research question is: '*what is risk measurement?*' We observe an unjust lack of attention for the concept of Measurement and its application. The focus usually lies on the measurement itself instead of the question 'what is measurement?' The word 'measurement' is thereby associated with mathematics and objectivity. However, measurement is an ambiguous concept and can be approached from different angles: mathematical, experimental and philosophical. The existence of these different angles is one of the reasons for every aspect of measurement to be disputable. Measurement implies making choices about arithmetic, quantity and scale. Two fundamental views on measurement have been identified, which have been called 'open' and 'closed'. Within the closed view, measurement can only be applied to exact sciences. Consequently, this view leaves no room for measurement from the philosophical angle. Applying the experimental angle will also be avoided whenever possible. The open view creates room for applying the concept of Measurement to social and behavioural sciences. This will, however, require different measurement methods.

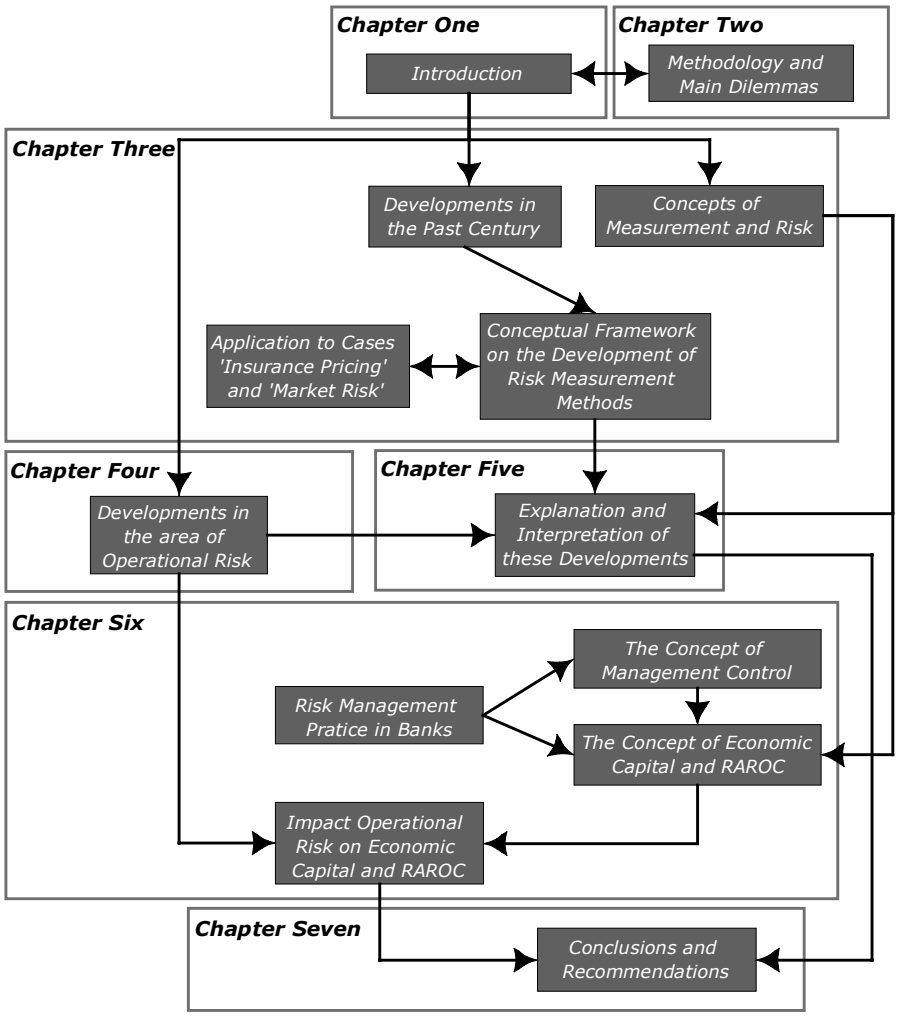

Figure 1.2: Research Structure

The concept of Risk can also be discussed fundamentally. We are of the opinion that only the absolute uncertainty should be marked as 'risk'. This matches with the constructivists, who are of the view that an objective definition for risk does not exist; that risk analysis includes qualitative aspects that are hard to measure; and that risk assessment and risk management are difficult to separate. The objectivists dispute this. They separate risk assessment and risk management and regard risk as objective and measurable.
The concepts of risk and measurement are described in more detail in Section 3.1.

In banking practice, we observe little fundamental discussion on risk measurement. Risk is regarded as objective and measurable, although qualitative elements play a role as well. In general, experimental measurement methods are applied, as the conditions for applying the initially preferred mathematical methods are not met. The background of this observation is subject of the second research question '*how can we expect risk measurement concepts to evolve*'. A historical exploration resulted in a conceptual framework, which recognises four steps in the development process of risk measurement methods, as illustrated below.

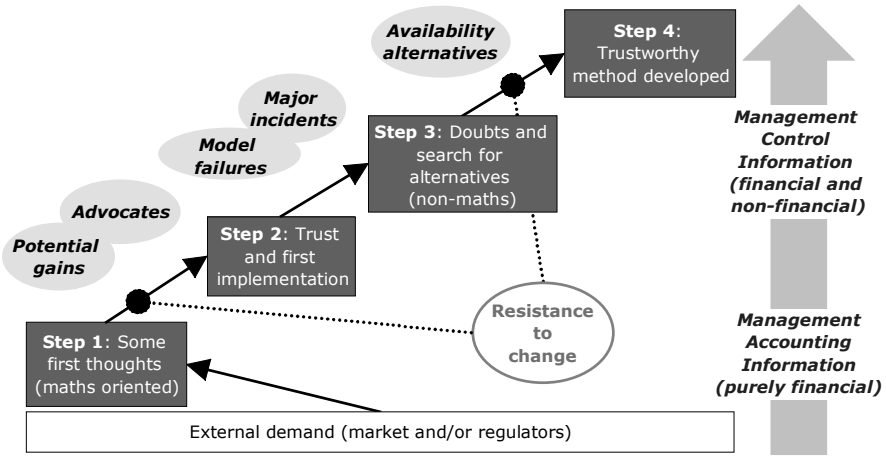

Figure 1.3: Conceptual Framework on Risk Measurement

- ✓ *Step One:* First thoughts, based on mathematical techniques. An external demand provides the impulse for this first step. This can be either the market or regulators. Banks seldom start measuring risk from their own needs. Education and experiences are part of the explanation why first thoughts are always based on mathematics.
- ✓ *Step Two:* Trust in and first implementation of mathematical techniques. Potential gains and the influence of strong advocates push towards step two of the measurement process. The advocates must overcome the natural resistance to change that plays a role in every innovation process. As the application of mathematical models increases, they also get a fixed place in the education and experience of people, resulting in an acceleration of the application of these kind of models.
- ✓ *Step Three:* Doubts and search for alternatives. Incidents and the recognition of flaws in the mathematical models stimulate the doubts about the application of these models. This cannot be avoided, as the models are experimental.

- ✓ *Step Four:* Development of trustworthy measurement methods. Whether or not trustworthy methods can be developed depends on the availability of alternatives for the mathematical models. Again, natural resistance to change must be overcome.

Ultimately, a mix will be realised of quantitative and qualitative methods based on both financial and non-financial information. Section 3.3 amplifies on these steps in more detail.

After this conceptual and historical exploration, we focus again on the subject of 'operational risk' with the question '*how has the concept of Operational Risk Measurement evolved since 1999?*' The developments, described in Chapter Four, make clear that the Basel Committee on Banking Supervision has played a major role. In 1999, this committee announced that it was working on explicit capital charges for operational risk, which presupposes measuring risk. Although the banking industry reacted reluctantly to these plans, the development of measurement methods started and accelerated. Before 1999, the most used definition for operational risk was 'everything which is not market or credit risk', but afterwards more specific definitions were formulated. Nevertheless, banks continued bringing up arguments to explain that a capital charge for operational risk would be inappropriate.

The first methods that had been proposed were based on mathematics. Internal loss data was to be used as a starting point to measure operational risk. If too little loss data were available, which applied to all banks, data from other banks had to be used as a supplement. It appeared that the support for this quantitative approach was insufficient. One of the underlying reasons is the number of conceptual problems that could already be foreseen. For example, banks can influence operational risk to a high extent, which implies that loss data can lose its relevance quickly. Also, the use of loss data from other banks is complicated, because of the differences in size of banks and the control structure implemented for managing operational risk. These conceptual problems resulted in striking proposals for adjusting the mathematical formula:

- ✓ Leave extreme losses out of the loss distribution, if banks can prove appropriate measures are taken;
- ✓ Provide a capital discount if the internal control environment is 'good'.

A small group of banks convinced the regulator of the value of an alternative method: the scorecard approach. Instead of using operational risk loss data as a basis for measurement, these banks proposed using questionnaires and qualitative indicators as a starting point. Within the Basel Committee and the banking

industry, it appeared to be problematic to reach consensus on the best method to apply. Hence, the Basel Committee agreed on a compromise not to chose between competing methods, but to leave all options open. Within the banking industry, the diversity of opinion was primarily about the measurement methods and the appropriateness of capital for operational risk in general.

The developments in the banking industry have been compared to the expectations based on the historical exploration described earlier. This comparison is subject of the fourth research question on which Chapter Five elaborates. To be able to analyse the developments, we have divided the banking industry in four groups, based on their preferences regarding measurement method (viz. qualitative or quantitative) and their opinion concerning the appropriateness of capital charges for operational risk (viz. appropriate or inappropriate).

	In Favour of Pillar One Charge	***Against Pillar One Charge***
Quantitative measurement techniques (loss data approaches)	Group A	Group B
Qualitative measurement technique (scorecard approach)	Group C	Group D

Table 1.4: A Typology of Industry Groups

The co-operation and geographical spread between groups was interesting. Groups only co-operated based on the preferred measurement method, not on their opinion whether operational risk should be dealt with in Pillar One of Pillar Two of the Capital Accord. Within two of the groups, there was little geographic spread: USA and Canadian banks formed group B, UK banks formed group D.
The observations show that the banking industry was in the first stage of the conceptual framework:

- ✓ Some banks had been collecting internal loss data for years, but most banks started doing this only after the release of the first consultative paper of the Basel Committee on Banking Supervision in 1999;
- ✓ There were ideas on quantification frameworks based on historical loss data, but these frameworks had not been implemented at that time;
- ✓ Many industry participants disbelieved in the framework itself or in the applicability of the frameworks given the state of the art in the industry. They wanted operational risk to move towards Pillar Two (no quantification at all);
- ✓ Only one industry group believed in the applicability of historical loss data in the measurement of operational risk on the short term;
- ✓ The regulators were pushing hard towards quantitative measurement methods. Qualitative elements were regarded with suspicion.

Measurement of operational risks clearly was a new subject. Reliable datasets were not available, resulting in the inability to support measurement methods with proof that it would have worked in the past. The discussions thus focused on the definition, the incorporation of qualitative elements, and the question whether historical data would be of any value in measuring operational risk. These are all characteristics of the first step in the development process as described earlier in this summary. The discussion on operational risk in the period 1999-2002 clearly showed characteristics of a first aquaphobia to apply methods based on historical loss data. Also the types of critics academics had on operational risk measurement underline this observation.

Besides researching the 'how' and 'why' of developing measurement methods, this research examines the implementation of operational risk within banking risk management practice. In current banking practice, five groups can be identified that are involved in the risk management process: executive management, line management, internal audit via the so-called 'operational audits', management control via management information and budgeting, and risk management. The tasks and objectives of these groups overlap on some aspects as explained in Section 6.1.
When facing risks, a bank can either control it or finance it. With risk control, we refer to implementing control measures, such as segregation of duties, limit structures, and physical access security. Risk financing can be done in many different ways. We distinguish balance sheet management, risk transfer, and measurement and pricing. It should be noted that choosing between these options is necessary. After all, if a risk is both financed and actively controlled, the bank pays twice for the same risk. This especially counts for buying insurance and holding a capital buffer. A combination of financing and control is only beneficial if the implementation of control measures immediately results in lower prices for risk finance.
Although parts of operational risk can and will be financed via risk transfer, it is sub-optimal to fully place operational risk within risk transfer. Preventing operational risk will often be cheaper than insuring it. Operational risk is a subject that can best be handled within risk control, which implies that it is covered in the domain of Management Control. Within this domain, the risk manager and the management controller 'battle' for the tasks. This reasonable, as the objectives of both functions within banks are similar and the risk management process in banks is comparable to the process of management control. Hence, we argue that the maintenance of separate functions/departments should be avoided. The most important concept controllers and risk managers in banking currently work on, is the determination and allocation of economic capital. Economic capital is defined

as the minimum amount of capital needed to guarantee continuity, based on assessments of the risks the institution is exposed to. Within banks, economic capital is to be used for performance control and budgeting. As a result, risks (via the concept of Economic Capital) and typical control tasks (budgeting and performance reporting) come more closely together.

In answering the last research question '*how can the concept of Operational Risk be incorporated in this risk management profession*', we mainly examine the concept of Economic Capital and the performance indicator Risk Adjusted Return on Capital (RAROC), which are described in Section 6.5. Analogue to literature, we distinguish two domains of performance control in banking: the Banking-Financial Domain, focusing on commercial activities and effectiveness, and the Technical-Organisation Domain focusing on processes and efficiency. It should be noted that, until recently, risk management has been associated with the Banking-Financial Domain. This explains our observation that measurement methods underlying economic capital and RAROC originate from the Banking-Financial domain. These methods aim for measuring effectiveness and limiting commercial activities. This also becomes clear from the foundations of economic capital:

- ✓ It is assumed that all risks can be quantified objectively;
- ✓ The assumption is made that one measurement methodology can be applied to all risk categories, so outcomes can be added together;
- ✓ There is supposed to be a positive relation between risk and potential revenues.

An entity that has more economic capital can perform more activities. Against each loan provided, the entity should hold an amount of capital. This amount is dependent on the risk profile of the loan. RAROC is calculated as income minus expected losses divided by the amount of economic capital put aside for this activity.

$$\text{RAROC} = \frac{\text{Earnings - / - Costs - / - Expected Losses}}{\text{Economic Capital}}$$

The incorporation of operational risk in these concepts may be problematic. After all, operational risk is neither directly nor completely related to commercial activities. Furthermore, operational risk generates no earnings, resulting in negative RAROC numbers on the short term. The RAROC can be improved significantly if capital can be moved away from operational risk and allocated to other risk categories. This can result in undesirable risk profiles and concentrations and a different relationship between risk and return. Operational risk generates no income, like commercial activities. This conflicts with one of the fundamentals of economic capital.

Also the other assumptions underlying economic capital cannot easily be applied to operational risk. Quantification of operational risk appears to be problematic, especially if existing techniques, already applied to market and credit risk, are used. This problem is inherent to the fact that operational risk belongs to the Technical-Organisation Domain and therefore must be controlled using different performance measures.

Summarising and returning to the overall research question, it can be concluded that an external demand has initiated the initial development of operational risk measurement methods. The banking regulator has put forward an explicit capital charge for operational risk, which forced banks to quantify this risk-type. To be able to do this, banks have tried to use existing methods, already applied to market and credit risk. These attempts are likely to fail due to many conceptual problems we have identified. The main cause of this is the specific character of operational risk: it is idiosyncratic (specific to the institution) and can be influenced to a high extent. In answering the question '*how have measurement methods for operational risk been developed*', it should be concluded that a similar process is applied as has been done for credit and market risk in the past. Nevertheless, we are of the opinion that the banking industry should have chosen another direction. An operational risk measure will never be accurate enough to be used as performance measure. Hence, we expect the measurement process for operational risk to be interrupted at some stage. The statisticians will be forced to leave the subject to management controllers, but also management controller should beware the pitfalls.
Performance measurement for operational risk is different from performance measurement for credit- and market risk. Incorporation of operational risk in economic capital should be under debate, even though this is no common practice in banks. The fact that banks incorporate operational risk in their economic capital concepts even has been one of the main reasons why the Basel Committee has proposed explicit capital charges for this risk in the first place. Given the analysis in this thesis, the Basel Committee would have made a better choice if they had dropped this proposal. After all, bank regulation includes more instruments than capital charges and it is better to develop a new instrument that enables regulators to achieve their objectives than to use an existing instrument that does not fit. As the relative importance of operational risk is growing and will continue doing so, it might be most beneficial if both banks and regulators leave the current statistical basis as it is and develop something, taking the operational risk peculiarities as the point of departure.

Notes – Chapter One

[1] Basel Committee on Banking Supervision, *Working Paper on the Regulatory Treatment of Operational Risk*, Working Paper No. 8, September 2001, page 2.

[2] However, this does not mean that the results of this research cannot be applied to other sectors of the financial industry. Especially insurance companies, pension funds and asset managers might face similar problems and might go through similar processes.

[3] Newman, P., M. Milgate, J. Eatwell, *The New Palgrave Dictionary of Money & Finance*, The Macmillan Press Limited, 1992, page 386.

[4] *Bank Lexicon*, NIBE/Kluwer, 1987, page 33.

[5] Vogelaar, N., 'Banken en Securitisatie', published in Boonstra, Van de Ven, *Van Alle Markten*, 1999, page 83-96. Page 83: 'Zij transformeren bedragen, looptijden en risico's van de overschot- naar de tekorthuishoudingen van de economie'.

[6] Swaan, T. de, 'Risicomanagement: de invalshoek van de toezichthouder', *NIBE preadviezen*, 1996, page 11.

[7] Méris and Feijen, 'Integraal risicomanagement in ontwikkeling', *TFM*, January/February 1999, page 21.

[8] Vaughan, E.J., T.M. Vaughan, *Essentials of Insurance: A Risk Management Perspective*, John Wiley & Sons, 1995, page 32.

[9] The Basel Committee on Banking Supervision makes a similar distinction for Operational Risk Management. In 'Sound Practices for the Management and Supervision of Operational Risk', the Committee uses the distinction risk control and risk mitigation as solutions for operational risk. (Principle 7, page 4)

[10] Bessis, J., *Risk Management in Banking*, John Wiley & Sons, 1998, page 31-32.

[11] Anthony et. al., *Management Control Systems*, McGraw-Hill, 9th edition, 1998, page 10.

[12] Bos, J.J., *Prestatiebeoordeling in banken*, Proefschrift Universiteit Twente, 1999, page 182.

[13] DNB, *Risk Analysis Manual*, June 2001.

[14] Culp, C.L., 'The Revolution in Corporate Risk Management: A Decade of Innovations in Process and Product', *Journal of Applied Corporate Finance*, Volume 14, No. 4, winter 2002, page 12.

[15] Matten, C., *Managing Bank Capital*, Second Edition, John Wiley & Sons, 2000, page 17.

[16] Bos, page 165.

[17] See also Bruggink, *Performance Control in Banking: Theory and Application*, Proefschrift, Universiteit Twente 1989, page 78.

[18] Matten, *Managing Bank Capital* (2nd Edition), page 4.

[19] NIBE, *Algemene Opleiding Bankbedrijf*, version July 1999, page A 6.3.

[20] De Leeuw as cited in N.J.T.A. Kramer en J. de Smit, *Systeemdenken*, Stenfert Kroese, vijfde herziene druk, 1996, page 91.

[21] Basel Committee on Banking Supervision, *International Convergence of Capital Measurement and Capital Standards*, July 1988.

[22] The 'assets' referred to are outstanding loans, these loans have a 'risk weighting' of 0% (OECD governments), 20% (non-OECD governments and OECD banks), 50% (Mortgages) or 100% (non-OECD banks and private companies). As most loans are given a 100% weighting, the risk weighting cannot be called 'risk sensitive'.

[23] A Shadow Committee of Professors stated that the Regulator would lose in the discussion with banks (de Telegraaf, January 22, 2001). One of their arguments was that the banks could develop such very sophisticated systems that it becomes difficult for regulators to fathom them.

[24] For certain parts of the proposals, the Committee also extensively consulted the insurance industry, the rating agencies and other relevant stakeholders.

[25] Miller, 1986; Van Horne, 1985

[26] McBarnet and Whelan, 1992 as cited in Shah, 'Regulatory arbitrage through financial innovation', *Accounting Auditing & Accountability Journal*, no. 1, 1997.

[27] Merton, R.K., *Social Theory and Social Structure*, The Free Press, 1968, page 254.

[28] Interview met A. Bruggink, 'Ook bankwereld in ban van regels: Over IAS en bancair pragmatisme', in Langendijk et.al, *30 over financiële verslaggeving in internationaal perspectief,* 2002: 'Vergis je niet in de invloed die Basel-I heeft gehad: het derivatenbedrijf is daar rechtstreeks uit ontstaan. Basel-I had grote commerciële betekenis. Sommige producten verdwenen, andere verschenen.'

[29] Monissen, H.G., *Explorations of the Laffer Curve*, www.gmu.edu/jbc/fest/files/monissen.htm, consulted 22 May 2002.

[30] Matten, 2000 (2nd edition), page 123-124. These types of regulatory arbitrage are explained in more detail in the pages 125-128 of the same book.

[31] Vogelaar, N., *Banken en Securitisatie*, page 84.

[32] Het Financieele Dagblad, 'DNB en PVK willen volledige integratie financieel toezicht', 12 December 2002, page 1.

[33] Basel Committee on Banking Supervision, *Capital Requirements and Bank Behaviour: The Impact of the Basel Accord*, Working Paper No. 1, April 1999, page 6-7. 'The charts show an increasing trend with the industry average capital ratio rising from 9.3% in 1988 to 11.2% in 1996.'

[34] Basel Committee on Banking Supervision, *Working Paper on the Regulatory Treatment of Operational Risk*, page 2.

[35] The Basel Committee on Banking Supervision also mentions those two opportunities regarding operational risk in *Sound Practices for the Management and Supervision of Operational Risk* as well as in *A New Capital Adequacy Framework*.

Chapter 2 Research Methodology

Simultaneously with this Ph.D. research important developments in the area of measuring operational risk and implementing operational risk management tools took place which has given us the opportunity to research these developments from inside the banking industry. We have chosen, therefore, to combine a participant-observer methodology with thorough literature analysis to answer the six research questions stated in the previous chapter. This chapter contains the methodological justifications of this Ph.D. research. Both the participant-observer methodology and research in practice are methodological choices that face many prejudices and are subject to fundamental discussion within the discipline 'business administration'. After describing the research method used, attention is paid to dilemmas of scientific research in the area of business administration in general and the application to this research. It appears that both the academic discipline 'business administration' and the concept of 'operational risk' are multidisciplinary subjects, facing difficulties fitting into commonly accepted practice. The basis for these difficulties lies in the struggle between objectivity and subjectivity.

2.1 Choice of Research Methodology

The choice of the research methodology is closely related to the type of research question formulated. Also, the constraints of -costs or budget available, -time available and target date for completion-, and -skills of the researcher-, impact this decision.[1] To choose between the five major research strategies (experiment, survey, archival analysis, history and case study), Table 2.1 has been used.[2]
The central research question was formulated in the previous chapter as *How do banks develop measurement concepts for the relatively new subject of 'operational risk' and how should these concepts be implemented into risk management practice?* As operational risk is a new subject, 'how' was very closely related to 'why'. The process of developing risk measurement methods was based on arguments.

Research strategy	***Form of research question***	***Requires control over behavioural events?***	***Focuses on contemporary events?***
Experiment	How, why	Yes	Yes
Survey	Who, what, where, how many, how much	No	Yes
Archival analysis	Who, what, where, how many, how much	No	Yes/no
History	How, why	No	No
Case study	How, why	No	Yes

Table 2.1: Research Strategy Choice

The combination of 'how' and 'why' can only be answered using experiment, history or case study as a research methodology. The words 'relatively new subject' point to a research focused on contemporary events. Although operational risk measurement is a theme of this research, we do not intent developing a measurement methodology for which an experiment may be a valid research strategy. Instead, the *process* towards developing measurement methods and controlling operational risk will be studied. The researcher cannot control this process. This leaves only the *case study* as a suitable methodological choice.
A case study can be defined as a type of research during which the researcher tries to gain a profound insight into one or several objects or processes that are restricted in time and space. The case study is characterised by:[3]

- ✓ A small number of research units;
- ✓ Labour intensive data generation;
- ✓ More depth than breath;
- ✓ A selective, i.e. a strategic sample;
- ✓ Qualitative data and research methods;
- ✓ An open observation on site.

The next sections discuss how these characteristics of case studies apply to the research on operational risk and what choices have been made regarding research method, research units, data generation, and sample.

2.2 Case study Research

2.2.1 Participant-Observer Research Method

Case study research can be implemented using different techniques. The researcher must collect empirical data *on site*. This data can be derived from documentation, archival records, interviews, direct observations, participant-observation, and physical artifacts.[4] Although case study research requires the use of several

sources of evidence, one of the above tactics may be dominant in the research implementation.

'Participant-observation has been the dominant data gathering technique for this research. Participant-observation can be defined as a research tactic in which the researcher joins a group of individuals working within the organisation being studied and whereby the researcher participates in the phenomenon while recording his or her observations.[5] It is a methodology that is applicable to answer 'how' and 'why' questions.

Participant-observations as a source of evidence have strengths and weaknesses:[6]

Strengths	***Weaknesses***
Reality – covers events in real-time	Time-consuming
Contextual – covers context of event	Selectivity – unless broad coverage
Insightful into interpersonal behaviour and motives	Reflexivity – event may proceed differently because it is being observed
	Cost-hours needed by human observers
	Bias due to researcher's manipulation of events

Table 2.2: Strengths and Weaknesses of Participant-Observer Research

Not all weaknesses have been applicable to this Ph.D. research. In describing the details of the participant and observer roles (Section 2.2.2), attention is paid to the strengths and weaknesses Yin mentions.

"Participant-observer" is a qualitative research methodology. A characteristic of qualitative research is the interaction between the (conceptualisation of the) problem and the observational data. Therefore, the research steps (i.e. research design, data gathering, analysis and reporting) are not strictly separated.[7] To be able to keep close control on the research, a journal containing observations has been essential.

2.2.2 Details on the Participant and Observer Roles

As a participant, the researcher works in the banking industry. As an observer, the researcher records statements of people from different areas in the banking industry; analyses these statements; and translates the statements to the conceptual framework derived from answering the first two research questions.

The researcher is participant and observer on two different levels in the industry: the level of an individual bank and the level of the banking industry as a whole via industry wide working groups, conferences and forums. On one of these two levels (banking industry), the undercover observation strategy has been chosen, on the other level, some individuals know that the researcher is a researcher, but the research goal and research methodology are unknown. The risk of reactive behaviour is therefore mainly eliminated (third weakness).

The first level is the level of an individual bank, where the researcher worked four days a week in a staff function, being responsible for creating operational risk awareness, developing operational risk management tools and co-ordinating operational risk management initiatives throughout the whole bank. The analysis and translation into practice of the upcoming regulation on operational risk, called Basel II,[8] also belonged to the responsibilities of the researcher in her daily work. On this level, the researcher talked with people working in different areas of the bank (viz. line management, staff members, executive board) who might have diverse opinions and interests. During these four days the participant role dominated the observer role. One day a week, the researcher was out of office, to allow for documentation and analysis of the observations. The participant-observer research strategy was time-consuming (first weakness). However, the kind of information the researcher has gathered, is hardly accessible from outside the banking sector.

The second level is the level of various national and international industry working groups, conferences and forums with operational risk professionals working in similar (operational risk) staff functions, where the researcher represented her bank and discussed operational risk measurement methods in relation to capital regulation. The industry Working Groups had regular contacts with regulators to discuss the issues regarding capital charges for operational risk. On this level, the researcher spoke to people in the area of operational risk staff units, having various views on how to measure operational risk. Besides, the researcher spoke directly and indirectly (i.e. via working group members) with regulators. These groups have been unaware of the double role of the researcher, being participant and observer, during the observation period.
In the working groups, conferences and forums, the researcher dominantly observed. The dominance of the observer role automatically reduced the fifth weakness (manipulation of events) to a high extent. Within the bank, the phenomenon being studied cannot easily be manipulated, as the bank is only one single case, where the industry group contains multiple cases.
As the industry working groups were hardly accessible, it would have been complicated to work with multiple observers. An advantage is that the fourth weakness was not applicable. The disadvantage is that the reliability of the observations decreased. A strategy to control this weakness can be the use of multiple sources of evidence (viz. articles, presentations, papers and/or interviews).

The weakness of selectivity is difficult to avoid (second weakness), but the use of multiple levels of observation and the access to opinions of different banks as well as regulators, might be an assurance that selectivity has hardly affected the research.
The implementation of the participant-observer methodology described above is a result of the explicit wish of the researcher to combine a research project with work in the same area in practice. This is the most extreme form of participant observation, but it enables the researcher to gain access to industry discussions and to obtain a complete picture of the operational risk measurement discussion, which could not be analyses from outside the banking industry. Minutes of meetings remain confidential and may not reflect what was actually said, which makes it difficult to analyse characteristics of a discussion unless one was part of it.

2.2.3 Other Case Study Choices

Research Units
With regard to 'research units', the research has focused on the two levels mentioned earlier. The data gathered from observing the industry working groups and attending conferences and forums has been the dominant source of information in describing the evolutionary process of the concept of Operational Risk (Chapter Four). Observations from within the bank have been helpful in identifying major driving forces behind operational risk measurement, and in gaining insight in the control aspect of operational risk. Also, the researcher had the opportunity to gain experience with the application of operational risk management tools.

Sample
The researcher has tried to attend several different industry working groups, both at national and international level, to prevent taking an unreliable sample. It appeared that the group of operational risk professionals was small, which made the differences between various industry groups small.

Data
The data generated consists of emails, draft documents, meeting summaries, conference slides, articles, notes made during meetings and notes made during conference calls. Also, information was gathered via informal discussions and conferences. As most information gathered is confidential, the researcher cannot release her material. Breaking the confidentiality of these materials could negatively affect future work of the groups involved and should therefore be avoided. For review purposes, one supervisor of this thesis has gained insight on a

confidential basis in relevant parts of the research material, in which all references to individuals or individual banks had been deleted.

2.3 Research Methodology and Business Administration

Academic research is subject to external assessments to assure certain quality standards are met. Generally, academic research is associated with objectivity and theory. Therefore, it is typical that mono-disciplinary research aimed at theory building and within the existing academic traditions receives the best judgements from the academic community.[9] Many academic journals only publish articles that fit within the existing traditions, thereby keeping the doors closed to other types of research methodologies.
Business Administration faces difficulties fitting into the existing traditions and is subject to philosophical and methodological discussions within the Netherlands.[10] This section elaborates on the dilemmas in business administration in general and the impact on the research on operational risk in particular.

2.3.1 Dilemmas in Business Administration

Business administration is a relatively new area of academic research that is *multi-disciplinary*. Business administration considers an organisation as an *open* technological, social, and economical *system*, based on information with, not necessarily economical, objectives.[11] The basic idea is that even the most technologically inspired intervention has organisational consequences. Business Administration always regards the organisation in coherence with its environment taking into account the dynamically developing society. The interaction and co-operation between the different mono-disciplines is essential.
Business administration has always faced a number of dilemmas: should research be theory-oriented or practice-oriented; is multidisciplinary research attainable; and should business administration confirm itself to the traditional research methodologies of 'high science'.[12] Business administration continuously balances between striving for objectivity and accepting subjectivity.

According to Van Riemsdijk, the confrontation with practice has pointed out the importance of subjectivist approaches:

> *Whoever tries to tackle problems in organisations, discovers immediately that the interpretation of the actors involved and their relations – including aspects like power, politics, behaviour, and human relationships – affect*

> *both the definition of the problem and the possible solutions for the problem.* [13]

Van de Poel defends the proposition 'methods that stimulate communication between practitioners, theorists, researchers, consultants, and future professionals are better than the methods derived from the exact sciences that academics prefer'.[14] The arguments used apply to all management inquiries: the objects of research do not act as white mice or little particles in a laboratory ('*het probleem van het terug pratende onderzoeksobject*'[15]). Theory should not become isolated from practice. Bos uses comparable arguments in stating that the research methods from the exact sciences are not per definition the only correct research methodology: In preferring 'mechanical empirical' research, human beings have to become more and more like photo-cameras.[16]

Van Triest refers to Pfeffer in arguing that the discussion on the position and methodology negatively impacts the discipline of business administration. As long as consensus on content, goal and methodology cannot be reached, a discipline depends more on acquaintances (kennissen) than on knowledge (kennis); has problems with fund raising; and faces a low acceptation rate of articles.[17] Ackoff agrees with this statement by saying that 'academic evaluations tend to be based on the subjective opinions of peers, not on any objective measure of performance'.[18]

Summarising the above, Business Administration faces the continuous threat to be labelled 'unscientific'. This is grammatically correct, as the English language distinguishes two words for what the Dutch call 'wetenschap': science for exact sciences, scholarship or learning for non-exact sciences. Notwithstanding, we agree with the aforementioned authors that Business Administration pre-eminently is multidisciplinary. Research in the area of Business Administration can therefore only add value if the research object is analysed from different perspectives.

The strength of business administration is also its weakness: it has no research object of it's own or a formal angle from which a concrete phenomenon can be studied.[19] Business Administration tries to copy the success of exact sciences in adopting the research methodology used in these sciences, but the success of exact sciences lies in its practical use, instead of its methodology.[20] Practical relevance of Business Administration research can hardly be reached if the traditional research methodologies are applied.

2.3.2 Application to the Research on Operational Risk

During our research on Operational Risk, we faced similar dilemmas as described in the previous section: must we strive for objectivity or does a qualitative research methodology resulting in 'subjective' outcomes fit the concept of Operational Risk better? Must we focus on theory or practice?
These dilemmas have been solved during the first two years of exploratory research. Operational risk appears to be a multidisciplinary subject that touches on various aspects of Business Administration (Figure 2.1).[21] Each of these disciplines has it's own objectivity. Therefore, operational risk can only be thoroughly researched if approached with an open view.

Figure 2.1: Operational Risk Management and Related Disciplines

The disciplines affecting operational risk are introduced below:
Financial Risk Management is the profession of measuring, analysing and managing financial risks within businesses (e.g. credit risk, market risk). As will appear later on in this thesis, although criticised, banks try to quantify operational risk by applying similar techniques as are used in market and credit risk measurement (e.g. stress testing, value-at-risk).
The *Audit* profession is responsible for assessing the quality of the control environment. Auditors provide assurance that the operations of the business are in accordance with the strategic plans and policies, senior management developed. Operational risk management use similar qualitative techniques, like Control Risk Self-Assessment.The link between *Operations Management* and Operational Risk

Management lies in the application of reliability engineering. Reliability Engineering focuses on the maintenance of system function and the reduction of operational uncertainty by making sure that realistic operating specifications are set for process outputs and then ensuring that those specifications are met.
Insurance can be used to transfer some operational risk to an external party (e.g. Risk Transfer as described in Section 1.1.1, page 4). Therefore, insurance is one of the operational risk mitigation techniques.
Total Quality Management involves changing the risk profile of processes and resources by improving its input and output availability, quality, relevance, and attractiveness. The risk of flaws in processes is part of operational risk. Process design and resource planning therefore are closely related to the concept of Operational Risk. Total Quality Management aims to stimulate employees to be heavily involved and committed to their work.[22] This aim is comparable to the aim of the operational risk management tool 'Control Risk Self-Assessment'.
The relation between *Facility Management* and Operational Risk Management lies in the area of Contingency Planning (i.e. provide back-up resources to keep business operations going in case of events). This is an important part of operational risk management.

As will appear from Chapter Four, the banking industry only analyses the problem of operational risk from one or two angles. This corresponds with the trend towards allocating and breaking up tasks that used to lie with line management to specialised support units. The specialists in these units tend to analyse problems from one specific angle. However, the heavy focus on techniques derived from Financial Risk Management will not solve the problems the banking industry faces.

2.4 Conclusion

Business Administration and the research subject 'Operational Risk' share the characteristic of multidiscipline. As a result, the subject can be studied from many different angles and applying a mono-disciplinary research would always lead to a partial conclusion about the problems to be solved.[23] This characteristic is difficult to match with the well-established values of the academic community and with banking risk management practice. The academic community values objectivity and quantitative research methods, which is comparable to risk management practice in banks that also strives for objectivity and quantification.
The research methodology selected to implement this research shows a significant contrast to risk management practice in banking, as it is a qualitative

methodology. It has been argued that this methodology suit the research question formulated best, as the study focuses on contemporary events that cannot be influenced. Besides, the most valuable research material on those types of research questions can be gathered within confidential settings. Also, the multi-disciplinary subject of operational risk requires a broader focus than mathematics or economics can provide.

Notes – Chapter Two

[1] Remenyi et. al., *Doing Research in Business and Management*, Sage Publications, 1998, page 45-46.

[2] Yin, R.K., *Case Study Research: Design and Methods*, 2nd edition, Applied Social Research Methods Series Volume 5, Sage Publications, 1994, page 6.

[3] Verschuren and Doorewaard, *Designing a Research Project*, Lemma – Utrecht, 1999, page 164.

[4] Yin, page 78.

[5] Remenyi et. al., page 286.

[6] Yin, page 80.

[7] Hutjes, F.M, J.A. van Buuren, *De Gevalstudie: Strategie van Kwalitatief Onderzoek*, Open Universiteit Heerlen, 1992, page 32-33.

[8] The term 'Basel' refers to 'The Basel Committee on Banking Supervision'. The 'II' in the abbreviation points to the second capital accord this Committee intends to draft. The 1988 Capital Accord is called Basel I. In the banking sector both the terms BIS II and Basel II are widely used. BIS refers to 'Bank of International Settlements'. The BIS facilitates the Basel Committee.
Only a small part of the Basel II regulations is devoted to operational risk.

[9] Verschuren, P.J.M., *Dogma's en Ontwikkelingen in Wetenschap en Methodologie: Bedreigingen en Kansen*, KUN, 2002, page 10.

[10] Van Triest concludes that The Netherlands is isolated in this discussion. In other countries, especially the US, there is no methodological discussion on Business Administration at all. Triest, S.P., 'Methodologie', *Bedrijfskunde*, 1999 No. 1, page 63.

[11] Bilderbeek, J., S. Brinkman, A.C.J. de Leeuw, *PolyBedrijfskundig Zakboekje*, Koninklijke PBNA, Third edition, 1998, page A1-2.

[12] Riemsdijk e.a., *Dilemma's in de Bedrijfskundige Wetenschap*, Van Gorcum, Assen, 1999, page 19-22.

[13] Riemsdijk, page 22: *'Wie problemen in bedrijven tracht aan te pakken ontdekt onmiddellijk dat daarbij de interpretatie en duiding van de betrokken actoren, hun onderlinge relaties –daaronder ook begrepen aspecten als macht, politiek, gedrag, intermenselijke verhoudingen en dergelijke- zowel de definitie van 'het probleem' als de mogelijkheden voor oplossingen mede bepalen.'*

[14] Poel, J.H.R. van de, 'En nu allemaal! Management accounting-onderzoek als een sociaal systeem', *Maandblad voor Accountancy en Bedrijfseconomie*, December 1999, page 650.

[15] Gelderman, M., 'Bedrijfseconomie als nutteloze wetenschap', *Maandblad voor Accountancy en Bedrijfseconomie*, maart 2000, page 88.

[16] Bos, J.J., *Prestatiebeoordeling in Banken: van 'Mixed Model' naar 'Fair Value'*, Proefschrift, Universiteit Twente, 1999, page 22: 'De moderne, positivistische trend om vooral wetenschappen hoog te waarderen die zich beperken tot 'mechanisch empirische' verschijnselen, komt er eigenlijk op neer, dat gezegd wordt: de mens moet hoe langer hoe meer gelijkvormig worden aan een fototoestel.'

[17] Van Triest, page 64 (reference to Pfeffer, 'Barriers to the advance of organisation science: paradigm development as a dependent variable', *Academy of Management Review*, 21(3), pages 691-717, 1996).

[18] Ackoff, *Creating the Corporate Future*, John Wiley & Sons, 1981, page 24

[19] Bilderbeek, J., S. Brinkman, A.C.J. de Leeuw, page A1-5.

[20] Gelderman argues that scientists lean to heavily on statistical techniques and other mathematical methods, which are not only complicated but also stretch the truth. (page 83)

[21] Figure derived from Marchall, C., *Measuring and Managing Operational Risk in Financial Institutions*, John Wiley & Sons, 2001, page 30.

[22] Knights, D., D. McCabe, 'Dreams and Designs on Strategy A Critical Analysis of TQM and Management Control', *Work, Employment & Society: a Journal of the British Sociological Association*, Volume 12, No. 3, 1998, page 33.

[23] Bilderbeek, J., S. Brinkman, A.C.J. de Leeuw, page A1-5.

Chapter 3 Evolution of the Concepts and Practices of Risk Measurement

Many books have been written on risk management from different angles.[1] The majority of these risk management books are technical. However, when discussing risk management issues more fundamentally, many authors question whether risk management is an art or a science.[2] When people act on their insights, feelings and experience, this can be called 'art'. Whenever people make decisions based on theories and calculations derived from the area of science,[3] this is called 'science'. Instead of 'art' and 'science', 'subjectivity' and 'objectivity can be used as synonyms. The clearest existence of science in risk management techniques is the attempt to measure risk. Risk measurement is an element of the risk management process as described in Section 1.1.3 (page 6).

Two developments have triggered researching the evolutionary process of the development of risk measurement techniques: (a) the recurring question of art and science, and (b) the enormous expansion of risk measurement techniques in the last decades. Value-at-Risk models for market risk were developed in the early 1990s and have been incorporated in the Basel regulatory framework in 1996; Credit risk modelling, and related to that, the development of rating methodologies and portfolio modelling has been developing very quickly since the late 1990s[4] and measurement of operational risk with the use of mathematical risk measurement techniques is currently emerging. This is an attempt to minimise the share of 'art' in the risk management profession. Still, it appears that these developments increase the discussion on whether risk management is a profession of art or a profession of science, as Section 3.2 describes.

This chapter attempts to answer the first two research questions:

- ✓ What is risk measurement?
- ✓ How can we expect risk measurement concepts to evolve?

Before describing the evolution of risk measurement methods and the driving factors behind this evolution in the past, some measurement and risk fundamentals will be discussed. Our observations regarding the evolution of risk measurement concepts will be summarised in a conceptual framework. Two case studies show how this conceptual framework fits practice.

3.1 Risk and Measurement Fundamentals

As we are discussing risk measurement techniques, it is appropriate to define first what the measurement contains, what risk is, and how these two concepts can be related. Without going into technical details and complicated formulas, this section discusses the fundamentals of risk and measurement.

3.1.1 The Concept of Measurement

The word 'measurement' is very much related to mathematics and objectivity. In searching for literature on measurement theory, it appeared that most journals refer to statistical techniques or are even solely filled with them.[5] In the 1920s, it was concluded that mathematicians had taken over the theory of measurement and the study of the foundation of physics.[6] The philosophical books on measurement theory are scarce and the discussion on measurement in relation to science seems not to be subject of discussion at all.[7]

> *Some attitudes and assumptions are so basic to how we think about and experience the world that it is difficult to consider them critically. For anyone educated in an 'advanced' technological society it is practically impossible to imagine that our ideas of objectivity and factual accuracy, and the basic place of numbering or quantification in our world-view, are historical products rather than eternal principles of analysis.*[8]

The most recent book we have found on this topic stated that today measurement in general is taken to be the assignment of numbers to entities and events to represent their properties and relations. Measurement theory is supposed to analyse the concept of a Scale of Measurement or numerical representation, to distinguish various types of scale and describe their uses.[9] This explains why recent literature on measurement theory is so technically oriented: it was written to guide empirical researchers through the maze of measurement techniques. Although the philosophical literature is scarce, we have used it to give some fundamental background to this research on operational risk.

Foundation

When discussing measurement, it is important to keep in mind the starting point and the implicit assumptions made in advance. One can strive for measurement using an existing technique that fits best to the problem, but one can also strive for the perfect measurement method. The foundations of measurement can be discussed from different angles. Kyburg distinguished three ways of focusing on the foundations of measurement:[10]

1. *Mathematical focus:* axiomatic characterisation of a structured domain, which will explain how it is that that structure can be represented mathematically by a structure in real numbers. The structure of the domain is in some sense 'given' empirically.
2. *Experimental focus:* Practical questions of devising scales and making measurements. The raw materials are forced to fit some relatively familiar structure
3. *Global and philosophical focus:* also concerned with the 'good reasons' for forcing data to fit mathematical structures, as well as good reasons for adopting the mathematical structures we do.

Bluntly, one could say that with the mathematical focus one strives for absolute proof, with the experimental focus one is already satisfied with a 95% confidence level, and with a global and philosophical focus one is searching for valid *qualitative* arguments.

Attention to the fundamental questions regarding measurement can only be found within the 'Global and Philosophical Focus'. It appears that most measurement applications in finance and economics focus on the *experimental foundation* of measurement.

> *An Example in the Area of Operational Risk:*
> *In the discussion on measuring operational risk, one is still searching for the shape of the loss-distribution. As there are little loss data available, it is impossible to present an empirical distribution that provides a reliable reflection of risk. Therefore, an existing parametric distribution is used (such as Weibull, log normal, binomial, and Poisson). The steps towards building a distribution are:*[11]
> 1. *Build a histogram of loss frequencies, times between events, or impacts*
> 2. *Identify the candidate distributions*
> 3. *Estimate the parameters of the distribution*
> 4. *Test the goodness-of-fit between the data and the theoretical distribution*
>
> *Especially steps three and four show that measuring with the experimental foundation does not aim for the absolute truth.*

Arithmetic, Quantity and Scale

Whatever foundation is used, when measuring something, three important aspects should be taken into account: arithmetic, quantity and scale. Arithmetic or 'theory of numbers' is the basis for measurement. For the concept of Measurement, analytic arithmetic is most commonly used.[12] Contrary to pure arithmetic, analytic arithmetical propositions are not known a priori with absolute certainty. Nor are they perfectly precise.

The concept of Quantity can be defined in different ways. Kyburg defines a quantity as a *function* which domain is the set of things that quantity may characterise, and whose range is included in the set of *real numbers* [italics added].[13] Ellis[14] doubts whether precise criteria for the existence of quantities can be given. Nevertheless, he formulated a general statement. 'The existence of a quantity entails and is entailed by the existence of a set of *linear ordering relationships*.' [italics added]

It turns out that quantity is about the ability to order and the use of real numbers. This is where 'scale' becomes important. Quantities are usually ordered on a scale. But, what is a scale? A scale of measurement can be defined as a relation-preserving function from a non-numerical relational structure to a numerical relational structure. Sometimes, a scale of measurement is called 'a frame of co-ordinates'. The best-known distinction of types of scales of measurement is the distinction of Stevens:[15]

- ✓ A nominal scale represents only differences among objects;
- ✓ An ordinal scale represents the order of objects with respect to some property;
- ✓ An interval scale represents intervals of a property;
- ✓ A ratio scale represents ratios of property.

Fundamental Viewpoints

All aspects of measurement can be brought up for discussion. One can doubt whether there are any real orders of quantities, and scales for measurement are sometimes considered to be only approximations to the true or perfect ones. Besides, there will always be a problem of choice on which kind of application of arithmetic should be used. The terminology in measurement theory was sometimes confusing and difficult to fathom. It appears that different terminology is used for roughly similar viewpoints. For the purpose of this research, we have split the fundamental viewpoints in two groups, which we have called 'open' and 'closed'. Table 3.1 provides a list of explanatory statements for both viewpoints.

According to the closed viewpoint, the concept of Measurement can only be applied in the exact sciences. The supporters of the open view extend the scope of measurement towards social and behavioural inquiries. This requires the rejection that quantities have a kind of primary ontological status,[16] as by admitting such a view, the range of measurability cannot be conventionally extended.

Some examples of the open viewpoint in relation to risk measurement are causal modelling and constructing relative frequency distributions.

Closed	***Open***
A grouping of viewpoints called 'interactionist', 'materialist', 'conservative' or 'realist' approach	A grouping of viewpoints called 'representationalist', 'empiricalist', 'operationalist', 'liberal' or 'antirealist' approach
The object of measurement exists independently of and prior to procedures used to measure it	Measurement is any assignment of numericals according to any operational, empirical rule.
Measurement requires counting, whereby counting is defined as placing the members of a collection in one-to-one correspondence with a segment of the natural numbers.	Measurement does not require counting. Everything is held to be capable of measurement of some sort.
Magnitudes are historically and theoretically determined reflections of quantitative aspects of objectively existing entities and not merely the outcome of metricization or measuring procedures	A scale of measurement is a relation-preserving function from a nonnumerical relational structure to a numerical relational structure
Measurement is ontologically committed (i.e., rooted in and, hence, grounded by objective reality)	See measurement as a device to make scientific theories conceptually and calculationally manageable

Table 3.1: Fundamental Viewpoints Regarding the Scope and Application of Measurement [17]

Measurement Theory and Systems Theory

The problem of measurement theory can be illustrated by means of systems theory. Systems theory has been developed from the 1950s onwards as a method to research phenomenon's that are characterised by coherence. A system is thereby defined as 'an accumulation of entities with the compilation of interactions between these entities'.[18] Therefore, the core of systems theory can be defined as multidisciplinary problem solving taking into account interactions of entities and their environment.

In 1956, Boulding has tried developing an overall systems theory. He presented a hierarchy of nine levels proving that reliable model development becomes more difficult if interaction in the system to be modelled increases. For example, a static structure can easily be modelled, but social systems cannot, as human interactions cannot be predicted reliably.

Ackoff is even more explicit in judging problem solving. He agitates against reducing problems to easily digestible chunks, as this would imply making too many simplifying assumptions. He states that disciplinary education puts blinders on us that keep us from seeing relevant variables that lie outside our own discipline.[19]

Ackoff explains his method of problem solving via a comparison of the Machine Age, which was commonly used in the early 20th century, and Systems Age, which was developed in the 1970s/1980s.[20]

The basis of the Machine Age is analysis: in order to understand something it has to be taken apart conceptually or physically. Within the Machine Age, reduc-

tionism is used for the purpose of problem solving and in adding the elements together again, cause-effect relations are assumed to be the only type of relation. Systems Age is the opposite way of thinking. Instead of splitting the problem in smaller elements, it places the problem within a larger context. The goal of Systems Age is to understand the problem in terms of roles or functions within that larger context. It should be noted that Systems Age does not replace Machine Age, they complement each other.

Machine Age	***Systems Age***
Analysis	Synthesis
Reductionism: split the problem in smaller elements	Expansionism: place the problem within the wider context
Determinism: input-oriented way of thinking	Teleology: output-oriented way of thinking
Environment-free	Environment-full
Causal relationships: acceptance of a cause as sufficient for its effect. In practice also probabilis-tic relationships were used within the Machine Age, which is not a full causal relationship as it may have a probability other than 1.0	Producer-Product relationships: requires environment to explain everything, as a producer is only necessary and insufficient for its product and can therefore not completely explain it.
Knowledge on 'how'	Understanding 'why'
The three steps towards problem solving are: 1. Decomposition of that which is to be explained; 2. Explain the behaviour or properties of the parts taken separately; 3. Aggregate these explanations into an explanation of the whole.	The three steps towards problem solving are: 1. Identify a containing whole of which the thing to be explained is a part; 2. Explain the behaviour or properties of the containing whole; 3. Explain the behaviour or properties of the thing to be explained in terms of its role(s) or function(s) within its containing whole.

Table 3.2: Machine Age versus Systems Age

Measurement models are usually based on causal relationships derived from Machine Age. The purpose of those models is to forecast the future and translate this into 'how' to act. Ackoff argues that forecasting is useless in situations where we can control the future and in situations where we can respond rapidly and effectively on changes that we neither control nor expect. The better we can adapt to what we do not control, the less we need to control.[21]

Hence, solving risk measurement problems purely from the Machine Age perspective will never result in reliable solutions. Organisations are complex environments in which one single causal relation can never be sufficient to solve a problem.

Conclusion

It appears that there is no uniform answer to the question 'what is measurement'. The concept is applied to a wide variety of subjects or things, but there is much discussion on whether all these applications can be called 'measurement'. There is a set of preconditions for measurement: arithmetic, quantity and scale should

be decided upon. It depends, however, on the acceptance of error whether measurement methods are acknowledged. From a closed viewpoint, many measurement methods used in daily practice are rejected. From an open viewpoint, they are acknowledged. With regard to risk management, it can be argued that only applying the discipline of measurement from a statistical point of view, will not solve the complex organisational problem of risk.

Based on this information, it is to be expected that any measurement method under construction that will only be acknowledged within the 'open' viewpoint and/or attempts to solve complex problems with measurement techniques derived from one single discipline (e.g. mathematics) may expect fundamental discussion on its application and value. We note that many attempts to measure complex or interactive systems unjustly abstract from these fundamental discussions.

3.1.2 The Concept of Risk

The concept of Risk can be illustrated using the fundamental discussion on this concept started in the 1920s. Knight started a discussion on the distinction between measurable and unmeasurable uncertainties:

> *The essential fact is that 'risk' means in some cases a quantity susceptible of measurement, while at other times it is something distinctly not of this character. It will appear that a* measurable *uncertainty or 'risk' proper, as we shall use the term, is so far different from an* unmeasurable *one that it is not in effect an uncertainty at all. We shall accordingly restrict the term 'uncertainty' to cases of the non-quantitative type. It is this 'true' uncertainty, and not risk, as has been argued, which forms the basis of a valid theory of profit* [22]

Given the statistical focus of current risk measurement techniques, one could conclude that *risk* measurement mainly focused on the so-called 'measurable uncertainty'. However, recent literature on operational risk measurement does not support this assumption. Marshall states for example: when we use the word 'risk', it captures both the effects of change and our *inability* to predict that change. It follows that as our knowledge and understanding of the impacts and causes of change increase the risks that we face decrease. But no amount of knowledge will remove all risks.[23] However, he does mention the distinction between risk (outcomes that, while not certain, have probabilities that can be estimated by experience or statistical data) and uncertainty (outcomes that

cannot be predicted even in a probabilistic sense), but in the remainder of his book, they are not separated.
This is illustrative for the struggle we observe in defining risk. It is the fundamental difference between 'expected = average losses' and 'unexpected losses' (we note that these terms are also have a statistical basis). Although definitions of risk may refer to 'losses due to', only the unexpected losses that could not be foreseen are to be feared. We would prefer risk to be defined in the way Knight defines 'uncertainty' and we agree with him that this 'true' uncertainty should form the basis for the risk management profession, capital management and capital regulation.

In studying the debate on risk definitions, Van Asselt[24] also found a variety of opinions on the characteristics of risk within the risk community. These opinions affect the extent to which risk is thought to be measurable and are comparable to the fundamental viewpoints on measurement, described earlier.
The risk definition of objectivists usually is a function of probability and negative utility. Risk definitions of constructivists are more vague, for example 'the set of undesired consequences associated with a certain activity'.

When these thoughts on risk analysis are compared to Knight's distinction between 'risk' and 'uncertainty', it appears to us that objectivists are focusing on 'risk' and constructivists on 'uncertainty'. The arguments of the latter should therefore dominate in the risk management profession.

Objectivists	***Constructivists***
Science is value free (i.e. positivism)	Science is entirely social (i.e. social or cultural relativism)
Distinction between objective and perceived risks	Risk is a social construct. There is no objective definition of risk
Objective risks are measurable in terms of probability and utility	Risk analysis should involve qualitative factors that are difficult to measure
Risk assessment and risk management have to be separated	Risk assessment and management are inseparable activities in which value differences are at the core
Right expert calculations can settle risk issues	Participatory processes are needed to manage risk issues

Table 3.3: Characteristics of the Two Major Schools of Thought in Risk Analysis[25]

3.1.3 The Concept of Risk Measurement

From the previous section, it can be concluded that the profession of 'risk measurement' aims at transforming unmeasurable uncertainties to measurable uncertainties by developing a scale of measurement and a rule to add numbers to qualitative structures. In this sense, it is important to notice the subtle difference

between Knight's and Marshall's definition of risk. Knight just mentions 'measurable', whereas Marshall discusses determining probabilities using statistical data *or* experience. This broadens the concept of measurement.
This makes risk measurement part of the open viewpoint of measurement. The basis of risk measurement is not a physical object that has quantities in nature, but a structure of qualitative relationships. Risk includes a certain position that can be affected by risk factors (causal relationships, qualitative). The sensitivity of the position in relation to the risk factor determines the effect on the Profit and Loss.

> *Example Regarding Credit Risk:*
> *IF the counterparty defaults AND there is insufficient collateral THEN the bank will face a credit loss*
> *Example Regarding Market Risk:*
> *When the long term interest rates drop, some positions will be affected heavily, others only a little. Besides, some positions will increase in value and others will decrease.*

Risk and Quantities

To measure risk, there should be arithmetic, quantity and measurement scale. As risk in itself is not a physical object, its quantity cannot easily be determined. In terms of determining quantity, risk can be called a cluster concept as one characteristic is insufficient to determine a quantity. The quantity of risk is in fact a formula, representing likelihood and impact of *loss events* occurring. Probability theory is essential with regard to quantifying risk, but probability theory is a much broader concept than people in the area of risk measurement might be aware of. There are different concepts of probability. McGoun distinguishes four concepts:[26]

1. Classical probability: the probability of an event is the ratio of the number of ways the event can occur to the total number of equipossible outcomes. Classical probabilities only apply to the simplest gambling activities.
2. Relative frequency probability: the probability of an event is the limit, as the number of trials increases, of the ratio of the number of times the event has occurred to the total number of trials. McGoun points out that the relative frequency probability is the only significant theory currently in use in economics, finance and accounting. It is impossible to know all possible outcomes when regarding risk.
3. Logical probabilities: the probability of an event is the degree of rational belief, relative to given information, in the event's occurrence. According to McGoun, there is no way to compute 'rational' degrees of belief incorporating information other than historical relative frequencies.

4. Subjective probability: the probability of an event is the quantitative degree of *individual* belief in the event's occurrence. It is hard to apply this concept of Probability for testing complex theories as that would require that these probabilities be aggregated or generalised in some way, which cannot be done.

Ellis (1968) leaves classical probability out of the discussion. According to him relative frequency probability and subjective probability are both empirical probabilities as their outcomes depend on how the world is, not merely on how we talk about it.[27] This in contrast to the logical probability that is non-empirical and the outcome of which does not depend on how the world is, but simply on the language we use to describe it and the principles of inductive reasoning that we have adopted.

Risk is about events, losses and catastrophes. In measuring risk, one aims to reflect as closely as possible how the world is. If probabilities are to be used, measuring risk can only be done with the use of *empirical* probabilities. Therefore, both relative frequency and subjective probabilities can be regarded as possible solutions to risk measurement.

Measurement Methods in Practice

Fundamental questions should be asked on 'what is measurement' and 'what are the conditions necessary for its application'. In practice, one can observe that risk measurement practitioners, applying measurement theory, fail to answer these fundamental questions. The necessary conditions for application are usually the assumption underlying the model, i.e. in developing a measurement model, it is assumed that the necessary conditions are met. Very common underlying assumptions of mathematical models applied in economics are rational decision-making or perfect and publicly available information.

Measurement methods in practice appear to be developed from *one* discipline. This conflicts with Ackoff's viewpoint that all problems should be analysed in coherence using a multidisciplinary approach. Statistical models and therefore the first risk measurement methods are based on simplistic underlying assumptions, derived from Machine Age. However, risk does not abstract from non-rational human behaviour, environmental influences or obscure organisation decision-making. Therefore, models need always be adjusted based on new knowledge and understanding and the outcomes should always be used with care. The focus should lie on *understanding* instead of *forecasting* and on *management* instead of *measurement*.

3.2 Historic Developments in Risk Measurement

Risk management started many years ago as a piece of art. Long before the mathematical basis of current models and measurement techniques were discovered, banks were selling loans and were managing their (operational) risks. Intuition, education and experience were the guides towards proper risk management. The growing trust in mathematical techniques, the emerging role of information technology, the growing role of (international) competition, and the growth of financial institutions, led to accelerations in the development of risk management and measurement techniques. The current profession of risk management in banking is based on the ability to quantify risks,[28] which means that these developments come from a science perspective. As measuring risks raises a number of practical and conceptual challenges, it took a long time before the scope of risk measurement in banking increased.

Stimulated by capital regulation, the financial sector is currently improving models and trying to cross the frontiers towards measuring all risks. However, 'the immense sophistication of modern risk management techniques should not lead us to think we have wholly conquered risk – or that such a conquest will ever be possible. Human beings will continue to interact, make choices and respond to those choices in unpredictable ways that are the ultimate sources of uncertainty. That is where the heart of risk management lies'.[29] From this quote, it should become clear that 'science' does not replace 'art'. Art continues to be the basis of risk management practice.
Every form of science starts with 'art'. As long as there is no clear demand for measurement techniques, they will not be developed and people will rely on their own instincts in managing their daily work. Currently, risk management in banking is clearly not a profession of pure art anymore. This section describes how developments took place.

3.2.1 A Summary of History

The interest in figures and quantification of events in the world started during the 'Scientific Revolution' in Western Europe (late sixteenth and seventeenth centuries).[30] Before this time, explanation had come from everyday experiences and qualitative judgement, which had been called 'knowledge'. The most interesting mathematical developments in the light of the current state of the art in risk measurement started at the end of the 19th century. By that time, financial institutions recognised the existence of interest rate risk and credit risk as the only risks a bank faces.[31]

The brief overview below does not claim to be complete, nor does it mention all relevant researchers in this area. Moreover, the way of thinking, the reasoning behind it and the impact on risk measurement in the financial sector are highlighted.

Before 1900

The relationship between probability and risk, which is one of the most important underlying assumptions of the concept of Risk used nowadays, was first noticed at the end of the 19th century.[32] In those days, research programs in economics raised the question whether profit is the return of bearing risk. In this discussion, insurance was an important topic. Insurance was one of the first practical applications of the theory of probability and the 'law of large numbers'.[33] Although the relationship between probability and risk had been established, researchers in those days (for example Haynes and Ross) were sceptical about the reliability and applicability of statistics to measure risks.

During the period prior to 1900, the first possibilities of moving a part of risk management from art into science had been recognised. However, this was not a reason to actually change anything in the proportion of art compared to science. The main reason for this seems to be lack of trust. Risk management remained a form of art.

1900-1920

Doubts about the combination of risk and statistics disappeared during the first 20 years of the 20th century. Boundaries on what is 'measurable' moved towards a more 'open' view of measurement. Between 1906 and 1920, the idea of risk as the dispersion of a relative frequency distribution was at least made explicit, if not fully accepted.[34] The future was thought to be predictable and people were assumed to be rational decision-makers, which made the economic system a guaranteed stability.[35] These assumptions made risk measurable, but no one actually attempted to 'measure' risk and relate it to returns. It should be remarked that, due to lack of IT, the creation of relative frequency distributions would have been a very time consuming effort.

Still, risk management was a form of art. The concepts of transforming this area into science were accepted and this resulted in many intellectual discussions, but no risk measurement methods were developed.

1920-1930

The idea of the economy as a risk-free system, always producing optimal results, disappeared after World War I. The war and the tensions of the post-war years showed that reality encompasses entire sets of circumstances that people never contemplated before. In those years, the concept of Risk used today has been developed. The economists Knight and Keynes were the first ones to notice that statistical curves and probabilities do not always fit reality and that patterns of the past do not always reveal the path to the future.[36] Knight had too many doubts about the rationality and consistency of human beings to believe that measuring their behaviour would produce anything of value.[37]

As discussed earlier, the concept of Risk used today is based on the assumption that it can be measured. Risk is regarded as a concept in the area of science. However, Knight made very clear that in his view, risk management would never become an area of pure science. Art will always play a role and according to Knight, it will play a crucial role.

Knight had three main reasons for rejecting probability as a measurement of risk:[38]

1. Reference class problem: there is no simple way to determine which historical conditions, *if any*, are sufficiently similar to current conditions in order to use the relative frequencies of an event under *those* conditions as an appropriate measure of the rational probability with which to expect the event to occur under *these* conditions.
2. Law-of-Large-Numbers problem: according to the law of large numbers, the term 'mean' is equivalent to the amount the investment will earn on average over several years. If the relative frequency distribution is stable enough to use its standard deviation as a 'measurement' of risk, it is also stable enough to ensure that investors will almost certainly earn the mean percent per year on average if they repeat the first investment year after year. Through willingness to ignore short-term fluctuations in return, patience can eliminate the 'risk' of difference from expectations.
3. Estimation problem: The dispersion of a real relative frequency distribution of historical events is used to estimate the dispersion of a hypothetical relative frequency distribution of possible future events *existing in the mind* of a decision-maker prior to the decision. Therefore, the 'measurement' of risk is itself risky.

Although he did not mention the term, one can conclude from Knight's thesis that *bounded rationality* is one of the main drivers of the reference-class problem. He stated that workable knowledge of the world requires three things:[39]

1. The assumption that the world consists of units that maintain an unvarying identity in time;
2. Classification of *kinds* of things, to infer from a perceived similarity in the behaviour of objects to a similarity in respects not open to immediate observation;
3. Use of the principle that things similar in some respects will behave similarly in certain other respects, even when they are very different in still other respects, as classification only would not carry far enough to be of substantial assistance in simplifying our problems to the point of manageability.

The observant reader recognises here the characteristics of 'Machine Age', which dominated thinking in this period.

During this period, risk measurement was subject of fundamental discussions. *Not only the applicability of quantitative techniques, but also definitions of risk, profit and uncertainty and the relations between them were fundamentally discussed. Knight laid his finger on the way people perceive risk. In this period, it became clear that in the end, risk management would be forced into the area of science. However, there is a clear warning that, whatever people may be able to measure, the true difference will always stem from the area of 'art', as that is the only way to manage uncertainty.*
Full reliance on statistic curves and forecasts purely based on historical experience disappeared. Calculations were still made, but people became more careful with the application of the results. This made risk management a profession of art, in which science could be one of the tools to come to a decision.

1930 - 1950

The rejection of the probabilistic measurement of risk only lasted for a decade. Between 1930 and 1940, a shift in the perception of economic research diminished the concern for the reality of econometric models. Data were no longer regarded as creative sources of ideas for building new models, but simply as means of testing a priori models. A model had been considered a simplification of reality for which assumptions needed to be made. Had theories worked, then the simplifications and assumptions made in the model were considered appropriate. The problems pointed out by Knight and Fisher were easily dismissed, by phrases like 'this difficulty may be overlooked' (Hicks, 1935), 'must be left for another occasion' (Makower and Marschak, 1938), 'sufficiently realistic' (Marschak, 1938) and 'in the absence of a better approach' (Domar and Musgrave, 1944).[40] The

acceptance of a probabilistic measure of risk was clearly an act of faith. Chapters Four and Five will show that similar arguments have been used in the discussion on Operational Risk Measurement.
From this period on, science attains a secured place in the risk management profession. The portion of science was still relatively small, but would grow steadily throughout the years. The availability of data to prove that models would have worked in the past is an important driver of this movement.

Moving from art to science had been possible if the scientific methods were trusted. In most cases, the people developing risk measurement techniques were aware of the pitfalls. However, they convinced the public that these methods could be relied upon by showing that the models would *have worked in history. The role of science in the risk management profession was clearly growing and faith seemed to be one of the main drivers. The method used to establish this faith has been testing a priori models with historical scenarios. If models would have worked in practice, they are trustworthy.*

1950-1970

As trust seems to play an important role, it is interesting to search for some reasoning behind this in the area of psychology and social research. An interesting idea in this area is discovering the impact of selective perception:

> *Presented with a complex stimulus, the subject perceives in it what he is 'ready' to perceive; the more complex or ambiguous the stimulus, the more the perception is determined by what is already 'in' the subject and less by what is 'in' the stimulus.*[41]

With the use of laboratory research, Simon explained the impact of education and experience on business decisions.
For the development of risk measurement techniques, selective perception can also be one of the driving forces. Many professionals working in the area of risk measurement have an economics or mathematics background. They improve models based on the fundamentals that universities have taught. The establishment of faith in statistical techniques and the relation between risk and return continues to have its impact.

Another important development in this period is Markowitz' research in the field of portfolio management and diversification effect. In his study, Markowitz recognises the relation between risk and return, without naming it. The theory on

portfolio management has been developed to diminish the 'undesirable variance in return'. This theory became the basis of many financial theories, among which the Capital Asset Pricing Model. For risk management in financial institutions, the portfolio theory turned out to be one of the key elements in market and credit risk management and measurement. These are all signs that risk management is slowly moving towards the direction of science. However, it must be recognised that still many parts of risk management had not yet been discussed.

People were influenced to accept mathematical techniques, which resulted in a growth of mathematical risk measurement concepts, such as Markovitz' portfolio management and diversification. These developments pushed risk management into the area of science. However, there were still many parts of risk management that had not been discussed yet. These elements were still part of 'uncertainty'.

1970s

One of the most important theories in finance developed in the 1970s is option theory. The breakthrough of option theory came in the early 1970s, with the Black and Scholes model for pricing European options (1973). The heart of the theory of Black and Scholes is 'the opportunity to trade in the future on terms that are fixed today'.[42]

The stock market, as the precedent of options, was described as another institution to shift risks:

> *Other institutions for risk shifting have emerged. The most important is the market for common stocks. By this means, the owner of a business could divest himself of some of the risks, permitting others to share in the benefits and losses. The stock market permits a reduction in the social amount of risk bearing.*[43]

In the stock price, from which the option is derived, the total risk profile including reputation risk should be included. The stock price of a firm can rise or fall with changes in strategy or risk. One of the interesting basic ideas behind option theory is the relation between volatility and risk in combination with the assumed relation between risk and return.

It appears that many of the changes in banking that have taken place in the 1980s and 1990s originate in the Black-Scholes options formula and arbitrage-free pricing.[44] Option theory is applied to options on stocks, but also forms the basis for

pricing Forward Rate Agreements, implicit options in lending products, and other derivative products, for which option theory identified the drivers of risk. The willingness of the investor to bear risk, for example, does not affect value, nor does the expected return on the stock.[45]
Option theory became the basis for many risk measurement models. The Capital Asset Pricing Model is based on it, but also the Value-at-Risk measure that banks developed in the 1990s to measure their market risk and on which the capital requirements for market risk are based.

Option theory was an important step in introducing some art in measurement methods. Although the Black-Scholes theory is a formula (science), it incorporates many elements that influence risk. In that respect, option theory tries to forecast the future based historical data, but taking into account different causal relationships.

1980s

The early 1980s were years of economic crisis. The stock markets crashed, the housing prices decreased dramatically, and there was huge unemployment. In general, economic crises lead to revisions in risk measurement models and the development of new risk measurement techniques. In this period, stress testing and scenario analyses were introduced as a supplement to risk measurement models.
For financial institutions, the crisis resulted in another important change. The stability of the financial system in times of crisis is of great importance for economies. Banks can only exist when people have faith in the fact that they will get their savings back. To guarantee safety in the financial system, banks are subject to a stringent supervisory regime. The economic problems in the early 1980s have led supervisors of the G10 to form a committee to discuss the introduction of minimum capital requirements. This committee has been called Basel Committee on Banking Supervision and the output of the discussion in the 1980s has been the 1988 Capital Accord, which has been described briefly in Section 1.3 (page 11). The tightening of the supervisory regime has influenced the developments in risk measurement techniques enormously.[46]

At the end of the 1980s, the interest in market risk increased. Black Monday (October 1987) played an important role in this, but also the range of new products introduced (e.g. derivative products). At the establishment of the 1988 Capital Accord, it was already clear that an amendment to incorporate market risk was to follow soon.

The economic crisis in the early 1980s resulted in an increased interest in risk and risk measurement. From the 1980s onwards, the application of measurement techniques increased, among others via the support of the Basel Committee on Banking Supervision. The need for qualitative elements was acknowledged, but not explicitly incorporated in risk measurement techniques.

1990s

New insights on human shortcomings were brought together in 'Prospect theory': (a) emotion often destroys the self-control that is essential to rational decision making, and (b) people are often unable to fully understand what they are dealing with. These insights are important attacks on the underlying assumptions of risk measurement methods, which often assume rational decision-making.

During the1990s also the interest in behavioural finance grew. Behavioural finance studies the way information is perceived, selected and manipulated in the decision-making process that eventually leads to an observable movement in price. The human element in economic models is still typically based on the standard assumptions of modern economics, despite decades of research into the psychology of the way decisions are made. Homo Oeconomicus, as he is known, behaves in an absolutely rational manner, is motivated solely by profit-maximisation and perceives and processes information flawlessly. The modern theory of the capital markets will allow deviations from this model only in extreme cases. A growing body of research demonstrates, however, that anomalies and aberrations are everyday occurrences and, in finance, are part of every transaction. The failure to learn from the past means the same events will occur again, largely because, we would argue, memory tends to be constructed out of positive outcomes. [47]

In banking, the 1990s have been the decade of developing quantitative models for measuring credit and market risk. The market risk models (i.e. Value-at-Risk) have been developed in the early 1990s and were widely applied after the recognition of these models for the purpose of regulatory capital calculation.[48] A clear shift is visible from implicit and qualitative valuations of risk to explicit and quantitative risk measurement techniques. Bessis points out that such a shift is only possible if a number of conditions are met:[49]

- ✓ The definition of risk must be improved so that risks can be tackled more efficiently;

- ✓ The benefits of risk management must become tangible enough to justify the shift. The potential applications and use of risk management as a policy tool for the top management of banks greatly helped to meet this condition;
- ✓ External incentives for banks are necessary to make the benefits more tangible.

Here one can observe the perceived large role that regulators play in the development of risk measurement methods. In 1995, the Basel Committee on Banking Supervision amended the 1988 Capital Accord to include a capital charge for market risks. In 1998, the discussion started to draft a new Capital Accord, including internal models for both credit and operational risk.

The theory development in the 1990s shows an increased interest in the impact of human behaviour on risk measures, but science still dominates banking practice. However, the first tears in the risk measurement concepts applied become clearly visible.

Summarising Overview of the Evolution of Risk Measurement Concepts

Time Period	***General Characteristics***	***Art or Science?***
Before 1900	The possible relation between profit and risk became subject of discussion; Discussions on the economic role of insurance; Establishment of the relation between probability and risk, but sceptical about applicability and reliability of statistics to measure risk due to lack of trust.	Risk management was purely a profession of art
1900-1920	Strong believe in risk being the dispersion of a relative frequency distribution; The future was predictable and people were assumed to be rational decision makers; No one actually attempted to measure risk and relate it to returns.	Risk management was still a profession of art, but the concepts of transforming this area into science were accepted
1920-1930	World War I destroyed the idea of economics as a risk-free system; Many discussions on the odds of using probabilities as a measure of risk; Discussions on the fundamentals of risk measurement.	Risk management was a profession of art, in which scientific models could be *just* one of the tools to come to a decision
1930-1950	New trust in reality of econometric models; The use of data for testing a priori models instead of building models out of data.	Science got a fixed but small place in the risk management profession.
1950-1970	Experience and education played a major role in which models gained acceptance. The renewed trust from earlier periods encouraged this; The first recognition of portfolio management and diversification aspects.	Risk management was slowly moving further towards the direction of science.

1970s	The development of the Option Theory: the opportunity to trade in the future on terms that are fixed today.	Option theory form another step towards measuring all risks scientifically
1980s	The deep economic crisis resulted in new risk measurement techniques, like stress testing and scenario analysis; Banks became subject of capital regulation to guarantee a sound and safe financial system; The new regulations enormously stimulated the development of scientific risk measurement techniques.	Banking regulation stimulated risk management to move towards the area of science.
1990s	Prospect theory discusses the impact of human shortcomings on risk measures; Interest in behavioural finance; The banking industry fully accepted market risk models; The development of credit rating techniques and credit risk models took an enormous flight; Banks started thinking about a new frontier called 'operational risk'.	The rise of science in the area of risk management is accelerating, but people get conscious that there will always be a piece of art that determines the best performer.

Table 3.4: A Summarising Overview of the Evolution of Risk Measurement Concepts and the Role of 'Art' and 'Science' in this

3.2.2 Characteristics of current Risk Management Practice

The probabilistic measurement of risk has been further developed and applied in practical instruments, also taking into account the assumed relation between risk and return. In today banking-literature, risk is defined in many different ways. Roughly two kinds of definitions can be pointed out:[50]

- ✓ Risk is the possibility of damage
- ✓ Risk is the variability around the expected value of the returns

The first definition stems mainly from an insurance perspective, whereas the second definition suits an investment environment. This second definition clearly illustrates the faith in the probabilistic measurement, which was rejected in the 1920s. Although there are distinctions in qualitative and quantitative risk measures, the distinction between risk and uncertainty is not made explicitly within financial institutions.

The dominance of objectivity and statistics in risk management also becomes clear from descriptions of risk management by a regulator. De Swaan describes three ways to define risk management in banking:[51]

1. In the first place, risk management refers to quantitative, statistical methods to identify, measure and control risks. Risk management can be defined as the active control of all financial positions that can influence cash-flows and Profit and Loss;

2. In the second place, the term risk management is used in a wider sense, combining quantitative methods with organisational aspects. Besides quantitative risk analysis, administrative organisation and internal control are part of risk management;
3. In the third place, risk management can be widened even more, by defining it as guarantee for soundly behaviour by the financial institution and its employees. This includes integrity and compliance issues, such as the 'zorgplicht' in the Netherlands.[i]

Only if risk management is described according to the third definition, it really recognises the value of subjectivity. However, it is clearly recognised that banking common sense cannot be displaced by statistical methods, as these will always be based on history. People should always be keen on trend breaks or unexpected events. It has been noticed that risk management will never become purely a profession of science or as Pidgeon (1988) stated 'one can never know completely what one does not know'.

The speculative (or financial) risks[ii], like market and credit risks, are captured in risk measurement models, using the mathematically based theories, among which is Markowitz' portfolio theory. The development of risk measurement techniques to measure pure (or non-financial) risks[iii] stayed behind until recently.[52] People have always been less interested in these risks, as nothing could be gained with these risks. Besides that, pure risks that really matter in risk measurement are the high impact events that have usually a low frequency. Jameson correctly states that 'making an unlikely event even less likely is not always exciting'.[53] The discussion on the review of the 1988 Capital Accord urged banks to start taking these risks seriously and develop measurement methods. However, the problem how to measure these 'high impact, low frequency events' remained. Chapters Four, Five, and Six provide more detailed insight in current risk management practice.

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[i] *If 'zorgplicht' is translated literally, it means 'obligation to take care'. This obligation is applicable to securities services, where banks must monitor whether the risk profile of a securities portfolio of a client matches its pre-determined risk appetite. In the case clients take more risk, the bank must provide a warning signal.*

[ii] *Speculative risks are risks with upside and downside potential. Taking these risks results in either profit or loss.*

[iii] *Pure risks are risks with only downside potential. The bank can lose money, but there is no direct return for taking these risks.*

3.3 The Conceptual Framework

The previous section has marked some essential phases in the evolution of trustworthy methods for measuring risk. This section translates the evolution of risk measurement methods into a four-step conceptual framework.

Step One

First of all, there must be a reason to start measuring risk. To date, this reason has always been an *external demand*. In financial institutions, the demand to measure risks mostly came from the market and/or regulators (see Figure 3.1). [54]

Figure 3.1: The First Step in Developing a Risk Measurement Model

As measurement is associated with statistics and mathematics, the *first thoughts* on measuring the risk have always been in the area of maths. People made assumptions regarding a loss distribution or formula, and loss data had been gathered to support the assumptions. This clearly is a procedure that stems from the empirical foundation of measurement. In this phase in the evolution, the thinking is theoretical, conceptual and fundamental. As one is forced to use the experimental foundation, fundamental critics are unavoidable. This first stage of development therefore has never been an easy step that could be taken in a short period of time.

Step Two

In order to translate the first theoretical thoughts to a workable solution to implement, some driving factors have been essential (as illustrated in Figure 3.2). We have seen in the description of historical developments that trust in the theoretical foundation of the methods is an essential prerequisite for implementation. Trust does not come out of the blue. There have always been some strong *advocates* that were able to convince a wider public. Also, implementation should be *beneficial from a business point of view*. Without a clear cost-benefit trade-off it has been hard to gain support for implementation. As discussed earlier, regulatory pressure has been important in starting to think about applications for risk measurement, but insufficient to start implementation.

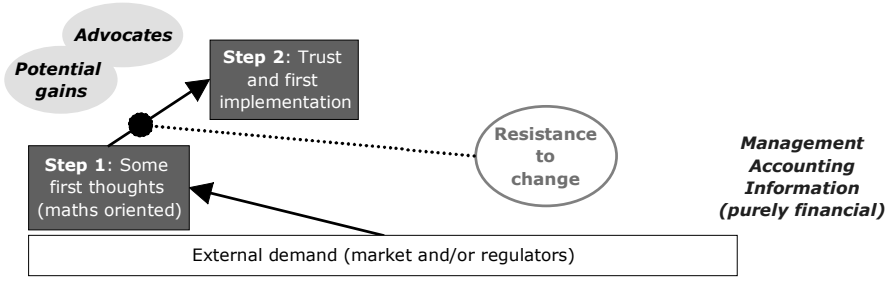

Figure 3.2: The Second Step in the Development of Measurement Models

Despite of the *resistance to change* that plays a role in every implementation project, the evolution of the measurement tool will move towards step two: 'trust and first implementation'. It should be noted that, these first stages, only management accounting information is gathered. Non-financial information plays no role.

Step Three

After the first implementation, the industry often faced problems: *major losses* and/or *model failures* were discovered. As a model is always a simplification of reality, this is unavoidable. Ackoff formulates this very strongly when stating that many problems cannot be solved, as incorrect assumptions block the way towards a solution.[55] The model abandons the influence of human behaviour. Humans are assumed to be rational decision-makers with perfect information. These incorrect assumptions result in unreliable models.

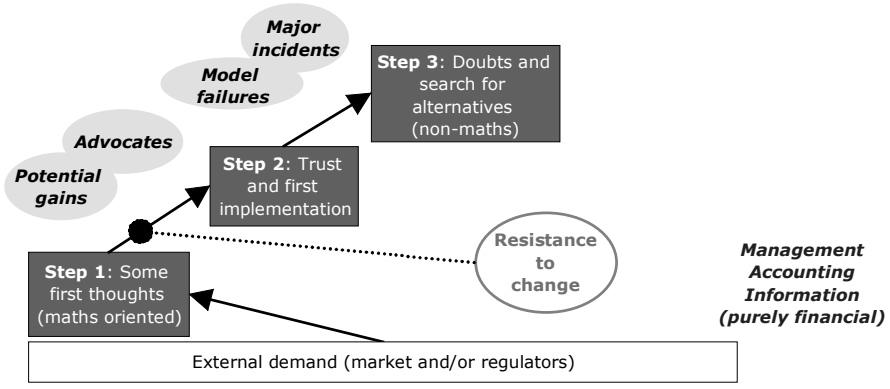

Figure 3.3: The Third Step in Risk Measurement Models

These unavoidable failures have been a starting point for a second fundamental discussion, resulting in Step Three of the framework (Figure 3.3): Alternatives are identified to remove the doubts expressed in the fundamental discussion.

Step Four

Again on a theoretical basis, the search for alternatives started. Depending on the availability of these alternatives and, again, trust in these alternatives, more advanced models could be developed. These new models always seem to be a combination of financial (quantitative) and non-financial (qualitative) information as visualised in Figure 3.4. We call this 'management control' information. After this fourth step has been reached, the evolution of the risk measurement technique will carry on. The improvement of models will never come to an end, as it is impossible to develop a model that can predict human behaviour and environmental influences adequately.

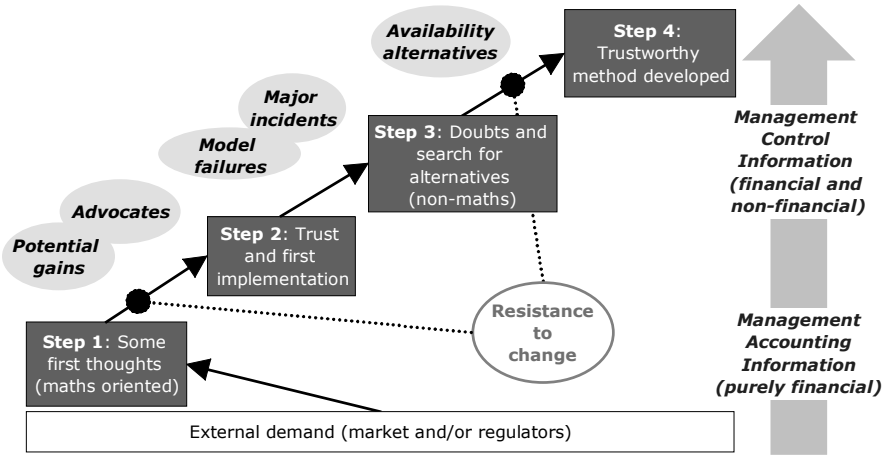

Figure 3.4: A Conceptual Framework for the Evolution of Risk Measurement Techniques

3.4 Insurance: a Case Study

The conceptual framework described in the previous section should be applicable to all areas of risk measurement. Insurance is part of risk transfer tools available in all kinds of areas. Insurance products are based on measures of risk. The risk measurement techniques in insurance also have a long and interesting history in which the four evolutionary steps can be recognised. The short overview in Section 3.4.1 is derived from Vaughan & Vaughan,[56] Bernstein,[57] and Dionne & Harrington[58]. Section 3.4.2 explains the roles of art and science in insurance, via an exploration of insurance pricing techniques.

3.4.1 A Historical Overview

Demand for Measurement

There is evidence of practices resembling property insurance in the ancient world. Chinese merchants utilised the technique of *sharing* risk by distributing their goods on each other's boats. When one of the boats sunk, it did not mean one person was completely ruined. In these days, but also later, insurance or risk-sharing was one of the most important forces in the stimulation of (world) trade. Although the technique of risk sharing is very old, the modern insurance business only started during the commercial revolution in Europe following the Crusades. The term 'underwriter' stems from these days, and refers to individuals who took over a part of the risk of marine expeditions. The first insurance companies were set up at the end of the 17th century. This was not a result of lack of external demand, but lack of thoughts on how to measure the risks.

First Implementation

The developments in mathematics during the 17th and 18th century, i.e. Pascal and Fermat (theory of probability) and Bernouilli (law of large numbers), provided the basis for a widespread use of insurance for different kinds of risk. The possibility to make an estimate of the risk made it easier to determine a reasonable price. The theory of probabilities and the law of large numbers still provide the basis for most of the current pricing methodologies of insurance products. The science aspect in insurance is dominating the developments and discussions.

Why has Damage to Insured been Higher than Expected?

The recognition of moral hazard[iv] introduced some part of art in the insurance business. As the insurance claims appeared to be higher than the average of the relative frequency distribution, prices increased. The next sections elaborate on insurance pricing methods. It will appear that for some risks, pricing based on intuition and experience (art) is unavoidable. These methods have been developed in the last steps of the evolutionary process (i.e. the 20th century).

Economics of insurance has a relatively short history. In early work that formally introduced risk and uncertainty in economic analysis, insurance was viewed either as a contingent good or was discussed in relation to gambling. This is in line with the context of the theory of probability and the law of large numbers, which were also developed to elucidate the outcomes of games of chance.

During the early 1960s, Kenneth Arrow and Karl Borch published several important articles that can be viewed as the beginning of modern economic

[iv] the insurance policy might itself change incentives and therefore the probabilities upon which the insurance company relied (Arrow, 1984).

analysis of insurance activity. They tackled issues like the reasoning behind risk shifting, the effect of insurance on the society and the economy, the role of different institutions and links between actuarial science and insurance economics.

3.4.2 Insurance Pricing Techniques: Art and Science

In analysing insurance pricing techniques, the struggle between the art and science of risk measurement becomes clear. Although the preference lies with mathematical applications, it appears that this is impossible for all risk types. The pricing methodology depends on the characteristics of the risks to be insured. A distinction is made between repetitive risks and one-time only risks. For the first group, it is easy to pool enough data to make the losses statistically predictable (science). An insurance premium can therefore be based on statistical measures 'mean' and 'variance'. For the second group, statistical measures are of little use (art).

Another distinction concerns the absolute amount of possible losses.[59] If each insurer is able to write the entire risk, or can make *individual* arrangements in the reinsurance market to cope with excess risk, each insurer quotes its own price. This price is either based on the past experience or other factors the insurer considers relevant. The law of probability and the law of large numbers can play an important role.

If risks are so large that no insurer can accept the risk alone, a different methodology is used. Each insurer can only write a small percentage of a 'special risk policy'. Once the price is established, any other insurer writing a portion of the policy applies the same price and other policy terms. However, when too few participants can be found to cover the risk fully, then the policy is withdrawn and no insurer provides any coverage. The reputation of the leading underwriter is an important factor in influencing other underwriters to accept the risk. For these large risks, the cascade effect, as described by D'Arcy and Oh,[60] can play an important role.

In general, it will be very difficult to pool enough policyholders to make very large losses statistically predictable. Hence, insurers will be unwilling to provide coverage for risks in Category IV. When there are any risks in this category, the pricing methodology will be comparable to the methodology in category III. However, the premium increases with the number of insurers needed to underwrite the policy, as the chance of finding enough underwriters decreases.

I Small,one-time only risks	II Large, one-time only risks
III Small, repetitive risks	IV Large, repetitive risks

Figure 3.5: The Four Types of Risk Determining the Pricing Methodology

Three relevant pricing methodologies remain to be discussed:

1. *Estimates in combination with individual rating techniques (mainly 'art')*
   The estimate of loss is similar to the estimate made in box II, where the cascade effect is used. The underwriter can develop his own individual rating techniques for such losses.
2. *Cascade effect (mainly 'art')*
   For large, one-time only events it is hard to gather evidence to be able to properly price the risk. The cascade effect is then crucial in providing insurance.

   > *A cascade begins whenever an insurer ignores its own signal about the expected losses and relies solely on the decision of earlier insurers. Knowing this fact, the price that is proposed to a given risk, as a result of the consultation between the lead underwriter and the insured, is determined considering the likelihood of starting a positive cascade.*[61]

   The price is fixed by the lead underwriter, under the condition that enough underwriters are willing to take part of the risk for this price. The price of a policy, created through a cascade, will on average be higher than the actual risk. After all, the lead underwriter has to overprice the insurance premium to reduce the chance of a total failure to get insurance due to a negative cascade.
   The cascade effect is clearly based on art. The leading underwriter is experienced in setting the price exactly on the correct level to start a positive cascade. As there is only limited data or no data at all to analyse, science cannot take an important place in this process.
3. *Statistical calculation with or without the use of classes (traditional 'science')*
   If a risk is repetitive, the insurance market is the mean to pool enough risk bearing individuals or institutions to predict the yearly damage with the use

of historical data. The use of classes is an extension of a statistical model. If it appears that clients with certain characteristics have a higher likelihood of losses, an insurance company will introduce classes within the statistical calculations.

Financial institutions will mainly search for insurance in the area of large, one-time only losses. Generally, insurers use a mixture of firm-specific data, industry data, external loss databases, and scenario analysis. The techniques an insurer uses are a mix of science and art, in which the relative portion of science depends on the availability and reliability of loss data.

Other Relevant Techniques in Relation to Insurance

The earlier types of insurance were mainly concerned with protecting physical assets, which is only a small part of the risks institutions face. In the past few decades, insurance contracts have broadened in purpose, from protecting assets to protecting corporate income against certain causes of loss.[62]

During the 1990s, corporations were offered new ways of financing their insurance risks, known collectively as alternative risk transfer. There are three types of Alternative Risk Transfer:

1. Finite Risk Insurance: Contracts are longer than traditional insurance contracts and they often involve a packaging of different kinds of insurance, including some risks that are difficult to place;
2. Insurance Derivatives (not used very often)
3. Securitisation of Insurance Risks Directly on to Capital Markets: Bond securitisation products seek to model the underlying loss experience on a portfolio of insurance risks within the corporation. Equity-based securitisation products are a form of contingent claim on equity markets. Technically speaking, they are a put option on the equity market.

3.4.3 Conclusion

The development of insurance products has started with the demand of customers (external demand, as described in the Conceptual Framework). Merchant's as well as private persons wanted to share or shift risks. Insurance clearly started from a pure scientific perspective. However, the piece of art in insurance pricing increased. One of the reasons for the adjustments in the risk measurement models used in insurance, was the notification that the total amount insurance companies had to pay to the insured was remarkably higher than what would be expected on average. This pointed out that the statistical models used, could not accurately predict the expected payoff. Another reason is the

diversification of demand. Large companies may ask for specialist products for more or less unique risks that can be catastrophic.
In this development from pure science to a 'mixed model' fits to the Conceptual Framework described earlier.

Time Period/ Pricing Technique	***General Characteristics***	***Conceptual Framework Art and Science***
Until discovery moral hazard	Insurance as an institution to shift risk; Pricing based on probabilities and law of large numbers; Insurance as a contingent good.	Insurance was in Step One of the Conceptual Framework and could be characterised as a science.
After moral hazard	Notification of moral hazard urged for an adjustment of prices; Economic analysis of insurance activity; Insurance for exclusive large impact events.	Moral hazard was an important model failure that pushed insurance towards step four. The request for the insurance of more exclusive risks makes the piece of art grow continuously.
Estimation/individual rating techniques	Only one insurer involved; Pricing based on experience and intuition; Very little historical data available.	This technique does not contain any mathematics. It is purely subjective and should be labelled as 'art'.
Cascade effect	More insurers needed to cover the policy; Pricing higher than risk as enough underwriters need to be found; Underwriters neglect there own information and analysis and base their decision on the decision of others.	The fact that historical data is never sufficient to base prices on, this pricing technique must be subjective. Again, this is called 'art'.
Statistical calculation (with/without classes)	Actuarial science; Pricing purely based on historical data.	Statistics form the basis for this technique, it is clearly derived from 'science'. The use of classes is only a refinement and cannot be called 'art'.

Table 3.5: The Development of Art and Science within Insurance Pricing

Although the insurance industry is very old, adjustments are still made to calculation methods. For example the terrorist attacks in Washington and New York on September 11, 2001 resulted in adjustment of models leading to a significant increase in prices. This observation emphasises that the development of risk measurement methods never comes to an end.

3.5 Market Risk: a Case Study

From the risks a bank faces and tries to measure, market risk is currently the most 'advanced' area. No aspect of financial mathematics anywhere has had near as much investment in both intellectual and computer technology as market-risk

modelling. This is rather ironic, as market risk is a relatively new phenomenon, and still forms only a small part of most banks' overall risk profile.[63] Bank failures in the past have been for certainly 90% due to credit and operational risk, not market risk. The drive to develop market risk models therefore cannot be explained from the impact side. However, the fact that activities in this area showed excessive growth and confronted managers and supervisors with exposures they could not understand, does make investments in market risk modelling a logical choice. Market risk also appears to be an area with a high availability of data, which makes the application of financial mathematics relatively easy.

Shortly after the introduction of the first Basel Capital Accord (1988), the off-balance trading activities came up. The risks involved were new to both banks and supervisors. This uncertainty about the risks in combination with some major events stimulated the Basel Committee to amend its Accord to include market risk. Internal market risk models were introduced in many banks short after this amendment on the Basel 1988 Accord to incorporate market risk (1996).[64] The new regulatory requirements presented banks with the choice between a rough standardised approach and internal models, which were based on Risk Metrics, the first market risk model implemented at JP Morgan. The regulator had provided sufficient incentives to make the choice for internal models attractive. The fact that management itself was insecure about the risks as well pushed the implementation of internal models strongly.

Although everybody accepted Value-at-Risk as *the* market risk model, the weaknesses of the underlying assumptions of the model were known from the beginning.[65] Value-at-Risk only has a predicting value under normal market conditions, but for capital adequacy purposes, these conditions are not interesting. Capital is to cover 'unexpected' losses, which are in the 'tail' of a loss distribution. Other critics are:[66]

- ✓ Value-at-Risk abstracts from changes in the level of liquidity of the market;
- ✓ Historical loss data are used to predict stock and price developments in the future. Stable relations in the past can suddenly be distorted;
- ✓ Historical data sets are regularly replaced by more recent sets. These replacements may lead to changes in the Value-at-Risk figure without any change in risk;
- ✓ Different methods to calculate Value-at-Risk lead to different results. This is called 'estimation risk'.

Therefore, Jorion stated that 'value-at-risk is a good first line of defence against financial risks, but no panacea'.[67] Szegö goes one step further and states that Value-at-Risk is not a measure of risk at all.[68]

In 1997, the Basel Committee adjusted the regulation regarding internal models slightly. The Committee had observed that banks had insufficient experience in modelling event and default-risk.[69] These are risks with a very low frequency but a significant impact. As long as these risks were insufficiently captured in the Value-at-Risk model, the Value-at-Risk figure was multiplied with four instead of three. This adjustment in regulation already pointed towards the first flaws in the Value-at-Risk model. Further development of the concept was a necessity. Using Value-at-Risk as a basis for capital requirements was only allowed if a bank met a list of criteria with regard to 'the quality of risk management', and 'integration of the model in daily management practice'.

In practice, it appeared that the number of market crashes increased after the introduction of the Value-at-Risk model. An important example is the Russian crisis in 1998 that unexpectedly affected Brazil as well. The previously uncorrelated positions suddenly became highly correlated. By the time models based on the past adjust these changes, it is no longer possible to reduce risk cheaply. The fundamental assumption of many risk management models is that events occur randomly. Unfortunately, in August 1998, events that risk models said had an infinitesimal probability of happening were happening several times a week.[70] The successful hedge fund Long Term Capital Management collapsed. The 1998 crisis showed how deep the effect of model assumptions went, going beyond issues such as volatility smiles to fundamental properties of markets such as liquidity.[71]

The crisis also impacted risk management. Value-at-Risk came under criticism, and some observers have argued that Value-at-Risk based capital rules exacerbated the crisis. One of the underlying assumptions of Value-at-Risk is that traders behave independently of each other. In practice, they tend to watch each other closely and react on each other's movements, supposing that others have more or better information. Prospect Theory explains this behaviour. Thaler and DeBondt demonstrated in 1985 that, when new information arrives, investors revise their believes. This is not done objectively, but by overweighing new information.[72] Long Term Capital Management was one of the leaders in the financial markets. Many traders tried to copy its success.
Crouhy, Galai and Mark conclude that the request for better and more accurate measures of market risk is ongoing; each new market turmoil reveals the limitations of even the most sophisticated measures of market risk.[73] Value-at-Risk is less reliable as a measure over longer time periods. The danger posed by exceptional market shocks, which are often accompanied by a drying up of market

liquidity, can only be captured by means of supplemental methodologies such as stress testing and scenario analysis. Stress testing aims to capture the tail of the loss distribution. It has been argued that it might have been better to base capital requirements on stress testing results. However, the possible subjectivity was regarded as problematic. Also the Journal of Banking and Finance devoted a full edition to the statistical and computational problems around Value-at-Risk in 2002.[74]

The argumentation above shows that risk managers in practice doubt about the effectiveness of Value-at-Risk and, as a result, they start using stress testing. Stress testing is the first introduction of 'art' in market risk modelling. Human judgement is critical to the success of a bank using risk management systems because they cannot encapsulate all the variables that exist in the real world of business.[75]

Conceptual Framework	***Time period***	***Characteristics***
External demand for measurement	Late 1980s – early 1990s	Explosive growth in derivatives trade; Regulators already announce their wish to incorporate market risk in the capital regulations.
Some first thoughts (Step One)	Early 1990s	The discussion with regulators on internal models started in 1993; The concept of Value-at-Risk is based on statistics and assumptions regarding distributions of price movements; Historical loss data are used to predict future stock and price developments.
Driving factors towards trust and first implementation (Step Two)	Early 1996 – 1997	Complexity of (derivative) instruments makes it hard for management to gain oversight of the risks involved. Insecurity leads to investments in risk modelling; Clear incentives in the Basel Committee amendment of the 1988 Accord;
Model failures and major incidents (Step Three)	1997/1998	The regulator observed that VaR models only measured 'general market risk' and not 'specific market risk'. Regulation was adjusted; Russian crisis affected Brazil as well. The unexpected correlation between the two regions led to high losses. Investment firm LTCM collapsed; The underlying assumptions of VaR make the tool only useful under 'normal' market circumstances.
Alternatives (Step Four)	1998 onwards	Stress testing has become more important than the calculation of the VaR figure. But, also stress testing is done based on simplified assumptions... Mathematicians have developed several alternative calculation methods to come up with a proper Value-at-Risk

Table 3.6: A Summary of the Developments in Market Risk

3.6 Conclusion

This chapter started with two questions: '*what is risk measurement*' and '*how can we expect risk measurement concepts to evolve*'. There is no simple answer to the first question. From the philosophical discussions on risk and measurement, it appears that both 'risk' and 'measurement' can be interpreted and defined in different ways. We identified closed and open views of measurement and two Schools of Thought on 'risk analysis'. The Objectivists School of Thoughts identifies objective and perceived risks. The objective risks are measurable in terms of probability and utility. The Constructivists School of Thought regards risk as a social construct, without an objective definition. Risk analysis should therefore involve qualitative factors that are difficult to measure.

To be able to 'measure' the 'risk', one should be able to decide on quantity, scale and arithmetic.

- ✓ Quantity: the basis of risk measurement is not a physical object that has quantities in nature, but a structure of qualitative relationships. As a result, determining the quantity of risk is a difficult task;[76]
- ✓ Scale: the scale applied to risk measurement is derived from mathematics. The aim is to measure risk as precise as possible. The quantity should be chosen so as to enable application of a linear scale;
- ✓ Arithmetic: the rule to add numbers to the qualitative relationships is derived from statistics.

Therefore, we conclude that the profession of 'risk measurement' aims at transforming unmeasurable uncertainties (structure of qualitative relationships) to measurable uncertainties by developing a linear scale of measurement and a rule to add numbers to qualitative structures. The fact that reference needs to be made to 'qualitative' structures, already implies that measurement will have its limitations. In practice, we observe that fundamental discussions on 'what is measurement' and 'how can it be applied to risk' are rare.

In studying the developments in risk measurement of the last century, we found that risk measurement methods tend to evolve from purely mathematical measurement methods to more balanced methods, taking into account human behaviour. Human behaviour is much harder to capture into a measurement method and often experience is needed to identify major dependencies. The development of measurement methods never starts out of the blue. An external demand from either the market or the regulator pushes quantification and/or product development. Besides, attention for quantification is highly dependent on the existence of clear business benefits.

We observed that measurement methods could always be discussed, as perfect methods to measure risk do not exist. As trust is dependent on education and experience, one can expect acceleration in risk modelling as soon as the first piece of trust is established. The banking industry is a good example of how such accelerations occur. The innovations in risk modelling and the amount of effort and time invested in this subject have increased substantially during the last decade. Market risk models were developed when credit risk modelling first received serious attention. The development and implementation of credit risk models was not even half way when operational risk measurement initiatives started, and while operational risk measurement is still in its infancy, banks already start thinking about measuring business and strategic risk.

The two cases described in sections 3.4 and 3.5, underline the conclusions drawn, as they show that risk measurement methods evolve and they illustrate the existence of the two Schools of Thoughts on risk analysis. In both cases we observed developments in the market leading to the first attempts to measure the risk. For market risk, these developments were incidents like 'Black Monday' and the attention the regulator paid to the risk category. For insurance, the external demand came from the community itself. People were unwilling to be exposed to certain risks that could damage their property. The first attempts to measure the risks involved were purely based on statistics and excluded any forward-looking element. Over time this has changed for both insurance and market risk. For market risk the tendency towards valuing the outcomes of stress tests more than the Value-at-Risk figure still continues.
The objectivists School of Thought is responsible for the initial attempts to measure risk and the constructivists push back as flaws in all models can and will be detected. As a result, the expert opinion will always have its role in the risk measurement and management process.

Notes – Chapter Three

[1] This thesis will not go into risk management techniques used within financial institutions. When the reader is interested to learn more about this subject in general, some interesting books are Bessis, Kocken, Brealey & Myers. For operational risk specific, the book of Marchall gives an excellent overview. The book of Crouhy, Dalai and Mark, although quite technical, also provides a full overview of risk management.

[2] Examples are Van Tets (1996), Hofstede (1981), Arrow (1971), Thieke (2000), Stulz (2000).

[3] The techniques that are regarded as (high) science stem from the areas 'physics' and 'mathematics'. These sciences are characterised by a high abstraction level.

[4] In April 1997 Credit Metrics was released. This was the first major publication on credit risk modelling.

[5] For example, risk management articles in the journals 'Journal of Banking and Finance', 'Journal of Finance', 'Journal of Credit Risk and Lending', and 'Journal of Derivatives'.

[6] Campbell, N., *Physics: The Elements,* 1920

[7] Kyburg, H.E. jr., *Cambridge Studies in Philosophy: Theory and Measurement*, Cambridge University Press, 1984.
Introduction (page 1): 'given the prevalence of measurement in all the branches of science, we would expect discussions of measurement to play an important role in writings on the philosophy of science. Our expectation is frustrated.'

[8] Young, R.M., 'Why are figures so significant? The role and the critique of quantification', published in Irvine, Miles, Evans, *Demystifying Social Statistics*, London Pluto Press, 1979, page 63.

[9] Wade Savage, C, P. Ehrlich, *Philosophical and foundational issues in measurement theory*, Lawrence Erlbaum Associates, 1992, page 2.

[10] Kyburg, page 4.

[11] Marchall, C., *Measuring and Managing Operational risks in Financial Institutions*, John Wiley & Sons, 2001, page 241.

[12] Some philosophical background on this discussion can be found in Ellis, *Basic Concepts of Measurement*, Cambridge University Press, 1968, first paperback edition, 1968. He discusses the application of arithmetic using different philosophical viewpoints and at the end of chapter one (the application of arithmetic) he distinguishes primary and secondary applications. The primary application is very fundamental, the secondary application consists of analytical and synthetic applications. His book focuses on these analytical applications of measurement theory.

[13] Kyburg, page 5.

[14] Ellis, page 32.

[15] Stevens, S.S., 'On the theory of scales of measurement', *Science*, 1946, 103, pages 677-680.

[16] Ellis, page 38.

[17] The statements in this table are derived from the book of Wade Savage, C. and P. Ehrlich. This book contains articles of different philosophers, among whom Berka, Domotor and Ellis.

[18] Kramer, De Smit, page 21, with a reference to Ackoff (1981), von Bertalanffy (1956), Hall en Fagen (1956) and Simon (1969)

[19] Ackoff, *The Art of Problem Solving*, John Wiley & Sons, 1978, page 49

[20] Ackoff, *Creating the Corporate Future*, John Wiley & Sons, 1981, pages 3-24

[21] Ackoff, *Creating the Corporate Future*, page ix

[22] Knight, F.H., *Risk, Uncertainty, and Profit*, University of Chicago, 2nd edition, 1971, page 19-20. The page numbers refer to the publication by Chicago University Press in 1971. However, Knight's work is originally published in 1921.

[23] Marchall, page 45.

[24] Asselt, M.B.A. van, *Perspectives on Uncertainty and Risk: the PRIMA Approach to Decision Support*, Kluwer Academic Publishers, 2000, pages 147-159.

[25] Van Asselt, page 150

[26] McGoun, E.G., 'The history of risk 'measurement'', *Critical perspectives on Accounting*, December 1995, page 512.

[27] The last chapter of Ellis's book on *Basic Concepts of Measurement* is devoted to probability theory.

[28] Bessis, J., *Risk Management in Banking*, John Wiley & Sons, 1998, page 30.

[29] Bernstein, P.L., 'The enlightening struggle against uncertainty', *Financial Times*, April 2000.

[30] Young, R.M., page 63.

[31] In those days, banks were very small companies on a specialised market. They had no trading activities, and market risk therefore did not exist. Operational risk has not been recognised as a separate risk category until the 1990s. Credit risk has not been issue for a long time as well. When a borrower could not pay back its loan, the whole family acted as a guarantee.

[32] McGoun, page 514.

[33] The law of large numbers says that the more cases can be pooled together, the more likely it is that the outcome will be close to average.

[34] McGoun, page 516.

[35] Bernstein, P.L., *Against the Gods: the remarkable story of risk*, John Wiley & Sons, 1996, page 216.

[36] Bernstein, *Against the Gods*, page 217.

[37] Bernstein, *Against the Gods*, page 219.

[38] As described in McGoun, page 512-513.

[39] Knight, page 205-206.

[40] Mc Goun, page 530.

[41] Simon, H.A., *Administrative Behaviour: a Study of Decision Making Processes in Administrative Organisation*, 3rd edition, The Free Press New York, 1976, page 309.

[42] Brealey & Myers, *Principles of Corporate Finance*, McGraw-Hill, 5th edition, 2000, page 485.

[43] Arrow, K.J, *Insurance Risk and Resource Allocation*, Chapter Five in Essays in the Theory of Risk Bearing, Elsevier Publishing Company, Inc., 1971, page 135.

[44] Alworth, J.S., Bhattacharya, S. 'Bank regulation and Capital Control', 1995, page 287.

[45] Brealey and Myers, page 502.

[46] Bos J.J., *Prestatiebeoordeling in Banken*, Proefschrift Universiteit Twente, 1999, states 'risk management is fed by capital requirements'.

[47] Brodie & Goldberg, 'The human factor', *Risk*, August 1999, page 94-95.

[48] In 1996, the Basel Committee amended its 1988 Accord to incorporate market risk. Within this amendment, two options were included: standard approach and internal models.

[49] Bessis, J., page 30.

[50] Tets, R.W.F. van, 'Risicomanagement: 'art' of 'science'', *NIBE preadviezen*, 1996, page 51.

[51] Swaan, T. De, 'Risicomanagement: de invalshoek van de toezichthouder', *NIBE preadviezen,* 1996, page 13-15.

[52] The terms speculative and pure risk are common in Insurance Economics. In the banking industry, the distinction 'financial risk' and 'non-financial risk' is more commonly used. It can however be argued that the latter are confusing as non-financial risks can have a financial impact as well.

[53] Jameson, R., 'Role playing', *Risk*, July 1999.

[54] Bessis states about the shift to advanced risk measurement models: 'the benefits of risk management have to become tangible enough to justify the shift. ... External incentives for banks are necessary to make the benefits more tangible. The capital adequacy regulations, with the related emphasis on internal models to value risks, provide such tangible benefits.' (Bessis, page 30)

[55] Ackoff, *The Art of Problem Solving*, page 6

[56] Vaughan, E.J., Vaughan, T.M., *Essentials of Insurance: a Risk Management Perspective*, John Wiley & Sons, 1995.

[57] Bernstein, 'The enlightening struggle against uncertainty', *Financial Times*.

[58] Dionne, G., Harrington, S.E., *Foundations of Insurance Economics*, Kluwer Academic Press, 1992.

[59] As described by D'Arcy and Oh in 'The Cascade Effect in Insurance Pricing', *Journal of Risk and Insurance*, 1997.

[60] 'The Cascade Effect in Insurance Pricing'

[61] D'Arcy, Oh, page 471

[62] Dickinson, G., 'Insurance finds a blend of innovation and tradition', *Financial Times: Mastering Risk*, June 6th 2000, page 3.

[63] Matten, *Managing Bank Capital*, John Wiley & Sons, 2nd edition, 2000, page 167.

[64] The discussion on how to amend the Accord (e.g. how should internal models look like) started in 1993. In the period between 1993 and 1997, the implementation of VaR models was booming.

[65] A market risk manager who was consultant in those days expressed it once as 'everybody knew that Value-at-Risk was a very weak concept, but banks had no choice. In my selling effort, I always started mentioning the long list of weaknesses, but it did not prevent me from getting the product sold'.

[66] Derived from Bos, *Prestatiebeoordeling in Banken*, page 167.

[67] Jorion, P., *Value-at-Risk: The new Benchmark for Controlling Market Risk*, Irwin, Chicago, 1997, page 305.

[68] Szegö, Measures of Risk, *Journal of Banking and Finance*, July 2002, page 1258.

[69] Huijser, 'Kredietrisicomodellen: uitdaging voor het toezicht', *Bank- en Effectenbedrijf*, July/August 1998, page 28.

[70] Stulz, 'Why risk management is not rocket science', *The Financial Times: Mastering Risk*, June 2000 page 6.

[71] Dunbar, N., 'The Evolution of Quantitative Finance', *Risk*, October 2001, page 103.

[72] DeBondt, W., R.H. Thaler, 'Does the Stock Market Overreact?', *Journal of Finance*, 1986, vol. XL, no. 3, pages 793-807.

[73] Crouhy, M., D. Galai, R. Mark, *Risk Management*, McGraw-Hill, 2001, page 180.

[74] *Journal of Banking and Finance*, Volume 26, nr. 7, July 2002.

[75] Young, K., 'Risky Business', *The Banker*, Feb. 1999, page 71.

[76] For example, the Dutch Position Paper regarding Operational Risk, March 2000, struggled to define the 'exposure' of operational risk. Volumes could be used as a proxy for the exposure, but applying a linear scale would not be fair. (Nederlandse Vereniging van Banken, *Discussion Paper on Operational Risk*, March 2002).

Chapter 4 Evolution of the Concept of Operational Risk Measurement

The development of risk measurement methods for operational risk is lagging the development of credit and market risk measures. This is partly due to the fact that the other risks were more evident, and thus had a higher priority, and partly to the intrinsic difficulties in quantifying operational risk.[1] As this chapter will show, operational risk covers a wide range of different events that occur infrequently. This makes measurement a tough challenge.

This chapter describes the evolution of operational risk measurement concepts. At the end of this chapter, the research question *'how has the concept of Operational Risk Measurement evolved since 1999?'* will be answered. The main sources of information for this chapter are observations via participation in the industry-wide discussion on capital charges for operational risk (e.g. conferences, working groups, and articles).[2] Chapter Five discusses the confrontation of the developments in the area of operational risk with the conceptual framework introduced in Chapter Three.

4.1 Operational Risk Measurement Before June 1999

The developments in the area of operational risk were given an enormous impetus in June 1999 when the Basel Committee announced specific attention for operational risk in Pillar One of its new Capital Adequacy Framework. Before this date, operational risk management had already been a subject facing growing attention in the industry. Some major operational risk events, sometimes leading to a corporate collapse, had triggered this interest.

4.1.1 Some Operational Risk Cases in the 1990s

Operational risk has caused losses at financial institutions since their existence. Operational risk management has always been the responsibility of all managers and employees in the bank. Also, the audit department was installed to provide assurance for the quality of internal controls, organisation and any other operational risk management aspects. Operational risk management as a separate pro-

fession within an organisation, comparable to credit risk management, has its roots in the 1990s. The growing awareness of the significance of operational losses was a direct result of the fact that operational risks have been at the heart of some important banking problems.[3] Some examples are given below.

The most famous and also most shocking example of operational loss was the collapse of Barings in February 1995. Barings was a respectable English bank, which had been regarded as conservative in risk taking. An employee of the bank, located in Singapore, caused bankruptcy of the bank through unauthorised trading and fraud. The employee was responsible for the front office and his wife helped him out in the back office, while the responsible back office employee was ill. This enabled him to keep large deals out of the reporting systems and used a suspense account for his fraudulent trades that was hidden from reports. Many books and articles have been published on the Barings case, including a book written by the guilty employee himself.[4] It becomes clear that inadequate (operational) risk management was the main cause of the collapse:

- ✓ Lack of segregation of duties between front and back office;
- ✓ No grip on the quality of management information in terms of completeness, accuracy and timeliness of the information provided;
- ✓ A bonus-culture that is out of line with the risk averse strategy of the bank;
- ✓ Numerous opportunities for fraud.

The activities in the small Singapore office had been a substantial part of Barings' profit in 1994 and had had a huge influence on senior management bonusses in London. This is suggested to be one of the reasons why the Executive Board had neglected audit findings and other 'smoke signals'. It also appeared that in January 1995 Barings had purchased a system that enabled the settlements department in London to reconcile trades made in any part of the world with clients' orders from any part of the world. If such a system had been bought earlier, the fraudulent use of the 88888 account would have been discovered before it was too late.[5] The Barings collapse could have been prevented with proper operational risk management and it was evident that even the most reliable and conservative bank can go bankrupt if some essential controls are not in place.

Seven months after the curtain fell on Nick Leeson, Toshihide Iguchi was arrested at Daiwa bank in Manhatten. Iguchi was known as a workaholic. He worked long hours and never took vacation for more than a couple of days. Responsible for trading in US Government Bonds, he managed to work eleven years without really attracting attention. According to the FBI, Mr. Iguchi had executed 30.000 unauthorised trades in eleven years, resulting in a loss of $1,1 billion. The method

he used was quite simple: when he lost money on a transaction, he sold bonds for his own account or the account of clients to compensate his losses. Afterwards he forged the documents to make the transaction look like an authorised transaction. He had no self-interest except camouflaging losses.
This operational loss event lead to Daiwa's president and two senior managers to resign. The Department of Justice charged Daiwa to close its US operations.[6]

The cases of the municipality of Orange County (1994) and the bank Sumitomo (1996) are comparable to the cases of Barings and Daiwa. They all have their roots in unauthorised trading and risky derivative portfolios. Orange County stunned the markets in December 1994 by announcing that its investment pool had suffered a loss of $1.6 billion, leading to bankruptcy of the County. Sumitomo faced a loss of $2.6 billion but was able to cope with the loss and continue to be in business.

We want to underline that these best-known cases are bad representative for the whole risk category 'operational risk', as they all occurred in a trading environment. Incidents in a trading environment track attention because of the high amounts of money involved. An influencing factor is the accounting practice (mark-to-market accounting instead of accrual accounting) applied to trading activities.

4.1.2 State of Development Operational Risk Measurement Methods

Although the collapse of Barings was impressive, it did not push banks to make operational risk management concrete. Most banks took a close look at the case and concluded that 'this could not happen in our bank'.[7] The major incidents may have increased awareness on operational risk, but commanded little action outside the afflicted bank. A research of Meridian Research Inc. in this period pointed out that even within progressive industries (among which banking), few firms had graduated beyond early-stage identification of operational risks.[8]

Operational risk measurement methods can only be developed if a clear definition is formulated (*minimise the degree of conceptual fuzziness within each firm*[9]). Therefore, an inventory of definitions in use gives a reflection of the state of development in the industry in a particular period.[10] Many institutions had no formal definition as of 1999, but if they had one, the most frequently used definition of operational risk was: [11]

Everything which is not market or credit risk

This definition was the starting definition for most financial institutions and it gives an overview of how those institutions struggled with the concept of Operational Risk Management. Operational risk was seen as the remaining risk, after credit and market risks were quantified. This definition implicitly states that the only risks a financial institution faces are market risk, credit risk and operational risk. However, there were more risks that were separately mentioned and managed by financial institutions, such as interest rate risk (in the banking book), risks following from changes in law and regulation and legal risks.[12] Therefore, it also seems to be a definition that had been chosen on political grounds. For newly appointed operational risk managers, the tempting definition is the one that allows them to expand their territory as far as possible without treading on any well-established toes.[13] Apparently only the areas credit and market risk are well established, not to be touched by the newly appointed operational risk managers.
A major disadvantage of this definition is its failure to mention the causes of risk. With this definition it is difficult to start measuring operational risk, because it is uncertain what should be measured. The advantage of this definition is the impossibility of forgetting a part of the operational risk. Also, no effort had been made to categorise the different risks an institution faces. In using a top-down approach on measuring the overall risk of a financial institution, this definition might be useful. Despite this, institutions that had adopted this definition were generally dissatisfied with it.[14]
The fact that this definition was used very broadly is an alarming signal. Operational risk was seen as the final frontier on the way to a revolutionary change in risk management and risk adjusted performance measurement. The wish to let operational risk be the final frontier made it almost impossible for banks to move forward and develop a tool for measuring this risk. The broader a risk category is, the harder it is to develop an adequate measurement method that takes into account all aspects of the risk category.

The small minority of institutions that had already developed a more advanced operational risk management framework used more concrete definitions. If a top-down approach has already been introduced, risk managers start seeking a more detailed bottom-up approach to explain the risk. They ask themselves the question which risks they face beside market and credit risk and this question leads to the use of more specific definitions like:

The potential for loss arising from breakdowns in policies and controls for ensuring the proper functioning of people, contracts, systems and facilities. This includes execution risk, information risk, relationship risk and legal/regulatory risk [JPMorgan].[15]
Operating risk includes: risk of fraud by employees or outsiders, unauthorised transactions by employees and errors relating to computer and telecommunications systems [Chase].[16]
Operational risk is the potential for adverse fluctuations in the profit-and-loss statement or the cashflow of the firm due to effects that are attributable to customers, inadequately defined controls, system or control failures, and unmanageable events [Deutsche Bank].[17]
Operational risks are risks associated with key resources of the firm, such as its relationships, people/human capital, technology/processing, physical assets and other external sources [Bankers Trust/OperationalRisk.com].[18]

The Basel Committee on Banking Supervision also posed a specific definition of operational risk.[19]

Operational risk is the risk that the 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.

Although the disadvantage of these definitions lay in the fact that it is difficult to obtain a complete overview, these definitions made operational risk more measurable and were, from that point of view, preferable. In some definitions, the disadvantage of the possible incomplete overview was tackled by using a category 'other'. This solution leads to the same disadvantages as for the definition 'everything which is not credit or market risk', but could make it easier to develop operational risk measurement in different stages. As soon as the explicitly mentioned elements are measured and controlled, an institution can take up the challenge to differentiate and quantify the remaining part. In practice, institutions use the term 'other' to be sure forgetting no risk and then focused on the risks that belonged to this category 'other'.
The major advantage was that institutions spent time thinking about the main risks they face and would like to manage. This is an important step towards awareness and good communication about the importance of managing operational risk.
When a financial institution has the serious ambition to quantify and manage operational risk, a specific definition enclosing the elements to be measured is a

necessity. Using the element 'other' had a negative impact on the development of tools to measure operational risk.

Anticipating planned revisions of the 1988 Capital Accord, regulators showed their interest in the subject of 'operational risk' by doing some research. The Dutch Central Bank questioned the three largest Dutch banks on this subject. The results showed that:[20]

- ✓ There was no uniform understanding of the scope of operational risk;
- ✓ Banks were of the opinion that operational risk could only be expressed qualitatively;
- ✓ Awareness of operational risk was growing;
- ✓ There was no uniform way of managing and monitoring operational risk. Line management was primarily responsible;
- ✓ Banks expected no major changes in their operational risk management approach in the upcoming years.

The Basel Committee interviewed 30 banks on their operational risk management practices as well. From these interviews, it appeared that (a) banks foresaw difficulties in applying statistical or mathematical techniques to operational risk and (b) internal audit played a major role in operational risk management.[21] The British Bankers' Association underlines this last conclusion: on its 1997 survey on operational risk, almost all respondents were internal auditors. In 1999, the respondents on a similar survey mainly were operational risk managers.

It should be noted that internal audit can never be responsible for operational risk *management* or have direct responsibilities for (parts of) the risk management process, as it should safeguard its independence and impartiality. This is also clearly stated in the Sound Practices for the Management and Supervision of Operational Risk, the Basel Committee issued in December 2001. Internal audit can, however, point out operational risks and support in the development of operational risk measurement tools. The fact that many banks pointed towards internal audit when operational risk management was regarded indicates that operational risk management was not yet dealt with explicitly within the bank.

4.2 The Impact of the First Consultative Paper: June 1999 - January 2001

The intensive discussion on operational risk measurement started with the launch of the first Consultative Paper of the Basel Committee on Banking Supervision in June 1999. In this consultative paper, the Committee stated that 'the growing significance of these other risks has led the Committee to conclude that they are

too important not to be treated separately within the Capital Adequacy Framework. ... The Committee also proposes developing an explicit capital charge for other risks, principally operational risk, and is exploring practical ways in which this could be done.'[22]

This announcement was the starting point of a discussion on the use of capital requirements and operational risk measurement methods. Also, it was an additional trigger for banks to start paying attention to the subject. Comparing two surveys of the British Bankers Association on the state of the art of operational risk management in 1997 and the second half of 1999 underlines this. The percentage of response was 14% in 1997 against 50% in 1999.[23]

4.2.1 Consultative Paper 1 and Papers on Other/Operational Risk

The paper 'A new Capital Adequacy Framework' has been a first step towards a total renewal of banking supervision. The 1988 Accord focused mainly on credit risk and was amended to address market risk in 1996. Interest rate risk in the banking book and other risks, such as operational, liquidity, legal and reputational risks, were not explicitly addressed. Besides the weakness that some risks were excluded in the 1988 accord, the ability of banks to arbitrage their regulatory capital requirement[24] and exploit divergences between true economic risk and risk measures under the Accord was regarded as an increasing problem. Finally, for some types of transactions, the Accord provided perverse incentives for risk mitigation techniques.[25]

The new capital adequacy framework should be an answer to the weaknesses mentioned above and was to be built on three pillars:

1. *Minimum Capital Requirements*
   Banking risks fall into three broad categories: credit risk, market risk and other risks. The Committee believed that the new framework should be enlarged so as to cover each of these three major risk categories more explicitly.
2. *Supervisory Review*
   The goal of supervisors reviewing a bank's capital position is to ensure that the position is consistent with its overall risk profile and strategy and to enable early supervisory intervention when the capital provided an insufficient buffer against risk.
3. *Market Discipline*
   The Committee believed that supervisors have strong interest in facilitating effective market discipline as a lever to strengthen the safety and soundness

of the banking system. Effective market discipline would require reliable and timely information that enables counterparts to make well-founded risk assessments.

The paper had been marked 'consultative', to indicate that intensive discussion with the industry would be required to fill in the gaps. For example, this first consultative paper was not explicit in measurement methods. On operational risk, which is a subset of 'other risk', the Committee made statements like 'difficult to incorporate in a truly risk-sensitive manner', 'the Committee has identified several options, which range from a simple benchmark to various modelling techniques', and 'in exploring various approaches for assessing a capital charge for other risks, the Committee believes that supervisors should also apply a qualitative judgement based on their assessment of the adequacy of the control environment in each institution'.[26]

In December 1999, the Risk Management Group, a subgroup of the Basel Committee responsible for other risk, released a discussion paper named 'Other/ Operational Risk',[27] focusing on the minimum capital requirement for other/ operational risk. The Risk Management Group had observed the state of the art in the industry via presentations, surveys and a workshop with 7 banks in October 1999.[28] Based on this information, the Risk Management Group drafted two possible approaches:

- ✓ *The Top-down Approach Using Financial Indicators*
  On a preliminary basis, the indicator 'non-interest income' is mentioned as the best proxy available for measuring other/operational risk from top-down perspective.
- ✓ *The Box Approach*
  The box approach divides operations risk into a series of business lines that are defined based upon 'business functions'. Each business line would be assigned a small number of risk indicators that characterise the risk weight related to the perceived inherent operating risk for business line.[29] The control environment surrounding each business line would then be scored. Industry experience and/ or pooled loss event data should be the basis for deciding upon risk exposure indicators, inherent risk weights, and quality scores.

The goal to prevent double charging businesses dictated the choice for 'non-interest income'. The overlap with credit and market risk would be kept to a minimum with this indicator. However, it would have been unfair to only charge the business lines that are dependent on provision income for operational risk. The indicator therefore has changed several times after this first proposal.

The Risk Management Group made clear that these two proposals were both presented from a *short-term* perspective. On the longer term, the aim was to rely on a more sophisticated process-driven or model approach. The indication of the relative weight of the other/operational risk charge was 25% of total regulatory capital.
Based on the proposals drafted and the outcomes of the operational risk workshop, huge differences in opinions appeared between the banking industry and regulators. One of the conclusions was that virtually all presenters were *opposed* to assessing a regulatory capital charge for operational risk. Several presenters believed that covering operational risks by earnings (i.e. directly from the Profit and Loss) would be more appropriately than covering it by capital.[30] Apparently, these presenters have tried to prevent the creation of a double burden (P&L and balance sheet).

In the discussion paper 'Other Risks', dated April 2000, the Risk Management Group elaborated more on the longer term aim 'internal measurement approaches' and the main issues around the application of loss data. Neither the December 1999 nor the April 2000 paper had an official status.[31]

4.2.2 Definition of Operational Risk

As was said in the previous section, the banking industry was not keen about measuring operational risk and putting capital aside for it. Many banks even expressed to the regulator that they were opposed to it.[32] This played a very important role in the discussion on the definition and in the discussion on whether operational risk should be dealt with under Pillar One (minimum capital requirements) or Pillar Two (supervisory review).
The definition of operational risk appeared to be an important issue in bargaining on capital charges. If capital requirements are to be set for a risk, it should be clear what this risk is exactly about. As mentioned before, the first definition of operational risk was 'everything that is not market or credit risk'. This definition only says what operational risk is not and cannot be called concrete, therefore a discussion on definition was necessary.

Given the lack of enthusiasm about measuring operational risk and putting capital aside for it, it is not astonishing that during the first period, operational risk only tended to become broader. After all, if operational risk is such a broad subject, it can easily be defended that measurement will prove being too difficult. Operational risk was a big garbage can with all kinds of leftovers that could not suit one uniform methodology. To illustrate how broad risk can be, the

multicoloured cube of De Leede can be used. According to De Leede, risk can be categorised using three axis:[33]

1. The nature of risk: Pure or Speculative. Pure risks can only result in losses, as there are no premiums to be gained in taking these risks (e.g. fire, fraud, theft). Speculative risks are rewarded with premiums (e.g. credit risk, market risk). The difference on this dimension is the difference between managing risks to earn money and managing risk to prevent losing money.[34]
2. The level on which the risk has its impact: Macro (society), Meso (company) or Micro (individual).
3. The frequency of the risk occurring: Quantitative or Qualitative. Quantitative risks are repetitive risks, which are measurable using statistical techniques. Qualitative risks are unique and occur seldom. For these risks, it is difficult to gather enough data to make statistical analysis reliable.

Although it had been agreed that operational risk belongs to the pure risks and that the impact on the individual must be left out of scope, the definition still encompassed four different boxes of the cube.

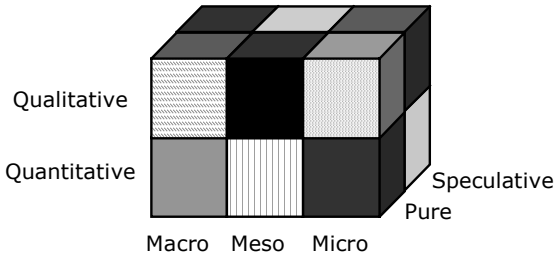

Figure 4.1: The Multicoloured Cube of Risk

In the first discussion on the definition, operational risk entailed qualitative and quantitative elements that affected the institution (meso level) and society (macro level).[35] Given this observation, it is reasonable that banks make a plea for operational risk not being measured by using one single methodology. Perhaps part of operational risk cannot be measured at all.

> *In our haste to quantify, we have failed to identify its many components. The truth is that some are quantifiable, but most are not.*[36]

4.2.3 Pillar One or Pillar Two

During the first consultative period, the question whether a Pillar One charge is appropriate was an important one. The journal 'Risk' asked seven banks to give an opinion on this matter.[37] Only one of them made a positive remark on capital charges for operational risk. Also the response of the International Swaps and

Derivatives Association shows a clear preference for a Pillar Two approach: 'the ISDA has reason to believe that a minimum charge would prove highly problematic and that, in order to ensure risk-sensitivity and an appropriate incentive structure, an alternative approach based on supervisory review should be pursued.'[38] In its detailed response, the International Swaps and Derivatives Association states 'to the extent that a charge for operational risk may ever be justified, this should be a Pillar Two matter'.[39] But also recognises that, for a variety of reasons, not all supervisors may be ready to apply a purely qualitative approach to operational risk.

The main arguments behind these statements are key conceptual issues. Operational risk losses do not resemble market or credit losses, which make capital a suitable defence on a routine basis. Operational risks are endogenous and it is unclear whether the relation between risk and return is always the same for operational risk as it is for market/credit risk.

On conferences and in papers, firm critics and impudent assertions are made. One example from IBC's annual operational risk conference in March 2000:

> *I compare the results of these quantitative methods with the famous statement in the Hitchhikers's Guide to Galaxy where computers were asked what is the meaning of life. After much number crunching it came out with the figure '42'.*[40]

Doerig wrote an extensive paper, in which he used the experience of the major mishaps in the past financial history and the military as his evidence.[41] The cases Section 4.1.1 described represent no good arguments for operational risk regulatory capital solving the problem as none of the quantitative approaches would have calculated a large enough capital requirement to avoid a total collapse of, for example, Barings. And, if the calculated capital had been enough, the organisation with such huge additional capital requirements would never have been competitive before the event.

Only a few banks were in favour of a Pillar One approach as this would be useful in reducing the risk weights for credit risk. As the Basel Committee wanted to keep the overall level of capital *on average* the same within the industry while at the same time decreasing regulatory arbitrage on credit risk,[42] a reduction of the credit risk charge was only possible if a capital charge for some other risk were to be introduced (as illustrated in Figure 4.2, derived from Schroder Salomon Smith Barney[43]). Most large international banks were convinced of the quality of their credit portfolio. It would then be likely that a reduction in the credit risk charge would outweigh the newly introduced operational risk charge.[44]

Figure 4.2: Capital Adequacy in a Nutshell – Basel I versus Basel II

Also, there was a danger of supervisory discretion resulting in an uneven playing field when operational risk would be subject to supervisory review only. In the end, the banks in favour of a Pillar One approach stated that the Basel Committee would want a quantified capital charge for operational risk under Pillar One and the industry would be better off proposing one instead of leaving it up to the regulators. However, most banks had problems with a charge for operational risk, as a proper definition was lacking, quantification techniques were still not robust and a crude capital charge would lead to inappropriate incentives. The conditions 'risk-based' and 'provide incentives for further development of operational risk measurement' should at least be met before a capital charge in Pillar One was regarded acceptable.

This first discussion already showed that arguments to start measuring operational risk came from the area of credit risk. The potential gains were reducing credit risk charges and safeguarding the level playing field.

4.3 From Consultative Paper 2 to Consultative Paper 2.5: January 2001- September 2001

In January 2001, the Basel Committee released its second Consultative Paper. The first Consultative Paper had only provided a rough outline of the direction of the new Accord, the second paper went into more detail regarding measurement methods, mainly in the area of credit risk.

The publication of Consultative Paper 2 underlined the wish of regulators to capture operational risk in Pillar One (minimum capital requirement). Also, this consultative paper provided a concrete definition on operational risk. The discussion between regulators and the industry changed. The definition was a renewed subject of discussion and the need for qualitative elements was felt. Another important development between January 2001 and September 2001 was the move from a silo approach with much discussion between silos to a big black box that would fit every bank.

4.3.1 Consultative Paper 2

The second Consultative Paper of the Basel Committee on Banking Supervision was a package of over 600 pages, which elaborated on the first consultative paper in terms of the proposed capital adequacy framework and provided a detailed description of the content, structure and technical details of the new Accord. The three-pillar structure as introduced in Consultative Paper 1 still formed the basis of the upcoming regulation. With regard to operational risk the Committee stated that:

> *The work on operational risk is in a developmental stage, but three different approaches of increasing sophistication (basic indicator, standardised and internal measurement) have been identified. The basic indicator approach utilises one indicator of operational risk for a bank's total activity. The standardised approach specifies different indicators for different business lines. The internal measurement approach requires banks to utilise their internal loss data in the estimation of required capital. Based on work to date, the Committee expects operational risk on average to constitute approximately* ***20%*** *of the overall capital requirements under the new framework. It will be important to collect sufficient loss data in the upcoming months to establish accurate calibration of the operational risk charge as a basis for allowing the more advanced approaches.*[45]

Besides a three-page summary, a technical document of 26 pages was released explaining the three approaches mentioned and providing more detail on definition and qualifying criteria. Also, an appendix on a possible fourth approach (Loss Distribution Approach) was included. The definition of operational risk proposed was *'the risk of direct or indirect loss resulting from inadequate or failed internal processes, people and systems or from external events'*. Strategic and reputational risk were not included.[46]

We note that reputational risk should never be included as a risk category, as this is not a risk in itself, but one of the possible damages resulting from other risk-types. Also, strategic risk would have been illogical to include, as it is not operational at all. Strategic risk is related to societal developments and management capabilities to analyse and react on these developments, not internal processes, people or systems.

Basic Indicator Approach

The simplest approach within the proposed framework was the Basic Indicator Approach. The capital charge for operational risk for banks using this approach would be a fixed percentage of a simple indicator. The Basel Committee proposes

to use 'gross income' as the simple indicator. The fixed percentage would be set at around 30%.
This basic approach had been developed for smaller banks with a simple range of business activities. The Committee expected internationally active banks and banks with significant operational risk to use a more sophisticated approach.

Standardised Approach

In this approach, the activities of a bank would be divided into a number of standardised business lines. Within each business line, the capital charge would be calculated by multiplying a bank's broad financial indicator with a 'beta' factor. No indication was provided on the height of the various betas. The sum of the capital charges across each of the business lines would be the total capital charge.

Business Units	***Business Lines***	***Indicator***
Investment Banking	Corporate Finance	Gross Income
	Trading and Sales	Gross Income
Banking	Retail Banking	Annual Average Assets
	Commercial Banking	Annual Average Assets
	Payment and Settlement	Annual Settlement Throughput
Others	Retail Brokerage	Gross Income
	Asset Management	Total Funds under Management

Table 4.1: Business Lines and Proposed Indicators Basel Committee, January 2001

Banks would only be allowed to use the Standardised Approach if they met a set of qualifying criteria on 'risk management and control' and 'measurement and validation'.[47] The indicators that are mentioned in Table 4.1, were still proposals to be discussed with the industry and to be tested with quantitative impact studies.

Internal Measurement Approach

The Internal Measurement Approach intended to go even further. Besides the business lines, standard loss types were defined resulting in a matrix structure. For each cell in the matrix, a capital charge would be calculated using:

- ✓ Exposure Indicator, a proxy for size set by the regulator
- ✓ Probability of Loss Event, based on (internal) loss data
- ✓ Loss Given that Event, based on (internal) loss data
- ✓ Gamma, a regulatory determined multiplication factor to translate the calculated 'expected loss' to 'unexpected loss'

'Gamma' was a black box for the banking industry. The regulators had planned to base these gamma factors on analysis of historical loss data.
The regulators listed several key issues around this approach to be elaborated and/or clarified. To be allowed to use this approach, a bank should meet the extensive qualifying criteria set for this approach, amongst which an operational risk loss database filled with loss data for a number of years.

Loss Distribution Approach

Annex 6 to the Supporting Document on Operational Risk was devoted to the Loss Distribution Approach. This approach differed from the Internal Measurement Approach in two important respects:

- ✓ It aims to assess unexpected losses directly and not via an assumption about the relationship between expected and unexpected loss;
- ✓ The bank itself determines the structure of business lines and risk types.

No further details on the Loss Distribution Approach were provided. The Committee stated that 'at present, several kinds of measurement methods are being developed and no industry standard has yet emerged. In this circumstance, basing the capital charge on the bank's own methodology will cause comparability problems, because the outcome may differ depending on the method used'.[48]

The Committee also stated clearly that it was not envisaged that this approach would be available at the outset of the New Basel Capital Accord.

It should be noted that the relative weight ascribed to operational risk had been reduced from 25% (Consultative Paper 1) to 20%. The 25% had been derived from a survey in the industry, based on expert opinions. The 20% was based on the results of a wider industry survey asking for the relative amount of economic capital allocated to operational risk.

4.3.2 The Definition of Operational Risk Again

The industry groups that had lobbied hard to be relieved from a capital charge for operational risk had to change their strategy. Their claim that operational risk is too broad subject was familiar to the Basel Committee. In 1998, a survey among large international banks had already pointed out that banks tend to give operational risk a broad interpretation.[49] Still, the Committee was reluctant to renounce its point of departure as can be concluded from the content of the second Consultative Paper. A method to calculate a capital charge for operational risk would be developed somehow or another.

Therefore, the character of the discussion on a definition for operational risk changed. Instead of broadening the definition in order to prove that operational risk was not measurable, the industry started pushing towards a narrower definition. Strategic, business and reputation risk should be excluded from the definition. The capital charge should only count for direct losses. Indirect losses, latent losses or near misses should be deleted from the definition.[50] A capital charge should only be set for the measurable aspects of operational risk and catastrophic losses should be kept out of the scope. In terms of the multicoloured

cube (Figure 4.1), this new definition only encompasses the box of quantitative risks that affect one institution (meso level).
Fishkin and Cagan observe that 'few passages in the history of risk management have generated as much discussion as this brief sentence' (i.e. the definition of operational risk as proposed in Consultative Paper 2).[51] As the definition should be narrow to allow for quantification and broad to ensure proper operational risk management, they conclude that it might be useful to come up with two definitions: one for the purpose of quantification and one for the purpose of managing risks.

4.3.3 Pillar One or Pillar Two Again

Although it seemed that most international industry-groups accepted that operational risk would be dealt with in Pillar One and started discussing technical details on operational risk measurement, many banks or national banking associations advised the Basel Committee in May 2001 to deal with operational risk in Pillar Two.[52] There are large differences between 'consensus documents' from international working groups (like International Swaps and Derivatives Association and Institute of International Finance) and the individual comments of the banks participating in such groups. Also on conferences, the huge differences in views could be observed.[53] For the banks proposing to treat operational risk under Pillar Two, this continued to be an issue under discussion during the four-year consultative period (1999-2003).
The explicit capital-charge was also challenged by academics and research institutes. Schroder Salomon Smith Barney called the explicit capital charge for operational risk 'the most contentious idea'.[54] LSE Financial Markets Group stated that 'While the proposal acknowledges the need for a more careful study of operational risk its inclusion of operational risk in Pillar One certainly seems premature to us from a methodological point of view'.[55]

4.3.4 Qualitative Adjustments

Another move towards more mellowing of the capital charges was the request for qualitative adjustments. It was clearly said in different meetings and memo's that the industry would feel 'more comfortable' if qualitative elements were included in the calculations. Arguments for qualitative adjustments as mentioned by the Institute of International Finance, are as follows:[56]

- ✓ Operational risk differs from credit and market risk. For operational risk, there may be some question as to the relevance of all but the most recent historical data;

- ✓ Operational risk is determined in part by the adequacy of the internal controls (e.g. policies, risk awareness, good quality of staff) designed to limit operational risk levels. Therefore, direct actions to improve controls will lower the bank's operational risk;
- ✓ Under the proposed regulatory capital framework, there is no clear and direct benefit to management to make the investments necessary to improve internal control frameworks.

There are numerous ways to incorporate qualitative elements into a risk measurement method. With regard to operational risk, two types of qualitative adjustments have been subjects of discussion:

- ✓ Qualitative adjustments on quantitative methods;
- ✓ Adjustments for losses with a low frequency and a high impact in order to exclude them from the loss distribution;

The quantitative methods were assumed to be the basis of any operational risk measurement model. However, loss data could give the wrong impression. Banks with high losses could simply have been unlucky and if banks face no losses this does not mean they face no risk. The qualitative adjustment should become the incentive to stimulate management to improve the internal control framework. If internal controls are sound, the bank should be granted a capital relief of 20-30% of total operational risk capital.[57]

The adjustment for low frequency-high impact losses would be closely related to qualitative adjustments in general. As major losses with a very low frequency can distort a data set of an individual institution, some banks proposed to adjust these losses after an organisation has improved internal controls. The amount of loss added to the database is then less than the actual loss.

An Example

VillageBank has gathered information on 3000 operational risk losses. One of these losses is an exceptional loss due to fraud: EUR 1 billion. The loss data of VillageBank are given in the table below:

Loss Range (EUR)	*# Data Points*	*Total Amount of Loss (EUR)*
10,000 – 25,000	1730	31,140,000
25,000 – 50,000	837	26,784,000
50,000 – 100,000	303	24,240,000
100,000 – 250,000	96	13,920,000
250,000 – 500,000	24	9,000,000
500,000 – 1,000,000	6	4,950,000
1,000,000 – 2,500,000	2	4,000,000
2,500,000 – 5,000,000	1	10,000,000
>5,000,000	1	1,000,000,000

The capital charge has been calculated with the use of the Internal Measurement Approach, which means that the total average loss has been multiplied with a certain γ. For the purpose of this example we choose $\gamma = 6$. It appeared that lack of segregation of duties was the underlying cause for the large loss. VillageBank learned its lesson and strengthened its controls by introducing strict segregation of duties. The likelihood that VillageBank will again be confronted with such a major fraud loss has been diminished substantially. Instead of entering the EUR 1 billion into the loss database, VillageBank enters EUR 1 million. The differences in capital charges are substantial:

	Without Qualitative Adjustment	*With Qualitative Adjustment*
Average loss	EUR 374,678	EUR 41,678
Capital charge	EUR 2,248,068	EUR 250,068

The fact that such adjustments were proposed make clear that industry was hesitant to rely on statistical measures of operational risk. It also is a strong argument for the proposition that measuring operational risk using similar concepts as used for market and credit risk is extremely undesirable, both conceptually and in practice. For some banks it has been a reason to reject the use of loss data, for others it has been a reason to propose adjustments for these large losses, i.e. to complicate the calculations by identifying exceptions.

The basic differences between credit, market and operational risk that make qualitative adjustments essential are partly caused by the elements of the formula in itself. Where market and credit risk both have an element referring to the present situation (viz. credit exposure and market risk sensitivity) and one referring to the past (viz. probability of default and volatility of underlying assets), operational risk is purely built on past experiences.

Credit Risk	=	*Exposure*	*	*Probability of Default*
Market Risk	=	*Sensitivity*	*	*Volatility*
Operational Risk	=	*Frequency*	*	*Severity*

This additional argument against applying market risk experience to operational risk practice has hardly been used in the industry discussion. Operational risk lacks an element in the formula that can be influenced on the short term via active risk management efforts. This is the core of the "incentive"-problem operational risk suffers from.

4.3.5 From Silos to One Big Black Box

For some of the industry participants the step towards a narrower definition of operational risk and the introduction of qualitative adjustments was not enough. A small group of banks appeared to be the driving force behind the switch from silos to one big black box. This section elaborates and reflects on this switch.

January 2001

The first set of silos was the structure of options for capital calculation, as described in the Consultative Paper of January 2001.[58] The Basel Committee proposed four different measurement methods for operational risk:

1. Basic Indicator Approach as Silo One
2. Standardised Approach as Silo Two
3. Internal Measurement Approach as Silo Three
4. Loss Distribution Approach or Internal models as a *possible* Silo Four

This structure of options was called the basic structure. The exact details of each approach were unclear at that moment. Banks were expected to move through the silos, until they reached their ambition level. The silos complement each other.

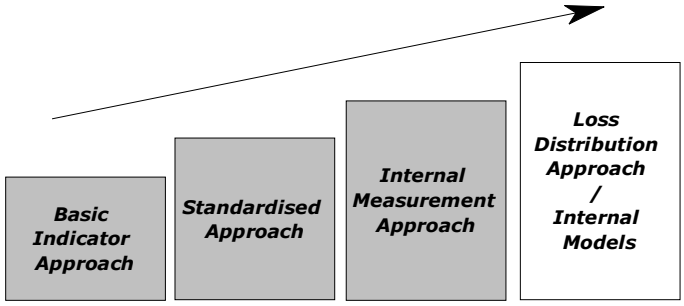

Figure 4.3: The Basic Structure Presented by the Basel Committee on Banking Supervision, January 2001

The fourth silo is illustrated in white, as it had no fixed place in the basic structure. Regulators were undecided whether this would be a bridge too far. However, one

of the appendices of the first consultative paper had been devoted to the Loss Distribution Approach, so it had been in mind already. In the banking industry, the term 'internal models' was also used for Silo Four. Some working groups even made a distinction between the Loss Distribution Approach and Internal Models. In this view, the Loss Distribution Approach was an intermediate stage towards 'true' internal modelling.[59]

Early 2001, the discussion within working groups and on conferences focused on the Internal Measurement Approach. Some proposals for a formula were considered, and the discussions focused on the use of internal loss data versus external loss data and the question whether the capital charge should capture the tail of the loss distribution (like stress testing) or the standard deviation from the mean (like Value-at-Risk). There already was some criticism:

- ✓ As loss data was to be used over a period of three years, the proposed formulas might adversely affect an individual firm for three years following one large loss;
- ✓ It was also noted that unexpected loss is not proportional to expected loss. A concern was expressed that both the formula and the assumptions had not been tested with data to see whether the assumptions are justified. Consequently, it was too early to commit to the formula as the preferred method for calculating regulatory capital.

However, the banking industry tried to constructively work in co-operation with the regulators and, as such, adopted a formula as its working hypothesis.
During the first months of 2001, the concerns raised increased, especially with regard to the use of (external) loss data. Some banks openly doubted whether moving towards the Internal Measurement Approach would be beneficial to them given the required data sharing in order to qualify for this option.[60]

March 2001

The silo 'Internal Measurement Approach' clearly was not acceptable to all banks. It appeared to be hard to come up with solutions for all the technical concerns raised. As a result, some banks even declared to abandon this third silo in the current format. Other banks were pushing this approach strongly, ignoring all weaknesses in the approach. However, there was no alternative 'option 3' on the table, so leaving out 'option 3' would mean moving back to option 2 (option 4: the Loss Distribution Approach and/or internal models were excluded from the regulatory framework at that time). The trust in the Internal Measurement Approach was based on the fact that it was the *only* option on the table, rather

than on the soundness of the formula.[i] Within the banking industry, the number of technical comments rose, putting pressure on the need to come up with an alternative. The main critics concerned the use of simulated data to test formula's, the problems in gathering loss data and the lack of a stable mean in the distribution of the internally collected loss data.
As the Basel Committee still aimed at finalising regulation by the end of 2001,[61] time was pressing. The ideal situation: a formula thoroughly tested with real data, would be a utopia.

April/May 2001

Some banks initiated the development of an alternative approach to option 3, the so-called Scorecard Approach.[62] This new approach introduced a new Silo: 3a. This new development came in a phase that the Basel Committee wanted to move towards a broad agreement on the spectrum of approaches, but faced many comments and difficulties with the Internal Measurement Approach. The new developments did not make life easier. The new approach created two camps within the banking industry: those in favour of the Internal Measurement Approach (silo 3) against those in favour of Scorecard Approaches (silo 3a).[63] Intensive discussions failing to lead to any kind of consensus dominated this period. The fear that all efforts put into the development of an operational risk formula would be wasted when the regulator would choose for scorecards was huge. This fear is not extraordinary, taking into account the fact that regulators wanted to present a basic structure with unique approaches that would fit in an evolutionary sequence. In this structure, there was place for only one 'silo 3' and the banks that supported the Scorecard Approach presented this approach as a full-fledged alternative to the quantitative approaches 'Internal Measurement Approach' and 'Loss Distribution Approach'. There was also time pressure. The Basel Committee wanted to agree upon the basic structure in its July 2001 meeting.
This period clearly illustrated that developing measurement methods is a mixture of politics and intellectual considerations. This complicates the development of methods that potentially are reliable, but differ from the established order.

[i] *It is interesting to compare these arguments with those used in the 1930s-1950s (cf. Section 3.2.1). They are almost literally the same.*

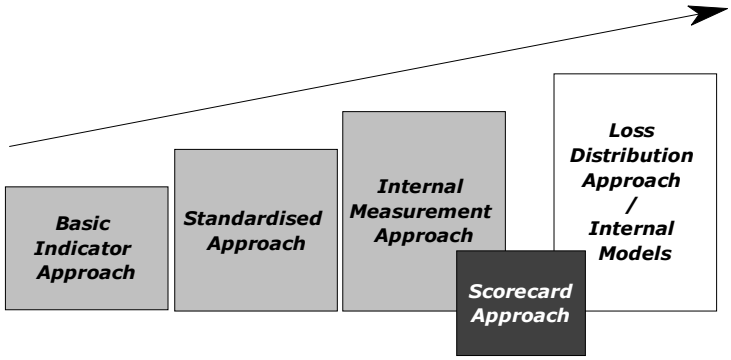

Figure 4.4: The Scorecard Approach Tries to Enter the into the Spectrum, May 2001

May/June 2001

The existence of silos and the alternative approaches that had been developed divided the industry roughly in two 'camps': a quantitative camp, that wanted to improve the Internal Measurement Approach and work on the Loss Distribution Approach, and a qualitative camp, that wanted to develop a Scorecard Approach. The two groups could not come to an agreement, as they simply did not understand each other (*I don't see what the difference is between the scorecard and the work of internal audit*), or did not want to understand each other (*I am really afraid that the Scorecard Approach is going to be successful*...).

As the regulators clearly aimed towards a broad consensus in the industry and between regulators, these developments caused difficulties. The criticism on the Internal Measurement Approach gradually increased, as well as the need for qualitative adjustments to the Internal Measurement Approach. Many attempts to bring the two camps together by integrating the approaches failed. The qualitative camp refused to work on scorecards for the purpose of qualitative adjustments and the quantitative camp refused to accept the Scorecard Approach as an alternative. The passionate discussion came to an end with the release of the Working Paper on the Regulatory Treatment of Operational Risk.[64] Some regulators felt unhappy with the Internal Measurement Approach, as the approach faced many fundamental problems. They searched for alternatives, but felt uncomfortable with the Scorecard Approach either. The Advanced Measurement Approaches, described in the next paragraph, created room for flexibility.

July-September 2001

The only possible way to move towards broad consensus and bring the two camps together was to eliminate the silos and introduce a big black box, called Advanced Measurement Approaches. All three advanced approaches under discussion (Internal Measurement Approach, Loss Distribution Approach and

Scorecard Approach) should be able to meet qualifying criteria for Advanced Measurement Approaches. Lawrence stated in September that the Basel Committee has opted not to choose between the competing methodologies that had been proposed by various industry participants. "Rather, by allowing multiple approaches, the Committee has chosen instead to 'let a thousand flowers bloom' among industry participants over the coming years as alternative capital models are developed and tested."[65]

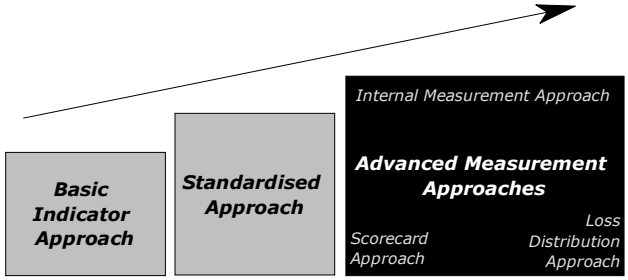

Figure 4.5: The Big Black Box Containing all Advanced Approaches the Industry Proposed

It is remarkable to see that advanced options for measuring operational risk, including the Loss Distribution Approach, were now seriously taken into consideration. In January 2001 these advanced approaches were mooted as only a possibility at some stage after Basel II came into effect.[66]

This move of the regulators poured oil on troubled waters. Camps that were irreconcilable earlier in the year were now able to state that the differences between them were really small:

> *I have never admitted that the Scorecard Methodology is not very different from an Internal Measurement Approach with qualitative adjustments. In June 2001 the world was still divided in silos that were standardised. At that time it was important to defend our silo. With the Advanced Measurement Approaches, the silos have disappeared. Now I do admit to supervisors that in the end the methods will not differ a lot. However, the underlying philosophy is absolutely different.*[67]

The industry and regulators started working on a list of qualifying criteria for Advanced Measurement Approaches. The formulation was tricky, as the criteria should allow for advanced approaches that had not even been developed yet. Only coincidentally, the astonishment of what the banking industry was working on was expressed: *'Isn't it bizarre that we are developing guidelines for measure-*

ment methods that are not even developed yet?' And in the end, what was the relevance of the whole exercise:

- ✓ Quantitative Impact Studies of the regulators showed such low amounts of loss that regulators expressed their fear to base capital numbers on the outcomes;
- ✓ Some banks confessed that their losses were so low that they did not dare to rely on them;
- ✓ The discussion focused on adjustments, the recognition of insurance and the kind of data to be used, but, for example, 'correlation' was not discussed. An industry participant even dared stating that 'operational risk could be fully diversified away from a bank's portfolio'.

Regulators as well as a large part of the banking industry focused on maths and loss data. The term 'advanced' in 'Advanced Measurement Approaches' already points out that the industry was searching for a mathematical solution for measuring operational risk, similar to methods used in market and/or credit risk. Mathematics is regarded as Science and is associated with objectivity, independence and truth. The term 'advanced' is often used in relation to complex mathematical solutions. However, these solutions have never been objective or independent. Each mathematical solution is built upon assumptions and simplifications that are assumed to be applicable. A very striking statement in this respect was '*I do not see how a measurement method can be advanced if no historical loss data is used*'. The other party used arguments such as '*a quantitative model also has qualitative elements, as the underlying assumptions of the model are always subjective*' or '*scaling is very risky in relation to risk. A larger organisation has tighter controls, which makes it hard to develop an adequate scaling method*'. Also the word 'data' was used in a mathematical context. It had been correctly concluded in the banking industry that the regulator had loss data in the back of its mind, when it used the word 'data'.

4.4 After Consultative Paper 2.5

The 'Working Paper on the Regulatory Treatment of Operational Risk', also called Consultative Paper 2.5, substantially differed from the previous consultative paper. Not only the move from Internal Measurement Approach to Advanced Measurement Approaches, but also the reduction of the capital charge for operational risk from 20% to 12% of total regulatory capital in the industry was an important change. The conviction of the Basel Committee that operational risk can be treated in a similar way as market and credit risk was again visible.

4.4.1 Consultative Paper 2.5

The 'Working Paper on the Regulatory Treatment of Operational Risk' was released at the end of September 2001. The major changes compared to the paper of January 2001 (Consultative Paper 2) include:[68]

- ✓ Refinement of the definition of operational risk that underpins the regulatory capital calculations;
- ✓ Proposed reduction of the overall level of operational risk capital charge;
- ✓ Introduction of a new regulatory capital approach that is based on banks' internal risk estimates (the 'Advanced Measurement Approaches'); and
- ✓ Consideration of the role of insurance as a risk mitigant in the regulatory capital calculations.

With respect to the definition, the regulators complied with the banking industry's wishes: strategic and reputational risks were excluded, and it was no longer the intention to include all indirect losses or opportunity costs. As a result, the reference 'direct and indirect' in the overall definition had been dropped. Also, the Risk Management Group confirmed that this definition excluded systemic risk.

The reduction of the overall level of operational risk capital charge was a response of the Risk Management Group on the comments received from the banking industry that 20% was too high.[69] The new percentage proposed was 12%. Banks that would qualify for Advanced Measurement Approaches would be rewarded with a lower capital charge to encourage improvements in risk management and measurement. However, this reduction would be subject to a floor of 75% of the capital requirement under the Standardised Approach.

With the introduction of Advanced Measurement Approaches, the Risk Management Group explicitly mentioned the approaches under discussion for the first time (viz. Internal Measurement Approach, Loss Distribution Approach, Scorecard Approach or a combination of those). For the group working on Scorecard Approaches, this was an important token of appreciation for its work.

On insurance, the arguments that had been put forward by the banking industry as well as by the insurance industry were recognised. These arguments had made the Risk Management Group considering recognition of insurance, however, its use would be limited to banks that qualify for Advanced Measurement Approaches.

Some sections of the working paper of operational risk (Consultative Paper 2.5) were devoted to the Standardised Approach as well. It appeared that the Committee proposed to use 'gross income' as the indicator for all business lines. The Committee also tried to come up with an indication of the beta values under the Standardised Approach, using the loss data received from the banking

industry via the Quantitative Impact Study. It appeared that 'there is significant volatility of results within each business line and, statistically, the Risk Management Group has found it difficult to determine with certainty whether the betas differ in a meaningful way across business lines'.[70] This made the basis for a Standardised Approach very weak and there even was some discussion on whether the Standardised Approach should be skipped.

4.4.2 The Banking Industry Doubts

The banking industry did not only react positively on the Risk Management Group's paper, even though the Advanced Measurement Approaches were incorporated, the definition of operational risk was adjusted, and the capital charge for operational risk was reduced from 20% to 12% of total regulatory capital. The journal 'Operational Risk' writes 'new operational risk paper gets cautious welcome, but reservations remain'.[71] The adjustment of the relative weight of operational risk from 20% to 12% seemed fair,[72] but gave the banks in favour of operational risk within Pillar Two an additional argument. They started doubting whether the investments in operational risk measurement would outweigh the savings in terms of a lower capital requirement. The proposals for operational risk were challenging and the implementation costs were expected to be substantial. The possible capital relief when implementing an Advanced Measurement Approach was relatively small in comparison to those implementation costs. Analysts correctly concluded that the regulators made a number of concessions to bankers, but not to those critics who argued that the notion of a capital charge for operational risk was misconceived and possibly dangerous because the risk was difficult to quantify and best reduced or averted by good management practice.[73]

The Basel Committee on Banking Supervision received 85 written responses on the contents of the Working Paper. The type of comments could be scaled back to three categories:[74]

1. Pillar One versus Pillar Two, i.e. operational risk should be treated under Pillar Two instead of Pillar One;
2. Doubts about the feasibility of the Advanced Measurement Approaches and therefore request to further develop the Standardised Approach;
3. Welcome the Advanced Measurement Approaches and stimulant to further develop the concepts.

The regulator did not reveal how many responses were received within each category.

A conference in November 2001 with senior representatives from both major banks and regulators showed that views were still diverse. One bank made clear it is just a 'common belief' that operational risk should be measured and that management of operational risk will improve by imposing a capital charge. The quantification approaches are only pushed hard by regulators and *some* firms as 'best practice'. This bank has clear concerns regarding the usefulness of loss data (will at best be modest), the focus on quantification (will divert important resources) and the management by analogy (misleading and dangerous).[75] On the contrary, another bank aimed for operational risk measurement in line with credit and market risk measurement. Measurement and analysis of operational risk losses would be one of the cores of their approach and no single word on doubts or foreseen problems were expressed.[76]

Also during the Second Global Operational Risk Forum (November 2001), the warnings and critics were clearly expressed:

- ✓ One bank concluded its presentation with 'keep things simple now and add complexity when the implications on the business are better understood'.
- ✓ Another bank was more positive about the developments but stated that the goals for the next 12 months were very ambitious. 'The banking industry must be careful not to pay the price for these ambitions in terms of flaws.'

The doubts were reasonable, given the problems banks faced in implementing operational risk measurement tools, including top management commitment and gathering loss data. As time passed by, the number of practical and conceptual problems identified increased, but simultaneously, the willingness of regulators and innovators in the banking industry to move back decreased. We expect that the fact that banks had already invested heavily in gathering and sharing loss data has played an important role in this consideration. Also, the individuals involved, who had worked on this approach for two full years already, did not want to lose face.

4.4.3 The Basel Committee Slogs Away

The Basel Committee did not divert its attention from the goals set initially, nor did the Committee listen to the repeated comments that operational risk had to be treated in a different way as market or credit risk. Whereas the banking industry had put much effort in redrafting the proposed qualifying criteria for an Advanced Measurement Approaches (which were clearly derived from market practices) in order to make them more suitable for operational risk, the Risk Management Group almost completely ignored the suggestions. The second draft set of qualifying criteria still pointed towards market risk practice. Also the paper

'Sound Practices for the Management and Supervision of Operational Risks',[77] which was published in December 2001, pointed out that regulators wanted to stay close to the market and credit risk practices they were familiar with. The principles reflected a supervisory assumption that operational risk could be quantified in the same manner as credit or market risk. The repeated comments from banking industry as well as academics had been neglected.
Fortunately, the general delay in drafting the full Basel II regulation, due to problems in the area of credit risk, gave the industry room for repeated discussion and fine-tuning of the operational risk rules.

4.5 Summary and Conclusions

This chapter started with the question *'how has the concept of Operational Risk Measurement evolved since 1999?'*. This process has been described chronologically in the sections above and has been summarised below.
It can be concluded that during the period before June 1999 the awareness for operational risks grew, mainly due to some catastrophic events during the 1990s. However, the willingness to start developing a measurement concept hardly existed in that period and we observed little driving factors to change this situation. The discussion with regulators on designing a capital adequacy framework for operational risk has pushed banks to at least discuss the subject. During the first year of consultation, the only incentives seemed to come from the area of credit risk, where possible capital relieves could be realised as compensation for explicit operational risk capital charges.[78]
The discussions between banks and regulators showed huge differences in viewpoints and methodologies proposed, ranging from purely quantitative to purely qualitative. The discussion on Operational Risk Measurement was not isolated from the discussion on credit and market risk that preceded the discussion. Operational risk practitioners regularly referred to their experiences in the area of market and/or credit risk. However, one could also observe emphatic distance between operational risk and the other risk areas due to differences in the nature of the risk concepts. Operational risk is more bank-specific and can be influenced to a large extent.

Time Period	***General Characteristics***	***Art/Science***
Before 1999	✓ Some catastrophic operational risk incidents; ✓ No formal definition for operational risk existed; ✓ Only very few banks had started to manage and measure operational risk in a structured way; ✓ Operational risk was the responsibility of line management with little or no attention from board level.	In the absence of operational risk measurement methods and management frameworks, operational risk management was purely a form of 'art'.
June 1999 – January 2001	✓ First discussions on operational risk measurement: The Basel Committee on Banking Supervision plans to develop an explicit capital charge of about 25% of the total capital charge; ✓ A very broad definition to prove that operational risk was not measurable; ✓ Banks push the Basel Committee to renounce its decision and treat operational risk under Pillar 2.	Although the Basel Committee had put the cat among the pigeons, banks clearly did not allow operational risk to enter the area of 'science'.
January 2001 – September 2001	✓ Basel Committee adjusts its operational risk capital number to 20% of total capital; ✓ Measurement could no longer be prevented; ✓ Proposals for measurement techniques were mainly statistically based; ✓ Towards a narrower definition of operational risk; ✓ Request for qualitative adjustments up to 30% of total operational risk capital charge.	Operational risk had to enter the area of 'science' but the industry worked hard to keep some form of 'art' in.
After September 2001	✓ Based on Quantitative Impact Study and industry comments, the capital charge has been brought back to 12% of total capital; ✓ No fundamental changes as compared to the previous period; ✓ Banks started implementing the proposed measurement techniques; ✓ Focus on qualifying criteria and sound practices.	Operational risk measurement gradually became a profession of 'science'.[79]

Table 4.2: Summary of Developments in Operational Risk Measurement

Although the number of conceptual and practical burdens increased as time passed by, the willingness to move back to Pillar Two decreased. Only a minority of banks continued recommending the Basel Committee to move operational risk back to Pillar Two. Although this seems illogical, one should bear in mind that many banks had already invested heavily in both operational risk measurement tools and credit risk models. Renounce the capital charge for operational risk would imply only little reduction of credit risk charges. The benefits of investing in these sophisticated models would than be gone.

The next chapter confronts the developments described above with the conceptual framework, outlined in Chapter Three.

Notes – Chapter Four

[1] Matten, C., *Managing Bank Capital*, 2nd edition, John Wiley & Sons, 2000, page 159.

[2] Chapter 2 describes the participant and observer roles of the researcher.

[3] This appears from an informal survey of the Basel Committee on Banking Supervision, published in the paper *Operational Risk Management*, Publication No. 42, September 1998, page 4.

[4] Two interesting books on the Barings case have been written by Leeson (*Rogue Trader*, Little Brown & Company, London, 1996) and Fay (*The Collapse of Barings*, Arrow Business Books, London, 1996). For this short discussion on the Barings case, two articles of Koolhof in Bank- en Effectenbedrijf were used.

[5] Fay, *The Collapse of Barings*, page 268 as cited in King, J.L., *Operational Risk*, Wiley Finance, 2001.

[6] Description of the Daiwa case was derived from Borghgraeff and Thelosen, 'Enterprise Risk Management', *Banking Review*, September 1997, page 49.

[7] Although nobody thought this could happen to his or her bank, another major loss due to rogue trading was reported in February 2002. This time an Irish bank was the victim. It appeared that the trader misled management with fake spreadsheets.

[8] Meridian Research Inc., *Operational Risk Management Technologies*, May 1998, as cited in Working Council for Chief Financial Officers, Confronting Operational Risk, 2000, page 9.

[9] Crouhy, Dalai, Mark, *Risk Management*, McGraw-Hill, 2001, page 476.

[10] In the early regulatory discussion, the Basel Committee asked the industry whether a clear definition would really be needed. This shows that the need for a definition of what should be measured was not commonly recognised.

[11] Parsley, M., 'Risk Management's Final Frontier, *Euromoney*, September 1996: 'The pat definition of operational risk is simply any risk of earnings volatility that is not market or credit related.' (page 74) Jameson, R., 'Playing the Name Game', *Risk*, October 1998: 'This definition was given most frequently during telephone research for this article.' (page 38)

BBA/ISDA/RMA, *Operational Risk the next Frontier,* supported by PriceWaterhouseCoopers, December 1999: '15% of all respondents use the definition 'everything, which is not market- or credit risk'. This is 22% of all respondents who have a formal definition.' (page 30)

The Basel Committee on Banking Supervision also draws this conclusion in its September 1998 paper on 'Operational Risk Management'.

[12] De Nederlandsche Bank, *Risk Analysis Manual,* August 1999: There are 7 kinds of risk besides credit, market and operational risk: interest rate risk, foreign exchange risk, liquidity risk, IT risk, strategic risk, legal & integrity risk, reputation risk.

Basel Committee on Banking Supervision, *A New Capital Adequacy Framework*, June 1999: The category 'other risks' includes interest rate risk in the banking book, operational, liquidity, legal and reputational risks (page 12-13).

[13] Vacelet, F., 'What Exactly is Operational Risk?', *Risk Professional*, February 2000.

[14] BBA/ISDA/RMA, page 32: 5 respondents are dissatisfied/very dissatisfied and only 1 respondent is satisfied/very satisfied.

[15] JP Morgan, Annual report 1998.

[16] Chase, Annual report 1998.

[17] Laycock, M., in Arthur Anderson, *Operational Risk and Financial Institutions*, 1998, page 131.

[18] Hoffman, D., M. Johnson, 'Operating Procedures', *Risk*, October 1996, pages 60.

[19] Basel Committee on Banking Supervision, *Risk Management Guidelines for OTC Derivatives* (Guidelines Vol. 16), 1994.

[20] De Nederlandsche Bank, *Questionnaire over Operationeel Risico* (Tz-Sbv/1997/01836), October 1997
Based on interviews with internal audit department of the 3 largest Dutch banks.

[21] Basel Committee on Banking Supervision, *Operational Risk Management*, pages 1 and 6.

[22] Basel Committee on Banking Supervision, *A New Capital Adequacy Framework* (Consultative Paper 1), page 50, No. 83.

[23] In 1997 320 financial institutions where asked to participate from which 45 responded (14%). In 1999 110 institutions where asked from which 55 responded (50%). These 55 respondents were all institutions with interest in the management of operational risks.

[24] As described in Section 1.3.3.

[25] Merits and weaknesses mentioned in Basel Committee, '*A New Capital Adequacy Framework: Consultative Paper*', page 8-9.

[26] Basel Committee on Banking Supervision, *A New Capital Adequacy Framework* (Consultative Paper 1), pages 50 (No. 83), 50 (No. 84), 51 (No. 87).

[27] This paper was released to the industry, but is no official Basel Committee paper and therefore not available on the Basel Committee web-site. The same counts for the revised paper on other risks, dated April 2000.

[28] Risk Management Group, *Other Risks*, April 2000, Annex 2 (Also Annex 1 to *Other/Operational Risk*, December 1999, but not released simultaneously with that paper). The 7 banks consulted were State Street Bank, Royal Bank of Scotland, CIBC, UBS, Bank of Tokyo-Mitsubishu, Deutsche Bank and BNP Paribas.

[29] It is remarkable that the Risk Management Group uses the word 'operations' risk in this publication as the definition used for operational risk is much broader than operations risk only. Operations risk only contains risks in the back office environment.

[30] Risk Management Group, *Other Risks,* Annex 2, page 17.

[31] The Risk Management Group of the Basel Committee often released draft discussion papers to industry groups to gain input in early stages. The frequency of Consultative Papers was too low to abandon such a process.

[32] Risk Management Group, *Other Risks,* Annex 2, page 17.

[33] Leede, E. de, *Syllabus voor het project Risicomanagement*, Erasmus Universiteit, 1993

[34] The big difference between these two management efforts is also described by Guldimann, T., *Operational Risk: Divide and Conquer*, Risk, April 1999. He wrote 'We will only see rapid progress in operational risk when somebody figures out how to make money by managing these risks better. And it is crucial here that making money is different from not losing it'. (page 54)

[35] Some examples: Y2K and Euro introduction were one-time only risks affecting society (qualitative/macro). The rogue trader was a quite unique risk affecting an institution (qualitative/meso). Settlement failures happen very often and affect only the bank making the mistake (quantitative/meso). In certain areas earthquakes or floods happen every once in a while and affect the whole region (quantitative/macro).

[36] Ong, M.K. in Arthur Andersen, *Operational Risk and Financial Institutions*, Risk Books, 1998, page 81.

[37] Cooper, L., 'Round Table: The struggle to define and measure goes on', *Risk: Operational Risk Special Report*, July 1999 (page 6-7).

[38] 'ISDA outlines need to strike Accord with Basel's position', *Operational Risk Manager*, April 2000, page 8.

[39] International Swaps and Derivatives Association, A New Capital Adequacy Framework: Comments on a Consultative Paper issued by the Basel Committee on Banking Supervision in June 1999, February 2000, page 44.

[40] Cunnington, T., Annual Operational Risk Conference, *IBC Conferences*, London, March 2000

[41] Doerig, H.U., *Operational Risks in Financial Services*, Institut International d'Etudes Bancaires, October 2002, page 32.

[42] Het Financieele Dagblad compares the goal of an average 'capital neutral Accord' with randomly reallocating marbles in a school class: 'verzamel alle knikkers van de kinderen in de klas. Verdeel ze vervolgens weer willekeurig. Het gemiddelde aantal knikkers per kind is hierdoor niet veranderd. Hoeveel kinderen zijn tevreden met de uitkomst van deze exercitie? ... Hoe dit definitieve voorstel [red. Basel II] er ook uitziet, sommige banken gaan erop achteruit. Die kunnen maar één ding doen: hun knikkers zo snel mogelijk weer terugwinnen.'

[43] Schroder Salomon Smith Barney, *Time to Catch Up*, September 2001, page 71.

[44] When the credit portfolio of large European and US banks is compared to the credit portfolio of Asian banks, the expectation of a lower credit risk charge is certainly justified. Sawyer states (*Asia Risk*, April 2001, page 11) that 'many low-rated emerging market banks will be better off adopting the revised standardised approach. Merill Lynch estimates that emerging market banks could have vastly inflated capital weights up to 374% if they use Internal Ratings Based Approach.' To keep the level of capital the same in the industry, other banks (e.g. Europe/US) will benefit substantially from the revised Capital Accord.

[45] Introduction to Consultative Paper 2: '*The New Basel Capital Accord: An Explanatory Note*', page 4. Bold added.

[46] Basel Committee on Banking Supervision, *A New Capital Adequacy Framework* (Consultative Paper 2), January 2001, Supporting Document: Operational Risk, page 2.

[47] These criteria can be found in Basel Committee on Banking Supervision, Second Consultative Paper, Supporting Document: *Operational Risk*, pages 11-14.

[48] Basel Committee on Banking Supervision, Second Consultative Paper, *Supporting Document: Operational Risk*, page 26 (Annex 6).

[49] Coppes, R.C., 'Veranderingen in het bancaire toezicht: enkele ervaringen', *Bank- en Effectenbedrijf*, oktober 1999, page 4 (with reference to the Basel Committee on Banking Supervision, *Operational Risk Management,* Publication no. 43, 1998).

[50] Narrowing the definition of operational risk was an item in almost every industry workinggroup. In the responses to the Second Consultative Paper, almost every bank discussed the broadness of the operational risk definition.

[51] Fishkin and Cagan, 'Arming the Corporate Everyman', *FOW/Operational Risk*, July 2001, page 11.

[52] Among them: The American Bankers Association and some individual American banks (e.g. Citigroup, FleetBoston, Bank of America, Merill Lynch etc.), the Swiss Banking Association, Royal Bank of Scotland, HSBC, Lloyds TSB, the Financial Guardian Group.

Some statements from the reaction of *Citigroup*: 'We note, however, that at this point quantitative measurement of operational risk within the industry is still in its infancy. ... Therefore, we believe the Committee should seriously consider including Operational Risk only as a component of Pillar 2 and continue its efforts, together with the industry, to refine the methodologies and further develop Operational Risk practices.'

Some statements from the reaction of *The Royal Bank of Scotland Group*: 'Philosophically we believe that operational risk is a reflection of the way a business is managed and of the control structures put in place to operate its day to day process. Given this perspective, we argue that it is inappropriate to create a Pillar 1 charge that adopts any particular quantitative. Our strong preference is a Pillar 2 approach, which recognises the qualitative but measurable aspects of operational risk.'

Some statements from the reaction of *FleetBoston Financial*: 'FleetBoston strongly urges the Committee to remove the explicit capital charge for operational risk from Pillar I and to incorporate the assessment of this risk type under Pillar II, Supervisory Review. This recommendation stems from the general lack of agreement on the conceptual framework and the view of the risk being one to earnings not to capital.

Some statements form the reaction of *Merrill Lynch*: 'We are also disappointed to see that operational risk proposals are a core requirement of the Pillar 1 proposals, and not a component of Pillar 2 as we argued in our response to the first consultative paper. We believe that the imposition of capital charges is not an appropriate response to these risks. Robust controls and procedures are the most effective means of mitigating operational risk, and so lend themselves to supervisory monitoring under a Pillar 2 approach.'

[53] For example on the yearly Risk Management Conferences of the Global Association of Risk Professionals, many banks presented their view (February 2001).

[54] Schroder Salomon Smith Barney, page 60.

[55] LSE Financial Markets Group, *An Academic Response to Basel II*, Special Report No. 130, May 2001, page 13.

[56] Institute of International Finance, Report of the Working Group on Operational Risk, *Response to the Basel Committee on Banking Supervision Regulatory Capital Reform Proposals*, May 2001, page 32/33.

[57] Institute of International Finance, page 33.

[58] Basel Committee on Banking Supervision, *A new Capital Adequacy Framework*, Second Consultative Paper, *Supporting Document: Operational Risk*, page 1 (No. 4).

[59] The discussion between the industry and the regulators disregarded the Basic Indicator Approach, as this approach had been developed primarily for small and medium sized banks.

[60] A statement of one of these banks on the Global Association of Risk Professionals conference, February 2001: 'One gets the feeling that regulators are aware that operational risk measurement and its quantification is questionable, but they want to use it for regulatory purposes anyway'.

[61] This deadline would be postponed two times after March 2001. After the comments on Consultative Paper 2 were received, a third consultative period was announced. The new deadline would be October 2002. In January 2002, another delay was announced due to difficulties in the area of credit risk. The new deadline would be at the end of 2003.

[62] The initiator of this group, Dr. M. Lawrence, received the 'Risk Manager of the Year' award for his work on Scorecard Approaches and his success in gaining acceptance for it. 'For his development of an operational risk system that has shown concrete benefits at ANZ and which the Basel Committee has included in the new Basel Capital Accord, Mark Lawrence is Risk's risk manager of the year.' (*Risk*, January 2002, page 49)

[63] The researcher had chosen to support the Scorecard Approach and actively participated in a working/lobby group to gain acceptance for these type of measurement concepts.

[64] Although this paper was not released until September 2001, in June 2001 the regulators already made clear to participants of the industry discussion that this movement was to be expected.

[65] Lawrence, M., 'Operational risk: the last frontier', *Risk*, September 2001, page 120.

[66] Basel II delay gives chance for other advanced op risk approaches, *Operational risk*, July 2001.

[67] An advocate of the Scorecard Approaches during a 'one-on-one' telephone call at the end of August 2001.

[68] Working Paper on Regulatory Treatment of Operational Risk, September 2001, page 2.

[69] Response *Institute of International Finance Working Group on Operational Risk* (May 2001), page 12: 'The Basel Committee's initial efforts to calibrate the minimum regulatory capital requirement are misguided and inappropriate. ... In any case, the WGOR believes that 20% of current minimum regulatory capital would be inappropriate for calibrating Option 2. ... Most importantly, many of the firms providing this data provided the amount of economic capital allocated to cover 'other risks', a much broader term than operational risk.'

Response of the *European Association of Co-operative Banks* (May 2001), page 35: 'The members of the EACB find it difficult to understand why regulators have selected a ratio of 20% of regulatory capital despite their acknowledging that it is "... based on a small sample of banks..." (No. 21 in document Operational Risk). ... The members of the EACB suspect that a ratio of 20% for operational risk would definitely be too high. It should be lowered considerably.'

Response of *The Hong Kong Association of Banks* (May 2001), page 3: 'The allocation of a 20% capital charge for operational risk is believed to be too high for banks in Hong Kong, thus leading to an overall increase in their capital requirements.'

Response of the *Spanish Banking Association* (May 2001): 'The level indicated by the Basel Committee for capital requirements for operational risk, around 20% of the total capital for other concepts, seems very high, and not at all justifiable in the light of current experience of most banks: the most common opinion would place this level below 10%, which would require an in-depth review of this global calibration, which obviously affects many other aspects of the proposed scheme.'

[70] Working Paper on Regulatory Treatment of Operational Risk, September 2001, page 10.

[71] Keefe, D., 'New op risk paper gets cautious welcome, but reservations remain', *Operational Risk*, October 2001, page 1.

[72] The Dutch newspaper 'De Volkskrant' doubts whether this is a good choice of the Basel Committee. They state 'volgens critici laten de nieuwste concessies zien dat centrale bankiers zichzelf kunnen overschatten. De 20% opslag voor operationeel risico zou hard nodig zijn omdat banken een natuurlijke drang hebben om hun risico's te onderschatten. De critici geloven dat het corrigerend vermogen van de toezichthouders onvoldoende zal zijn om dat te voorkomen.' (Pieter Elshout, 'Hoofdzaken Bazel 2 blijven overeind', *De Volkskrant*, 2 October 2001, page 15)

[73] Keefe, D., 'Basle regulators cut op risk charge benchmark to 12%', *Operational Risk*, October 2001, page 12.

[74] Statement made by the Swedish regulator (C. Norgren) during the Second Global Operational Risk Forum, Berlin, November 2001. The written responses have not been published on the web-site of the Bank of International Settlements (responses on consultative paper 2 had been published there).

[75] Guldimann, T., *Capital Allocation for Operational Risks*, Presentation on Joint Conference of the Board of Governors of the Federal Reserve System and the Federal Bank of Boston, November 2001.

[76] Sabatini, J.A., *Capital Allocation for Operational Risk*, Presentation on Joint Conference of the Board of Governors of the Federal Reserve System and the Federal Bank of Boston, November 2001.

[77] Basel Committe on Banking Supervision, *Sound Practices for the Management and Supervision of Operational Risk*, Publication no. 86, December 2001.

[78] This argument that may have convinced banks to accept an operational risk charge lost its relevance during the consultative period, as the relative weight of operational risk decreased from 25% to 12%. However, by the time the 12% was announced, banks had moved so far that the argument of credit was no longer essential to persuade banks.

[79] Crouhy, Dalai, Mark (page 531) observe that the division between art and science for operational risk is about 80% art and 20% science.

Chapter 5 The Discussion on Operational Risk and the Conceptual Framework

A Capital Accord, in the end, will always be a mix of intellectual arguments and politics: what is technically possible, what do banks want to implement, and how can the interests of different countries be combined. In drafting the Basel II guidelines for operational risk, this process could be observed within the Basel Committee, as well as between the Committee and industry groups. Despite of the political aspects, it has been possible to observe the thread of the conceptual framework, drafted in Chapter Three: the driving factors, the four-step approach and the struggle between a quantitative model and a qualitative model. As may have been expected, the discussion has outweighed the implementation in the period until mid 2001.

This chapter combines the two previous chapters, in which our expectations regarding the evolution of risk measurement concepts are formulated (Chapter Three) and the evolution of the concept of Operational Risk is drafted. In doing so, it will answer the fourth research question '*how does this fit our expectations based on past experiences?*'

5.1 Conceptual Framework

In Chapter Three we introduced a conceptual framework consisting of four steps towards developing a 'trustworthy' measurement method. In two cases on insurance and market risk we have shown how this framework can be recognised in practice.
The previous chapter has given an overview of the developments in the area of operational risk. As operational risk measurement was a relatively new subject for banks, we expect to observe characteristics of 'Step One' of the evolutionary process.

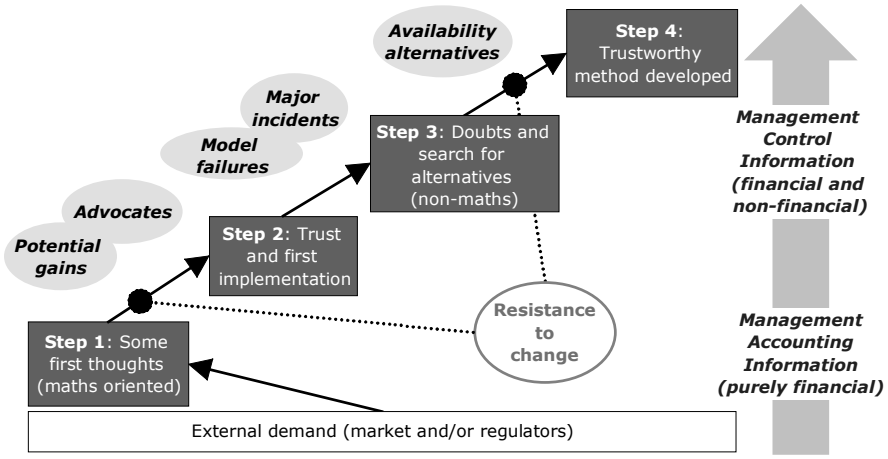

Figure 5.1: The Conceptual Framework as Drafted in Chapter Three

Characteristics of 'Step One' are:

- ✓ There are thoughts on measurement methods, but trust is lacking;
- ✓ Measurement methods have not been implemented yet;
- ✓ There is an external push to develop risk measurement methods;
- ✓ There is fundamental discussion around the measurement methods proposed.

The next sections evaluate whether these characteristics were applicable to the development of a measurement method for operational risk in the period 1999 – 2001.

5.2 Four Industry Groups and the Basel Committee

Already in an early stage of the discussion, the Basel Committee made clear that a capital charge for operational risk was unavoidable. The Committee also left no doubt about the direction of the measurement method to be used: operational risk loss data should be the basis of any method. This forced banks to constructively contribute to the discussions on the form of the capital charge, even though, at that time, the majority of banks were of the opinion that operational risk should be treated under Pillar Two. The written responses on the Second Consultative Paper on 'A New Capital Adequacy Framework' and direct observations within the banking industry made clear that the banking industry could be divided in four different groups. We observed that the banks within countries often had similar opinions. This might be an explanation why it has been

so hard to reach consensus in the Basel Committee. Regulators from different countries tended to defend the interests of the banks in their own country.

Two issues dominated the discussion within the industry and between the industry and the Basel Committee. These issues were 'Operational Risk Treated within Pillar One or Pillar Two' and 'Quantitative or Qualitative Measurement Methods'. The industry could be divided in four groups, based on their position on these two issues.[1]

	In Favour of Pillar One Charge	***Against Pillar One Charge***
Quantitative measurement techniques (loss data approaches)	Group A	Group B
Qualitative measurement technique (scorecard approach)	Group C	Group D

Table 5.1: A Typology of Industry Groups

The banking industry consists of thousands of banks. It has been problematic to research the position of all individual banks. Besides, not all of them have been explicit in their position. Consequently, it is hard to give an indication of the relative size of the four groups. We had the impression that the combination of Group A and B (quantitative) was larger than the combination of Group C and D (qualitative). However, the fact that the industry moved from the Internal Measurement Approach (purely quantitative) to the Advanced Measurement Approaches, indicates a strong basis for the groups C and D as well.

Industry Group A

A large number of European and Japanese banks was of the same opinion as the Basel Committee. They represented Group A. In this group, we identified no single British bank in this group.[2] Together with the banks represented in Group B, these banks worked on:

- ✓ The Internal Measurement Approach formula and its technical details;
- ✓ Sharing of loss data and loss data simulations;
- ✓ Qualitative adjustments to mathematically derived capital numbers.

The philosophy of this group fits Giarini's[3] description of 'deterministic philosophies', which means that risk and uncertainty are viewed as indicators of inadequate knowledge. The frame of reference of this group has been equilibrium and certainty, which means that in the end, everything will be measurable. In Chapter Three, we have called this an 'open' view of measurement.

Industry Group B

The banks in this group are based in the United States of America or Canada. The major difference with Group A is the attempt to push operational risk to Pillar Two (Supervisory Review). Operational risk measurement was complicated given the state of development, and, in contrast to European countries, these countries had experienced the functioning of 'Supervisory Review' for a long time already.
In the industry, the difference between groups A and B was difficult to observe. Banks represented in Group B had chosen to support the work of Group A. Apparently, Group B was of the opinion that 'if operational risk had to be treated under Pillar One, then a quantitative method based on historical loss data would be the best solution'.

Industry Group C

Industry Group C was a small group[4] with banks from many different countries. The group was formed out of dissatisfaction with the measurement methods proposed for capital calculation. The question whether operational risk should be treated under Pillar One was a non-issue for this group. The Scorecard Approach is a product of Industry Group C, developed in co-operation with Group D.

Industry Group D

Most British banks were at an extreme side of the discussion. They pushed qualitative methodologies (i.e. scorecards) and were in favour of a flat charge instead of a spectrum of approaches. This group belonged to the 'indeterministic philosophy', stating that uncertainty and lack of information are an inevitable and incompressible part of any living system, simply due to the fact that the future is open and not necessarily determined.[5] Measuring operational risk with the use of historical loss data was regarded as nonsense, as data would never be complete and events that happened in history would say very little about possible future events. Especially in the area of operational risk, which is highly dependent on the quality of internal controls and can be influenced to a very high extent by the institution itself, the use of historical loss data is disputable. This group placed operational risk in the area of behavioural inquiries, which need other measurement methods than those used in natural sciences. This also is an open view of measurement, as this group believed that alternative measurement methods *could* be useful. However, the wish to have a flat charge and by pushing operational risk towards 'Pillar Two', they made clear that they thought that these alternative measurement methods would not be developed in the near future.

Regulators

The regulator, represented by the Basel Committee on Banking Supervision, pushed towards a Pillar One charge, based on quantitative elements. Historical loss data were regarded as the basis of operational risk measurement. The

regulator was willing to discuss the technical details of the approaches with the banking industry. The core principles have not been subject of discussion and qualitative elements were regarded with suspicion. Regulators have been reluctant to introduce any element that might have given the impression of a 'subjective' capital charge. Although they were confronted with the industry groups C and D, they ignored that there might be relevant operational risk data available, other than loss data, worth considering.

5.3 Reflection on the Four Groups

This section analyses and explains the composition of the groups and the relationships between them from different angles: co-operation, geographic spread, Schools of Thought, and 'art/science'.

Co-operation

In describing the four groups, we already pointed out that the groups A & B and C & D co-operated during the consultative period. Although the grouping is based on two fundamental opinions (Pillar One/Two and Qualitative/Quantitative), the co-operation between groups can only be observed within the opinion on the measurement method. Groups B and D, both supporter of a Pillar Two approach, did not combine their effort to attain this. The opinion on the Pillar issue was mainly brought forward in the comments of individual banks or national banking associations, not in international working group comments.

We can explain this industry choice, as there was common ground to discuss practical solutions to operational risk for all groups:

- ✓ Group A and Group C wanted operational risk in Pillar One, which required a practical measurement solution;
- ✓ Group B and Group D had incentives to develop a measurement method to fall back on, if their lobby for a Pillar Two approach would not have the preferred effect.

As the regulator was very explicit about its intentions during the period of consultation, a Pillar Two approach did not stand a true chance. Within industry-wide working groups, it was difficult to extensively discuss the Pillar-issue, as the banks belonging to groups A and C had no incentive to do so. After all, the Basel Committee had already decided and had no intention to renounce this decision.

On measurement methods, the Basel Committee was open to suggestions, implying that both Group C-D and Group A-B had reasons to lobby.

The fact that industry Group B supported Group A was to be expected, as American and Canadian banks were also the pioneers in developing risk

measurement models for market and credit risk. These models are also founded on mathematics. The basis for trust in mathematical models clearly exists in these countries. Within the UK banking sector, this basic trust seems to be lacking, pushing British banks towards Group C.

Geographic Spread

One of the explanations for the geographic spread of the various industry groups may be the current supervisory system. With the implementation of the Basel II Accord, the Basel Committee tries to achieve world-wide uniform banking supervision. This is not yet common practice. Banks that are familiar with extensive supervisory review (such as the USA and the UK) expressed a more comfortable feeling to rely on Pillar Two for operational risk. Therefore, it cannot be surprising that both USA and UK banks are supporters of a Pillar Two approach. It would imply little changes to their current practice. On the contrary, banks that operated under a less strict qualitative supervisory regime were afraid to rely on Pillar Two, as various regulators could interpret the Pillar Two-demands differently and regulators could become very strict in applying the Pillar Two rules. Another role in the explanation of the geographic spread may be assigned to the national banking associations. Banks within one country or region meet more often than banks from countries in different continents. As a result, the experience of banks in one region will be shared more easily. We have argued in Section 3.3 (page 62) that experience plays a crucial role in the acceptance of certain measurement methodologies.

Schools of Thought on Risk Analysis

The industry groups can be divided among the two major schools of thought in risk analysis, as described by Van Asselt (Section 3.1.2, page 48). Groups A and B support quantitative analysis and therefore fit into the Objectivist School of Though. The other two groups are searching for qualitative solutions. Their arguments fit the Constructivists School of Thought. A more detailed analysis of the position of the Groups C and D, which seem to be outliers, is included in sections 5.4.2 and 5.4.3.

Art and Science

In Chapter Three we emphasised that risk measurement can be regarded as a profession of art or as a profession of science. The struggle between 'art' and 'science' was evident between industry groups and the regulator. On the scientific extreme one could see the regulator, dictating the use of historical loss data and opposed to any form of qualitative measurement. On the other extreme one could see Industry Group C, working hard to gain acceptance for 'Scorecard Type Approaches'. Although the science approach seemed to be the frame of

reference, the need for some piece of art was widely acknowledged by the industry.

5.4 Conclusion on the Current State of Evolution of Operational Risk Measurement

Trust is very important when promoting measurement methods. Simon[6] proved in the 1950s that education and experience play an essential role in decision making, the phenomenon of 'selective perception'. The way, in which people analyse problems, says more about the education and experience of this person than it says about the problem itself. Therefore, people tend to trust methods that are familiar to them more easily than new concepts. Evidence that methods have worked in the past is also an important aspect in establishing trust.
Within operational risk management, individuals involved were from an auditing or a market risk background. Auditors have experience with internal control measures; market risk managers have experience with statistical models. These two aspects were highlighted within the discussion on operational risk measurement. The comparison of operational risk measurement with market risk measurement was often made. Discussions were held on issues like Value-at-Risk, holding period, confidence interval and stress testing. On the other hand, qualitative adjustments (the recognition of the quality of internal controls) were a returning subject.

5.4.1 Where did the Industry Stand as of 2002?

Converting the different opinions of the four Industry Groups to the conceptual framework about the evolution of risk measurement methods, we observe that, as of 2002, the industry has been in the early stages of developing an operational risk measurement framework. Indicators were:

- ✓ Some banks had been collecting internal loss data for years, but most banks started doing this only after the release of the first consultative paper of the Basel Committee on Banking Supervision;
- ✓ There were views on quantification frameworks based on historical loss data, but these frameworks had not been implemented at that time;
- ✓ Many industry participants disbelieved in the framework itself (Group D) or in the applicability of the frameworks given the state of the art in the industry (Group B). They wanted operational risk to move towards Pillar Two (no quantification at all);

- ✓ There was one industry group that believed in the applicability of historical loss data in the measurement of operational risk on the short term (Group A);
- ✓ The regulators were pushing towards quantitative measurement methods. Qualitative elements were regarded with suspicion.

As measuring operational risk was a relatively new subject, historical loss data were inadequate. Whatever method had been developed, it could not be founded with evidence that it would have worked in the past. Therefore, (philosophical) discussions focused on the definition[7], qualitative elements and the question whether historical data would have any value in measuring operational risk. These characteristics were also visible in the discussion on risk measurement in general in two periods: before 1900 and 1920-1930. In the period before 1900, would not rely on the measurement methods they had just developed. In the 1920s, the discussion was a reaction on events happened in the 1910s that had proved that the measurement methods were unreliable.
The discussion between 1999 and 2002 had more similarities with the fundamental discussions of the 19th century than with those of the 1920s. In 2002, there still were no measurement methods, based on historical data that had proven to be fallible in specific situations. The discussion on operational risk measurement in the period 1999-2002 was a matter of the first hydrophobia to apply measurement methods based on historical loss data, as was the case with risk measurement in general in the 19th century. All troubles around the Internal Measurement Approach can be translated back to this problem. Without proper testing with 'real' data, the industry did not want to go ahead with the formula. It is not surprising that, in this stage of development, no one could be positioned in step 2 or 4 of the conceptual framework. Contrary to steps 1 and 3, these steps are practical implementation steps. The industry clearly was having fundamental discussions that can only be found in steps 1 and 3.

Also, the type of criticism from academic sources indicates that operational risk measurement is in its earliest stage. Danielsson[8] firmly argues against the notion of model based regulations for operational risk. To found his statements, he uses the criticism on the underlying assumptions of Value-at-Risk models for market risk and the idiosyncratic nature of operational risk. We also publicly questioned whether measuring operational risk is a reasonable request given the nature of the risk and the state of industry developments.[9]

It might be that operational risk should go through the same steps as risk measurement. When we look more closely to the developments in market risk, which are ahead of operational risk, it can be argued that this is what actually will happen. Market risk measurement has already gone through the steps of developing models based on historical data, trusting these models, and applying them widely. In the early 21st century, market risk models seemed to be the subject of fundamental discussions again. This might point to the second period of uncertainty about modelling, similar to the renewed fundamental discussions in the 1920s. However, the determination of capital charge for market risk have not been reviewed under Basel II.

The Basel Committee on Banking Supervision directed towards a mathematical measurement approach for operational risk. In doing so, it attempted to stimulate the banking industry to move to step 1 of the conceptual framework. The groups A and B hesitantly accepted this goal and started developing and implementing quantitative operational risk measurement methods. Group C and Group D acted different. From the opinions explained earlier in this chapter, one might get the impression that Group C is ahead and Group D is behind in some way. The next sections elaborate on these impressions.

5.4.2 Was Industry Group C Ahead?

Group C had already been fundamentally discussing whether actions and decisions of human beings could really be captured in a statistical figure on operational risk, which provides the impression that this group is already in step 3. They criticised the scaling techniques proposed for the use of external data and believed that other models based on the quality of internal controls or key risk indicators, should be allowed under the regulatory regime. Instead of discussing mathematical solutions, this group searched for non-mathematical alternatives. The discussions within this group can be compared to the fundamental discussions of the 1920s than to the discussions before 1900. Also for operational risk, many people doubted whether statistical techniques could be applied. Some even doubted whether historical loss data was of any use at all. The arguments of Knight can almost literally be used in the discussion within this group.

What is lacking in this group is 'proof'. The banks had not gone through the first two steps and therefore they could present no cases to support their ideas. This made it difficult to obtain a chance of success at convincing the Basel Committee. And, in looking more carefully at the 'scorecard approaches' banks in this group had implemented at that time, little difference with the Loss Distribution Approach can be found.[10]

In fact, the Industry Group C, supported by Group D, has pushed regulators to move from silos to one big black box. They managed to open the discussion around a framework that seemed to be established. Still, the type of approaches that are proposed by Group C would not succeed in meeting the new qualifying criteria. The regulators insisted on historical loss data to be the basis of any approach that would be granted with their approval. Also, these banks will have to start measuring operational risk using approaches that fit the first two steps of the evolutionary process. Industry Group C should be patient for a number of years before its view will be accepted.

> *'Quantitative models remain a weak link, which is no surprise as there is disagreement between firms and statisticians on how operational risk should be quantified. Some industry officials believe that the statistically heavy quantitative approach to measuring operational risk is likely to be scaled back in the next round of BIS amendments.'*[11]

5.4.3 Was Industry Group D Behind?

Industry Group C appears not to be ahead of the others, but Industry Group D also is an outsider compared to the state of the art described in Section 5.4.1. The question arises whether this group was behind in thinking compared to the rest of the banking industry. Many industry analysts concluded that the United Kingdom was behind in implementing Basel II, especially regarding operational risk. KPMG's research on the implementation practice of the Basel II proposals in Europe also shows this attitude of British banks. Most British banks 'appear to be towards the back of the queue'[12] and Britain was the only country to rate the cost of compliance as the biggest obstacle to implementation of the new Accord. However, being behind in implementation does not imply being behind in thinking.

Industry Group D has been the group that commented most critically on the proposals, focusing on conceptual problems. We had the impression that this group was the only group that understood from the beginning that the concept of Operational Risk needs another basis than statistics. As a result, co-operation with Group C was the only option for this group. But whereas other banks continued applying a familiar concept that already proved its flaws on a new subject, Group D was the only group that had the courage to insist in advising the Basel Committee to treat operational risk within Pillar Two now *and* in the future.
Based on the intensive observation of the banking industry and study of the characteristics of the subject of Operational Risk, we tend to believe that Group D is the only group that was ahead of the banking industry, at least for those parts

of operational risk that cannot be measured. We refer to the multicoloured cube, introduced in Section 4.2.2 (page 87).

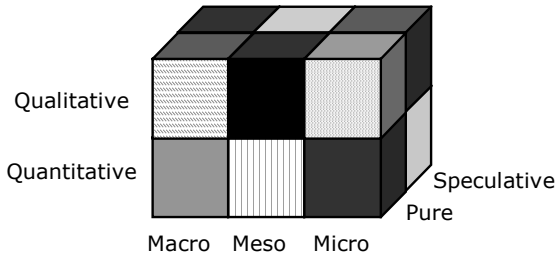

Figure 5.2: The Multicoloured Cube

We are of the opinion that operational risk measurement and holding regulatory capital for it, will never be a reasonable solution as the concept contains too many elements that cannot be measured using loss data and elements for which no data can be gathered. Chapter Six elaborates on this opinion.

5.4.4 Driving Factors

Although many disagreements existed on measurement methodology, the industry had started developing measurement methods for operational risk. Although some banks had already started implementing operational risk measurement methods before the Basel Committee announcement that it wanted to set capital charges for this risk, the major driving factor behind this development has been the Basel Committee.[13] The importance of this driving factor became clearer as the implementation date for the new capital regulation was postponed again. Operational risk practitioners complained to each other that senior management began to lose interest in the regulatory capital framework, which provided the main impetus for further developing operational risk management at that time.

The open discussion within the industry made it possible to observe the difficulties individual banks faced in implementing operational risk management. Although the Basel proposals were the most important driving factor, the presence of the Basel proposals in itself was insufficient to start implementing operational risk management (step 2). Without a proper business case, proving the internal benefits of operational risk management, virtually all banks faced difficulties with their senior management. These benefits should go beyond the reduction in capital charges in order to receive a budget for implementation. An advocate in the executive board was the best thing an operational risk manager could have in those days.

Observations within departments of the researcher's bank also indicate that measurement is not the driver of operational risk projects. No single department or senior manager needs a figure on operational risk. For many (senior) managers, gathering operational risk loss data is an extra burden for regulatory purposes only. If the regulator provides no substantial benefits, this additional burden will be avoided if possible. We conclude that the top of the banking industry (large international banks) is implementing mathematically oriented measurement methods for operational risk, but the current incentives are too small for smaller banks to follow. Therefore, banking industry as a whole cannot yet be placed within step 1 of the conceptual framework.

5.5 The Roles of Art and Science in Operational Risk Measurement

In the observations, grouped together in Chapter Four, the struggle between 'art' and 'science' was clearly present. The implicit assumption underlying the discussion on capital charges for operational risk has been that in the end all risks can be measured. People acted as if they knew the risk, although they knew they did not and they never would.

There are two groups of observations that attract attention in relation to the relative importance of art and science in operational risk management. The first is the definition of operational risk and the second is the request for qualitative elements in the capital calculation. There are also observations that have clear relations with the establishment of trust in measurement methods.

The first element that indicates the art/science-discussion, is the process of determining a definition for operational risk, as described in sections 4.2.2 and 4.3.2 (pages 87 and 93). The initial reaction of some large industry groups to start pushing the Basel Committee to renounce its decision and treat operational risk under supervisory review (Pillar Two), instead of formulating a capital charge was a sign that operational risk should not entertain the science approach. The main argument was 'operational risk is not measurable'. To support this argument, the discussion focused on the definition of operational risk. Operational risk was considered as a very broad subject, with so many different elements in it, that it was impossible to measure this 'trash' in a uniform way.
The second element referring to the art/science-discussion is the request for qualitative adjustments. This discussion started just after the release of the second consultative paper. As described in Section 4.3.3 (page 94), the industry was of

the opinion that capital requirement for operational risk should be based on both quantitative and qualitative aspects. Banks should not be punished for the effect of bad luck due to the randomness of operational risk incidents, and measures taken after incidents, took place should be rewarded.

These discussions make clear that operational risk measurement has been riddled with pitfalls. The fact that operational risk is firm specific and can be influenced by the bank itself much more than credit or market risk, makes the reliance upon statistical measures weak. This might be related to the fact that operational risk measurement is still an area under development. It takes time for the industry to trust scientific methods and when there are no reliable models and there are insufficient historical loss data to perform analytics, this trust will be hard to establish. For the time being, operational risk management will stay a profession of art, with minimal use of science. However, the Basel regulation on operational risk might have accelerated developments in the science direction.

In analysing the developments, we are of the opinion that too little attention has been paid to alternatives for measurement. Banks have gone back to known statistical techniques too quickly. Maybe the lobby for a Pillar Two approach would have had a chance if the full banking industry had supported it.

5.6 How will Operational Risk Measurement Evolve?

The discussion on operational risk measurement at least made very clear that it is different from credit and market risk. Its internal focus makes this risk category impressionable and manageable to a higher extent than other risk categories. The characteristics of Operational Risk make it hard to manage this risk category using existing risk management techniques. Chapter One already distinguished financial and non-financial risks. The financial risks are part of the primary process of banks as banks are intermediary in financial risks. The non-financial risks just disturb the primary process. As a result, these risks are treated differently and the responsibility for managing these risks is often assigned to staff units outside the line organisation.[14]

Although little scientific research has been done on the use of operational risk management tools, some consultants, industry groups and other stakeholders did surveys on the state of the art of operational risk. In those surveys, the use of operational risk management tools was a recurring subject. The absolute number

one in most surveys on operational risk management seems to be *Control Risk Self-Assessment*. Control Risk Self-Assessment is a purely qualitative tool to identify and assess operational risks. The most important strength is its ability to involve employees on all levels in the organisation, thereby creating awareness and commitment on all those levels. For translation into a quantitative figure, Control Risk Self-Assessment is practically useless, but that does not keep banks from using it, which is an indicator that non-mathematical methods are appreciated from a management control point of view.
The least used tool in 1999 appeared to be *loss databases*. This tool is a prerequisite for complying with the Basel II proposals, but still many banks continue doubting about the use of it. The use of loss databases will increase if the regulator continues pushing it. Also data sharing initiatives will be viable if the regulator pushes. However, for many banks it will continue to be an administrative burden with little business benefits.
The tool *Operational Risk Indicators* can be found in between these two extremes. Although many articles refer to this tool, only a small sample of banks actually uses it or works on implementation of Operational Risk Indicators as operational risk management tool.[15] A reason for this can be that many banks have build self-assessment forms or scorecards around risk indicators, so there is some overlap with these tools. Another reason might be that it is difficult to identify indicators with true predictive value. One of the conclusions of the Global Operational Risk Forum 2001 was that *Key* Risk Indicators are an illusion. The indicators should be used as a warning to be able to act proactively, not as a predictor.[16]

Based on the characteristics of operational risk, it is not envisaged that one uniform 'operational risk management tool' will be developed within the industry. Banks will prefer developing a methodology that fits the organisation's specific needs and requirements. One of the influencing factors will be the organisation's culture, as this affects the way incentives for managing operational risk can be created. As appears from loss data analysis, only a small percentage of operational risk losses goes beyond the level of 'expected losses'.

Chapter Six elaborates on the expected organisational development and the effect on the operational risk management process.

5.7 Capital Regulation: Reflection on the Role of the Regulator

The conclusions with regard to the risk management process also impact capital regulation. If operational risk is really different from credit and market risk and even belongs to a different domain within banking, the question whether the regulator had made a reasonable choice in pushing quantitative measurement techniques so hard is justified. In the regulatory regime, some risks that are easier to quantify than operational risk are kept outside Pillar One of the Capital Adequacy Framework (for example interest rate risk in the banking book). The reason why operational risk must be covered under Pillar One, despite of firm critics from the banking industry, was unclear.

There is evidence of insecurity at the regulatory camp: (a) the contact with the industry was very intensive, and (b) in proposing the Advanced Measurement Approaches, they emphasised the wish to have 'everybody on board'. The Risk Management Group planned time to spend with various industry groups and individual banks almost every meeting it had. It seems that the discussion between regulators and banks had the characteristics of a 'polder-model',[i] with regulators carefully addressing all objections from the industry.[17] Some of the underlying arguments from the regulatory side may have been:

- ✓ The major change in the new Accord has been the refinement of credit risk capital charges. This refinement would almost certainly lead to a decrease in capital requirements within the industry. The regulators wanted to avoid this decrease and used operational risk as a buffer to keep the capital requirements in the industry on the same level;
- ✓ The development of measurement methods for operational risk was still in its infancy. Nobody felt comfortable in setting measurement standards that were insufficiently tested. The Basel Committee was dependent on the industry for testing its proposals;
- ✓ The regulators generally had little insight in the impact in terms of implementation of the Accord. As they were unable to gain experience with the implementation, they relied on input from the banking industry;
- ✓ The chairman of the Basel Committee was about to retire. The Basel II accord should become the crown on his work and it was of major importance for him that capital requirements became 'risk sensitive'. Neither the Basic Indicator Approach nor the Standardised Approach attained this criterion.

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[i] *Polder model is the designation for the consensus model the Dutch society is known of and praised for during the late 1990s-early 2000.*

However, in the end it was the Basel Committee that would decide. It appeared that sometimes, industry input was ignored or only marginally used. Especially with respect to the use of loss data, the regulators disregarded repeated comments from various banks. It was not surprising that many representatives from regulators had experience with the quantitative market risk rules.

In our observation, political arguments have outweighed the practical ones. It would have been better if operational risk were treated under Pillar Two for a period of *at least* another 5 years. The industry would then have had enough time to gain experience with operational risk measurement methods to develop valid frameworks. An amendment to the Accord in 2012, similar to the Amendment to incorporate market risk in 1996, would have been a good alternative.[18]
This solution would also provide the flexibility to conclude in the end that a capital charge for operational risk is inappropriate, which was the first intuitive thought of the banking industry and which is underlined with this research. Capital requirements are a method to restrict commercial activities. In order to prevent banks from moving their assets to the most risky commercial activities, the calculation method for capital requirements should be based on risk. However, it should stick with those risks that are directly related to the activities that should be restricted, i.e. commercial activities. The risk/reward trade-off for operational risk is negative on the short term, as rewards are indirect and will only become visible over time (downside risk). Also, the effect on reputaion and opportunities is difficult to quantify. As a result, 'taking' operational risk will never be a commercial decision. This impression is reinforced by the absence of a true causal relationship between operational risk controls and operational risk losses. Investing in operational risk provides no assurance for any type of reward.

5.8 Conclusion

This chapter started with the question '*how does this fit our expectations based on past experiences?*'. Although industry groups C and D might have given the impression that the industry was in various stages of the conceptual framework, this was not true. All the banks that actually had implemented a measurement method in 2002 used loss distributions.[19] The data that provided input to these distributions varied from estimates of operational risk loss potential to actual loss data and all banks used external loss data either directly or indirectly. These banks had all taken the first steps in 'step two'. All the other banks, including the regulators, were in 'step one' of the evolutionary concept. It will take at least 5 to 10 years before the industry will be moving towards the third step. These years

are needed to gain experience with the mathematical models and to allow for major disasters to affect the trust, which is currently to be realised.

> *For many practical reasons, any industry-wide shift towards historical loss-based methodologies is likely to be slow and painful.*[20]

With regard to driving factors, it can be concluded that the regulator has played an important role.[21] However, this regulator pushed the industry with reason:

- ✓ It had observed large losses due to the absence or non-functioning of controls (as described in Section 4.1.1, page 79);
- ✓ It had observed banks developing economic capital models, taking into account operational risk as a separate risk category;
- ✓ It reacted on wild guesses from the industry in the 1990s that operational risk might even be the most important risk category for banks.[22]

The next chapter will take a closer look at one of the driving factors for the regulator: the application of the concept of Economic Capital.

The evolution of the concept of Operational Risk until 2002 therefore meets the expectations formulated in the conceptual framework, which partly surprises us. The banking industry apparently prefers applying familiar concepts that only partially meet expectations in practice, rather than developing new concepts that might be more satisfactory.

The first steps in measuring operational risk have been taken. However, it is unclear whether an appropriate end product can be developed. The intentions the industry and the Basel Committee have with operational risk do not fit to the full concept. 90-95% of the losses, resulting from what Basel identifies as 'operational risk', will be expected losses that should not be covered by capital and cannot be labelled as 'risk'. Also, for larger events, banks have insurance policies in place. Operational Risk Management should aim at mitigation and control instead of measurement and quantification. A qualitative opinion on the quality of operational risk measurement combined with process oriented risk indicators should be sufficient for management purposes. Given this conclusion, we agree with those banks that had the courage to continue lobbying for placing operational risk within Pillar Two. Operational risk is not a uniform risk category, on which one measurement method can be applied and operational risk data must be defined much broader than just 'loss data'.

Notes – Chapter Five

[1] As positions may change over time, we have chosen the period 'summer 2001' as a point of reference. At the end of May 2001, banks responded to CP 2. Early June 2001, the switch from Internal Measurement Approach to Advanced Measurement Approaches was announced. Banks that pushed the regulators to the Advanced Measurement Approaches have been placed in the 'qualitative' camp. The division among Pillar One/Pillar Two was made based on individual responses to the Basel Committee at the end of May 2001.

[2] In the magazine *Operational Risk* of August 2001, it was concluded that 'most British banks certainly appear to be towards the back of the queue' in implementing Basel II. In the area of operational risk, only 50% of the banks questioned had started projects in preparation of Basel II. All European banks involved in the survey had all started operational risk projects already.

[3] Giarini, Orio, A comment on Peter Bernstein's "Against the Gods: The Remarkable Story of Risk", *Geneva Papers on Risk and Insurance*, April 1999, page 140-144.

[4] This observation is based on the active participation in this group. There may have been a large group of banks that supported the work of group C and had the same philosophy, but did not actively make their position known.

[5] Giarini (1999), page 140-144.

[6] Simon, 1976, page 309-312.

[7] About the debate on the definition of operational risk, the Economist wrote that it was discussed 'with fierce and sometimes philosophical arguments'. (April 21, 2001)

[8] Danielsson, J., *The Emperor has no Clothes: Limits to Risk Modelling*, Financial Markets Group, London School of Economics, September 2001, pages 2; 19.

An Academic Response to Basel II, FSE Financial Markets Group, Special Report No. 130, May 2001, pages 3; 13.

[9] Tillaart, A.H.A.J. van den, 'Operationeel risico meten: een kritische beschouwing', *Maandblad voor Accountancy en Bedrijfseconomie*, November 2001.

[10] 'Lawrence explained that the bank's scorecard capital methodology is a blended approach, including historical loss information and scenario analysis along with the more qualitative input from the business units. The result, he says, is a forward-looking measure of risk that "rests upon a very rigorous quantitative foundation, including Monte Carlo simulation".' (Jameson, R., 'The true cost of operational risk', Erisk.com, February 2002, page 3)

[11] Haggerty, J., 'Sharp cut in operational risk charge due', *International Financing Review*, July 2001, page 105.

[12] Lyon, P., 'UK lags Europe for Basel II implementation', *Operational Risk*, August 2001, page 12.

[13] Haar, H. ter (March 2002): 'Op het gebied van operationeel risicomanagement gaat de komende jaren veel veranderen De financiële sector vindt het van groot belang om het risicomanagement naar een volgende ontwikkelingsfase te brengen. Het risico wordt immers complexer en de drang naar risico- en risicokostenbeheersing wordt groter. Bazel heeft hierbij een belangrijke katalyserende werking.'

Bruggink, A. (March 2002): 'De stimulans die het Baseldocument nu lijkt te geven, is mijns inziens te gering om banken er echt toe te brengen extra te investeren in theorievorming en modelontwikkeling ten behoeve van het beheersen van operationeel risico.'

[14] Examples are Security Department, BCP unit, Insurance Department, Compliance Department, etc.

[15] 50% in de British Bankers Association/International Swaps and Derivatives Association/Robber Morris Associates study.

[16] Conclusion of one of the workshops on Key Risk Indicators. The Global Operational Risk Forum is a yearly conference for senior operational risk experts to discuss latest operational risk experience and practice via a combination of presentations and workshops.

[17] The Economist (November 10, 2001): 'The Basel Committee is getting into knots trying to address every objection as it arises. Each time, it seems, the Committee adds another layer of complexity for banks and their supervisors to master.'

[18] Some even doubt whether the whole package 'Basel II' would be a wise decision of the regulators. In a reaction to the threat of Germany to veto any new European directive based on the latest proposals from the Basel Committee, The Economist wrote 'Supervisors and financial firms may well end up thanking Mr. Schröder if he vetoed the lot.' (November 10, 2001)

[19] For example, the ANZ Scorecard Approach was more an operational risk capital allocation tool than a method to calculate the amount of operational risk needed. The calculations of the total amount of operational risk capital needed were based on loss data.

[20] Jameson, R., 'The true cost of operational risk', page 2.

[21] The regulator also aims to be an important driving factor. In a special report from Risk on Operational Risk (July 1999), J. Quick, a British regulator, states 'Capital has two purposes. One is to provide a second line of defence to systems and controls, that is, a buffer for unexpected losses. The second is to encourage banks to invest in better systems and controls.'

[22] Parsley in Euromoney (September 1996): 'Banks measure credit and market risk because they can, not because these are the biggest risks they face. Operational risk is larger, more dangerous and no-one knows exactly what to do about it'.

Hoffman and Johnson in Risk (October 1996): 'Operational risk is everywhere. In the past few years it has reared its head frequently. We have all seen the headlines and read the stories. Whether we are talking about failures of controls between front and back office, unauthorised trading or legal risk, the issue is large and complicated and the capital at risk is huge.

BBA/ISDA/RMA did a survey on operational risk in mid 1999. They found that the combined operational and business risk capital at the total firm level ranges from 10% to 65%. These results are based on the responses of 16 institutions. (page 92)

Chapter 6 Implications for Management Control

Developments in operational risk measurement, as described in the previous chapters are closely related to the planned regulatory changes, called Basel II. These changes are not a result of a stand-alone initiative of the banking supervisors, they are a reaction from these regulators on developments in the banking industry towards (1) advanced credit risk modelling,[1] and (2) integrated risk measurement.

This chapter firstly elaborates on the research question '*what risk management area fits best to the concept of Operational Risk*'. During recent years, risk management departments within banks have become mature staff units, formulating policies and procedures, setting limits, and reporting on positions and performance. These developments have also stimulated some banks to introduce a new Executive Board function, the Chief Risk Officer.[2] Section 6.1 elaborates on concepts and practices in banks, thereby examining the roles of the executive manager, the line manager, the auditor, the management controller, and the risk controller.

The remainder of the chapter discusses the incorporation of Operational Risk in this risk management area to answer the last sub-question: '*how can the concept of Operational Risk be incorporated in this risk management area*'. Relevant theories will be discussed and the relation of this risk management area with the risk management process will be revealed. Section 6.5 introduces the concept of Economic Capital and the performance measure 'Risk Adjusted Return On Capital' (RAROC), thereby focusing on the goal and content of the concepts. Afterwards, the place of operational risk measurement within the concept of Economic Capital and RAROC will be explained as well as the impact of the developments in the area of operational risk on the implementation of RAROC.

6.1 Risk Management: Concepts and Practices in Banks

Although banks have always faced risks, risk management has not been a separate role or function within banks until the 1990s. Risk management was implicitly part of everybody's daily work. Besides, the corporate insurer played a role in transferring those risks that were unacceptable to executive management to external parties. Risk information was not separately provided to executive management. The development of risk measurement methods has changed the risk management role. Risk management has become an explicit process in banks, with concrete responsibilities assigned to various functions.

6.1.1 Risk Management Roles in Practice

Risk management is a delegated responsibility in banks. Executive management decides on strategy and acceptability of risks, but line management must implement actions to realise the goals set. To ensure independent reporting on line management performance, control units provide performance information to executive management. Thus, risk management roughly involves three roles.
In banking practice, various functions execute these roles:

- ✓ *Executive management:* Determining the overall bank strategy and deciding upon risk retention is the main task of executive management. The implementation is delegated, but must be controlled.
- ✓ *Line management:* Responsible for daily operations, including the implementation of control measures and changes in processes to improve efficiency or effectiveness.
- ✓ *Management Control:* The controller gathers financial and non-financial performance information, analyses this information, and reports to line management and executive management. Management control information is used for various types of decision making.
- ✓ *Risk Control:* The risk controller gathers risk information, monitors limit utilisation, compliance with policies and reports on excesses and trends. We note that in banking practice, the function of risk controller is often called "risk manager". However, this "risk manager" is not responsible for the whole risk management process, but only for the control function within this process.[i]

[i] *Although in banking it is common practice to use the term 'risk management department' for departments that actually perform risk control tasks, we will use the term 'risk control department' to prevent confusion between risk management as a process and risk management as a control function.*

- ✓ *Internal audit:* Most banks have internal audit departments, performing operational audits in various parts of the business. These audits are process reviews, focusing on the internal control environment. Besides internal audit, banks hire external auditors to judge the reliability of the financial statements and sign them off. These audits are called 'financial audits'.[ii]

The roles of executive and line management are not subject to discussion, as they both represent one of the three roles of risk management (decision making and implementation). The other three stakeholders, risk controller, (management) controller and auditor, represent the monitoring/control role. At first sight, this situation indicates an overemphasis on control and/or overlapping functions, which can be marked as inefficient.

Although recent articles in controllers and auditors magazines discuss whether the goal and tasks of internal audit and management control differ significantly enough to have two functions,[3] we are of the opinion that the internal auditor and the controller complement each other. The internal auditor visits the people on the shop floor to extensively test the controls and procedures. The management controller relies on these investigations and uses the outcomes as performance indicator (i.e. outstanding audit points). Although both position themselves as an advisor to management, focusing on a prospective view and making use of a multidisciplinary background, the interpretation of this goal and the translation into work practice differs.[4] When top management is considering mergers or acquisitions, both the management controller and the operational auditor may play an advisory role from a finance and control perspective. However, the auditor will do this based on in-dept study of the administration and the controller will do this based on higher level analysis of performance and strategy.
The management controller and the risk controller are more similar. In providing management information, the controller cannot neglect risk information, as risk and return are inextricably bound up with each other. Both the controller and the risk controller provide similar risk information to management. Moreover, management control does not only consist of providing performance information, it also involves putting boundaries on risks to be avoided, analysing strategic uncertainties and advising management on how to address these and

[ii] *It should be noticed that in the Netherlands, banks' internal auditors also perform financial audits and sign off the financial statements together with the external auditor. However, this is a typical Dutch situation. In other countries, the internal auditors will never (co)-sign off financial statements. As a result, the internal auditor in Dutch banks is more difficult to position. For this thesis, we have neglected the Dutch situation.*

safeguarding the core values of a company. Some of these tasks also lie within the risk control function, viz. advising on risk limits and analysing the impact of extreme events given the risk positions the bank has entered into. Although management control is a broader area and might be more generic, all risk control tasks fit within the concept of Management Control. Pezier also argues that 'it would be a tragedy if, somehow, risk management was seen as a discipline divorced from that of management when it should be an integral part of it'. In too many banks, he observes, risk management is seen as the task of one department alongside other departments fulfilling other support functions, which is also encouraged by supervisors.[5]

Based on this observation, it may be beneficial to combine both roles in one function. Although this question was excluded from our research, we can identify some potential reasons why in banking practice these roles are separated:

- ✓ The expansion of activities and the international competition has created new risks. The expansion of the risk control function has in many banks been fed by major incidents, like the collapse of Barings. Major incidents often result in an overemphasis on controls.
- ✓ Mergers and acquisitions have created large banking organisations in which executive management must lean more heavily on control functions to obtain control over delegated responsibilities.
- ✓ As the control function has grown, the influence of the controller increased. Issues of politics and concentration of power may potentially have been arguments to assign the corporate risk control function to a separate department.
- ✓ The societal attitude towards risk has changed. The acceptance of incidents has decreased. Credit risk losses, which have been normal practice since banks exist, are extensively discussed in the press and are not considered as the result of normal banking practice anymore.

Although any of these arguments may be valid given current banking practice, we are of the opinion that a heavy focus on control tasks will disturb the balance between commerce and control within an organisation. If the control function has become so large that it must be split, organisations should reconsider its need for control.

6.1.2 Risk Management Roles and Operational Risk

Until 1998, operational risk was mainly a task of the internal auditor.[6] However, the internal auditor cannot be responsible for managing risks, as this would conflict with its independence and impartiality. As explained in Section 4.1.2

(page 84), this situation only indicates that the risk managers and controllers did not explicitly address this risk, not that internal audit actually managed it. Audit periodically judged the organisational arrangements and operational risk controls and provided recommendations on how to prevent operational risks from occurring. Risk managers and management controllers focused on financial risks (i.e. credit, market and interest rate risk). The attention the Basel Committee pays to operational risk changes this attitude. The operational risk management responsibility is gradually assigned to either the risk control or the management control function. To determine which choice would be preferable from a theoretic point of view, we recall the four areas of risk management, introduced and defined in Chapter One: Balance Sheet Management, Risk Transfer, Measurement and Pricing and Management Control.

To place operational risk within one of these areas, the definition and characteristics of operational risk are relevant. Operational risk is defined as the risk of losses resulting from inadequate or failed internal processes, people, and systems or from external events. Failure of people in strategic decision making lies outside the scope of operational risk and should be treated separately. The concept of Operational Risk, as it has been discussed in the banking industry, is process-driven. The use of business lines in the Basel proposals, but also the frequent use of product lines in Advanced Measurement Approaches of individual banks confirms this. Other relevant characteristics of operational risk are:

- ✓ It only has downside potential, and
- ✓ The bank can influence it to a very high extent.

As stated in Section 1.1.1 (page 4), *balance sheet management* is a tool that can be used to manage market risks, interest rate risks, and liquidity risks. Operational risk falls outside the scope of balance sheet management, as changing the balance sheet hardly influences the 'operational risk position'. *Risk transfer* is a tool that can be used to sell operational risk, for example via insurance policies. However, risk transfer should only be used for risks that fall outside the bank's tolerance level. The bank should be able to manage the risks that fall within the tolerance level more efficient than via risk transfer. Therefore, risk transfer never is the only risk management method used for a specific risk category. For *measurement and pricing* to be applicable, it should be possible to hold clients responsible for the operational risk a bank runs. As operational risk is about internal problems that often are not directly linked to clients, this cannot be true. As a result, it will be hard to let the client separately pay for operational risks. The last option, *management control*, conceptually fits the concept of Operational Risk best. Both concepts focus on internal processes and try to get grip on disruptions

of these processes. Furthermore, operational risk is closely related to attitude and culture. These are aspects that fit into the definition of management control.

6.1.3 Conclusion

Operational risk can best be handled within the concept of Management Control. The emphasis within this domain should lie on controlling the risks instead of financing them. This conclusion conflicts with current banking practice, where we observe the development towards assigning the operational risk management role to a separate function 'as if these risks could be treated separately and independently of the economics of the main business activities'[7]. This prevents banks from integral analysis of risk and reward.

The goals and tasks of the Risk Control and the Management Control functions are similar. Within banks, Risk Control and Management Control may have more similarities than in non-financial institutions. The primary processes are financial processes, in which profit is made through running financial risks. As a result, a large part of the most relevant management control information is related to financial risk. Both the Risk Control and the Management Control functions aim at influencing behaviour of all employees in the business.

Although internal audit will continue playing a role as 'risk management advisor', it will not interfere with implementation responsibilities or continuous monitoring of improvements. Given the current banking practice, this leaves the controller and the risk controller to divide the tasks. However, we regard merging both roles as being highly beneficial. Lengthy discussions on responsibilities and borders can be prevented and an integrated view can be safeguarded.

The next sections elaborate on the concept of Management Control, the overlap between Risk Control and Management Control and the application to Operational Risk.

6.2 The Concept of Control

Control can be defined in different ways varying from 'domination' (i.e. the person in 'control' has the power to enforce his will on others) to 'regulation' (i.e. the controller detects the difference between 'what is' and 'what ought to be'). In business usage, these two terms are usually combined.

The concept of Control is a concept that can be defined in different ways:

- ✓ Emmanuel, Otley and Merchant define the concept of Control as 'The application of policies and procedures for directing, regulating and co-

ordinating production, administration and other business activities in a way to achieve the objectives of the enterprise'.[8]

- ✓ Kramer defines control as 'each sort of goal-oriented influencing';[9]
- ✓ Lorange and Scott Morton state that 'the fundamental purpose for management control systems is to help management accomplish an organisation's objectives by providing a formalised framework for (1) the identification of pertinent control variables, (2) the development of short term plans, (3) the recording of the degree of actual fulfilment of short-term plans along a set of control variables, and (4) the diagnosis of deviations'.[10] This definition is said to be a reflection of many definitions between the 1950s and the 1980s.[11]

The objectives play a crucial role in all definitions. According to Otley and Berry[12] the existence of an objective is the first necessary condition that must be satisfied before any process can be controlled effectively.[13] The second condition for effective control is *measurability of the output*. The third condition is the existence of a *predictive model* of the process and the last condition is a *capability of taking action* so that deviations of attainment from objectives can be reduced.

These conditions are visualised in Figure 6.1. The characteristics of the process and the extent to which errors are acceptable determine how the control system should be designed. Important distinctions are the distinction between feedback and feed-forward control[iii] and the distinction between programmed and non-programmed decisions.

A manager must choose what to control: the input, the process or the output, thereby taking into account 'technical feasibility of monitoring and measurement', 'understanding of cause and effect', 'costs of generating information', and the 'desired level of innovation'. It should be noted that information about inputs is necessary, but rarely sufficient, for control.[14]

[iii] *Feedback control is based on analysis of the past and feed-forward control focuses on the future developments. Therefore, the difference between feed-back and feed-forward control is that the measurement of actual process output is replaced by a prediction of expected output at some future time.(Emmanuel, Otley, Merchant, page 13)*

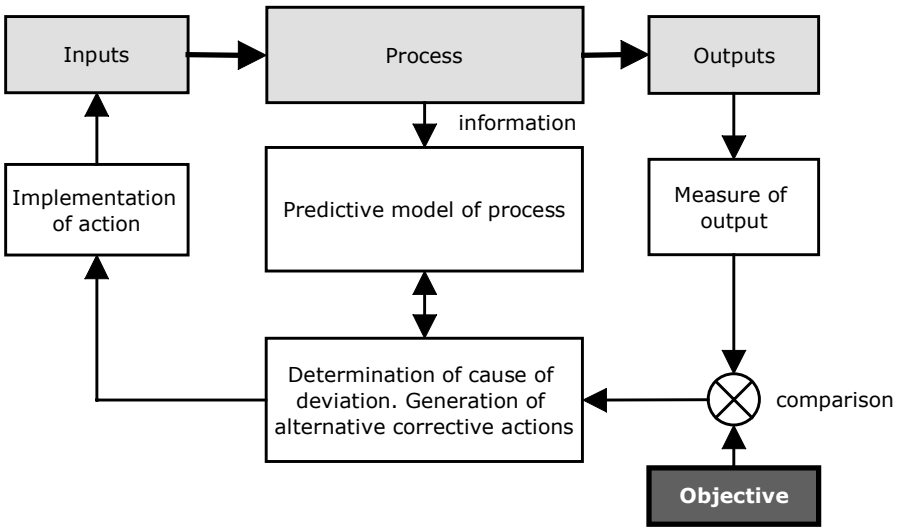


Figure 6.1: The Control Process

6.3 What is Management Control?

Management control seems to be an elusive subject as there are many views on the scope of management control, the definition, the positioning in relation to management accounting and the role with regard to risk management. Management control is pre-eminently a profession that has its roots in business administration, due to its multidisciplinary character.

Business scientists therefore often argue that business economics is insufficient in managing organisations.[15] The next sections explain and illustrate the multidisciplinary character of management control via definitions, concepts and tools and reasons for existence.

6.3.1 Management Control Definitions

Within management control, three organisational entities play an important role: management, the organisation it tries to influence and the support unit providing management with relevant performance information. The 'activity' management control requires action from both management and the support unit concerned with control.

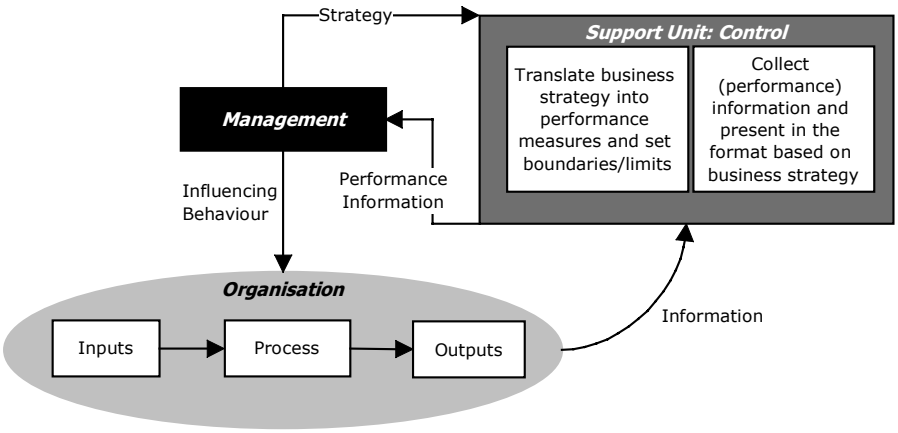


Figure 6.2: The Process of Management Control

There is a conceptual agreement in management control literature that business strategy is the starting point for every concept of Management Control. However, the definitions used are diverse. The definition mostly referred to is Anthony's definition. In 1965, he defined management control as 'the process by which managers assure that resources are obtained and used effectively in the accomplishment of the organisation's objectives'.[16] In his later works, he adjusted the definition towards 'the process by which managers influence other members of the organisation to implement the organisation's strategy'.[17] Both definitions focus on management action. It appears that management control can be defined from the perspective of management, focusing on influencing behaviour but also from the perspective of control, focusing on data gathering and translation of these data into management information.

Definitions from the perspective of management are for example:[18]

- ✓ Control managers exercise over other managers (Fisher);
- ✓ Control is concerned not with directing future activities instead of correcting past mistakes. Thus management control consists, in part, of encouraging people in an organisation to do certain things and to refrain from doing others (Sizer).

Definitions from the perspective of control are for example:

- ✓ A system of organisational information seeking and gathering, accountability and feedback designed to ensure that the enterprise adapts to changes in its substantive environment and that the work behaviour of its employees is measured by reference to a set of operational sub-goals (which conform with

overall objectives) so that the discrepancy between the two can be reconciled and corrected for (Lowe);

- ✓ The formal, information-based routines and procedures managers use to maintain or alter patterns in organisational activity.[19]

Management control is a broad concept. Influencing other members of the organisation may contain everything one could think of. Although the concept of Management Control can be defined from two perspectives, organisations must not choose between them, but combine them.
Not only definitions of management control are different, the translation of the concept of Management Control to concrete performance measures and actions in practice also shows enormous differences in scope. The main distinction between the various concepts of management control is the extent to which non-financial indicators/ aspects are included.

6.3.2 Why is Management Control Necessary?

Before discussing management control systems in more detail, attention should be paid to the question 'why do management control systems exist'. We note that an accurate discussion on this subject requires an extensive research, which was outside our scope. Therefore, we restrict ourselves to mentioning a limited number of relevant theories to provide a general background on the existence of management control.

The basis for the management control function is the agency theory. Many organisations have become too large to keep all responsibilities on one hand. If responsibilities are delegated, executive management runs the risk of not attaining its goals. Employees on the shop floor are agents for higher management but might have other (personal) interests that might be conflicting with the organisational objectives. Management is dependent on its employees to realise organisational objectives (delegation responsibilities). The management control function is one of the instruments management uses to make sure that employees behave in a way that is beneficial to the organisation.

Merchant therefore builds his management control concept on the general question: *are our employees likely to behave appropriately?* This question is translated into three important aspects for management control:

1. Provide clarity on direction
2. Motivate employees
3. Take into account personal limitations

Simons focuses on four goals, employees should strive for: to do right, to contribute, to achieve, and to create. Within his concept, good management control is future oriented, objectives driven and not always economically desirable.

6.3.3 Concepts and Tools

The traditional concept of Management Control is a top-down process focusing on internal issues with as main goal 'keeping things on track'.[20] The information used in traditional management control systems is backward looking (events that happened in the recent past). The focus lies on financial indicators, which always refer to the past. The budget-cycle is the most important aspect of this management control concept. One of the main contributors of this traditional management control system is Anthony. In describing this management control concept, Anthony strictly separates 'strategy formulation', 'management control' and 'task control'.[21]

Changing environments; increased competition; technological innovations; and globalisation have pointed out the need to broaden the scope of the concept of Management Control. The internal focus and financial indicators are no longer sufficient to implement strategy. Increasingly, management control is linked to 'the learning organisation'. Both Merchant and Simons follow on these developments and present broader management control systems.
Merchant[22] pays significant attention to the so-called *soft controls*. A management control system should consist of action controls, result controls and personnel/ cultural controls.

- ✓ Action controls are process-oriented controls, putting boundaries on what personnel is allowed to do. Examples are deal approval, segregation of duties, introduction of username/password security on computers, back-ups for systems and documents, and physical access restrictions. These controls are close to the business and also are an important focus for operational audits.
- ✓ Result controls are purely output controls providing employees with the freedom to act (empowerment) and reward them for generating good results, or punish them for bad results. The (financial) control department often plays a crucial role in providing management with performance information to control results.
- ✓ Personnel/cultural controls are soft controls that are relatively cheap to implement and can form a very effective control mechanism. The three major methods of personnel controls are (1) selection and placement of

employees, (2) training, and (3) job design and providing necessary resources. Cultural controls focus on shared traditions, norms, beliefs, values, ideologies, attitudes and ways of behaving. Methods of shaping an organisation's culture are codes of conduct, group-based rewards, intra-organisational transfers, physical and social arrangements and a proper role modelling at the top.

The three aspects of a management control system can be placed in the process of management control, described earlier.

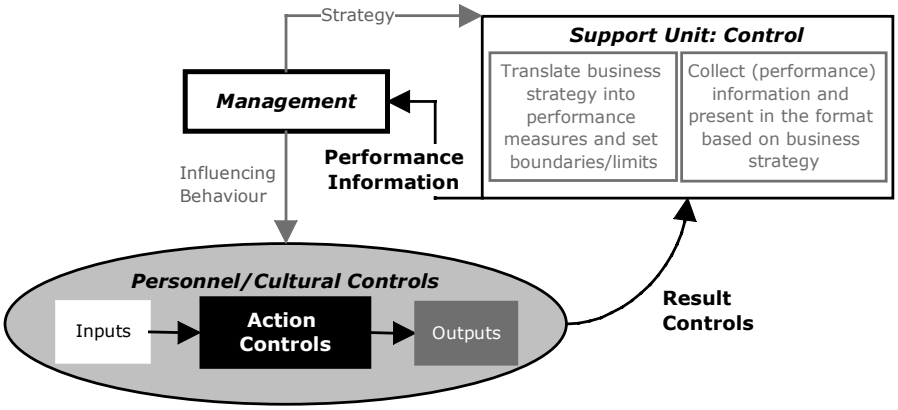


Figure 6.3: Action Control, Result Control, and Personnel/Cultural Control placed within the Process of Management Control

Both Anthony's control concept and Merchant's three aspects of management control systems can be found in Simons' Four Levers of Control. The traditional control tasks are grouped in one of the four Levers of Control, illustrated in Figure 6.4: 'diagnostic control systems'. These systems are designed to execute performance control or result control.

Together with three other aspects of management control, these diagnostic control systems form the 'levers of control':

1. *Belief systems* used to inspire and direct the search for new opportunities. These systems are comparable to Merchant's cultural controls. Examples are mission statements, vision statements, and statements of purpose;
2. *Boundary systems* used to set limits on opportunity-seeking behaviour and are comparable to the action controls described above. Examples are codes of business conduct, operational guidelines, and risk limits;
3. *Diagnostic control systems* used to motivate, monitor, and reward achievement of specified goals. Examples are measure outputs, link initiatives to goal achievement and set standards;

4. *Interactive control systems* used to stimulate organisational learning and the emergence of new ideas and strategies. Merchant does not explicitly identify this control lever, but empowerment and organisational learning are important aspects of Merchant's result and personnel controls as well. Interactive control systems focus on creating attention to subjects. Examples are continually challenge and debate about data, assumptions and action plans, but also participation in face-to-face meetings with subordinates.

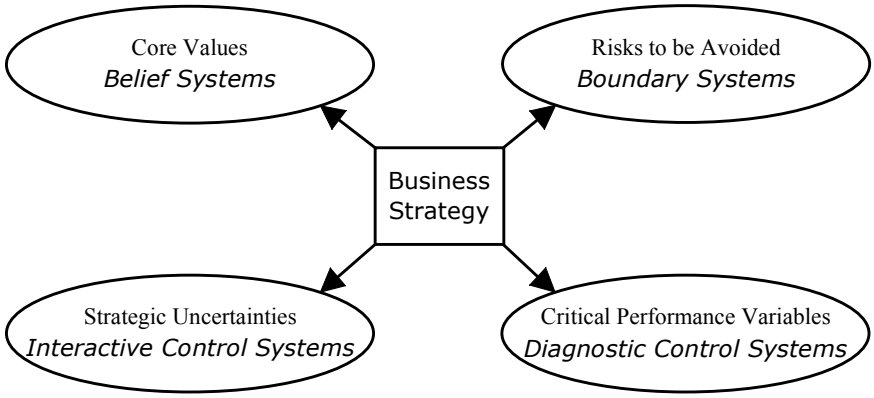


Figure 6.4: Simons' Management Control Concept

Anthony defined management control as 'influencing behaviour'. The four Levers of Control are explicitly linked to human behaviour. Employees should be supported to contribute, to do right, to achieve and to create. For each of these activities, managerial solutions exist in one of the four levers.

Employee Desire to	***Organisational Blocks***	***Managerial Solutions***	***Relevant Control Lever***
Contribute	Unsure of purpose	Communicate core values and mission	Belief Systems
Do right	Pressure or temptation	Specify and enforce rules of the game	Boundary Systems
Achieve	Lack of focus or resources	Build and support clear targets	Diagnostic Control Systems
Create	Lack of opportunity or afraid of risk	Open organisational dialogue to trigger learning	Interactive Control Systems

Table 6.2: Human Behaviour, Organisational Blocks and Levers of Control [23]

Although Simons states that the assumptions underlying his concept of Management Control are somewhat heroic[24] (i.e. that people want to contribute, achieve, innovate, and do competent work), the concept underlines that management control is based on management accounting and management information systems, but also is a social issue.[25]

Management control tools are numerous. Besides budgeting, the Balanced Scorecard might be the most widely used tool for management control. The Balanced Scorecard communicates the multiple, linked objectives that companies must achieve to compete based on their intangible capabilities and innovation. The scorecard translates mission and strategy into goals and measures, organised into four different perspectives: financial, customer, internal business process, and learning and growth.[26]

Although the underlying assumptions of the Balanced Scorecard are similar to those applying to budgeting, the four perspectives assure a better mix of financial and non-financial performance measures. For example 'customer value' includes product/service attributes, image and client relationship.[27] Those aspects cannot be measured using financial indicators. By introducing three perspectives besides the financial perspective, the Balanced Scorecard retains the financial measures and simultaneously introduces drivers of future *financial* performance (i.e. feedback *and* feed-forward control), the so-called 'leading variables'. However, the tool is still based on the cause-effect theory, which is based on the Machine Age (cf. Section 3.1.1, page 45).

6.3.4 Management Control and Management Accounting

The relation between management control and management accounting has changed over the last decade. In Anthony's work about planning and control-systems (1965), the accounting aspect of management control was highly emphasised. On Harvard Business School, where Anthony did his research, management control was thought as a subset of management accounting, the so-called responsibility accounting.[28] The work of Anthony is criticised most often on his over-emphasis on accounting controls[29] and on neglecting the linkages between strategic planning, management control and task control. Although his definition of management control is very broad (influencing behaviour), the development of the concept is rather narrow. In this period, management accounting also was the main focus and role of the finance and control departments, as the only performance measures were of the financial kind. The observation that the accounting information was used on a very limited basis for internal decision making triggered controllers to pay more attention to non-financial performance measures (and the development of, for example, the Balanced Scorecard).

Non-financial performance measures and subjective information (e.g. observations, statements) appear to play a key role in decision making.[30] Kaplan and Johnson[31] concluded that management information systems should not be designed primarily to satisfy external reporting and auditing requirements. Systems should be designed to support the product strategy, technology and organisation structure. Too much focus on external reporting and auditing requirements have been one of the main reasons for the declined role of management accounting in decision making.

Vosselman concluded in 1996 that the dominance of the accounting-aspect of management control has diminished significantly. Non-financial information has become more important, as the goal of management control is influencing *behaviour*. Also, Bonnet observed the growing attention for the phenomenon 'learning organisation'.[32] Therefore, Vosselman argues that it could be more reasonable to define management accounting as a subset of management control[33] and that is what Simons does with his 'concept of Management Control'.

6.4 Management Control in Banking

The questions "*what is the difference between 'risk control' and 'management control' in financial institutions and is it necessary to separate these functions in two units?*", seem reasonable. From the management point of view, integration of both roles should be preferable, as integrated risk and control information would be helpful in decision making. This section illustrates the similarities of risk control and management control mentioned in Section 6.1.1, making use of Simons' Management Control concept and Bruggink's two domains for performance control.

Section 6.5 describes how the performance measure 'RAROC' stimulates the integration of risk control and management control roles.

6.4.1 Risk Management and Simons' Levers of Control

Simons levers of control can be grouped in 'process controls', which are restricting and try to guarantee the realisation of objectives (boundary systems and diagnostic control systems) and 'strategic controls', which are soft controls, needed to formulate goals and strategy (belief systems and interactive control systems).[34] As explained in Section 6.3.3, the diagnostic control systems can be considered as the concept of Financial Control, relying on the planning and control cycle. Boundary systems form the other part of the process levers. These systems are meant to point out what is unacceptable, given the business strategy. This can be an ethical standard, but also a specific market the company wants to

avoid or a product it wants to exclude. In the banking sector, important boundary systems are limits set for market risk positions and credit exposures to certain counterparts, but also the approval process for larger credit exposures via Credit Committees.
Diagnostic control systems and boundary systems have in common that the focus is on control[iv] and together they can be called the concept of Risk Control.
Moving towards management control incurs expanding the concept with systems that are mainly related to *strategic management* instead of control. The core values of a company as well as strategic uncertainties are more subjective aspects of the management control concept. Effective interactive control systems require discussions with employees and external parties on various levels. It creates openness and commitment and is essential to gain insight in the whole spectrum of future risks. Whereas risk control is mainly based on the past, interactive control is based on the future.

An important difference between financial and non-financial institutions regarding risk management, is the relation to organisation objectives. In financial institutions, risk management is closely related to the organisation's objectives, due to the fact that it's products, services and business processes are of the financial kind. In non-financial institutions, there is a difference between primary processes and financial processes. Hence, the goal of risk management differs. In non-financial institutions, risk management has a defensive goal (mitigate the risks). Financial institutions aim for increasing profit and add value by managing risks as well as mitigating risks.[35]

Figure 6.5 illustrates that risk control is part of 'management control'. Risk control requires critical performance variables to be defined to keep insight in the amount of risk and comparing them with the tolerance level set in the bank's strategy. The structure of limit setting (all risks) and approval processes for credit risk can be categorised under 'boundary systems'.
Essential for proper risk management is a risk aware culture at all levels in the organisation. The remuneration policy of the bank should be designed in such a way that employees are hired that match with the corporate culture and have the appropriate attitude towards risk. Finally, risk management is not a profession of pure science. Strategic uncertainties are numerous, which makes the interactive control system one of the most important aspects towards accomplishing the bank's objectives. These aspects of risk management are not covered in the risk control departments banks have created.

[iv] *The Dutch distinguish 'control' and 'controle'. These two systems are mainly based on 'controle'*

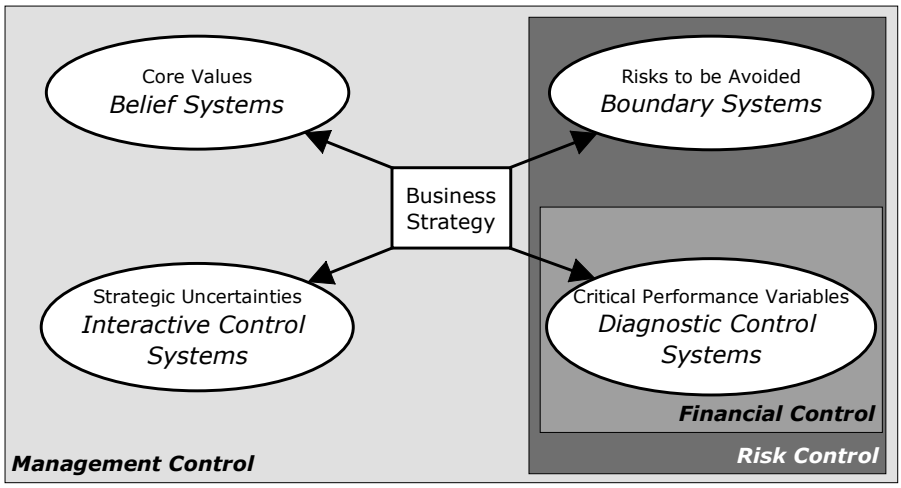


Figure 6.5: The Difference between Financial Control, Risk Control, and Management Control using Simons' Concept of Management Control (1999)

6.4.2 Bruggink's Concept of Performance Control

Performance control in banking includes two different domains: the banking-financial domain and the technical-organisational domain. The banking-financial domain is market oriented and focuses on positions instead of processes (effectiveness). The technical-organisational domain is process oriented and focuses on internal aspects (efficiency).[36] The first domain is also called 'risk management' as management action is based on risk positions.[37] If we compare the banking risks identified in Section 1.1.2 (page 5) with Bruggink's domains for performance control, we observe that all risks the banking industry has attempted to measure until recently fall within the Banking-Financial Domain.

Risks in Banking-Financial Domain	***Risks in the Technical-Organisation Domain***
Credit Risk	Operational Risk
Market Risk	Legal Risk
Interest Rate Risk	
Liquidity Risk	
Country Risk	

Table 6.3: Banking Risks divided among Bruggink's Domains for Performance Management

Operational risk and legal risk cannot be placed within the Banking-Financial Domain, but fit the Technical-Organisation domain. The most recent developments in banking, however, are managing business risks and sustainability. These aspects are of the societal kind and are difficult to group in one of Bruggink's

domains. A separate domain for performance control of societal risks may be needed, but this lies outside the scope of this research. It is important to note that Bruggink's research underlines why risk control is part of the overall performance measurement system used for the purpose of management control.

6.5 The Concepts of Economic Capital and RAROC

Risk Adjusted Performance Measurement and the allocation of Economic Capital have been buzzwords in banking since the early 1990s. The concept of Economic Capital has its roots in the Basel 1988 Capital Accord. The solvency requirements introduced in this accord made capital a business constraint, which should be used in an optimal way as explained in Section 1.2.1 (page 8). The assumption that equity is the most expensive form of funding forms the basis of all capital concepts.[38] Hence, the bank has incentives to use equity optimally.
The interest in measuring and analysing a bank's health started in the 1980s.[39] The performance indicator 'Return on Capital', which was used for measuring bank effectiveness, was gradually replaced by the indictor 'Return on Solvency' after the introduction of the Basel I Accord. Due to lack of risk sensitivity in the calculation of solvency, the use of the performance indicator 'Return on Solvency' conflicted with the risk/return theory, which also played a major role in performance measurement. Both the banks and regulators have recognised the perverse incentives resulting from the 'Return on Solvency'-measure and the need to fine-tune both solvency regulation and performance measurement. Economic Capital and the performance measure Return on Economic Capital or RAROC have gradually replaced 'Return on Solvency' as of the late 1990s.

6.5.1 The Concept of Economic Capital

Every company needs equity to provide funding for the assets of the business. For banks, there are three reasons to hold equity:[v] provide funding for assets, absorb financial risks, to avoid systemic crisis. Providing funding for the assets of the business is only of minor importance for banks. The primary purpose of equity in a financial institution is to absorb financial risk, like credit losses.[40] This is not just incidental to a bank's business, it forms an integral part of the business itself. It

[v] *In banking the term 'equity' is broader than in non-financial institutions. The banking regulator recognises three types of capital that can be used as a buffer for unexpected losses: tier 1, tier 2, and tier 3 capital. Only tier 1 capital can be called equity capital. Tier 2 capital contains revaluation reserves and subordinated loans with an original maturity of at least 5 years. The subordinated loans with an original maturity of 2-5 years are called 'tier 3' capital. The sum of tier 1, 2 and 3 is often referred to as 'capital'*

follows that equity itself is an integral part of the business. A third reason for banks to hold equity stems from its societal function. The acceptance of bank notes as a currency is highly dependent on the stability of the financial system, in which banks play a crucial role. Therefore, banks are subject to a regulatory regime, requiring them to hold equity as a cushion against unexpected future losses.

Equity is the bank's most valuable asset and it is very costly to hold more equity than needed. As a result, it should not be surprising that managing equity and allocate it as to benefit most from it, is a major concern for banks.

Perspectives on Capital

In managing a bank's capital, different perspectives on capital must be recognised, which may be difficult to align with each other:[41]

1. The treasurer's view: What capital is available? What instruments exist to raise capital? How can we manage the available base to meet requirements? How should we invest the funds raised?
2. The regulator's view: Does the bank have enough equity to protect the depositors and other creditors against loss?
3. The risk manager's view: What does the risk profile of the bank's positions say about the potential size of loss? What is the probability of that loss? Is performance measured on a risk-adjusted basis? Are compensation incentives aligned with both the risks and the returns?
4. The shareholder's view: What returns are being earned on the funds invested? Is the riskiness of the activities undertaken properly compensated in the form of the returns generated for shareholders?

The treasurer is concerned with 'physical capital'[42], the regulator with 'regulatory capital', the risk manager with 'risk capital' and the shareholder with 'economic capital'. The first two stakeholders focus on 'how much equity *is* available' within the bank, the latter focus on 'what level of equity *should* at least be available'.

Matten defines economic capital as:[43]

> *The amount of a shareholder's investment which is either at risk in a business or has already been utilised to purchase future earnings.*

He adds to this that the only difference between economic capital and risk capital, at least at an enterprise-wide level, is the inclusion of goodwill in the former, which is assumed to be deducted from total equity. And thus, he states:

> *Risk Capital + Goodwill = Economic Capital*

Another definitions for economic capital are 'the capital required to cushion against unexpected losses up to some level of insolvency risk dependent on internal standards'[44] and 'the minimum amount of capital needed to guarantee the continuity of an organisation, based on assessments of the risks the institution is exposed to'.[45] For the purpose of this research, we will use this last-mentioned definition, as it is concrete and it recognises that the concept of Economic Capital can also be applied to non-listed organisations without shareholders.
The questions asked from the risk manager's perspective already reveal the quantitative focus: the probability of loss refers to the statistical way of thinking. The assumed risk/return relationship is also derived from statistics. As economic capital elaborates on risk capital, the concept is 'hijacked by statistics as well'.[46] The Objectivist School of Thought clearly gave interpretation to the concept of Economic Capital translating all building blocks into statistics.

In the ideal situation, economic capital should equal regulatory capital. If economic capital is lower than regulatory capital, the bank is forced to hold too much equity, compared to its risks. If economic capital is higher than regulatory capital, the bank may choose to hold too little equity, compared to its risks, thereby putting the stability of the financial system at risk.

Essence of the Concept of Economic Capital

Creating (shareholder) value is only possible when taking risks. The Economic Capital concept is based on the assumption that risk has an upside and a downside potential.[47] To be able to profit from risk taking, a bank should be able to absorb (high) losses from time to time. If these losses would never occur, banking regulation would be less demanding.
The idea behind economic capital is that the continuity of the bank can only be ensured if the bank is able to cover very large losses incidental losses. However, it is also in the interest of shareholders if capital is invested in the most profitable way. As the return on investment for commercial activities is expected to outweigh the benefits of lower funding costs, value can be created by keeping the equity reserve as low as possible. Economic capital tries to find the perfect balance to assure an optimal return on investment for shareholders, given a predetermined tolerance level for risk.

Calculating Economic Capital

Economic capital is the equity required, to guarantee continuity and should thus be sufficient to cover the risk of potential losses up to a certain extent. As holding equity to cover all potential losses is far too expensive, a threshold called 'confidence interval' is introduced. The bank only holds equity for losses that have a higher likelihood than the bank's threshold. Often, some correlation can be

observed between the threshold a bank defines and the rating it strives for. A bank with an AAA-rating will hold a relatively larger equity cushion than a bank with an A-rating. The risks beyond the defined confidence level are labelled 'catastrophic loss' (see Figure 6.6). It is too costly for the bank to hold equity for those losses.

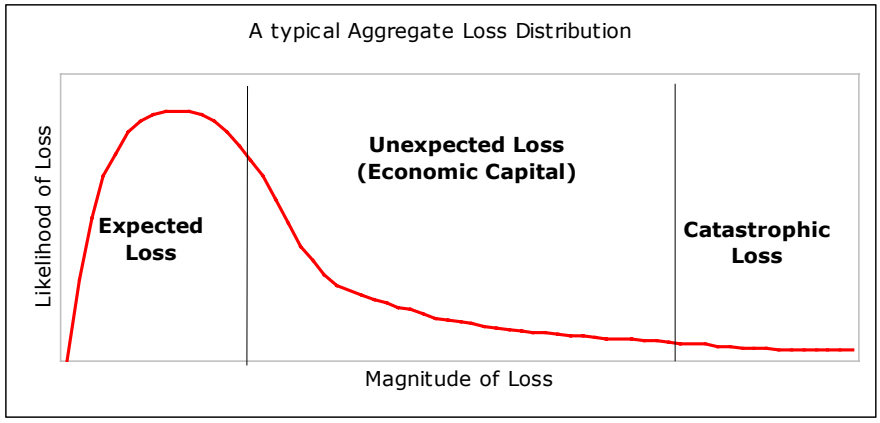


Figure 6.6: Expected, Unexpected and Catastrophic Loss

The distinction between expected loss and unexpected loss is frequently used. Expected loss equals the long-term average loss. An institution can foresee this loss based on past experiences (statistically determined). As a result, these losses can somehow be incorporated in the pricing. When losses are higher than average, an institution will need equity to cover them. This part of the losses is called 'unexpected loss'.

It goes beyond the purpose of this thesis to discuss how 'Economic Capital' can be calculated and allocated to business units. Those interested in this subject are referred to existing literature on this subject.[48] It is important to note the dominance of statistics in the concept of Economic Capital. The use of terms 'expected' and 'unexpected loss' already indicates this.

6.5.2 The Performance Measure RAROC

Before the concept of Economic Capital was introduced, banks already used performance measures related to risk-adjusted capital. The indicators 'Return on Capital' and 'Return on Solvency' were most widely used. Bos argues that those indicators create perverse incentives, as 'solvency' does not adequately reflect risk.[49] The concept of Economic Capital is an answer to this problem, as economic capital should be an adequate reflection of 'risk capital'. When economic capital is used as the basis for performance measurement, the RAROC figure becomes

relevant.[50] The acronym RAROC stands for Risk Adjusted Return on Capital. It measures the earnings (i.e. income) net of expected losses, divided by *Economic Capital*.

$$\text{RAROC} = \frac{\text{Earnings - / - Costs - / - Expected Losses}}{\text{Economic Capital}}$$

As capital is a scarce resource, the cost of economic capital needs to be included in the performance measures of all business units. It can be argued that RAROC analysis is the glue that binds a firm's risk control and business activities together.[51]

In applying RAROC, banks compare the return on equity to a minimum threshold, called 'hurdle rate'. If the RAROC is below the hurdle rate, the business unit destroys economic value or, for listed companies, shareholder value.[52] Therefore, the RAROC approach consists of calculating the Risk-Adjusted Return on economic capital and comparing this ratio to the fixed 'hurdle rate'.

Although the RAROC performance measure has become extremely popular in a short time, the concept has some major weaknesses:

- ✓ Inability to account for value that is not reflected in financial figures. The RAROC measure purely focuses on financial information. The qualitative aspects that indirectly influence earnings and/or expected loss are neglected.
- ✓ The market risk component can change quite rapidly. A trade that uses little capital today may require significantly more capital in the future due to the changing volatility of financial markets, but also, a position that is not profitable today can be extremely profitable tomorrow.

In fact, the RAROC measure is a purely financial performance measure. Financial performance measures provide feedback afterwards, which makes it a lagging variable. Given the growing attention for non-financial performance measures, it is to be expected that the opinions on RAROC are not entirely positive.

As products, structures and risk types evolve, there is a fear that RAROC will become even less watertight. Despite these concerns, Bennett concludes, it has become clear that business lines must neither reject RAROC figures out of hand nor use them uncritically.[53]

Finally, we note that risk may result in direct and indirect losses, but also in opportunity losses and damage to reputation. Especially damage to reputation is relatively often a side effect of operational risk. Economic capital and RAROC

only take into account the financial losses, which results in an incomplete overview of the effects of risk.

6.5.3 Important Assumptions Underlying Economic Capital and RAROC

The concept of Economic Capital and its performance measure RAROC are built upon a number of assumptions regarding risk and return that are listed below:

- ✓ *Risk explains all Profit and Loss fluctuations*;
  The determination of the equity buffer is fully based on estimates of risk. Equity is required to absorb fluctuations in the Profit and Loss, which illustrates that this implicit assumption is made.
- ✓ *Risk and return are positively related*;
  The allocation of economic capital to activities enables the comparison of investments with different risk profiles. It is assumed that investments with a low risk profile will have a low return and investments with a high risk profile have a high return. By dividing the profit of both investments by the economic capital usage, the profitability of both investments can be compared. The relation between risk and return is supposed to be a causal relationship.
- ✓ *All risks can be quantified, making use of objective statistical models*;
  Economic Capital must be one figure, incorporating all risks. This requires that all risks can be aggregated in a meaningful way. As market and credit risk are measured using statistical models, all risks should be measured using these methods. The quantitative aspect of economic capital indicates striving for objectivity.
- ✓ *There is a causal relationship between the risk-position and the possibility of losses occurring*;
  The risk profile and potential losses are assumed to change together with a change in risk position. As a result, reducing the risk position automatically decreases both expected losses and economic capital.
- ✓ *Risks are either completely independent or the relationship between risks can be calculated*
  One of the core elements of economic capital is the recognition of diversification benefits. This requires measuring the correlation between risk categories.

Given these assumptions, it can be concluded that the concepts of Economic Capital and RAROC are developed with 'objectivity' in mind. This emphasises that the banking industry has adopted the *objectivists* School of Thought, described in

Section 3.1.2 (page 48), when risk measurement is regarded. Also, the concepts elaborate on existing market risk practice.
What also attract attention are the similarities between these underlying assumptions and the basic thoughts from the Machine Age (cf. Section 3.1, page 45). Causal relationship are the only possible type of relationship, the concept is based on decomposition of risk into risk categories and aggregation of the outcomes of the analysis of these risk categories, and the concept abstracts from environmental influences. As argued before, concepts build on the Machine Age principle result in knowledge, instead of understanding. They are useful as backward-looking instruments, but have little value in forecasting future developments.

6.5.4 Place Within the Concept of Management Control

Section 6.3.2 already explained that although one of the four aspects in Simons' management control concept actually mentions the word 'risk', risk management cannot fully be placed within this lever:

- ✓ Not all risks can be related to processes and therefore risk cannot be managed on a process level (boundary systems and diagnostic control systems);
- ✓ Given the nature and characteristics of business risk and strategic risk, they should be placed under the strategic aspects of the management control systems (interactive control systems) in the first place;
- ✓ Risk awareness of employees (belief systems) is a prerequisite for proper risk management.

It can thus be argued that integrated risk *management* requires action in all four levers of Simons' concept. However, if we restrict ourselves to risk *measurement*, the control aspect dominates.

The performance measure 'RAROC' and the concept 'Economic Capital' combine the levers of diagnostic control systems and boundary systems. The allocation of economic capital is a new method of setting boundaries on the risk taking activities of the bank's business units. The performance measure RAROC will be integrated in the diagnostic control system and provides input on how to allocate the economic capital.
The line between 'risk control' and 'strategic management' is not problematic in relation to economic capital and RAROC. The risk control function can advise management from a control point of view what would be the best project to invest in. However, in practice, the business line with the highest RAROC might not always have the highest level of capital allocated. The allocation of capital is a

combined decision based on control information and strategic considerations. It can be a strategic decision to invest in businesses with a lower RAROC, because that business fits to the banks risk appetite, or because the strategic importance of these businesses is high to the bank). These two types of information can be drafted independently from each other, and therefore can come from different support functions.

6.6 Operational Risk Within the Concept of Management Control

Section 6.1 already placed operational risk within the risk area 'Management Control'. Within Management Control, operational risk belongs to the Technical-Organisational domain, because of its internal focus and dependency on the quality of the control environment instead of positions in the market. As economic capital should cover all risks, banks try to incorporate operational risk in their economic capital concept. This section explains the relative importance of operational risk within the concept of Management Control and its impact on the implementation and application of economic capital and the performance measure RAROC.

6.6.1 Relative Importance Operational Risk

Operational risk seems to become one of the major risk categories in banks. The relative weight of operational risk is likely to increase over time, as products will become more sophisticated; business volume will increase; new technology will be introduced; and mergers/acquisitions will continue.[54] As a result, banks assign an important role to operational risk within the economic capital concept.

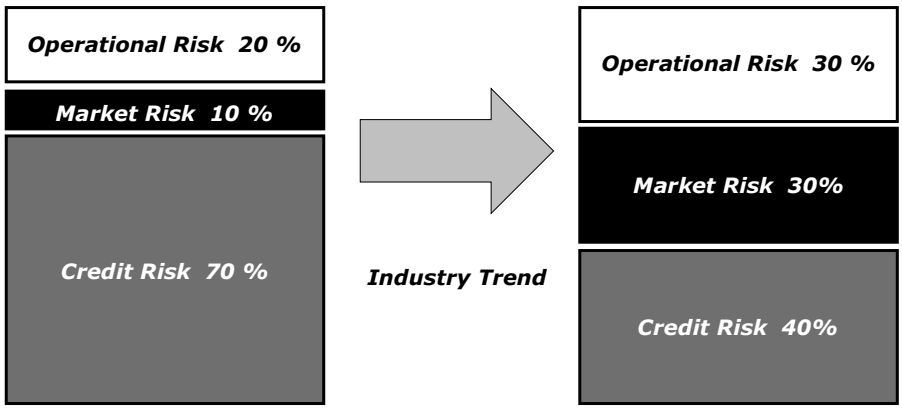


Figure 6.7: Current and Future Capital Allocation[55]

The growth of the Market Risk capital number can easily be understood, as the implementation of fair value accounting will affect the relative importance of market risk. Also, banks are innovative in developing new (derivative) products that fall within the domain of market risk. The relative growth of operational risk can be explained as the globalisation of banking and the use of information technology continuously increases. Besides, clients have become mature, resulting in more claims if banks have acted dishonest in their view.
If the convergence, described in Section 1.3.4 (page 14), continues, banks will increasingly become intermediaries, not taking financial risks on the balance sheet anymore, but pushing them on to the market. The relative importance of credit and market risk can then in theory fall down to zero, leaving just operational risk management and customer care as competitive strengths.

6.6.2 Impact on Economic Capital and RAROC Implementation

As operational risk should be placed within the concept of Management Control, incorporation in the concept of Economic Capital and the performance measure RAROC could be beneficial. However, one of the underlying assumptions of the concept of Economic Capital is that all risks incorporated can be measured in an objective way. Economic capital therefore clearly aims for science, not art.
For successful implementation of economic capital and RAROC, the state of the art of operational risk measurement is problematic. For concepts such as RAROC, methodologies tend to become useful only if they become more scientific.[56] A sound measurement method for all risks included in the model is essential for building trust and for providing reasonable information for management to base decisions on. As a result, the development of the concepts of Economic Capital and RAROC has pushed banks to invest in operational risk measurement in a specific way.

Technical Problems

A measure for operational risk is only valuable in relation to economic capital and RAROC if it is represented in terms that are comparable with market and credit risk.[57] Although this prerequisite is reasonable, it causes major problems in the area of operational risk. Due to its characteristics, operational risk is more a management issue than a quantification issue.[58]

Some of the conceptual problems are:

- ✓ One can gather operational risk loss data, but to be able to use this data to predict future loss potential, a relation with an 'exposure' should exist. For credit and market risk, the exposures are clear. A bank knows how much

money has been borrowed to a certain customer. If the bank makes use of an adequate internal rating methodology, it can also calculate the probability of default of this client. The bank can use historical loss data to calculate how often clients with certain credit ratings default. Exposure, probability of default and loss given default can be calculated.

- ✓ The bank can influence both 'probability of event' and 'loss given event' of operational risks directly. Historical losses are of little value if the bank adjusts the control environment after an incident occurred to prevent such incidents from occurring again. For example, if a bank faces a major fraud due to lack of segregation of duties on the trading floor, it may implement proper segregation of duties on all trading floors. In this respect we recall the statement made earlier in Chapter Four: if the measurement approach for credit and/or market risk were applied to operational risk, both elements would be based on historical data. Similar formulas for credit and market risk contain a present and a historical element (Section 4.3.4, page 94)
- ✓ Operational risk loss data can only be relevant for a relatively short period of time (i.e. 2-3 years). This complicates statistical analysis, especially for low frequency/high severity risks.
- ✓ Operational risk is a trash of all kinds of problems. To be able to use a methodology similar to credit or market risk, a model should be build for every type of problem. Within each category, the bank should have enough 'critical mass' to be able to use any type of statistics. Only within a large homogenous group of data, statistics can reliably be applied. Consequently, operational risk measurement would require massive amounts of data.

In the absence of proper operational risk measurement methodology and reliable data sets, banks start with simple top-down measures. The major disadvantage of these rough measures is their inability to provide incentives to the business to actually mitigate operational risk, which is preferable from a management control/ risk control perspective. When the relative importance of operational risk grows, the pressure to come up with an adequate measurement method will increase. Banks are aware that if they cannot adjust the concept of Economic Capital to incorporate what Bruggink called the 'Technical-Organisational Domain', the concept of RAROC as steering mechanism will fail.

Conceptual Problems

Apart from these technical problems, there are major conceptual problems with incorporating operational risk in the economic capital-model. Holding capital for a risk in practice means restricting commercial activities. Given the amount of capital, one can only process a limited number of transactions with external

parties. A unit should be stimulated to invest capital in a profitable way. RAROC is introduced as a measure for this. Although operational risk is inherent in all transactions processed, it is neither directly nor completely related to commercial activities and generates no direct revenues. Operational risk will thus be confronted with negative RAROC figures, indicating that it only destroys value of the organisation.

Another conceptual problem lies again in the underlying assumptions of Economic Capital and RAROC. It is often argued that operational risk creates revenues, as investment in operational risk controls reduces the operational risk losses. This statement is based on the following assumptions:

- ✓ The implementation of controls directly affects operational risk losses and therefore directly results in a decrease of operational risk capital;
- ✓ There is a causal relationship between operational risk controls and operational risk losses.

This first assumption is incorrect, as argued in Section 4.3.4 (page 94). The operational risk formula contains no elements that can be influenced on the short term. Both frequency and severity of events are based on historical loss data. Hence, these elements can only change gradually.

Regarding the second assumption, we refer to Ackoff, who stated: 'Perhaps the most common single cause of failure in problem solving derives from incorrectly assuming a causal relationship between variables that have only been demonstrated to be associated. Variables that tend to change together, in the same or opposite directions, are associated.'[59] This applies to operational risk, as operational risk controls and operational risk losses are associated variables, but there is no guarantee that losses go down if controls are implemented. A bank may be 'lucky' and face little losses although a crucial control is not in place.

The absence of a causal relation between operational risk losses and operational risk controls can de-motivate managers to invest in operational risk management. He has to accept certain costs and is unsure whether any benefits will follow.

Based on these technical and conceptual problems, we cannot justify managing operational risk via means of economic capital in the same way as credit or market risks are managed.

6.7 Conclusions

In the first section, we already concluded on the first research question discussed in this Chapter: operational risk can best be dealt with within the risk

management area 'Management Control'. The most important reason for this is the specific nature of operational risk. The remainder of this Chapter discussed the concept of Management Control and its application to operational risk to answer the research question 'how can the concept of Operational Risk be incorporated in this risk management area?'

In Section 6.1, we concluded that in current banking practice many functions play a role in the risk management process: executive management, line management, management control, risk control, and internal audit. As the management control and risk control roles both have extended their scope, similarities and overlap has increased. The development of economic capital models has strengthened the similarities between the management control and the risk control role in such a way that integration of both has become even more beneficial. However, in practice we observe a trend towards separating the risk control and management control functions. Although arguments may exists, we are of the opinion that this is inefficient and that it would mean ignoring all improvements made in both areas and moving back to the 1980s.
The banking industry should be careful to maintain the balance between control and commerce. The analysis of Shirreff on the expanding role of risk controllers can be applied to management controllers at financial institutions as well: 'First he sat in the back seat, then he had his foot on the brake, now he's got one hand on the steering wheel! ... Next he'll be right there in the driving seat'.[60] The diagnostic control system can be linked to 'the back seat', the foot on the brake is the extension with 'boundary systems', and one hand on the steering wheel is the move towards providing input in the interactive control system. It is neither realistic nor desirable that the controller or risk controller will reach the driving seat at any time.

The application of current management control concepts to operational risk is not straightforward. The economic capital concept is developed within the Banking-Financial Domain resulting in market and position oriented performance measures. However, only part of the banking risks can be placed within this domain.
Our analysis on the incorporation of the concept of Operational Risk within Economic Capital and RAROC points out that it is an ambitious goal to force risks from the Technical-Organisation Domain into these concepts as they are neither directly nor completely related to commercial activities. The formulas do not fit and the requirements regarding performance measures are different. Both technical and conceptual problems have been identified. It is to be expected that

other risks that fall beyond the scope of the Banking-Financial Domain, such as business and strategic risk, will face similar conceptual and technical difficulties. Another problem pointed out is the dependency of the value of the performance measure RAROC on the quality of risk measurement. What appears from the developments in the area of operational risk is that integrated risk measurement is an ambitious goal. As a result, measurement methods become more complicated and the number of underlying assumptions increases. This affects the ability to judge the applicability of the performance-measure and interpret the outcome accordingly. Referring back to Knight (1921), we emphasise that *It is this 'true' uncertainty, and not risk, as has been argued, which forms the basis of a valid theory of profit.*

Notes – Chapter Six

[1] Credit risk also developed from a profession of 'art' to a profession of 'science'. Drzik describes a seven-step movement of credit risk management 'from a highly decentralised, paper-based, and judgmental-intensive function to a highly centralised function relying on sophisticated analytical techniques, advanced information technology, and expert judgement that is highly specialised and narrowly focused'. [Drzik (1998) the Seven Stages of Risk Management, *the Journal of Lending & Credit Risk Management*]

[2] Fishkin, C.A., 'Are You the Risk Manager of Tomorrow?', *The RMA Journal*, Febuary 2001: 'A growing number of institutions have found the need to create a new position of Chief Risk Officer (CRO), who has broad responsibility for risk oversight. ... As the role develops and expands, the CRO will likely become one of the most senior members of the firm.' (page 23)

[3] Horn, H.A.L.M. van, *Interne Accountant: Kaper op de kust voor de controller*, Controllers Magazine, August/September 2002, page 20-23. This article has been written as a reaction on the article in De Accountant, Interne Accountant of Controller: wie overleeft?, June 2002

[4] Derived from Driessen, Geeve and Molenkamp, who compare the roles of the (operational) auditor and the (management) controller in more detail in *Operational Auditing, Controller en Auditor: een (on)mogelijke combinatie?*, 1996.

[5] Pezier, Dr. J., *Risk Management – An Integral Part of Good Management*, ISMA Centre Discussion Papers in Finance 2002-21, pages 1 and 23.

[6] The conclusion was drafted by several institutes: British Bankers' Association in its Operational Risk Survey of 1997, Basel Committee on Banking Supervision in its first paper on operational risk, 1998, and the Questionnaire on Operational Risk De Nederlandsche Bank distributed in 1997, was only addressed to auditors.

[7] Pezier, page 23

[8] Emmanuel, Otley and Merchant, *Accounting for Management Control*, Chapman & Hall, London, Second Edition, 1990, page 7.

[9] Kramer, N.J.T.A., J. de Smit, *Systeemdenken*, Stenfert Kroese, vijfde herziene druk, 1996, page 86.

[10] Lorange and Scott Morton as cited in Bruggink, A., *Performance Control in Banking*, 1989, page 17.

[11] Bruggink, A., page 17 'in the last thirty, forty years many definitions of control systems have been suggested. A reflection of these definitions is the definition, proposed by Lorange and Scott Morton.'

[12] Otley, D.T., A.J. Berry, 'Control, organisation and accounting', *Accounting, Organisations and Society*, 1980, nr. 5, pages 231-246.

[13] However, Merchant states that strategies are useful but not necessary in designing a management control system. When strategies are formulated more clearly, more control alternatives become feasible, and it becomes easier to implement each form of management control effectively. Managers can, however, design and operate some types of controls without having any clear strategies in mind. [Merchant, *Modern Management Control Systems: text and cases*, Prentice Hall International, 1998, page 5]

It should also be noted that in practice, it would appear that also without explicitly formulated goals control measures would be implemented. In many cases, implicit assumptions would be made about goals and strategy.

[14] Simons, R., *Performance Measurement and Control Systems for Implementing Strategy*, Prentice Hall, 2000, page 62.

[15] Van Triest, S.P., *Methodologie*, Bedrijfskunde, 1999 – No. 1, page 66.

[16] Anthony, *Planning and Control Systems*, Graduate School of Business Administration, Harvard University, Boston, 1965, page 17.

[17] Anthony, Govindarajan, *The Management Control Function*, McGraw-Hill, 9th edition, 1998,page 10.

[18] Except for the definition of Simons, these definitions are derived from an article of E.G.J. Vosselman (*Management Accounting en Management Control: theoretische perspectieven*) and the book of Emmanuel, Otley and Merchant (*Accounting for Management Control*).

[19] Simons, *Levers of Control*, page 5.

[20] Bonnet, 'Leren beheersen', *Tijdschrift Financieel Management*, mei/juni 2001, page 75.

[21] Anthony, *Planning and Control Systems*

[22] Merchant, *Modern Management Control Systems: Text and Cases*, chapters 2, 3 and 4.

[23] Simons, *Levers of Control*, page 173.

[24] Simons, *Performance Measurement and Control Systems for Implementing Strategy*, p. 14 as cited in Corbey, M. 'Prestatiebeloning vanuit management control perspectief', *MAB*, maart 2002.

[25] Bos J.J., Bruggink, A., *Management control bij banken*, page 16.

[26] Simons, *Performance Measurement and Control Systems for Implementing Strategy*, page 187.

[27] Kaplan and Norton, *Linking the Balanced Scorecard to Strategy*, Harvard Business School Press, 1996, page 62.

[28] Anthony, Govindarajan, *Management Control Systems*, 'Management Accounting has three subdivisions: full cost accounting, differential accounting, and management control (also called responsibility accounting)', page 14.

[29] See for example Puxty, A.G., 'The problems of a paradigm: a critique of the prevailing orthodoxy in management control', in *Critical perspectives in Management Control*, 1985.

[30] Wouters founded these observations with case study material and theory in his oration at the University of Twente 'Bedrijfseconomische informatievoorziening: leuker kunnen we het niet maken, wel begrijpelijker', 2002.

[31] Kaplan, Johnson, *Relevance Lost: Rise and Fall of Management Accounting*, Harvard Business School Press, page 261.

[32] Bonnet, 'Leren beheersen', *TFM*, mei/juni 2001, page 71.

[33] Vosselman, E.G.J., 'Management accounting en management control: theoretische perspectieven', *MAB*, juli/augustus 1996.

[34] Leeuwen O. van, P. Wallage, 'Moderne controle-benaderingen steunen op interne beheersing', *MAB*, maart 2002.

[35] De Méris and Feijen present the differences in risk management between financial and non-financial institutions in their article 'integraal risicomanagement in ontwikkeling', *TFM*, January/February 1999, page 21.

[36] Bruggink, page 82.

[37] Bos J.J., Bruggink, A., *Management control bij banken*, page 9.

[38] For example the Capital Asset Pricing Model and the Pecking Theory are based on this assumption.

[39] Bruggink mentions this as one of the important developments that form the background of his thesis on performance control in banking, page 5.

[40] Banken zijn handelshuizen in risico: ze willen zoveel mogelijk verdienen en tegelijk zo min mogelijk risico lopen (*Elsevier*, 9 February, 2002).

[41] Matten, C., *Managing Bank Capital*, Second Edition, John Wiley & Sons, 2000, page 30-34.

[42] *Physical capital*: all capital instruments issued by the bank, regardless of how and whether they qualify for inclusion in capital by regulatory standards.

Regulatory capital: all qualifying capital instruments issued by the bank, according to official rules and guidelines as to what constitutes qualifying capital.

Risk capital: the amount needed to cover the potential diminution in the value of assets and other exposures over a given time period, at a given statistical confidence interval.

[43] Matten, *Managing Bank Capital* (2nd edition), page 34.

[44] Marchall, page 496.

[45] Van den Tillaart, *Economisch vermogen, kans en bedreiging voor de Rabobank organisatie*, Rabobank Nederland & Universiteit Twente, mei 1999, page 4.

[46] Bos, Chapter 5, page 167: warning that market risk relies too heavily on statistics

[47] It should be noted that this is only valid for financial risks. As explained in Chapter Three, non-financial risks only have a downside potential.

[48] The following books are recommended: Matten, *Managing Bank Capital*; Marchall, *Measuring and Managing Operational Risk in Financial Institutions*, Chapter 16; Crouhy, Galai, Mark, *Risk Management*; and Bessis, *Risk Management in Banking*. In Dutch, the Ph.D. thesis of Bos, *Prestatiebeoordeling in banken* and the Masters thesis of Van den Tillaart, *Economisch Vermogen, kans en bedreiging voor de Rabobank organisatie* are recommended.

[49] Bos, Chapter 4, page 148.

[50] RAROC (Risk Adjusted Return on Capital) is one of the RAPMs (Risk Adjusted Performance Measures). Others are RORAC (Return on Risk Adjusted Capital) and RARORAC (Risk Adjusted Return on Risk Adjusted Capital). In banking practice, the term RAROC is must frequently used.

[51] Crouhy, Galai, Mark, *Risk Management*, McGraw-Hill, 2001, page 529.

[52] Crouhy, Galai, Mark, p *Risk Management,* page 561.

[53] Bennett, O., Reinventing RAROC, *Risk*, September 2001, page 113.

[54] Crouhy, Dalai, Mark, *Risk Management,* page 508.

[55] Crouhy, Dalai, Mark in Arthur Andersen, *Operational Risk and Financial Institutions*, Risk Books, 1998, page 59.

[56] Crouhy, Dalai, Mark, *Risk Management,* page 531.

[57] Hoffman, D.G. in Arthur Andersen, *Operational Risk and Financial Institutions*, page 34.

[58] Ong, M.K. in Arthur Andersen, *Operational risk and Financial Institutions*, page 82.

[59] Ackoff, *The Art of Problem Solving*, John Wiley & Sons, 1978, page 101

[60] Shirreff, D., 'the rise and rise of the risk manager', *Euromoney*, February 1998, page 56.

Chapter 7 Conclusions and Recommendations

Chapter One introduced three terms relevant for this research: Risk Management, Capital, and Banking Regulation. These terms are related and affect the concepts and practices in controlling Operational Risk. The Chapters Three to Six elaborated on the material needed to answer the research question *'how do banks develop measurement concepts for the relatively new subject of 'operational risk' and how should these concepts be implemented into risk management practice'*. In this last chapter, we recall the sub questions formulated to answer this overall research question and draw conclusion on each of them. Also, the conclusions are translated to capital and banking regulation. The chapter ends with some practical and theoretical recommendations.

7.1 Conclusions

7.1.1 Evolution of Risk Measurement Concepts

The research started with the questions: *'what is risk measurement'* and *'how can we expect risk measurement concepts to evolve'*. We concluded that both 'risk' and 'measurement' can be interpreted and defined in different ways. There are closed and open views of measurement and two Schools of Thought on 'risk analysis'. The Objectivists School of Thoughts identifies objective and perceived risks. The objective risks are measurable in terms of probability and utility. The Constructivists School of Thought regards risk as a social construct, without an objective definition. Risk analysis should therefore involve qualitative factors that are difficult to measure.

To be able to 'measure' the 'risk', one should be able to decide on quantity, scale and arithmetic.

- ✓ Quantity: *the basis of risk measurement is not a physical object that has quantities in nature, but a structure of qualitative relationships. As a result, determining the quantity of risk is a difficult task;*

- ✓ Scale: *the scale applied to risk measurement is derived from mathematics. The aim is to measure risk as precise as possible. The quantity should be chosen so as to enable application of a linear scale;*
- ✓ Arithmetic: *the rule to add numbers to the qualitative relationships is derived from statistics.*

Therefore, we conclude that the profession of 'risk measurement' aims at transforming unmeasurable uncertainties (structure of qualitative relationships) to measurable uncertainties by developing a linear scale of measurement and a rule to add numbers to qualitative structures. The fact that reference needs to be made to 'qualitative' structures, already implies that measurement will have its limitations. In practice, it appears that fundamental discussions on 'what is measurement' and 'how can it be applied to risk' are rare. Also, definitions of risk refer to 'losses due to', but only the unexpected losses that are unforeseen are to be feared. We would prefer risk to be defined in the way Knight defines 'uncertainty' and we agree with him that this 'true' uncertainty should form the basis for the risk management profession, capital management and capital regulation. We note that the terms 'expected' and 'unexpected' already reveal that the concept of risk applied in banking is derived from statistics.

In studying the developments in risk measurement during the last century, we found that the development of risk measurement methods starts with purely mathematical measurement methods. As the concept of risk is more complex than might have been expected initially, measurement methods are adjusted to more balanced methods, taking into account human behaviour. Human behaviour is much harder to capture into a measurement method and often experience is needed to identify major dependencies. The development of measurement methods never starts out of the blue. An external demand from either the market or the regulator pushed quantification and/or product development. Also, attention for quantification is highly dependent on the existence of clear business benefits.

We observed that measurement methods could always be discussed, as there are no perfect methods to measure risk. As trust is dependent on education and experience, one can expect acceleration in risk modelling as soon as the first piece of trust is established. The banking industry is a good example of how such accelerations occur. The innovations in risk modelling and the amount of effort and time invested in this subject increased substantially last decade. Market risk models were under development when credit risk modelling first received serious attention. The development and implementation of credit risk models was not even half way when operational risk measurement initiatives started, and while

operational risk measurement is still in its infancy, banks already start thinking about measuring business and strategic risk.

The two cases described in Chapter Three, underline the conclusions drawn. The development of measurement methods follows the four steps identified, and the existence of the two Schools of Thoughts on risk analysis was illustrated. In both instances, we observed developments in the market leading to the first attempts to measure the risk. For market risk, these developments were incidents like 'Black Monday' and the attention the regulator paid to the risk category. For insurance, the external demand came from the community itself. People did not want to be exposed to certain risks that could damage their property. The first attempts to measure the risks involved were purely based on statistics and excluded forward-looking elements. Over time this has changed for both insurance and market risk. For market risk the tendency towards valuing the outcomes of stress tests more than the Value-at-Risk figure still continues.
Representatives of the objectivists School of Thought are responsible for the initial attempts to measure risk in a scientific way. Constructivists push back as flaws in all models can and will be detected. As a result, the expert opinion (art) will always regain its role in the risk measurement and management process. All experiences point out that the mathematical basis, measurement starts with, does not completely fit to the concept of risk and must always be complemented with 'expert judgement'. However, the banking industry continues choosing the same basis to start from.

7.1.2 Evolution of the Concept of Operational Risk

The next question was *'how has the concept of Operational Risk evolved since 1999'*. Based on the observations grouped in Chapter Four, it can be concluded that the willingness to start developing a measurement concept hardly existed before 1999. However, the discussion with regulators on designing a new capital adequacy framework for operational risk has pushed banks to at least discuss the subject. These discussions showed huge differences in viewpoints and methodologies proposed, ranging from purely quantitative to purely qualitative. The discussion on Operational Risk Measurement had not been isolated from the discussion on credit and market risk that preceded the discussion. Operational risk practitioners regularly referred to their experiences in the area of market and/or credit risk. However, one could also observe emphatic distance between operational risk and the other risk areas due to differences in the nature of the risk concepts. Operational risk is more bank-specific and can be influenced to a large extent.

To compare these observations to the expectations based on past experiences, we grouped banks in four industry groups based on their opinion on two essential dilemmas that the banking industry faced:

1. Should operational risk be part of Pillar One or Pillar Two; and
2. What type of measurement methodology would suit best to the concept: quantitative or qualitative.

	In Favour of Pillar One Charge	***Against Pillar One Charge***
Quantitative measurement techniques (loss data approaches)	Group A	Group B
Qualitative measurement technique (scorecard approach)	Group C	Group D

Table 7.1: A Typology of Industry Groups

Although Industry Group C might have given the impression that the industry was in various stages of the conceptual framework, this was not true. All the banks that implemented a measurement method in 2002 used loss distributions. The data that provided input to these distributions varied from estimates of operational risk loss potential to actual loss data and all banks used external loss data either directly or indirectly. These banks had all taken the first steps in 'step two'. All the other banks, including the regulators, were in 'step one' of the evolutionary concept. Only one group distinguished itself from the others, which was Industry Group D. This group continued debating the basic choices made and rejected measuring operational risk using loss data. This group at least gave the impression of understanding that another basis than mathematics should be chosen for (parts of) operational risk. As long as operational risk is defined as a uniform risk category, both the views of group A and Group D can easily be supported with solid arguments. Parts of operational risk will never be quantified due to data limitations and nature of the risks, but other parts can certainly be quantified when data gathering initiatives evolve and measurement techniques get developed.

With regard to driving factors, it can be concluded that the regulator has played an important role. However, this regulator pushed the industry with reason:

- ✓ It had observed large losses due to the absence or non-functioning of controls;
- ✓ It had observed banks developing economic capital models, taking into account operational risk as a separate risk category;
- ✓ It reacted on wild guesses from the industry in the 1990s that operational risk might even be the most important risk category for banks.

Therefore, the evolution of the concept of Operational Risk until 2002 meets the expectations formulated in the conceptual framework, which partly surprised us. The banking industry apparently prefers applying familiar concepts that only partially meet expectations in practice, rather than developing new concepts that might be more satisfactory.
The first steps in measuring operational risk have been taken. However, it is unclear whether an appropriate endproduct can be developed. The intentions the industry and the Basel Committee have with operational risk do not fit to all aspects of the concept. 90-95% of the losses resulting from operational risk will be expected losses that should not be covered by capital. Also, for larger events, banks have insurance policies in place. Operational Risk Management should aim at mitigation and control instead of measurement and quantification.[1] A qualitative opinion on the quality of operational risk measurement combined with process oriented risk indicators should be sufficient for management purposes. Measurement methods similar to credit and market risk practice are not yet implemented and the number of technical and conceptual problems increases. Hence, operational risk may mark a new era, in which statistics move to the background and behavioural performance measures become the core of risk management. Although the statisticians have pushed themselves forward in the discussion on the concept of Operational Risk, the operational risk characteristics may push them backwards again.

7.1.3 Operational Risk and Risk Management Areas

We have asked the question *'what risk management area would fit best to the concept of Operational Risk'*. It appeared that incorporation in the concept of Management Control would be the best solution for operational risk. An important reason for this is the specific nature of operational risk. Besides, operational risk is not explicitly related to balance sheet items, nor is it directly or entirely related to commercial activities.

The concept of Management Control has evolved from a top-down concept focusing on financials, to a multidisciplinary concept stimulating the 'learning organisation'. Operational risk management will strengthen this development in management control. Our observation is that influencing human behaviour is one of the main drivers behind operational risk management. Operational risk management seems pre-eminently a product of social sciences, not natural sciences. The struggles around developing measurement methods for this risk category already pointed in that direction.

The integration of risk control and management control appears to be stimulated by the development of the concept of Economic Capital and its performance measure RAROC. It has been argued that the primary focus on financial information conflicts with the development of the concept of Management Control. The development of economic capital models has strengthened the similarities between the management control and the risk control function in such a way that integration of both has become more beneficial. Separating risk control and management control would mean ignoring all improvements made in both areas and moving back to the 1980s.

In banking, we observe two alarming trends:

1. Risk control and management control functions gradually become more separated. The risk of specialisation is losing the overview. Risk control is not a mono-discipline that can be isolated from control or other aspects of business administration. Also, the responsibility for operational risk *management* should not be removed from line management;
2. Risk management becomes more and more 'scientific' and complex. Measurement models are the cores of current developments in risk management. To be able to develop these models, many assumptions are needed, and even with these assumptions, it is unclear to what extent models can be trusted and how the outcomes should be interpreted.

These two trends together form a serious threat to the quality of risk management. Specialisation and focusing on mathematical methods may result in concepts that become isolated from practice.[2]

We expect operational risk to adjust these trends to a direction that recognises the art of risk management and reduce the influence of statistics on the risk management process. The range of risk data that can be used for management control purposes is much broader than loss data, which forms the basis of statistical models. As we illustrated in Section 6.5.1, the relative importance of operational risk will grow significantly in the upcoming years.

The application of current management control concepts to operational risk is not straightforward. The economic capital concept is developed within the Banking-Financial Domain resulting in market and position oriented performance measures. However, only part of the banking risks can be placed within this domain.

Our analysis on the incorporation of the concept of Operational Risk within Economic Capital and RAROC points out that it is an ambitious goal, if even possible, to force risks from the Technical-Organisation Domain into these

concepts as they are neither directly nor completely related to commercial activities. The formulas do not fit and the requirements regarding performance measures are different. It is to be expected that other non-financial risks, such as business and strategic risk, will face similar conceptual difficulties. Another problem pointed out is the dependency of the value of the performance measure RAROC on the quality of risk measurement. What appears from the developments in the area of operational risk is that integrated risk measurement is an ambitious goal. As a result, measurement methods become more complicated and the number of underlying assumptions increases. This affects the ability to judge the applicability of the performance-measure and interpret the outcome accordingly.

Important prerequisites for proper operational risk control are a broad interpretation of the word 'data' (i.e. broader than 'loss data') and willingness to develop alternative performance measures.

7.1.4 Impact on Capital and Banking Regulation

Although the effect and the adequacy of capital regulation were no explicit part of the research question, it has been discussed between the lines, so we want to devote some concluding paragraphs to this issue. As the Basel Committee on Banking Supervision admitted, the first Basel Capital Accord was a flawed concept due to its single focus on the balance sheet and its insensitivity to risk. Although research showed that the amount of capital in the industry increased after the implementation of the Accord,[3] no insight could be given in the (increased) level of *risk* within banks. The risks involved in off balance sheet positions are unclear, even to the banking industry itself. It is complicated to gain insight in the effects of regulatory arbitrage as a result of the first Basel Capital Accord.

In proposing the new Capital Adequacy Framework, the Basel Committee elaborates on the first Capital Adequacy Framework. Capital calculations are refined to bring solvency and risk closer together. Banks are allowed to use their own models to calculate their risk exposures. We observed three major weaknesses in the current Basel II proposals:

a) *Operational Risk should have been placed within Pillar Two*

   We doubt whether capital requirements for operational risk would result in better operational risk management. Also, the administrative burden to gather all operational risk loss data is massive. Banks may put effort in decreasing the numbers of high frequency events, which usually have a low impact. This part of the risk can be identified and addressed and is the least important part of operational risk. For the infrequent events that might show

more substantial loss numbers, identification and quantification is complex, if even possible.

b) *Recognition of Internal Models conflicts with Conditions for Effective Control*
Although banks welcome the incorporation of internally developed models, a group of scientists called 'the shadow Basel committee' warns of serious problems:[4] 'Regulators will be confronted with complex internal risk management systems, which will be difficult to assess properly. As banks have a huge interest in underestimating their risk exposures (i.e. lower capital requirements), the level playing field can be distorted. Conservative banks will face competition with banks that allow themselves to handle requirements less strictly.' In Chapter One, we already pointed out that a reliable model of the entity controlled is the most difficult condition for effective control to meet. The incorporation of internally developed models in capital regulation complicates this even further.

c) *No clear distinction is made between Expected Losses, to be covered by earnings, and Unexpected Losses, to be covered by capital*
Although the Basel Committee recognises that capital should only cover unexpected losses, all definitions it puts forward and the formulas it proposes include both expected and unexpected losses. As a result, banks are forced to hold capital for expected losses that are already covered in the Profit and Loss via pricing or provisions. Banks will therefore continue arbitraging on the rules drafted to compensate for this disadvantage. We refer to Knight (1921) in stating: '*It is this 'true' uncertainty, and not risk, as has been argued, which forms the basis of a valid theory of profit.'*

The Basel II Capital Accord will be a compromise with some major conceptual flaws. Operational risk is to cover the gap credit risk leaves behind, but why should operational risk fill this gap and not, for example, interest rate risk? This choice cannot be founded conceptually. Also, banks get the freedom to develop internal models, complicating the control model between banking regulators and banks. Banks will profit from this development, but the stability of the financial system may be distorted.

7.2 Recommendations

7.2.1 Recommendations for the Banking Industry

Our most important recommendation to the banking industry is not to measure operational risk, but to manage it. The attempt to develop measurement methods may seem logical and the concepts developed so far may sound reasonable, but there is a major issue that seems to be neglected. All measurement methods are somehow based on the current situation and experiences from the past. In building a measurement method, one tries to understand historic developments in order to build causal relationships.

As argued before, the concept of Operational Risk conceptually does not fit into the economic capital models that banks are currently designing. Besides the technical problems, such as the measurement methods that apply to market and credit risk are unsuitable for operational risk, some conceptual problems have been pointed out. If operational risk is incorporated in economic capital, a business unit can in theory create more space for commercial activities via implementing controls for operational risk or even via increasing operational risk.

Although causal modelling is the ultimate aim for operational risk, the banking industry should admit that, due to the excessive data request on each of the possible causal relationships, causal modelling is utopia. Besides, we doubt whether the underlying assumptions of causal modelling fit operational risk. For successful implementation of economic capital and to make the performance indicator RAROC more valuable on the short term already, we have some suggestions.

1. Incorporate non-financial risks in the hurdle rate. The hurdle rate can be determined in different ways. Operational risk (and other non-financial risks) can be taken out of economic capital and integrated in the hurdle rate. As a result, the RAROC of business units increase and the criteria to add value to the bank increase as well. This solution allows for a completely different methodology for operational risk that can be purely qualitative. For example, it could be investigated whether audit ratings can be used to determine the appropriate hurdle rate.
2. Develop the RAROC concept purely for financial risks. Another option is just to let go of the goal to let RAROC be the overall performance measure that integrates all risks in the bank. If only financial risks are included in the concept, the development and implementation will become much easier and attainable. RAROC will then be a performance measure for the Banking-

Financial Domain only with the purpose of comparing the returns of various investments and for restricting commercial activities. Other domains can then be assigned other performance measures that fit to that domain and provide the right incentives. Economic capital can still be used as the proxy for the required level of equity, but the equity kept for non-financial risks should not be allocated to commercial business lines.

For the concept of Economic Capital to become successful, it is important to pay attention to theory as well as to the interests of various stakeholders. The potential users of economic capital are senior managers on bank level and business unit level, (financial) controllers and risk managers. It should support strategic decision-making and, eventually, it should qualify as internal model for regulatory capital calculations. The requirements of stakeholders as well as the various goals can result in conflicting requests. We doubt whether enough attention is paid to specification of underlying assumptions and the incorporation of 'the art or risk management'. This can be compared with Ackoff's view on problem solving:[5] *'A puzzle is a problem that we usually cannot solve, because we make an incorrect assumption that precludes a solution.'* As long as people develop concepts using experience and methods that have been taught, both creativity and the optimal solution will be blocked.[6]

7.2.2 Recommendations for Further Research

The concept of Operational Risk lends itself to specialised research on possibilities of the different measurement techniques. For example, it would be interesting to find out whether operational risk generally has a limited number of consequences. The risk category itself is very broad, but the underlying causes of risk may be similar. As data availability is growing within the banking industry, the possibilities for mathematical research increase. However, we agree with Lawrence's warning that there is always more detail, but chasing it would be a 'false Grail', a waste of time.[7] Operational risk should be regarded as the first topic in a new period with other objectives regarding risk management. Our main recommendations are:

- ✓ Investigate how a management framework should be designed, taking into account its place within the concept of Management Control and the broad interpretation of data needed to control operational risk.
- ✓ Research the role of the controller in banking. As argued in Chapter Six, risk control is best placed within Management Control. In most banks, this is no common practice. It could be researched whether the current controller in

banks is able to extent its role towards risk control and how this fundamental change can be realised in banking practice.

- ✓ Investigate the impact of the convergence between banks, insurance companies and pension funds in terms of the changing role of banks, the products to be offered and the role of operational risk management in this new situation.

We would like to end this thesis with a reference to a part of Adams' advice to anyone seeking to manage risk:[8]

- ✓ Remember, everyone else is seeking to manage risk too;
- ✓ They are all guessing; if they knew for certain, they would not be dealing with risk;
- ✓ Their guesses are strongly influenced by their beliefs;
- ✓ For the foreseeable future, nature will retain most of her secrets, and science will continue to invent new risks;
- ✓ Human behaviour will always be unpredictable because it will always be responsive to human behaviour – including your behaviour;
- ✓ It will never be possible to capture 'objective risk', however powerful your computer, because the computer's predictions will be used to guide behaviour intended to influence that which is predicted;
- ✓ In the dance of the risk thermostats, the music never stops.

It is about time that the banking industry starts valuing this advice and stops pushing each other to run as fast as they can in order to stay in the same place.

Notes – Chapter Seven

[1] Moody's also emphasises this in its 'Special Comment', January 2003: Whilst capital is important, it is merely one defence against risk and is unlikely to be the preferred solution. An increase in capital will not in itself reduce risk; only management action can achieve that.

[2] Gelderman also warns for these developments: 'Risk management moet waken om te zeer verwijderd te raken van de werkelijkheid. Het toenemend gebruik van statistische en andere wiskundige methoden die niet alleen onbegrijpelijk zijn, maar de werkelijkheid ook nog eens geweld aan doen. Daarbij streven onderzoekers (maar dus ook risk managers) ook nog eens naar het afbakenen van het eigen vakgebied (zie inperken definitie operational risk) en doen dit veelal door te streven naar een dusdanige specialisatie van hun onderzoekingen dusdanig futiel zijn dat het grotere beeld van het echte bedrijfsleven volledig verdwijnt.' (M. Gelderman, 'Bedrijfseconomie als nutteloze wetenschap', *Maandblad voor Accountancy en Bedrijfseconomie*, maart 2000)

[3] Calculations by De Nederlandsche Bank point out that in the period 1988-1996, the average capital ratio of banks increased from 9,3% in 1988 to 11,2% in 1996.

[4] Elsevier, 9-2-2002, page 63: 'In een nieuw voorstel, het zogenoemde Basel 2, mogen banken zelf vaststellen hoeveel kredietrisico ze lopen en daarmee hoeveel eigen vermogen ze aanhouden. Volgens Benink is dat vragen om moeilijkheden. 'Toezichthouders moeten dan de complexe interne risicomanagementsystemen van banken beoordelen. Dat is bij voorbaat een ongelijke strijd. Banken hebben bovendien een enorme financiële prikkel om de risico's die ze lopen bewust te onderschatten. Ze kunnen er veel geld mee verdienen. Conservatieve banken zullen te maken krijgen met concurrenten uit andere landen die zichzelf al of niet met behulp van hun toezichthouder veel minder strenge eisen opleggen. Met alle gevolgen voor de internationale financiële stabiliteit.'

[5] Ackoff, R.L., *The Art of Problem Solving*, John Wiley & Sons, 1978, page 6.

[6] Ackoff started his book with the following quote: *We must continually learn to unlearn much that we have learned, and learn to learn that we have not been taught. Only thus do we and our subject grow.* [R.D. Laing, 1972].

[7] Lawrence, M., 'Risk Manager of the Year', *Risk*, January 2002, page 49.

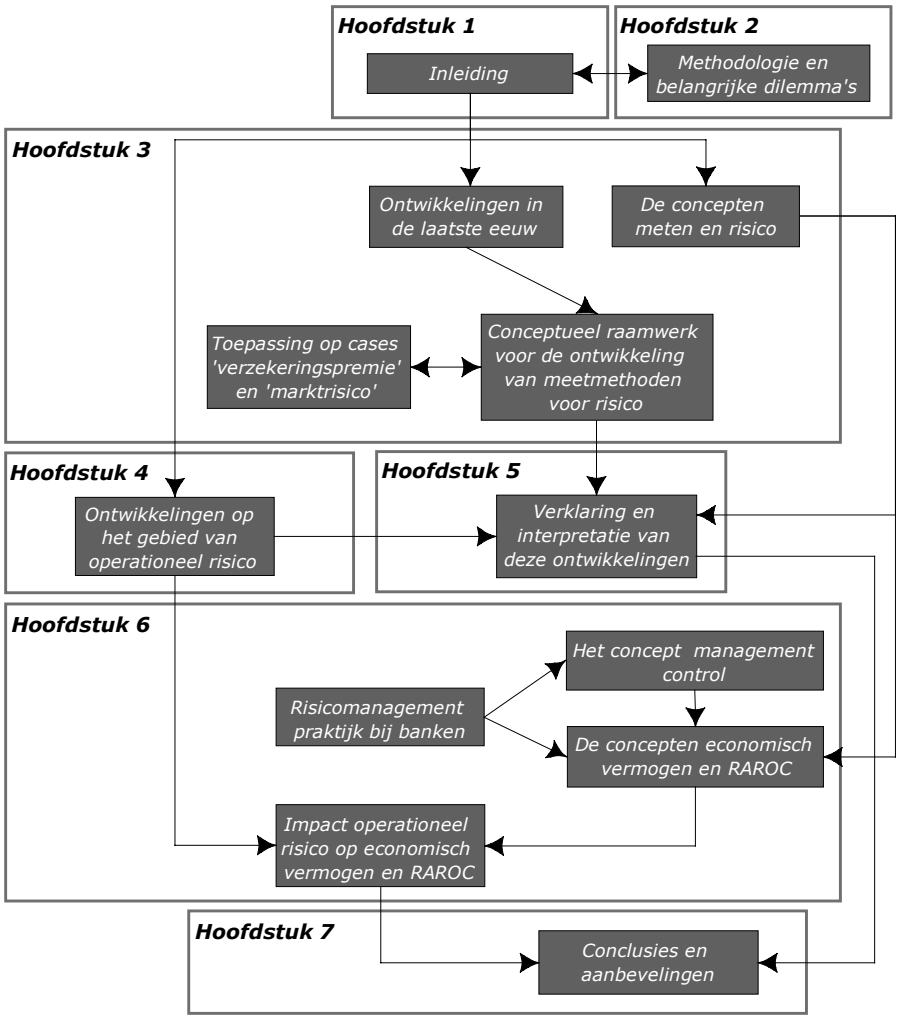
[8] Adams, *Risk*, University College London Press, second edition, 1995, pages 214-215.

Samenvatting

Het onderwerp van dit proefschrift is het beheersen van operationele risico's in een bancaire omgeving. Operationeel risico is gedefinieerd als 'het risico van verliezen als gevolg van tekortkomingen in interne processen, mensen, systemen of door externe gebeurtenissen'. De definitie geeft al aan dat dit een breed onderwerp is, dat vrijwel het gehele bancaire bedrijf raakt. Daarom hebben we ervoor gekozen om de nadruk te leggen op de positie van operationeel risico binnen de risicomanagement functie van banken en op de ontwikkeling van meetmethoden voor het bepalen van de hoeveelheid vermogen die banken voor dit risico moeten aanhouden. De onderzoeksmethode die hiervoor is gehanteerd is de deelnemer-observant methode. Dit houdt in dat de onderzoeker zowel deel uitmaakt van het object van onderzoek als het object van onderzoek observeert.
De onderzoeksvraag die leidend is geweest voor dit onderzoek luidt: '*hoe en waarom ontwikkelen banken meetmethoden voor het relatief nieuwe onderwerp 'operationeel risico' en hoe zouden deze methoden kunnen worden geïmplementeerd in de praktijk van risicomanagement*'. Hoewel de beheersing van operationele risico's een onderwerp is dat op vrijwel alle bedrijven van toepassing is, is dit onderzoek beperkt tot banken. Dit heeft te maken met de grote rol die de regelgeving in het verleden heeft gespeeld en naar verwachting ook in de toekomst zal blijven spelen in het ontwikkelingsproces van meetmethoden. Om deze onderzoeksvraag te beantwoorden is een zestal subvragen geformuleerd, welke de structuur vormen van het onderzoek, zoals in figuur S.1 is geïllustreerd.

De eerste vraag die is gesteld is fundamenteel van aard: *wat is risico meten?* Vaak wordt deze vraag overgeslagen en ligt de nadruk op het meten zelf in plaats van op de vraag wat meten is. Het woord 'meten' wordt veelal geassocieerd met wiskunde en objectiviteit. In de praktijk wordt echter ten onrechte relatief weinig kritisch omgegaan met het concept meten en de toepasbaarheid daarvan. Meten is geen eenduidig concept en kan vanuit verschillende invalshoeken worden benaderd: wiskundig, experimenteel en filosofisch. Het feit dat verschillende invalshoeken bestaan heeft onder meer tot gevolg dat over elk aspect van meten een fundamentele discussie kan worden gevoerd. Meten impliceert immers het maken van keuzes ten aanzien van rekenmethode, kwantiteit en de schaal waarop wordt gemeten. Twee fundamentele visies op meten zijn geïdentificeerd, die 'open' en 'gesloten' zijn genoemd. Vanuit de gesloten visie kan meten alleen

worden toegepast binnen de exacte wetenschappen (natuurkunde, scheikunde, wiskunde). Binnen deze visie is geen ruimte voor een filosofische invalshoek en zal ook de experimentele invalshoek bij voorkeur niet worden toegepast. De open visie laat ruimte voor het toepassen van meten binnen de sociale en de gedragswetenschappen. Dit laatste vergt echter andere meetmethoden.

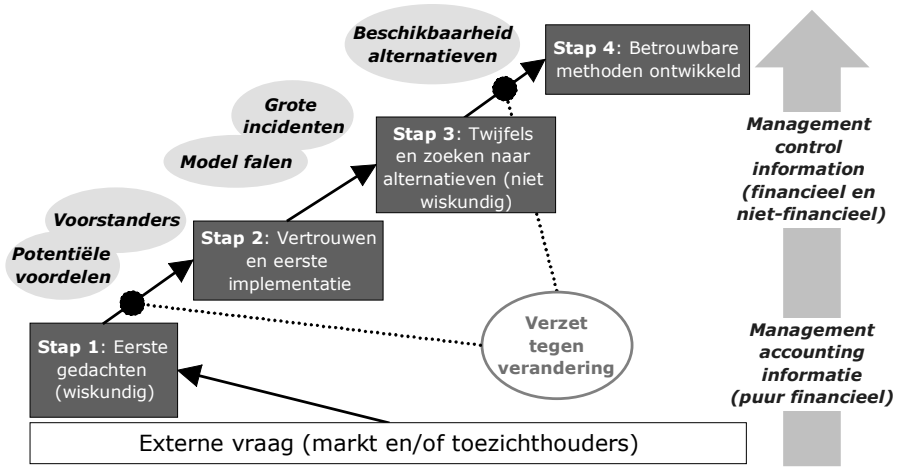


Figuur S.1: Structuur van het onderzoek

Ook over het concept 'risico' kunnen veel fundamentele discussies worden gevoerd. Immers, is risico het product van kans en schade of is het juist het onzekere, waarvan geen betrouwbare inschatting van kans en schade kan worden gemaakt en waarvoor meten dus problematisch is. In onze ogen kan

alleen het echte onzekere met recht 'risico' worden genoemd. Dit is in lijn met de constructivisten, die van mening zijn dat er geen objectieve definitie bestaat van risico; dat risicoanalyse kwalitatieve factoren omvat die moeilijk meetbaar zijn; en dat risico beoordeling en risicobeheersing moeilijk splitsbaar zijn. Dit wordt echter tegengesproken door objectivisten die risico beoordeling en risicobeheersing wel strikt scheiden en risico als objectief en meetbaar beschouwen.

In de praktijk van het bankwezen is weinig fundamentele discussie waar te nemen. Risico wordt ingeschat als objectief en meetbaar, hoewel kwalitatieve elementen zeker een rol vervullen. Ten aanzien van meten wordt de experimentele invalshoek gehanteerd. De achtergrond hiervan is onderzocht in de tweede subvraag '*hoe kunnen we verwachten dat meetmethoden zich ontwikkelen*'. Op basis van een historisch verkenning is een conceptueel raamwerk ontwikkeld, dat een viertal stappen onderkent in het ontwikkelingsproces van meetmethoden voor risico:



Figuur S.2: het conceptuele raamwerk voor risico meten

- ✓ Stap 1: Eerste gedachten, gebaseerd op wiskundige technieken. De aanzet voor stap 1 wordt gegeven door een externe vraag (markt of toezichthouders). Banken starten zelden vanuit de eigen behoefte met het meten van risico.
- ✓ Stap 2: Vertrouwen en eerste implementatie van de wiskundige technieken. Stap 2 wordt mogelijk gemaakt door de potentiële baten die uit het meten kunnen voortvloeien en de invloed van enkele sterke voorstanders. Deze voorstanders moeten afrekenen met het natuurlijke verzet tegen veranderingen dat bij elke innovatie een rol speelt. Doordat de toepassing

van wiskundig methoden toeneemt, krijgen zij ook een vaste plek in het onderwijs en de ervaring van mensen. Dit resulteert in een stroomversnelling van de verdere toepassing van dit type methoden.

- ✓ Stap 3: Twijfels en zoeken naar niet-wiskundige alternatieven. De twijfels worden aangewakkerd door incidenten en de onderkenning van zwakheden in de wiskundige modellen. Dit is onvermijdelijk gezien de experimentele aard van de modellen.
- ✓ Stap 4: Het ontwikkelen van vertrouwenswaardige meetmethoden. De mogelijkheid hiertoe wordt primair bepaald door de beschikbaarheid van alternatieven. Ook hierbij moet rekening worden gehouden met het natuurlijk verzet tegen veranderingen.

Uiteindelijk zal een mix ontstaan van kwantitatieve en kwalitatieve methoden en financiële en niet-financiële informatie.

Na deze theoretische en historische verkenning is het onderwerp 'operationeel risico' weer opgepakt met de vraag '*hoe heeft het concept operationeel risico meten zich ontwikkeld sinds 1999?*'. Het blijkt dat het Bazel's Comité voor bankentoezicht een nadrukkelijk rol heeft gespeeld in deze ontwikkelingen. In 1999 maakte dit comité bekend te werken aan de ontwikkeling van een vermogenseis voor operationele risico's. Het ontwikkelen van een vermogenseis impliceert meten van risico. Hoewel het bankwezen alles behalve enthousiast reageerde op dit voorstel, is de ontwikkeling van meetmethoden toch in gang gezet en in een stroomversnelling geraakt. Waar we vóór 1999 nog definities aantroffen als 'alles wat niet markt of kredietrisico is', werden definities specifieker en concreter in de periode daarna. Toch bleven banken argumenten aandragen waarom een vermogenseis voor operationele risico's niet terecht zou zijn.
De eerste methoden die werden voorgesteld waren wiskundig van aard. Op basis van interne verliesdata zouden banken het operationele risico moeten meten. Indien te weinig verliesdata voor handen waren, wat bij alle banken het geval was, moesten data van andere banken worden gebruikt ter aanvulling. Er bleek echter onvoldoende steun voor deze kwantitatieve benadering, wat mede te wijten was aan een aantal conceptuele problemen dat reeds kon worden voorzien. Zo is operationeel risico goed te beïnvloeden door banken, waardoor historische data snel hun waarde kunnen verliezen. Bovendien is het vertalen van data van andere banken naar de eigen situatie gecompliceerd, vanwege verschillen in omvang en beheersingsmethoden voor operationele risico's. Deze conceptuele problemen resulteerden in opvallende voorstellen voor aanpassing:

- ✓ Geef banken de mogelijkheid om extreem grote verliezen uit de dataset te laten indien kan worden aangetoond dat passende maatregelen zijn getroffen;
- ✓ Geef banken een korting op hun vermogenseis als de interne beheersing als 'goed' wordt beoordeeld.

Een kleine groep banken wist de toezichthouders te overtuigen van een alternatieve methode: de scorecard methode. In plaats van historische data over verliezen, gebruikten deze banken vragenlijsten en kwalitatieve indicatoren als basis voor het meten van operationele risico's. Binnen zowel het bankwezen als het Bazel's Comité bleek het bereiken van overeenstemming over de beste methode niet haalbaar. Als compromis is daarom besloten niet te kiezen en alle mogelijkheden open te laten. In het bankwezen bleven niet alleen de meningen ten aanzien van de beste meetmethoden uiteen lopen, ook de meningen of een vermogenseis voor operationeel risico in het algemeen realistisch is bleven verdeeld.

De ontwikkelingen in het bankwezen zijn vergeleken met de verwachtingen die zijn geformuleerd op basis van de historische verkenning. Deze vergelijking was onderwerp van de vierde subvraag. Om deze vraag te kunnen beantwoorden is het bankwezen ingedeeld in vier groepen, op basis van de visie ten aanzien van het type meetmethode (kwantitatief of kwalitatief) en het standpunt ten aanzien van vermogen voor operationeel risico (wel of niet realistisch).

	Vóór vermogenseis	***Tegen vermogenseis***
Kwantitatieve meetmethoden (gebaseerd op verlies data)	Groep A	Groep B
Kwalitatieve meetmethoden (scorecard methode)	Groep C	Groep D

Tabel S.1: Typologie van groeperingen binnen het bankwezen

De samenwerking en geografische spreiding tussen de groepen was interessant. Groepen werkten alleen samen op basis van hun voorkeur voor het type meetmethode en niet op basis van de voorkeur voor vermogenseisen. Binnen twee van de vier groepen wsa nauwelijks geografische spreiding: de Amerikaanse en Canadese banken vormden groep B, de Engelse banken vormden groep D.
De observaties geven duidelijk aan dat het bankwezen zich bevindt in de eerste stap van het conceptuele raamwerk:

- ✓ Enkele banken hebben reeds een jarenlange historie van verliesdata beschikbaar, maar de meeste banken zijn hier pas aarzelend mee gestart na 1999;

- ✓ Er zijn visies op meetmethoden gebaseerd op historische data, maar deze zijn niet of nauwelijks geïmplementeerd;
- ✓ Verschillende banken geloven niet in de meetmethoden of in de toepasbaarheid ervan gegeven de mate van ontwikkeling op dit gebied binnen het bankwezen. Zij pleiten ervoor af te zien van een vermogenseis voor operationeel risico;
- ✓ Er is groep banken die echt gelooft in de toepasbaarheid van historische verliesdata voor het meten van operationeel risico op de korte termijn;
- ✓ De toezichthouders (het Bazel's Comité) voeren veel druk uit om kwantitatieve methoden te implementeren. Kwalitatieve elementen worden met argwaan bekeken.

Het meten van operationele risico's was duidelijk nieuw. Betrouwbare datasets waren niet beschikbaar, waardoor het onmogelijk was om een meetmethode te onderbouwen met bewijsmateriaal dat het in het verleden zou hebben gewerkt. De discussies richtten zich daarom op de definitie, eventuele kwalitatieve elementen en de vraag of historische verliesdata waarde zouden hebben bij het meten van operationeel risico. Dit zijn karakteristieken van stap 1 uit het ontwikkelingsproces zoals eerder beschreven en ze zijn dan ook goed vergelijkbaar met de fundamentele discussie over risico meten, die aan het einde van de 19^{e} eeuw actueel was. Ook toen durfden mensen niet te vertrouwen op de wiskundige methoden die net waren ontwikkeld. De discussie over operationeel risico in de periode 1999-2002 toonde duidelijk karakteristieken van een eerste watervrees om methoden, gebaseerd op historische verliesdata, toe te passen. Ook het type kritiek dat academici hebben op operationeel risico meten onderschrijft dit.

Naast het hoe en waarom van het ontwikkelen van meetmethoden is in het onderzoek ingegaan op implementatie binnen de risicomanagement praktijk van banken. In de huidige praktijk bij banken zijn drie afdelingen te onderscheiden die zich op enigerlei wijze met risicomanagement bezighouden: de interne accountantsdienst via zogenaamde 'operational audits' en 'IT-audits', de management control afdeling via bestuurlijke informatie, en de risico control afdeling (ook wel bekend als risicomanagement afdeling). De werkzaamheden en de doelstellingen van deze afdelingen kennen enige overlap.
Er is een aantal mogelijkheden om met risico om te gaan: beheersen of financieren. Met risicobeheersing wordt gedoeld op het treffen van interne beheersingsmaatregelen, zoals functiescheiding, limieten en toegangsbeveiliging. Risicofinanciering kan op verschillende manieren worden gedaan. We onderscheiden balansmanagement, risico transfer en doorberekenen in tarieven. Balansmanagement is een instrument om rente- en liquiditeitsrisico's te beheersen,

bijvoorbeeld door het verkopen van delen van de balans (securitisatie) of het bewust innemen van rentemismatch posities. Risico transfer is het verkopen in de markt van eventuele verliezen voortvloeiend uit risico. Een bekend voorbeeld hiervan is verzekeren. Het doorberekenen van risico's in tarieven is het verschuiven van de kosten voor risico naar de klant, waardoor een vermogensbuffer ontstaat om eventuele verliezen op te vangen. Het dient te worden opgemerkt dat altijd een keuze tussen de beide opties moet worden gemaakt. Immers, indien een risico is gefinancierd en het wordt vervolgens ook actief beheerst betaalt de bank twee keer voor hetzelfde risico. Dit geldt met name voor verzekering en het aanhouden van een vermogensbuffer. Een combinatie van beheersing en financiering is alléén voordelig indien de implementatie van beheersingsmaatregelen een directe positieve invloed heeft op de prijs van de financiering.
Hoewel delen van operationeel risico via risico transfer kunnen en zullen worden gefinancierd, is het niet optimaal om operationeel risico volledig binnen risico transfer te positioneren. Immers, het voorkomen van verliezen zal vaak goedkoper zijn dan het verzekeren ervan. Operationeel risico is een onderwerp dat het best kan worden ondergebracht binnen risicobeheersing, wat impliceert dat het valt binnen het domein van management control. Binnen dit domein 'strijden' de risico controller en de mangement controller om de taken. Dit is niet verbazingwekkend, daar de doelstellingen van beiden functies binnen het bankwezen op dit gebied gelijk zijn en het risicomanagement proces bij banken vergelijkbaar is met het proces van management control. Wij beargumenteren dan ook dat het in stand houden van aparte afdelingen moeilijk verdedigbaar is. Het belangrijkste concept waaraan risico controllers en management controllers op dit moment werken binnen het bankwezen is de bepaling en allocatie van economisch vermogen. Economisch vermogen wordt hierbij gedefinieerd als de minimale hoeveelheid vermogen die de bank nodig heeft om de continuïteit te garanderen. Deze hoeveelheid vermogen wordt gebaseerd op de potentiële verliezen voortvloeiend uit de risico's die een bank loopt. Economisch vermogen wordt binnen de bank ingezet voor prestatiemeting van bedrijfsonderdelen, het alloceren van vermogen en het toewijzen van budgetten. Hiermee komen risico's (de basis van het concept economisch vermogen) en typische control taken (budgettering en rapporteren van prestaties) nog dichter bij elkaar.

Bij het beantwoorden van de laatste onderzoeksvraag '*hoe kan operationeel risico worden geïmplementeerd binnen deze risicomanagement functie*', zijn met name het concept economisch vermogen en de prestatie indicator 'RAROC' onder de loep genomen. Hierbij is tevens gebruik gemaakt van de theorie van Bruggink ten

aanzien van prestatiemeting bij banken. Hij maakt een onderscheid tussen het bancair-financieel domein, gericht op commerciële activiteiten en de effectiviteit daarvan en het technisch-organisatorisch domein, gericht op processen en de efficiëntie daarvan. Het dient te worden opgemerkt dat risicomanagement tot voor kort volledig werd geassocieerd met het bancair-financieel domein. Het is dan ook niet verwonderlijk dat de meetmethoden die ten grondslag liggen aan economisch vermogen en RAROC voortkomen uit dit domein. Ze beogen het meten van effectiviteit en het limiteren van commerciële activiteiten. Dit blijkt ook uit de grondslagen van economisch vermogen:

- ✓ Er wordt verondersteld dat alle risico's op betrouwbare wijze kunnen worden gekwantificeerd;
- ✓ De aanname wordt gedaan dat één meetmethodologie consistent kan worden toegepast op alle risico categorieën, zodat de uitkomsten kunnen worden opgeteld;
- ✓ Er wordt een positieve relatie verondersteld tussen risico en potentiële opbrengst.

Hoe meer economisch vermogen een eenheid krijgt toebedeelt, hoe meer activiteit zij kan ontplooien. Tegenover elk krediet dat wordt verleend en elke positie die wordt ingenomen moet vermogen staan. De hoogte hiervan is afhankelijk van het risicoprofiel. RAROC wordt berekend aan de hand van gerealiseerde opbrengst minus verwachte verliezen, wat wordt afgezet tegen de hoeveelheid economisch vermogen die wordt gebruikt:

$$\text{RAROC} = \frac{\text{opbrengsten - / - kosten - / - verwachte verliezen}}{\text{economisch vermogen}}$$

De opname van operationeel risico in deze concepten is problematisch. Immers, operationeel risico is noch direct noch volledig gerelateerd aan commerciële activiteiten. Bovendien genereert operationeel risico geen opbrengsten, waardoor de RAROC altijd negatief zal zijn. De RAROC kan significant worden verbeterd indien vermogen kan worden verschoven van operationeel risico naar andere risico categorieën. Dit kan resulteren in ongewenste risicoprofielen of concentraties en een ongewenst volatiele RAROC, aangezien de verhouding tussen risico en opbrengst wijzigt. Het operationele risico genereerde geen opbrengst, waar commerciële activiteiten dit wel zouden moeten doen. Eén van de fundamenten van economisch vermogen wordt daarmee aangetast.

Ook de andere veronderstellingen van economisch vermogen zijn moeilijk toepasbaar op operationeel risico. Het is gebleken dat het kwantificeren van operationeel risico moeizaam is, zeker indien hiervoor gebruik dient te worden gemaakt van technieken die gebruikelijk zijn voor het meten van markt- en kredietrisico. Dit is inherent aan het gegeven dat operationeel risico binnen het

technisch-organisatorisch domein valt en dus met andere prestatie indicatoren moet worden beheerst.

Terugkomend op de algehele onderzoeksvraag kan worden geconcludeerd dat banken niet vanuit een eigen behoefte zijn gestart met het ontwikkelen van meetmethoden voor operationeel risico. Het waarom komt voort uit de eis van het bankentoezicht om expliciete vermogenseisen voor operationeel risico te ontwikkelen. Hiervoor is nadrukkelijk aansluiting gezocht bij bestaande methoden voor markt- en kredietrisico. Toch blijkt de succeskans gering. De conceptuele problemen zijn talrijk en de voornaamste oorzaak hiervoor is het specifieke karakter van operationele risico's: ze zijn individueel en liggen steevast binnen de eigen invloedsfeer. Niet voor niets wordt door Bruggink een onderscheid gemaakt tussen bancair-financieel en technisch-organisatorisch als het gaat om prestatiemeting bij banken. Als antwoord op de vraag *'hoe worden meet-methoden voor operationeel risico ontwikkeld'* kan worden geconcludeerd dat een soortgelijk proces wordt doorlopen als bij markt- en kredietrisico is gebeurd, maar ook bij bijvoorbeeld het prijzen van verzekeringspremies. Toch zijn wij van mening dat het bankwezen een andere richting had moeten kiezen. De uitkomst van een operationeel risico berekening zal nooit nauwkeurig genoeg zijn om hem te kunnen gebruiken voor prestatiemeting. Om deze reden verwachten wij dat het ontwikkelproces voor meetmethoden op enig moment wordt onderbroken. De statistici zullen het onderwerp moeten loslaten en het overlaten aan de management controllers, waarbij ook de management controller op moet letten voor de vele valkuilen waarin hij met dit onderwerp terecht kan komen.
Prestatiemeting voor opertioneel risico is anders dan prestatiemeting voor markt en kredietrisico. Implementatie van operationeel risico in de concepten economisch vermogen en RAROC zou daarom ter discussie moeten staan. In de bancaire praktijk is dit echter niet het geval. Het gegeven dat banken operationeel risico opnemen in hun economisch vermogen is zelfs de aanzet geweest voor het Bazelse Comité om ook vermogenseisen voor dit risico te formuleren. Gegeven de uiteenzetting in dit proefschrift, had het Bazels Comité deze vermogenseis echter beter achterwege kunnen laten. Immers, bancair toezicht kent meer instrumenten dan vermogenseisen alleen. Bovendien is het beter om een nieuw instrument te ontwikkelen dat de toezichthouder in staat stelt zijn doelen te bereiken, dan een bestaand instrument te gebruiken dat slecht werkt. Aangezien het relatieve belang van operationele risico's toeneemt, kan het wel eens het meest voordelig zijn om de huidige statistische basis te laten voor wat zij is en iets nieuws te ontwikkelen met de karakteristieken van operationeel risico als uitgangspunt.

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