CONTRIBUTIONS TO THE STUDY AND MODELING OF KNOWLEDGE DEVELOPMENT SYSTEMS

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by

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DECLARATION

I hereby declare that the thesis entitled "**Contributions to the study and modeling of knowledge development systems"** completed and written by me, has not previously formed the basis for the award of any Degree or Diploma or other similar title of Saurashtra University or any other University or Examining body.

I further declare that the work done by me is of my own and original creation

Place: Rajkot
Date: 2 July 2008 MARUTI PENUBOTHU

CERTIFICATE

I hereby certify that Maruti Penubothu has completed his thesis for Doctorate Degree in Computer Science & Engineering on the topic- "**Contributions to the study and modeling of knowledge development systems"**

I further certify that work done by him is of his own and original and tends to the general advancement of knowledge. For the thesis that he is submitting, he has not been conferred any Degree, Diploma or Distinction by either Saurashtra University or any other University according to the best of my knowledge

Place: Rajkot
Date: 2 July 2008

Dr, N. N. Jani
GUIDE

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Chapter 1

Emerging Knowledge Perspectives

Abstract

This chapter presents the study & discussion on Data, Information, Knowledge & wisdom and forms the foundation for understanding the concepts and philosophy of Knowledge Management. Presentation in this chapter includes summary of our literature survey on Knowledge, discussion on the classification of Knowledge, the philosophy of Knowledge Management and Knowledge modeling concepts.

Key words: Data, Information, Knowledge, Wisdom, Knowledge Development, Knowledge Management, Knowledge modeling,

Introduction

Knowledge management is the hottest subject of the day as KNOWLEDGE is required on every task, in each sector of Economy for meeting the Global competition and for sustainability in the market.

In this Chapter, the presentation **[Maruti P. 2004]** includes the discussion on the emerging perspectives on Knowledge and its development. The contents covered in the discussion include the following:

- Developing a Context
- Knowledge – Definition
- Types of Knowledge
- A Continuum- DKIW: Data, Information, Knowledge, Wisdom
- Knowledge Development & Management
- The Value of Knowledge Development & Management

- Knowledge Modeling
- Types of Knowledge Models

1. Developing a Context

Like water, this rising tide of data can be viewed as an abundant, vital and necessary resource. With enough preparation, we should be able to tap into reservoir -- and ride the wave -- by utilizing new ways to channel raw data into meaningful information. That information, in turn, can then become the knowledge which leads to wisdom.[Alberthal Les. 1995]

Before attempting to address the question of knowledge development and management, it is probably appropriate to develop some perspective on knowledge. Consider this observation made in [Fleming Neil. 1997]:

- A collection of data is not information.
- A collection of information is not knowledge.
- A collection of knowledge is not wisdom.
- A collection of wisdom is not truth.

The idea is that information, knowledge, and wisdom are more than simply collections. Rather, the whole represents more than the sum of its parts and has a synergy of its own.

2. KNOWLEDGE

Some of the simplest questions that open up the discussion include the following:

1. How to develop (capture), store and transfer knowledge?
2. How to ensure that knowledge workers share their knowledge?

For answering these questions, it is necessary to understand the difference between information & Knowledge. It is identified world wide that the scarce resource is not information but human attention. It is logical to account for human attention, innovation and creativity needed for renewal of archived knowledge, creation of new knowledge and innovative applications of knowledge in new products (including software products) and services that build market share.

Knowledge is gained either by experience, learning and perception or through association and reasoning. The term knowledge is also used to mean the confident understanding of a subject, potentially with the ability to use it for a specific purpose.

The unreliability of memory limits the certainty of knowledge about the past, while unpredictability of events yet to occur limits the certainty of knowledge about the future. Epistemology is the philosophical study of the nature, origin, and scope of knowledge.

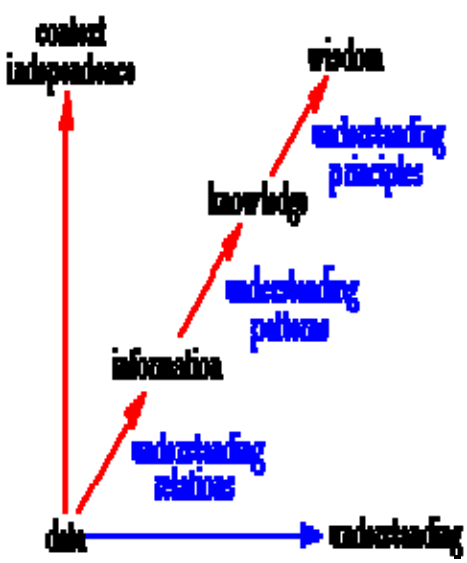
2.1. DEFINING KNOWLEDGE

The definition of knowledge is still a live debate for philosophers. In order for there to be knowledge, according to most thinkers, at least three criteria must be fulfilled. A thought must be justified, true, and believed.

2.2. WHAT IS KNOWLEDGE?

According to ancient Indian thoughts, knowledge & Jnaana have no isolated existence. One who wishes to know, is “Gnaana”, the knowledge. Representation of a problem-solution in a human-mind is knowledge.

We begin with data, which is just a meaningless point in space and time, without reference to either space or time. It is like an event out of context, a letter out of context, a word out of context. The key concept here being "out of context." And, since it is out of context, it is without a meaningful relation to anything else. When we encounter a piece of data, if it gets our attention at all, our first action is usually to attempt to find a way to attribute meaning to it. We do this by associating it with other things. If I see the number 5, I can immediately associate it with cardinal numbers and relate it to being greater than 4 and less than 6, whether this was implied by this particular instance or not. If I see a single word, such as "time," there is a tendency to immediately form associations with previous contexts within which I have found "time" to be meaningful. This might be, "being on time," "a stitch in time saves nine," "time never stops," etc. The implication here is that when there is no context, there is little or no meaning. So, we create context but, more often than not, that context is somewhat akin to conjecture; yet, it fabricates meaning.



That a collection of data is not information, as Fleming Neil indicated, implies that a collection of data for which there is no relation between the pieces of data is not information. The pieces of data may represent information, yet whether or not it is information depends on the understanding of the one perceiving the data. It depends on the knowledge of the interpreter, but we are probably getting ahead of ourselves, since we haven't defined knowledge. The extent of our understanding of the collection of data is dependent on the associations we are able to discern within the collection. And, the associations we are able to discern are dependent on all the associations we have ever been able to realize in the

past. Information is quite simply an understanding of the relationships between pieces of data, or between pieces of data and other information.

While information entails an understanding of the relations between data, it generally does not provide a foundation for why the data is what it is, nor an indication as to how the data is likely to change over time. Information has a tendency to be relatively static in time and linear in nature. Information is a relationship between data and, quite simply, is what it is, with great dependence on context for its meaning and with little implication for the future.

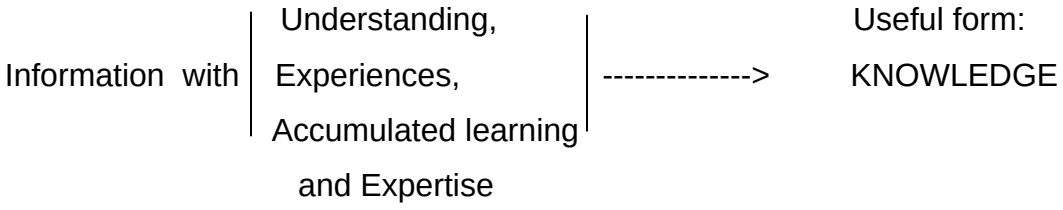
Beyond relation there is pattern, where pattern is more than simply a relation of relations. Pattern embodies both a consistency and completeness of relations, which, to an extent, creates its own context.

When a pattern relation exists amidst the data and information, the pattern has the *potential* to represent knowledge. It only becomes knowledge, however, when one is able to realize and understand the patterns and their implications. The patterns representing knowledge have a tendency to be more self-contextual. That is, the pattern tends to create its own context rather than being context dependent to the same extent that information is. A pattern which represents knowledge also provides, when the pattern is understood, a high level of reliability or predictability as to how the pattern will evolve over time, for patterns are seldom static. Patterns that represent knowledge have completeness to them that information simply does not contain.[Makhafi.com].

Wisdom arises when one understands the foundational principles responsible for the patterns representing knowledge being what they are. And wisdom, even more so than knowledge, tends to create its own context. These foundational principles are universal and completely context independent. In [Thrimurthy 2006], concise definitions are given as follows:

- **Data:** Symbolic representation of facts. It doesn't convey any thing
- **Information** is data with interpreted meaning
- **Knowledge** conveys Understanding , Experiences, Accumulated learning and Expertise
- **Wisdom** is a derivative of appropriate information

Knowledge maps the "relevant information" into a more immediately useful form by using the understanding, Experiences, accumulated learning and expertise..



So, in summary the following associations can reasonably be made:

- **Information** relates to description, definition, or perspective (what, who, when, where).
- **Knowledge** comprises strategy, practice, method, or approach (how).
- **Wisdom** embodies principle, insight, moral, or archetype (why).

2.3. An Example

This example uses a bank savings account to show how data, information, knowledge, and wisdom relate to principal, interest rate, and interest.

2.3.1. Data: The numbers 100 or 5%, completely out of context, are just pieces of data. Interest, principal, and interest rate, out of context, are not much more than data as each has multiple meanings that are context dependent.

2.3.2. Information: If we establish a bank savings account as the basis for context, then interest, principal, and interest rate become meaningful in that context with specific interpretations.

- Principal is the amount of money, Rs.100/-, in the savings account.
- Interest rate, 5%, is the factor used by the bank to compute interest on the principal.

2.3.3. Knowledge: If I put Rs.100/- in my savings account, and the bank pays 5% interest yearly, then at the end of one year the bank will compute the interest of Rs.5/- and add it to my principal and I will have Rs.105/- in the bank. This pattern represents knowledge, which, when I understand it, allows me to understand how the pattern will evolve over time and the results it will produce. In understanding the pattern, I know, and what I know is knowledge. If I deposit more money in my account, I will earn more interest, while if I withdraw money from my account, I will earn less interest.

2.3.4. Wisdom: Getting wisdom out of this is a bit tricky, and is, in fact, founded in systems principles. The principle is that any action which produces a result which encourages more of the same action produces an emergent characteristic called growth. And, nothing grows forever for sooner or later growth runs into limits.

If one studied all the individual components of this pattern, which represents knowledge, they would never discover the emergent characteristic of growth. Only when the pattern connects, interacts, and evolves over time, does the principle exhibit the characteristic of growth.

3. TYPES OF KNOWLEDGE

3.1 SITUATED KNOWLEDGE

Situated knowledge is knowledge specific to a particular situation. Imagine two very similar breeds of mushroom, which grow on either side of a mountain, one nutritious, one poisonous. Relying on knowledge from one side of an ecological boundary, after crossing to the other, may lead to starving rather than eating perfectly healthy food near at hand, or to poisoning oneself by mistake.

Some methods of generating knowledge, such as trial and error, or learning from experience, tend to create highly situational knowledge. One of the main benefits of the scientific method is that the theories it generates are much less situational than knowledge gained by other methods.

Situational knowledge is often embedded in language, culture, or traditions. Critics of cultural imperialism argue that the rise of a global monoculture causes a loss of local knowledge.

3.2.PARTIAL KNOWLEDGE

A discipline of epistemology is focused on partial knowledge. It states that in most of realistic cases, it is not possible to have an exhaustive understanding of an information domain, but that we have to live with the fact that our knowledge is always not complete, that is, partial. Most of real problems have to be solved by taking advantage of a partial understanding of the problem context and data. That is very different from the typical simple math problems that we solve at school, where all data are given and we have a perfect understanding of formulas necessary to solve them.

3.3 SOCIOLOGY OF KNOWLEDGE

Aspects of knowledge exhibit a social character. For instance, knowledge is a form of social capital. Sociology of knowledge examines the way in which Society and knowledge interact.

Through experience, observation, and inference, individuals and cultures gain knowledge. The spread of this knowledge is examined by diffusion. Diffusion of innovations theory explores the factors that lead people to become aware, try, and adopt new ideas and practices -- this can help to explain development of knowledge.

3.4. OTHER DEFINITIONS OF KNOWLEDGE:

Knowledge is "information combined with experience, context, interpretation, and reflection. It is a high-value form of information that is ready to apply to decisions and actions." [Davenport T. et al.,1998]

"Explicit or codified knowledge refers to knowledge that is transmittable in formal, systematic language. On the other hand, tacit knowledge has a personal quality, which makes it hard to formalize and communicate." I. [Nonaka, 1994].

"Knowledge as the human expertise stored in a person’s mind, gained through experience, and interaction with the person’s environment." [Sunasee and Sewery, 2002].

"Knowledge is a physical, mental or electronic record of relationships believed to exist between real or imaginary entities, forces and phenomena." [Worthington, 2005.]

"The insights, understandings, and practical know-how that we all possess – is a fundamental resource that allows us to function intelligently." [Wiig, 1996].

"Knowledge is information evaluated and organized by the human mind so that it can be used purposefully, e.g., conclusions or explanations." [Rousa,2002].

"Knowledge is... a mental grasp of a fact(s) of reality, reached either by perceptual observation or by a process of reason based on perceptual observation." [Rand,1967].

There are numerous type of knowledge divided according to its functions and its carrier systems (for example, management knowledge, manager knowledge).

4. A CONTINUUM - DIKW (Data, Information, Knowledge, Wisdom)

Note that the sequence data -> information -> knowledge -> wisdom represents an emergent continuum. That is, although data is a discrete entity, the progression to information, to knowledge, and finally to wisdom does not occur in discrete stages of development. One progresses along the continuum as one's understanding develops. Everything is relative, and one can have partial understanding of the relations that represent information, partial understanding of the patterns that represent knowledge, and partial understanding of the principles, which are the foundation of wisdom.

5. KNOWLEDGE MANAGEMENT

According to Mike Davidson, [Davidson Mike.1996], what's really important is:

- **Mission**: What are we trying to accomplish?
- **Competition**: How do we gain a competitive edge?
- **Performance**: How do we deliver the results?
- **Change**: How do we cope with change?

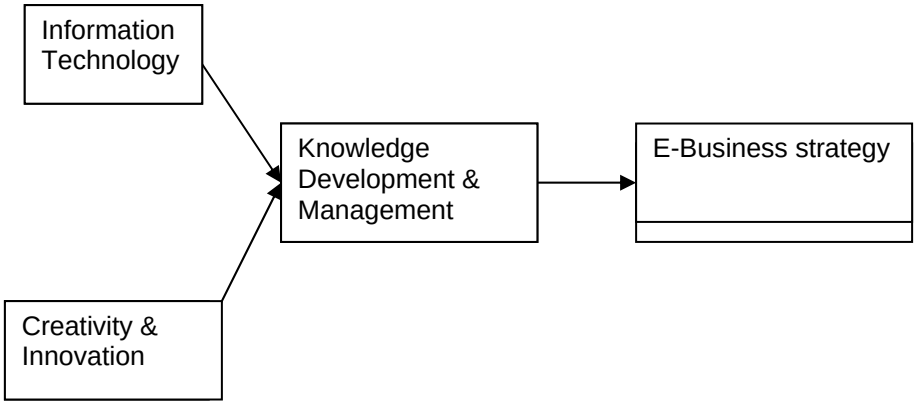
As such, knowledge management, and everything else for that matter, is important only to the extent that it enhances an organization's ability and capacity to deal with, and develop in these four dimensions.

Knowledge management seeks to understand the way in which knowledge is used and traded within organizations and treats knowledge as self-referential and recursive. This recursion means that the definition of knowledge is in a state of flux. Knowledge management treats knowledge as a form of information, which is impregnated with context based on experience. Information is data, which causes a difference to an observer because of its observer-specific relevance. Data is something that can be observed, but does not need to be. In this sense, knowledge consists of information augmented by intentionality (or direction). This conception aligns with the DIKW (Data, Information, Knowledge, Wisdom) model, which places data, information, knowledge and wisdom into an increasingly useful pyramid.

The main objective of knowledge management is to ensure that the right information is delivered to the right person just in time, in order to take the most appropriate decision. In that sense, knowledge management is not interested to manage knowledge per se, but to relate knowledge and its usage. This leads to Organizational Memory Systems.

Knowledge Management caters to the critical issues of organizational adaptation, survival and competence in the face of increasingly discontinuous environmental change. Its primary focus is on the outcomes in terms of performance rather than the specification of inputs. With rapid advancements and availability of technologies, there would be multiple choices in terms of selecting specific technologies that could facilitate a specific e-business strategy such as customer relationship management (CRM), Supply Chain Management (SCM) or Selling Chain Management. This view relates more closely to the dynamic view of business strategy as driver of corporate information strategy.

Knowledge Development & Management for e-business strategy



5.1. THE VALUE OF KNOWLEDGE DEVELOPMENT & MANAGEMENT

In an organizational context, data represents facts or values of results, and relations between data and other relations have the capacity to represent information. Patterns of relations of data and information and other patterns have the capacity to represent knowledge. Yet, what is the real value of information and knowledge, and what does it mean to manage it?

Without associations, we have little chance of understanding anything. We understand things based on the associations we are able to recognize. If someone says that sales started at Rs.100,000/- per quarter and have been rising 20% per quarter for the last four quarters, I am somewhat confident that sales are now about Rs.207,300/- per quarter. I am confident because I understand what "rising 20% per quarter" means and I can do the mathematical calculations.

Yet, if someone asks what sales are apt to be next quarter, I would have to say, "It depends!" I would have to say this because although I have data and information, I have no knowledge. This is a trap that many fall into, because they don't understand that **data doesn't predict trends of data**. What predicts trends of data is the activity that is responsible for the data. To be able to estimate the sales for next quarter, I would need information about the competition, market

size, extent of market saturation, current backlog, customer satisfaction levels associated with current product delivery, current production capacity, the extent of capacity utilization, and a whole host of other things. When I was able to amass sufficient data and information to form a complete pattern that I understood, I would have knowledge, and would then be somewhat comfortable estimating the sales for next quarter.

In this example what needs to be managed to create value is the data that defines past results, the data and information associated with the organization, its market, its customers, and its competition, and the patterns, which relate all these items to enable a reliable level of predictability of the future.

The value of Knowledge Management relates directly to the effectiveness with which the managed knowledge enables the members of the organization to deal with today's situations and effectively envision and create their future. Without on-demand access to managed knowledge, every situation is addressed based on what the individual or group brings to the situation with them. With on-demand access to managed knowledge, every situation is addressed with the sum total of everything anyone in the organization has ever learned about a situation of a similar nature. Which approach would you perceive would make a more effective organization?

6. KNOWLEDGE MANAGEMENT -THE RATIONALE

The field of knowledge management (KM) has grown exponentially in different sectors of economy. KM emphasizes capturing strategic information, analyzing markets, designing databases, developing document repositories, and policies and procedures to capture and share knowledge.

KM is the systematic process of locating, selecting, organizing, and presenting information/ knowledge in a manner that contributes to organizational effectiveness.

It is an emerging discipline that promotes a systematic study of the intellectual assets of organizations. The study and practice of knowledge management are products of the 1990's, with many practitioners in different disciplines including business, engineering, information science, management, communications, among others.

Topics in knowledge management are varied. They span the knowledge cycle from creation to use, and include identifying, selecting, organizing, indexing, storing, integrating, retrieving and sharing knowledge assets.

In addition to studying knowledge forms and processes, the discipline of knowledge management includes the study of enabling systems and technologies that have become essential to sound and successful business practices in the 21st century.

7. KNOWLEDGE MODELING:

Traditional Information systems for meeting the well defined goal oriented objectives, realizing increased efficiency, were more suitable for the stable and predictable Business environment. However, such stable systems are inadequate in the e-business era that demands dynamic & unforeseen changes in the business environment [Arthur, 1996 and Malhotra,1998].

The emerging e-business environment requires dynamic decision making support based on the organizational decision making processes which need to be continually reassessed but also the underlying assumptions, by keeping pace with the changing business environment..

The technologies of the “Knowledge Age” are transitioning our focus from individual, isolated information systems and repositories to an expanded exchange and sharing of information in order to broaden the size and depth of knowledge available to individuals and activities.

According to leading researchers around the world [Makhafi.com], by the year 2010, more than one trillion intelligent computing devices will be utilized in all aspects of the commercial environment.

Research literature classifies knowledge as follows:

Classification-based Knowledge	»	Ability to classify information
Decision-oriented Knowledge	»	Choosing the best option
Descriptive knowledge	»	State of some world
Procedural knowledge	»	How to do something
Reasoning knowledge	»	What conclusion is valid in what situation?
Assimilative knowledge	»	What its impact is?

For more than two millennia, intellectuals, philosophers and scientists have tried to conceptualize awareness, information, knowledge and intelligence in various shapes, forms and situations. Unquestionably, many efforts have been made and many applications have been developed that resemble the capture and use of Knowledge in various forms by using different methods.

However, with the rapid increase in the amount of available information combined with the flexibility in accessing this information put forward the need for a concentrated effort to accelerate our utilization of information under a common framework.

As available technology advances our expectations and level of complexity embedded with knowledge, this situation increases the need for effective synthesization and efficient distribution. In time, Knowledge will gradually move into the sphere of the public domain – where it becomes “information”, while at the same time new knowledge gets created.

What is Knowledge Modeling?

If one thinks information is valuable, than one should see knowledge in action!

Knowledge Capture and Modeling (KCM) – or in short Knowledge Modeling – is a cross disciplinary approach to capturing and modeling knowledge. Knowledge Modeling packages combinations of data or information into a reusable format for the purpose of preserving, improving, sharing, aggregating and processing Knowledge to simulate intelligence.

Knowledge Modeling offers a shift from local proprietary solutions to produce and disseminate embedded Knowledge Models into larger computational solutions in effort to generate “applied knowledge.”

The core difference between working with information and knowledge is that – in addition to facts – a Knowledge Model includes enactment and has the ability to support intuition as well as the subjectivity of experts and/or users.

Among its benefits, a Knowledge Model has the ability to be constantly monitored and improved. Furthermore, Knowledge Models help us to learn from past decisions, to assess present activities and, just as important, to preserve domain expertise. KCM saves time and overhead costs, and reduces the mistakes from overlooks.

Knowledge Models are very valuable and often outlive a particular implementation and/or project. Accordingly, the challenge of KCM is that this process must be designed not only as an abstract idea, but as an implementable

process with the ability to aggregate and disseminate applied knowledge for the purpose of creating intellectual capital for generations of humankind to come.

Knowledge categories & models:

In general, knowledge can be categorized into two distinguishable types:

Explicit knowledge - Can be articulated into formal language, including grammatical statements (words and numbers), mathematical expressions, specifications, manuals, etc. Explicit knowledge can be readily transmitted to others. This type of knowledge can be easily "modeled" using various computer languages, decision and rule based tools.

Tacit knowledge - Personal knowledge embedded in individual experience and involves intangible factors, such as personal beliefs, perspective, and the value system. Tacit knowledge is difficult (but not impossible) to articulate with formal language. Neural network offers the best possible method for modeling tacit knowledg**e.**

In the simple form, a Knowledge Model could be designed with the purpose of receiving data produced from various sources and generate outputs that could initiate actions.

Knowledge models can be implemented as software applications, hardware components, object library, web-services, and many other forms and shapes using various techniques.

8. **Model Types**

At its highest-level, Knowledge Models can be categorized into following seven groups:

8.1. Diagnostic models

This type of model is used for diagnosing problems by categorizing and framing problems in order to determine the root or possible cause.

Example: I have these symptoms. What is the problem?

8.2 Case-based models

This type of model is designed to produce possible options for a specific case. The options may be generated using techniques such as Genetic Algorithms or Monte Carlo simulation, or case-base system.

Example: I know the problem. What are my options?

8.3 Selective models

This type of model is used mainly for the decision-making process in order to assess or select different options. Selective Models can be used for selective Choice among alternatives. Such a selection process deal with “conflicting objectives.”

Example: Now I know the options. Which one is the best for me?

8.4 Analytic Models

Analytical Models are mainly used for analyzing pre-selected options. This type of model has the ability to assess suitability, risk or any other fitness attributes.

Example: I picked my option. How good and suitable is it for my objective?

8.5 Instructive Models

This type of model provides guidance through interactive process.

Example: How can I achieve the target?

8.6 Constructive Models

A Constructive Model is able to design or construct the solution

Example: Design a system which accomplishes a task with the stated specifications.

8.7 Hybrid Models

In many cases more advanced models are constructed by combining several models together. It is good if each model is designed and implemented as an independent component. This will help in easier maintenance and future expansion. A sophisticated, comprehensive application may utilize all the above models:

As a best practice approach, knowledge models should stay implementation neutral and provide Knowledge Modeling experts with flexibility of picking the appropriate technology for each specific implementation.

Summary & Conclusion:

The presentation in chapter 1, includes the background study & discussion on Data, Information, Knowledge & wisdom that forms the foundation for understanding the concepts and philosophy of Knowledge Management. It also includes summary of the literature survey on Knowledge, discussion on the classification of Knowledge, the philosophy of Knowledge Management and Knowledge modeling concepts**. This presentation forms the basis on which the computer based knowledge development systems could be designed for different applications.**

Chapter 2

KNOWLEDGE DEVELOPMENT MODEL
FOR
CORPORATE CREDIT MANAGEMENT SYSTEM

Abstract:

A knowledge development model is designed for Corporate Credit Management by encapsulating credit policy and credit related activities. While taking care of the requirements on “any where banking”, the system is designed to contain a framework to automate the origination of corporate and commercial credit for banks. It also provides the capabilities of monitoring of assets and generates relevant MIS. The framework can be deployed centrally and can be used for de-centralized (Branch/RO/Head office) as well as centralized way (Credit factory approach) of credit processing. **[Maruti P. 2005].**

Keywords:

MIS : Management Information System
JDBC: Java Data Base Connectivity
J2EE: Java 2 Enterprise Edition
HTTPS: Secured Hyper Text Protocol
API: Application Programming Interface
EJB: Enterprise Java Beans
LDAP: Light weight Directing Access Protocol
POA : Power of Attorney
PLR: Prime Lending Rates
MPBF: Maximum Permissible Bank Finance
IRR : Internal Rate of Return
NPV : Net Present Value

Introduction:

Business networking is one of the major trends for credit management institutions with virtual organizing and knowledge as inherent elements. Implementing Business networking requires multiple decisions on the strategic process, system and technology levels which have to be taken into account among multiple partners. Having studied a variety of processes on the subject of credit management, an attempt is made to bring out a knowledge based model to handle the credit management that could be implemented in any financial institution. The system is designed with modular approach and its modules are to be seamlessly integrated. The modules include Borrower Demographics, Appraisal, Financial assessment, Risk Rating among several others, for loan origination. It offers significant competitive advantages as it increases the productivity and improves the quality of service to the clients. It also brings down the Total Cost of Operation (TCO) of the bank for implementing such solutions. The framework also supports comprehensive MIS needs of the bank and suits banking requirements. The suite of reports can help the bank in getting timely feedback for taking corrective and preventive actions and for exercising control. Thus in a nut shell, the knowledge development framework encapsulates the following:

1. It deals with the process of origination of corporate and commercial credit for banks. It handles loan origination of a bank, policies & guidelines, credit appraisal, credit rating, building credit-scoring models and monitoring of advances given to the commercial organizations.
2. It supports various working capital, term loan, bills and non-fund based products like Letter of Credit, Guarantees etc apart from proposal handling and sanction of regular, ad-hoc, fresh, renewal and enhancement of limits for working capital and term loan.
3. It also deals with the assessment of different types of business activities such as manufacturing, trading, leasing and hire purchase.
4. Based on the information and knowledge (experiences gained on the banking sector over the years), the system is designed to focus on

achieving speedy and efficient corporate financing.

5. The presentation of the model includes the technical & functional architectures on knowledge development in Corporate Credit Management System.

1. A CORPORATE CREDIT MANAGEMENT SOLUTION

Corporate Credit Management System is designed based on modern web based n-tier architecture. It automates the process of corporate loan origination of a bank that may provide a competitive edge through improved efficiency and enhanced customer service. In addition to this, specific functional modules like monitoring and MIS make it an attractive solution for the banks.

It automates the activities of credit department of the bank, viz., policy, appraisal, monitoring, MIS. It also has the capability to build credit-scoring models and provision to get integrated with third party risk management tools. It is a flexible system, providing single point data entry and system security. The suite of reports can help the bank in getting timely feedback for taking corrective actions and control. Further, it also supports credit activities of the bank.

1.1. FEATURES PROVIDED BY CORPORATE CREDIT MANAGEMENT SYSTEM

- Anytime, Anywhere Browser based User Interface
- Complete Loan Origination features for
  - Big Corporate
  - Small and Medium size companies
- Financial Assessment & Online Appraisal of Fund and Non Fund based facilities for
  - Working Capital finance
  - Term Finance
  - Project Finance

- Specialized Appraisals of industries like Sugar, Tea, Coffee, Construction, Hotel, Hospitals, Software, Export etc.
- Internal Risk Rating Model, can also link to external risk rating agencies
- User Definable Financial assessment rules(Balance sheet/Profit Loss/Ratio/Risk Rating etc)
- Online Paperless approval of loan papers and Storage of supporting documents in system
- Can interface with various defaulter's list for verification of borrower details
- Online Generation of Loan Documents(Sanction Letter/Rejection Letter etc)
- Interface with Retail Banking system for
    - Customer Info
    - Account Opening
    - Post Sanction Monitoring
- Miscellaneous Sanction activities (Amendments, In-principal approval, Validity Extension, Adhoc /Additional Limits etc)
- Renewal and Review of Accounts
- Proactive Monitoring of Loan Accounts
- Various pre-defined reports for statutory authorities and management

1.2. ADVANTAGES FROM THE KNOWLEDGE DEVELOPED FROM CORPORATE CREDIT MANAGEMENT SYSTEM

- Round the clock productivity
- Reduced Turnaround Time
- Customer Satisfaction
- Lower Cost of Ownership
- Faster Deployment
- Better Managed Business Processes
- Timely and accurate reporting
- Standardization of Processes
- Improved Credit Quality and Improved Productivity

1.3. KEY COMPONENTS

Credit Appraisal

Credit Appraisal addresses assessment of credit needs of the borrowers who deal with the Bank. It supports proposal handling and sanction of regular, ad-hoc, renewal and enhancement of limits.

Credit Appraisal helps in assessment of credit needs of the borrowers who deal with the Bank. It supports appraisal and sanction of regular, renewal, enhancement and reduction of limits. It also helps in assessment of adhoc / additional limits, amendment of sanctions, in-principle sanctions, confirmation of sanction and review/validity extension.

Functional capabilities of the appraisal module are detailed below:

- Using this system, Working Capital or Term Loan or Working Capital and Term Loan limits can be assessed.
- The appraisals can be undertaken for different types of business activities namely, Manufacturing & Trading, and Leasing & Hire-Purchase Appraisals are undertaken based on the financials submitted by the Company. The financials are assessed using various financial techniques and methods of lending.
- **Specialized Appraisals:** These are undertaken for specific industries such as Sugar/Tea/Construction, Project Finance and Export. For these assessments Cash Budget Methods are being used by the system
- **Methods of Lending:** Three methods of lending (namely, Turnover Method, First Method and Second Method for assessment of need based requirements of the Company/Borrower) are presently deployed in the system.
- **Appraisal of Regular, Ad-hoc/Additional limits, Reviews:** The system can appraise requirements of an ongoing concern on regular basis. It can also assess the adhoc or additional funds requirements for a company. In today's scenario with stringent prudential norms in place, maintaining

quality of loan is very important. Towards this the system helps in review of the accounts on predefined periodic intervals. This frequency of review can be fixed on the basis of the quality of asset.

- Each appraisal results in a credit decision. The credit decision could be sanction or rejection. The system can accord sanctions of various types
    - Fresh: These are accorded for new borrowers/ projects.
    - Renewal: These are accorded to the existing borrowers without increase in bank's exposure
    - Renewal-cum-Enhancement: These are also accorded to the existing borrowers with increase in bank's exposure
    - Reduction: These are accorded to the existing borrowers with decrease in bank's exposure
    - Rescheduling: In this case the loan repayment schedules are changed or altered.
- The system is also equipped to handle the appraisals for the following:
    - **In-principle Approvals**

It involves a short interim appraisal for a prospective borrower or a new project of an existing borrower. It entails bank's commitment of finance for the project. This is followed by a regular sanction, proposal for which needs to be submitted by the Company within specified time duration after which in-principle approval lapses. The system has the requisite follow up mechanism built up.

- **Validity Extensions**

Working capital limits are sanctioned for short term and these are required to be renewed. If the borrower is unable to submit the financial papers, a short review of the account can be undertaken using the system. For preparation of this review, most of the details are available in the system which are displayed and new/refined information need to be provided to the system.

- **Confirmation of Actions**

In branches branch manager has to accommodate the urgent needs of the borrower exceeding sanctioned limits/discretionary powers. In such cases the

system aids in preparation of the process notes for approval by higher authorities.

- **Amendment of Sanctions**

Each sanction for limits carries loan contracts which ought to be abided by the borrower. At times the borrower is not in a position to comply with some of the terms and conditions and seeks waiver or amendment. The system enables the bank to carry out amendment of the sanction.

- Quality of assets can be maintained through well-defined follow up mechanism. The system proved this mechanism for the following:
  - **Renewal of accounts**

It generates and sends reminder letters to the branch/RO/borrower for the proposals falling due or fallen due for renewal in the defined period.

- **Adjustment of adhoc/additional limits**

In case the adhoc/additional limits are not adjusted on the due date the system has provision to generate letters for branch/RO/borrower seeking their reply in the matter.

- **Validity extensions**

Reminder letters can be generated using this system in respect of the proposals which already have their validity extended.

- In order to assess the credit needs of the borrower methodically standard tools, aids, benchmarks and guidelines are used. The system facilitates the same through
  - On-line availability of benchmarks, guidelines, norms & guidelines
  - Use of financial tools & techniques such as ratio analysis, trend analysis, cash flow, fund flow, break-even analysis and projections based assessments of limits for the borrowers
  - Capital Budgeting for Project Finance to assess and select the best investment option, that is, the best project out of several options available.
  - Study of movement of stocks: Based on the stock movements the system gives alerts.

- Account Performance and Remuneration Analysis
- Provision to calculate ‘Standard’ and ‘Additional’ Ratios

- The system also provides to banks the facility for the following:
  - Define ratios and underlying formulae
  - Search in Defaulter’s & Caution Lists
  - At the time of assessment the system can search borrowers name in the defaulter and caution lists and can give alerts.
  - Check list of documents needed for appraisal
  - On line availability of loan contracts

    Depending on the type of facilities sanctioned the system automatically retrieves terms and conditions for a sanction. It also permits deletion and addition of the terms and conditions.
  - Group exposures & prudential exposure monitoring

    The system also helps in monitoring of Group & prudential exposures based on the net worth of the bank.
  - Credit Rating as a tool for borrower appraisal and pricing

    Credit rating is organized using the model which includes financial analysis, Operating performance, Industrial and Management risks, a number of financial ratios and operational parameters along with qualitative aspects of management and industry characteristics that have bearing on the creditworthiness of borrowers. Rating score is used for pricing of the asset by the system.
  - Focus Questions to aid credit officer to comment on the deviations in values of important financial indicators, like current ratio, debt equity ratio etc. and variations as per trend analysis. The system prompts questions which need to be addressed by the concerned bank official/Company.
- Capture of Credit Decision

  Each appraisal results in capture of credit decision i.e. sanction or rejection.

- Other Facilities
    - Facility for uploading of Balance Sheet and Profit and Loss Statements data
    - Availability of previous data for renewal. This reduces requirement of inputting of the financial data
    - Process notes are generated by the system retrieving data available in the system and requirement for entering data is reduced. The process notes are generated for regular sanctions, renewals, in-principle approvals, validity extensions, confirmation of actions, and adhoc/additional limits
    - Electronic Approval of Appraisal Note based on bank specified work flow. This work flow can be configured as per the requirements of the bank.
    - Generation of Sanction/Rejection Letters with loan contracts
- Various types of term loan, working capital, fund based, non fund based facilities
- Covers various business activities i.e. manufacturing, trading, leasing & hire, purchase etc.
- Various specialized industries viz. sugar, tea, hotel, hospitality, construction,, software, chit fund, Schools
- Different formats for different industries & sectors
- Use of financials submitted by companies or projections made by the bank
- Financial projections/computations based on flexible assumptions, parameters etc.
- Uses ratio analysis, break even analysis, sensitivity analysis etc.
- Uses various investment techniques viz. NPV, IRR, Pay back period
- Covers Trend analysis, focus questions, repayment schedule, stock statement analysis

Policy

- Capture policies, guidelines & Circulars- Internal as well as statutory (given by central bank) through different masters. These include inventory norms, interest rates, industry master, ratios master, maximum permissible bank finance, asset classification, facility details, bank fees master, security master, credit schemes, borrower group master, facility master, rates master, banking arrangement, MPBF methods, rating models, prudential norms, terms & conditions for loan sanction etc.

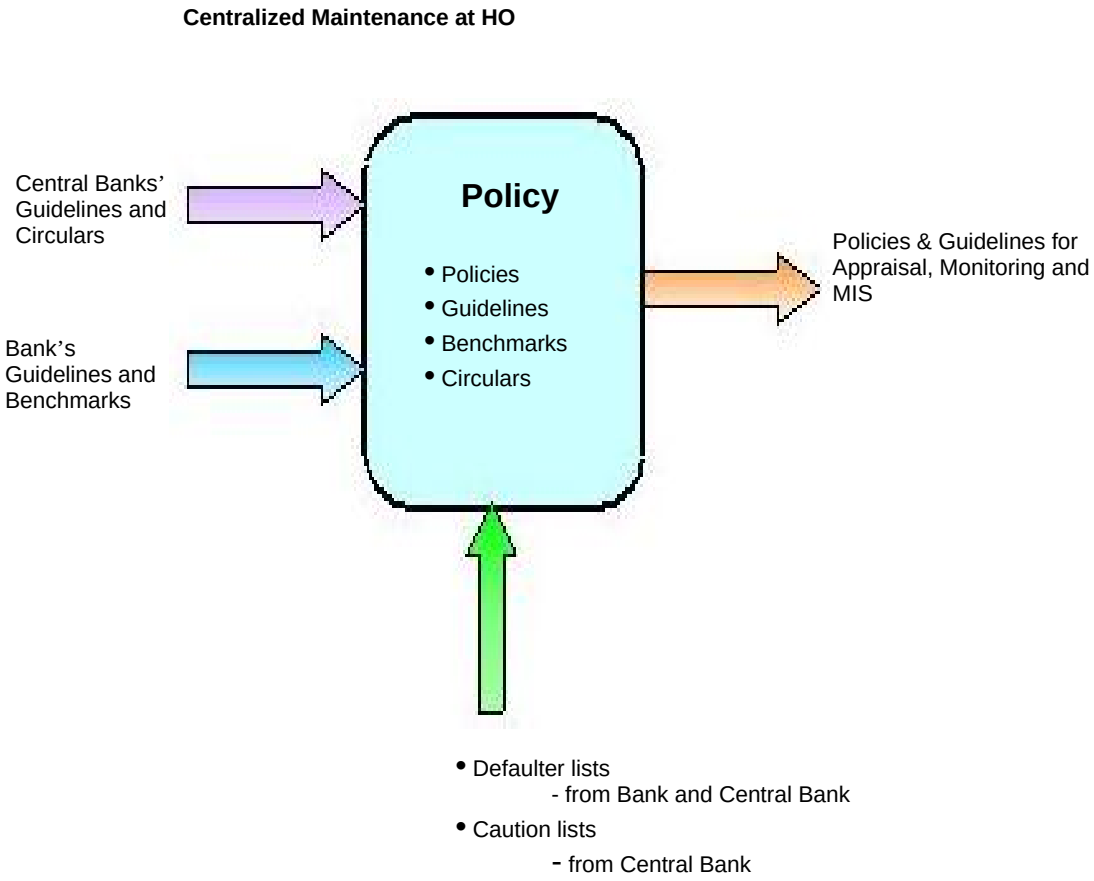


Figure 1: Schematic diagram showing policy maintenance and utilization

- Masters include inventory norms, interest rates, industry master, ratios master, maximum permissible bank finance, asset classification, facility details, bank fees master, security master, credit schemes, borrower group master, banking arrangement, rating models, prudential norms, terms & conditions for loan sanction etc.

- Also captures defaulters lists, caution lists, bank's & central bank's circulars
- Also maintains history of modifications in policies

Credit Rating

- In built Credit Risk rating model based on
  - Financial analysis and a number of financial ratios
  - Operating performance
  - Industrial Scenario
  - Management capabilities
- Rating score is used for pricing of the asset by the system.

Monitoring

The accounts are monitored based on internal follow up of the bank. This follow up is undertaken based on various internal reports, reviews and follow up measures, like stock verification by CA and bank's officials, visit reports etc. The system generates reports in the form of letters for non-receipt of information and based on review comments.

Further, the accounts are also monitored based on feedback from the borrowers. This is undertaken based on audit, quarterly and half-yearly results submitted by the borrowers. The information is analyzed, reviewed and follow up measures are taken. The system generates reports based on review comments for closure of irregularities.

- Borrower accounts are monitored for their conduct after a loan has been sanctioned and disbursed.
- Monitoring of sanctioned limits based on financial details submitted by the borrowers
- Periodic Review of Large Borrowers
- Follow-up based on internal reports of the Bank namely, CA Stock Verification, Branch Compliance Certificate for a sanction, Monitoring

Officers Reports, Site Visit Reports, Position of Accounts

- Areas of irregularities can be maintained which can be linked to bank defined irregularities
- For each of the internal reports, the irregularities are specified and the reviewer can specify review remarks
- Tracking of irregularities/clarifications/review comments till their closure or waiver
- Generation of letters and reminders for closure of irregularities and clarifications
- Generation of letters and reminders for branches/RO/borrowers seeking clarifications for addressing issues in a time bound manner
- The system generates reports in the form of letters for the following:
  - Non receipt of information
  - On review comments for clarifications raised by the reviewer
  - On variance analysis made by the system.

1.4. TECHNICAL ARCHITECTURE

1.4.1. SALIENT FEATURES

The proposed system would be deployed using a centralized architecture .The application would be using n-tier architecture on technology like J2EE. N-tier architecture would comprise of Presentation layer, Business layer and Database layer. Few salient features are explained below.

1 Scalability
2 Interoperability
3 Efficiency
4 Security

Scalability

Scalability describes the ability of the architecture to support more capabilities and additional users as required. To address scalability, the corporate credit management system has been designed in such a way that the bank can grow in number of users as well as volume of business done without any changes to the application.

Interoperability

Interoperability is the ability for applications to work together and share information. The architecture typically defines the way that this data can be shared. XML (Extensible Markup Language) is becoming a popular data format for information exchange. Therefore, native support for XML is preferred architecture attribute. To address interoperability, the system would be implemented as an XML based architecture.

Efficiency

Efficiency is a measurement of how well an application handles application data and functions. High efficiency ratings result in faster processing time and faster application response to the end user. Although additional hardware can assist with faster response times, the efficiency of how the architecture works is what benefits the most to an organization.

A Graphical Representation of the system is given below:

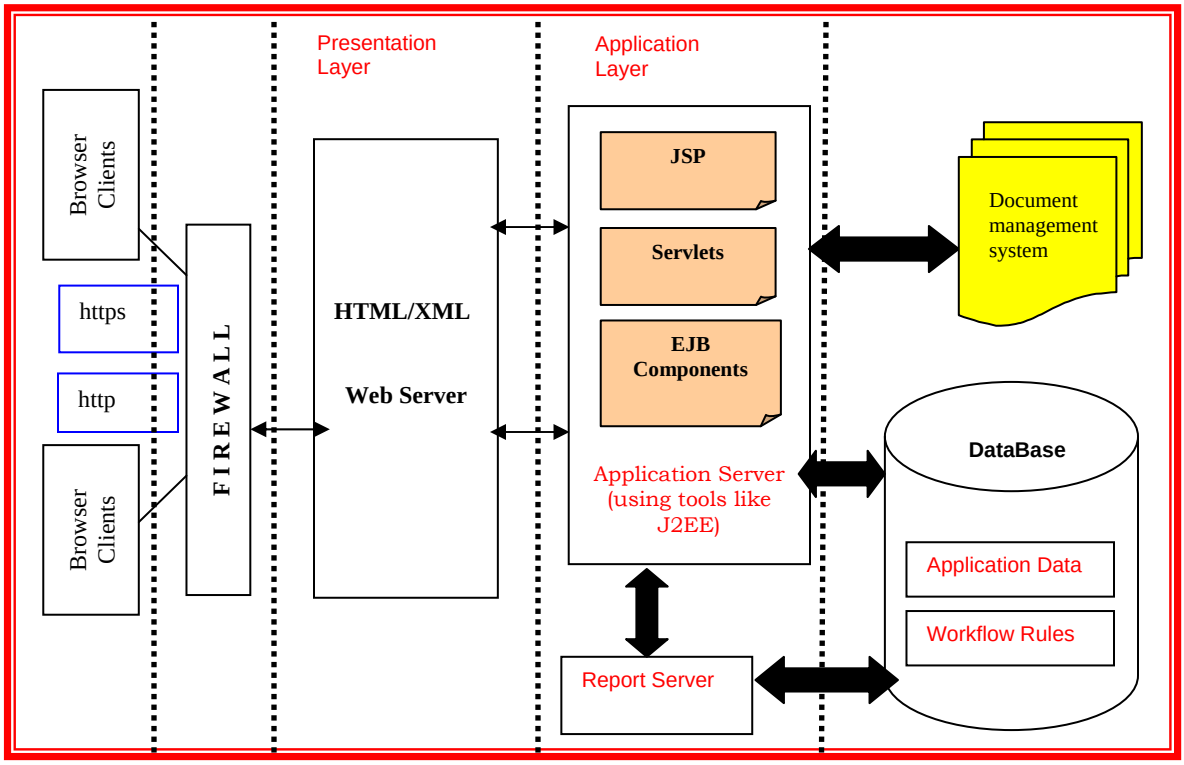


Figure 2: Technical Architecture

1.4.2. PRESENTATION LAYER

Presentation layer consists of two parts – presentation logic and presentation layout. Presentation logic describes the flow of control from the perspective of each user interaction; request processing, followed by content generation and delivery. The goal of presentation logic is to create a logical answer to a request, and to prompt for another request.

Technical Aspect

All technical aspects of this layer would be implemented on the web server that would provide output in the HTML / XML format for all web based forms. These forms would also, in turn, entail all front-end validations by embedded java scripts (e.g. Date format and other form based validations). The communication between the web based clients and the web server would be via HTTPS protocol.

Prior to the connection with the web server via the Internet all requests would be routed via the FIREWALL for the application as well as network security.

1.4.3. APPLICATION LAYER

This layer provides the runtime environment for the application's business logic. Provides a framework/container to integrate application services such as deployment of server side code, framework to integrate with Corporate Credit Management System coupled with the Database. In short, business logic involves the content provided by and generated for the application.

Technical Aspect

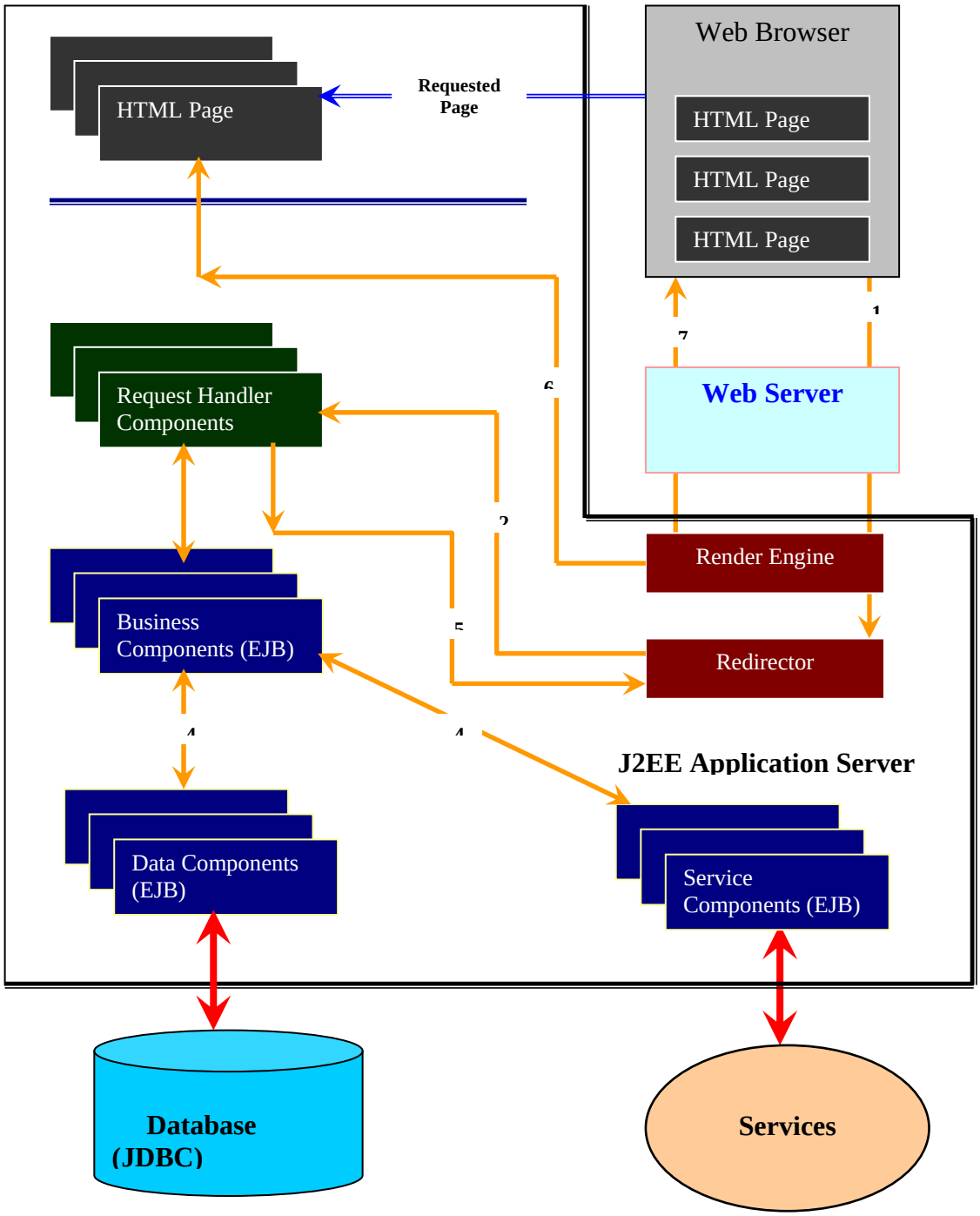
The server side code would be implemented through APIs developed using languages like java servlet and Enterprise Java Beans. This would encompass all the business logic of the application based on the Object - oriented methodology using features such as EJBs. This layer would also provide connectivity via JDBC to the Database that is residing on DBMS like ORACLE for transactions. Apart from this, there is also integration with the Report Server that would provide accessibility to all the predefined reports residing on the report server. Report Server would handle activities like Report Scheduling, Report queuing, Exception handling etc. Report Server will be integrated and Database Server. Other activities that would involve are Server-side validations via LDAP as well as application security based ACL (Access level), Session Tracking and Management and Connection Pooling.

1.4.4. DATABASE LAYER

This layer provides the access to the database for creation of records and facility to fetch records on the basis of the request from the application layer via JDBC. It would also provide all database security aspects. Database level privileges and rights will be set for the users.

1.4.5. DATA FLOW

A typical data flow in the Corporate Credit Management System based on the web-based architecture is shown and described below:



Data Flow (Steps depicted in the above figure)

i. Clients (HTML or client side extension) access standard the system's web page via a web server using standard methods
ii. The web application servlet intercepts the request and passes control to a custom component called servlet controller specifically designed to run when this web page is requested
iii. The controller servlet may use any of the application's components to perform business rules associated with this page
iv. The business logic component may access the application's components, external data sources or external services to perform "real work"
v. Based upon the information received from the business components, the controller servlet updates a list of required content changes maintained by the web server
vi. When controller servlet is finished, the web application reads the appropriate pages from the web server, merges in the required content changes and delivers the result to the client
vii. The user receives a standard web page that looks as though it came from a static site, even though it is dynamically created

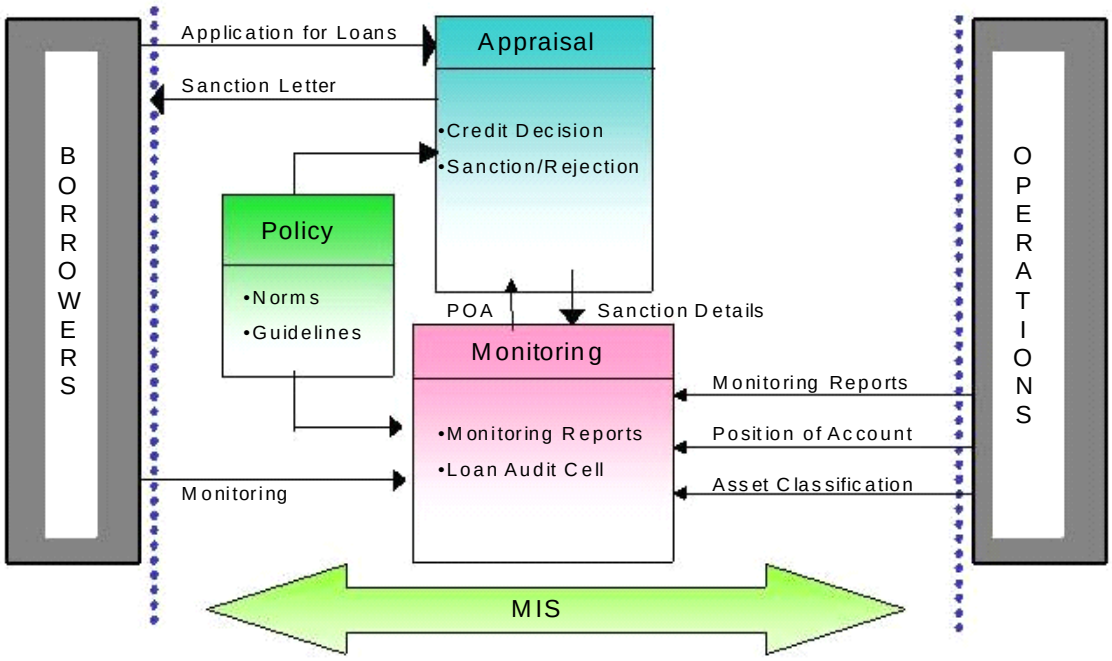
1.4.6. HARDWARE SPECS

The hardware configuration required for a centralized version of CMS may vary widely based on the bank's volumes and performance requirements. The actual server configurations and data storage requirements can be arrived at only after studying the bank's volumes, growth in data etc. The network bandwidth will be influenced by the performance desired by the bank.

1.5. FUNCTIONAL ARCHITECTURE

It offers significant competitive advantages as it increases the productivity and improves the quality of service to the clients. It can be installed at designated branches and Head office of a bank for processing of loans and for handling credit administration of the bank. It supports comprehensive MIS needs of the bank and suits banking requirements. The suite of reports can help the bank in getting timely feedback for taking corrective and preventive actions and for exercising control.

The following figure shows at a glance, the functional architecture of the Corporate Credit Management system.



The system is expected to provides the following functionality:

- Provides facility for assessment and follow up of Corporate and Commercial credit
- Supports various working capital, term loan, bills and non-fund based products like Letter of Credit, Guarantees etc
- Supports proposal handling and sanction of regular, ad-hoc, fresh, renewal and enhancement of limits for working capital and term loan
- Provides facility for assessment of different types of business activities such as manufacturing, trading, leasing & hire purchase.
- Provides facility to generate appraisals notes and electronic approvals which can save lot of time and cost to the bank
- Provides facility to carry out In-principle approvals, validity extensions and amendment of sanctions
- Provides facility to generate sanction and rejection letters
- Provides facility to generate reminders for review of sanctions
- Provides facility for storing defaulters' lists and using them during appraisal
- System flexibility through extensive use of parameterization, Provides facilities for parameterization of Bank's policies e.g. Applicable Interest rates for various products, setting-up default terms and conditions, document checklists etc. for various products and types of applications
- Provides facility to monitor sanctions based on inputs from branches and borrowers
- Tracking of irregularities, variance analysis, clarifications, review comments based on monitoring reports
- Automated generation of letters and reminders for customers, branches and provinces
- Alerts and exceptions taking care of the needs of bank's processes
- Exhaustive set of statutory, control and MIS reports for credit department
- Web based n-tier architecture

- Single point data entry
- Efficient system security
- Credit processing at the Branch, Province and the Head Offices level
- Online availability of policy, benchmarks, guidelines and norms
- Decision support tools such as ratio analysis, break even & sensitivity analysis
- Availability of risk rating model and pricing
- Electronic approval of appraisal notes and automated workflow

1.6. Outcome of Corporate CMS

Credit Management System could be used in financial institutions with different flavors. A number of reports are generated for credit department, which are meant for control, top management and for statutory reporting. These require to be customized as per bank's requirements. The following is a brief description of the outcome in the form of knowledge that could be developed through Credit Management System:

1. Borrower Wise Rating Detail – This report gives a list of credit ratings of all borrowers of money from the bank sorted according to the borrower.
2. Borrower Details – This report gives the details regarding the amount of money borrowed, the rate of interest, the number of repayments remaining and other details pertaining to the borrower.
3. Sanction Details – This is a collection of information related to sanctioning of loans such as the security involved in the agreement, its valuation, duration of loan and others.
4. Monthly Advances of Sanction – A monthly generated report stating the sanctioned advances for that month.
5. Details of Loan Sanctioned – This report is a list of all loan accounts which are sanctioned providing details such as the sanctioned amount, compound interest, duration for the loan.
6. Details of Top account – This is a list of all such accounts who the highest borrowers of money from the bank.

7. List of rejected Proposals – This is a collection of all those customers whose proposal for loans have been rejected along with the reason for the rejection.
8. Statement of new advances – A statement of the new loans given for the duration as given by the user.
9. Advances on PLR – This is a report giving details of all the advances given by the bank based on the prime lending rate.
10. Pending Approval cases – This lists the accounts for which approval is awaited before providing the loan to the borrower.
11. Terms And Conditions Master – A repository of terms and conditions which are applicable to different loan products as per the bank's rules.
12. Bank Fees Master – This is a list of the bank fees applicable for different types of transactions.
13. Defaulters List – A list providing the details of all those customers who have not paid their last repayment for the duration as provided by the user.
14. Currency Master – This provides a list of currencies that are available in which the loan can be taken.

The following is an additional indicative list of useful reports that could be developed, using the corporate credit manage system:

1. Document master PLR
2. Consortium Meeting
3. Monitoring Report
4. Bank Master
5. Borrower Rating Report
6. Overdue Proposals
7. Proposals Due For Renewal
8. Outstanding Treasury Guarantees
9. Group Exposure
10. Track BCC checklist
11. Facilities granted Govt. Corp.
12. Declined Credit Applications
13. Advances on PLR
14. AD-HOC Sanction
15. Credit Ceiling Master
16. Rating Score Master
17. State Master
18. Security Insurance Master
19. Banking Arrangement Master
20. Reminder For QIS 1
21. CA Stock clarification
22. Pending stock verification…
23. Site visit seeking clarification

24. POA Awaiting clarification
25. In Principal Approval
26. Group Wise exposure
27. Pending POA
28. Deployment Of funds
29. Telephonic Sanctions
30. Power Register
31. Govt. Guaranteed Account
32. Decrement in Borrower rating
33. Increment in Borrower Rating
34. Proposal Allocation Details
35. Prime Rates Master
36. Present Value Master
37. Facility Master
38. Asset Classification Master
39. Interest Rate Master
40. Loan Purpose Master
41. Department Master
42. Borrower Rating
43. Legal Capacity Master
44. MPBF Methods
45. Credit Schemes Master
46. Borrower Group Master
47. Industry Master
48. Discretionary Power Master
49. Security/Sub-security Master
50. Borrower Constitution Master
51. Ratio Master
52. Document Master
53. Commodity Master
54. Designation Master
55. District Master
56. Region Master
57. Branch Master
58. Checklist Master
59. Inventory Norm

SUMMARY

A knowledge development model which ensures the coherent organization and management of credit system is presented in this Chapter 2. Corporate Credit Management System is designed for automation of several tasks in the lifecycle of borrowing. Suitable Graphical User Interfaces for interaction with the user are incorporated.

This model not only helps in identifying and assessing strategic options on existing approaches but also offers a structured methodology from strategic analysis and conceptualization to implementation. It offers solutions for different levels by addressing information system with suitable knowledge development on credit management. Based on the sound principles of reasoning, a top-down and

a bottom-up approach are combined in designing the Knowledge Development system for credit management with several foundations to meet the intrinsic challenges. This knowledge model offers a shift from the local proprietary solutions to produce and disseminate embedded knowledge models into larger computational solutions in effect to generate suitable applicable (desired) knowledge.

The system has transparent features for recording all the actions taken by the concerned banker which help for the audit trails. This becomes a repository for references in the future. The technical architecture, apart from meeting the business requirements, also provides security in terms of firewall and implementation of various authentication mechanisms.

The system is a means of monitoring loan accounts proactively. It gives reminders in form of messages and reports to the end-users by listing the outstanding credit and debit balances of the customers in addition to several customized reports as desired. This is helpful in tracking the repayments due to be paid by the customers in the specific time period as required.

This knowledge development model for credit management can further be combined with common interpretative environment, which fold up the semantic space for knowledge management in virtual organizations on credit handling in the paperless environment.

Chapter 3
Aspects of Modeling Security Systems
Extrapolating Knowledge Management

Abstract:

In the present business environment, security is one of the most pressing IT concerns. As an organization expands its assets and increases its exposure to a variety of users, a simple patchwork of security controls no longer suffices. Instead, organizations require a comprehensive solution that facilitates proactive management of their security environment.

This chapter presents a spectrum of aspects on secure knowledge management and evolves a model for developing a comprehensive security system using knowledge Management philosophy.

1. Introduction

Secure knowledge management consists of secure strategies, processes, and metrics. In addition, security technologies such as the secure semantic web and privacy-preserving data mining are technologies for secure knowledge management. Security techniques for knowledge management include access control and trust management.

Researchers are working on secure knowledge management that complements the ideas we have presented in this paper. An excellent introduction to secure knowledge management is given in [S. Upadhyaya, H. R. Rao, and G. Padmanabhan- 2005] Work on trust management and policy-driven approaches for the semantic web have been reported in [L. Kagal, M. Paolucci, N. DSrinivasan, G. Denker, T. Finin, and K. Sycara -2004].

In this Chapter, [Maruti P & Jani N N - 2008], we address the entire spectrum of aspects on secure knowledge management and evolve a model for developing a comprehensive security system using knowledge Management philosophy.

2. Aspects of Secure Knowledge Management:

We identify the following important aspects of secure knowledge Management:

- Security Strategies: Policies, Plans and Procedures
- Security Processes for workflow and sequencing
- Software tools for Management of Information: DBMS, Data Mining, Networking, Web of Sciences
- Metrics on security impact
- Techniques for Security: Access control, Trust Management, Privacy Management

2.1. **Security strategies** for knowledge management include the policies and procedures that an organization sets in place for secure data and information sharing as well as protecting the intellectual property. Some of the questions that need to be answered include how often should knowledge be collected? How often should the organization conduct audit strategies? What are the protection measures that need to be enforced for secure knowledge sharing? Secure knowledge-management strategies should be tightly integrated with business strategies. That is, if by enforcing intellectual-property protection, the organization is going to be unprofitable, then the organization has to rethink its secure knowledge-management strategy.

2.2. Secure processes for knowledge management include secure workflow processes as well as secure processes for contracting, purchasing, and order management. Security has to be incorporated into the business processes for workflow, contracting, and purchasing. For example, only users with certain credentials can carry out various knowledge-management processes.

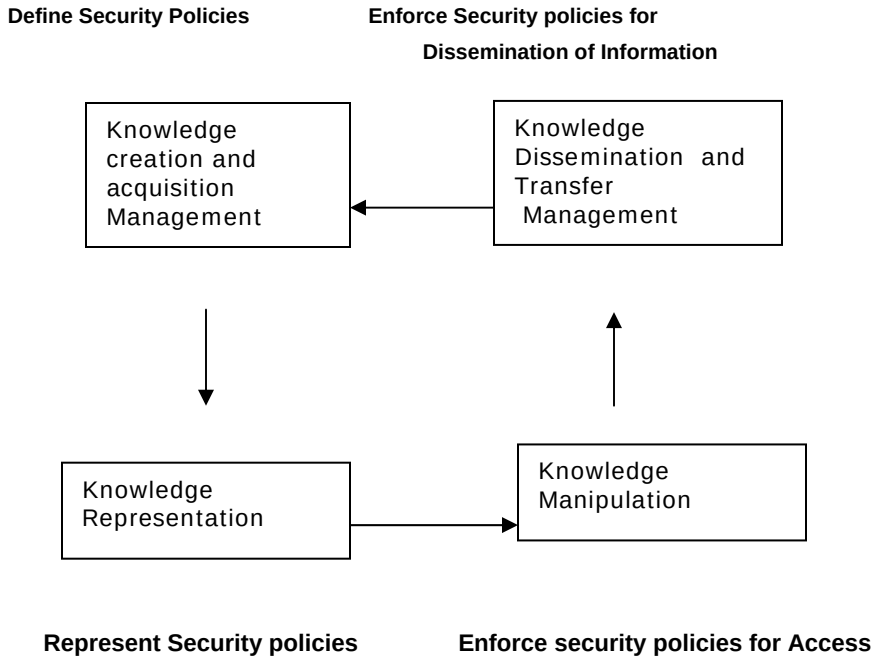
2.3. Software tools for Management of Information include among others**,** DBMS, Data Mining, Networking, and Web of Sciences

2.4. Metrics for secure knowledge management should focus on the impact of security on knowledge-management. Some examples of knowledge-management metrics include the number of documents published, number of conferences attended, or the number of patents obtained. When security is incorporated, then the number of documents published may decrease as some of the documents may be classified. Organizations should carry out experiments determining the impact of security on the metrics gathered.

2.5 Security techniques include access control, trust management, as well as privacy control. These techniques are enforced at all stages of knowledge-management processes. Secure knowledge-management technologies include data mining, the semantic web, as well as technologies for data and information management. The component technologies have to be secure if we are to ensure secure knowledge management.

3. K M Architecture for Secure System

The components of the architecture are a secure knowledge-creation manager, secure knowledge-representation manager, a secure knowledge manipulation and sustainment manager, and a secure knowledge dissemination and transfer manager.



Knowledge Management Architecture with security Orientation

3.1. Secure knowledge-creation task includes creating knowledge as well as specifying security policies enforced based on the knowledge.

3.2. Secure knowledge representation tasks include representing the knowledge as well as policies in a machine-understandable format. Knowledge representation languages such as rules and frames as well as some of the more recent semantic-web languages such as resource descriptive framework (RDF) and ontology languages are appropriate for knowledge and policy representation.

3.3. Secure knowledge-manipulation tasks include querying and updating the knowledge base. In addition, the knowledge gained has to be sustained as long as possible. Various processes have to be in place to sustain the knowledge securely.

3.4. Secure knowledge dissemination and transfer task includes disseminating and transferring the knowledge to authorized individuals. This section has provided an overview of the various aspects of secure knowledge management. The remainder of the chapter will discuss certain security techniques for confidentiality, trust, and privacy.

4. Modeling Secure Computer Based System for an Enterprise:

Based on the identified aspects, we propose suitable systems for various management activities of an enterprise:

4.1. Services Management
4.2. Service support Management
4.3. Service Delivery Management
4.4. Financial Administration Management

Having assessed various alternatives, we propose the corresponding functional systems for accomplishing the overall management under the umbrella coverage of the above systems. They include the following:

4.5. Life Cycle Process of a Business Function

- Business portfolio planning
- Business Modeling & requirement
- Analysis, Modeling & Construction
- Change Management
- Testing

4.6. Operations Performed at each Stage

- Network & systems
- Applications & Databases
- Job Optimization
- Desktop & servers

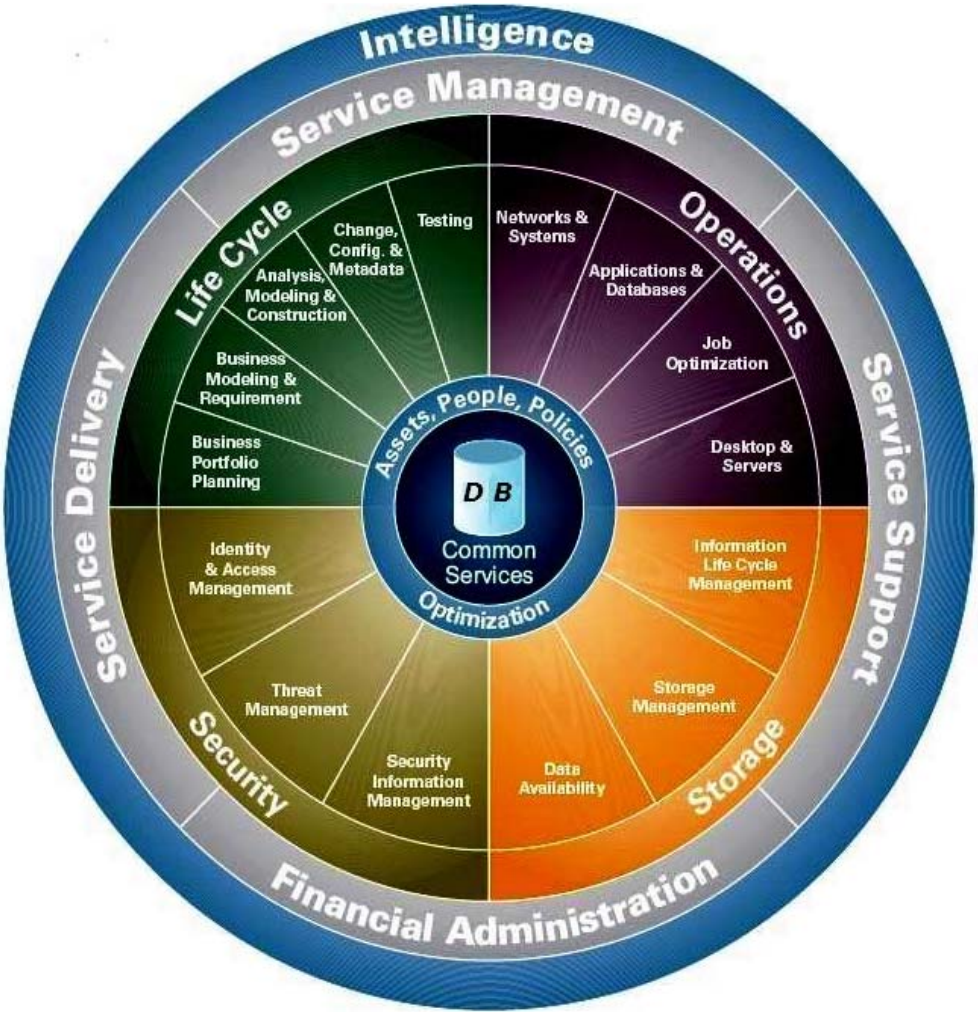
4.7. Storage Management Strategies

- Information Life Cycle Management
- Storage Management
- Data Availability

4.8. Security Management Systems

- Identity Access Management
- Threat Management
- Security Information Management

Identifying all the above aspects which are to be based on the available assets, people and policies, we model the security oriented computer based system by keeping the common services of the enterprise on the Master Data Base as follows:



Security oriented model of Computer based enterprise system

In this model, we integrate the traditionally distinct operations such as storage, security, life cycle and service management into an effective business centric model to optimize the performance, reliability and efficiency of enterprise IT environments. The functions interact with each other leveraging common services software components that perform reusable functions across multiple applications.

5. SUMMARY AND DIRECTIONS

This Chapter has formulated some key points in secure knowledge management on the experience of the author in implementing secure systems for Business functions. The emphasis is that security has to be incorporated into the knowledge-management lifecycle. Having cited the issues on integrating security strategy with knowledge management and business strategies of an organization, architecture for secure knowledge management and modeling has been designed.

There are many areas that need further work. First, we need to develop a methodology for secure knowledge management. While we have discussed some aspects of secure knowledge management strategies, processes, and metrics, we need a comprehensive lifecycle for secure knowledge management. The security critical components have to be identified for knowledge management. Finally, privacy issues need to be investigated further.

In addition to enhancing and formalizing the policies discussed here, we also need to explore the incorporation of some of the real-world policy specifications into the knowledge management strategies. For example, we need to examine the P3P specified by the World Wide Web Consortium and determine how we can enforce such a policy within the framework of secure knowledge management. We also need to investigate integrity aspects of knowledge management.

For example, how do we ensure the integrity of the data and the activities? How can we ensure data, information, and knowledge quality? The best way to test out the policies is to carry out pilot projects for different types of organizations including those from academia, industry, and government. Based on the results obtained, we can then continue to refine the policies for knowledge management.

In summary, secure knowledge management will continue to be critical as organizations work together, share data, as well as collaborate on projects. Protecting the information and activities while sharing and collaborating will be a major consideration. This chapter has provided knowledge based modeling for incorporating confidentiality, trust, and privacy.

Chapter 4

Knowledge Based Core Banking Systems

Abstract:

Consumers who were simple retail banking customers a decade ago, have today moved up the value chain to emerge as a consumer of large number of financial products, dividing their income portfolios among many banks. In order to maximize its share of income of a retail customer, a bank would find its retail banking offerings entering the high profile private banking and wealth management domains.

This chapter **[Maruti P-2006]** presents the contributions on modeling the knowledge development systems in the form of Core Banking Systems for automation of banking transactions (Retail Banking) that include liability management, loans and advances, mortgages, debit cards, credit cards and so forth.

Through the above systems, customized services are offered to individual customers usually at local branches of various banks.

Introduction:

Computerization has changed the way in which some of these operations are performed today. **Banking** is defined as “Accepting of deposits of money from public for the purpose of Lending or Investment, repayable on demand or otherwise and withdrawable by cheque, draft, or otherwise”

A banking company must perform both of the essential functions

- accepting of deposits
- lending or investing the deposits

and such a company is called a Bank.

Alternately, an institution (person or body, corporate or otherwise) cannot be a bank if it does not -

• Take deposit accounts
• Take current accounts
• Issue and pay cheques
• Collect cheques crossed and uncrossed for his customers

If the purpose of accepting of deposits is not to lend or invest, then the business will not be called as a banking business.

The Business of Banking

Several services are extended by banks. Let us consider a service on deposit handling in a bank and illustrate the same logically. When the bank accepts deposits, it pays interest on the deposit to the customer. When the bank lends money, it charges interest on the money lent to the customer. Also, the bank provides certain services to its customers for a fee. Thus, the business of a bank is based on this principle of

- The difference in interest received on the amount lent and the interest paid on the deposits collected. This difference between interest earned and paid is also called **Spread**.
- Income received by means of fees for the services rendered

In very simple terms, the business model of a bank can be summarized as follows -

Profit = (IR – IP) – (OC + OE) + FI

Where,

IR - Interest Received on Advances

IP - Interest Paid on Deposits

OC - Operating Costs

OE - Operating Expenses

FI - Fee based Income

Similarly , all services are to be analyzed logically in designing Knowledge development models for Core Banking Systems.

Having considered the functions of the bank as per the Bank Regulation Act-1949 and the enhancements made over the years, this chapter **[Maruti P-2006]** presents the design of knowledge development model for Core Banking System (CBS), which can automate every aspect of a retail bank operational requirements and to provide solutions to meet the challenges faced by the financial institutions in India.

Functions of Banks in India as per the Bank Regulations: (BR Act 1949; **Section 6**:)

1. The borrowing , raising or taking of money ;

2. The lending or advancing of money, either upon security or without security;

3. The drawing, making, accepting, discounting, buying, selling, collecting and dealing in bills of change, hundies, promissory notes, coupons, drafts, bills of lading, railway receipts, warrants, debentures, certificates, scrips & other instruments & securities, whether transferable or negotiable or not;

4. The granting & issuing of letters of credit, travelers cheques & circular notes;

5. The buying, selling & dealing in bullion & silver;

6. The buying & selling of foreign exchange, including foreign bank notes;

7. The acquiring, holding, issuing on commission, underwriting & dealing in stock, funds, shares, debentures, debenture stock, bonds, obligations, securities & investments of all kinds;

8. The purchasing & selling of bonds, scrips & other forms of securities on behalf of constituents or others;

9. The negotiating of loans & advances;

10. The receiving of all kinds of bonds, scrips or valuables for deposit or for safe custody or otherwise;

11. The providing of safe deposit vaults;

12. The collecting & transmitting of money & securities;

13. Acting as agents of the Government, local authority or person & carrying on agency business, but excluding the business of a secretary & treasurer of a company;

14. Undertaking contracts for public & private loans, & negotiation & issue of the same;

15. Effecting, insuring, guaranteeing, underwriting, participating in managing & carrying out of any issue of state, municipal or other loans or of shares, stock, debentures, or stock of companies & lending money for the purpose of any such issue;

16. Transacting every kind of guarantee & indemnity business;

17. Managing, selling and realizing any property which may come into its possession in satisfaction or part satisfaction of its claims;

18. Acquiring and holding, and dealing with any property or any right, title or interest in any property which may form the security for any loan or advance;

19. Undertaking and executing trusts;

20. Undertaking the administration of estates as executor, trustee or otherwise;

21. Establishing, supporting, and aiding associations, institutions, funds, trusts, etc., for the benefit of its present or past employees and granting money for charitable purposes;

22. Acquisition, construction and maintenance of any building for its own use;

23..Selling, improving, managing, developing, exchanging, leasing, mortgaging, disposing of all or any part of the property and rights of the company;

24. Acquiring and undertaking the whole or any part of the business of any person or company, when such business is of a nature described in the Section (6) of the BR Act;

25.Doing all such things which are incidental or conducive to the promotion or advancement of the business of banking; and

26.Undertaking any other form of business which the central government may specify as a form of business in which it is lawful for a banking company to engage.

Also a banking company is prohibited from engaging, directly or indirectly, in trading activities and undertaking trading risk. However, a banking company is permitted:

- to realize the securities given to it or held by it for a loan, if need arises for the
- realization of the amount lent, and
- to buy or sell or barter for others in connection with bills of exchange received
- for collection or negotiation and undertaking the administration of estates as
- executor, trustee, etc.

New Avenues in Banking

Following are the new avenues are pursuant to Banking Laws (Amendment) Act 1983)

•Merchant Banking:

Financial intermediaries in the process of transfer of capital from those who own it to those who use it

•Leasing

Contract between a lessor and lessee for the use of specific assets for a predetermined period by the lessee on payment of lease rent. In a lease transaction, the lessee does not have an automatic option to purchase the equipment at the end of the lease period unlike a hire purchase transaction. All Public Sector Banks and some NBFCs deal in lease operations. Types are:

- .Operating lease
- .Financial lease
- .Leveraged lease

•Mutual Funds

Concept is based on the rationalistic choice of the investment portfolio. Minimization of risk, maximization of yield and liquidity are the objectives of the investors. Mutual funds publish the NAV (net asset value) of their different schemes.

- **Factoring**

Factoring involves undertaking to collect, account for and manage the clients' debts and also financing them, either by lending against accounts receivable or purchasing/ discounting the receivables outright for a charge called discount. This concept is of recent origin in India and have the potential of becoming popular in India as numerous large and small units face problems in collecting their trade debts.

- **Housing Finance**

The sources of funds are:

- Public deposits/borrowings from the market
- Borrowings from banks
- Foreign currency borrowings at concessional rates from international development agencies
- Refinance from the National Housing Bank
- Securitization of receivables.

Credit Cards

Banks tie up with international networks such as Master Card or VISA.

Debit Cards

Whereas ATM card can be used on specified ATMs to withdraw, deposit, transfer funds (Transfer to other accounts in the bank, pay utility bills, etc), inquire balances and order drafts and cheque books, these cards can be used like credit cards everywhere: But with the difference that the debit hits the account immediately and there are no hidden service charges.

Travel Related Business

This includes arranging package tours, especially for foreigners, arranging hotel accommodation and making transport arrangements.

Money Market Mutual Funds (MMMF)

MMMFs are just another form of MFs investing in lucrative money market instruments as distinguished from capital market instruments. Their portfolios are limited to securities traded in the money market, such as treasury bills, money at call and short notice, certificate of deposits, commercial paper, etc.

Role of other types of Banks

Regional Rural Banks (RRBs):

Benefits of the co-operative banking system were not reaching all the farmers in rural areas. RRBs are institutions in rural and semi-urban areas which could combine local knowledge and familiarity with the problems being faced by co-operative banks with the degree of organizational ability and resource mobilization capacity of commercial banks.

Co-operative Banks:

Co-operative banks exist side by side with commercial banks and play a supplementary role in providing need-based finance, especially for agricultural and agriculture-based operations. They are:

.State co-operative banks (SCBs)

- .Central co-operative banks (CCBs)
- .Primary (urban) co-operative banks (PCBs)
- .Primary agricultural credit societies (PACs)
- .Farmers service societies (FSS)
- .Large-sized adivasis multi-purpose societies (LAMPS)
- .Land development banks (LDBs)

THE CHALLENGE

Financial institutions face unprecedented competition from non-financial institutions, foreign banks, as well as traditional competitors. New competitors offer specific savings, lending, or investment products, though they are not full-service banks or traditional financial institutions. Competition from overseas is anticipated as countries are in the process of de-regulating domestic markets so that foreign banks can enter the retail banking market. Traditional competitors are using new technologies to deliver incremental services and provide additional customer access points to lure customers away from them. The increased competition affects banks in many different areas:

Product development—All banks—especially new entrants into a market—attempt to differentiate themselves by providing and promoting innovative products. As the level of competition increases, new products must be quickly developed to capitalize on market opportunities and defend market position.

Target customers—Promoting the new products to existing customers is the most efficient and effective way to reduce marketing costs, as well as defend customers from the competitors. Banks must have a clear and complete view of all their customers so that marketing activities can be targeted to achieve the most cost-effective results.

Delivery channels—Increased competition can be based not only on new products but also on new delivery channels. All banks are introducing new delivery channels to gain competitive advantage.

Costs—As the level of competition increases, so does the pressure on the bottom line. To respond to product development, marketing, and new delivery channel pressures requires significant investments that must be optimized. In addition to these new investments, banks must reduce the cost of operating their existing technology infrastructure.

MEETING NEW MARKET DEMANDS

Financial institutions face fierce competition from many directions. To compete effectively, they must manage core business costs, invest in new technologies that provide services and retain customers, and build better customer relationships. The CBS is a core banking software solution which automates every aspect of a retail bank's operational requirements—regardless of size.

The solution can encompass retail, e-Commerce, treasury, and management information system components—all in one homogeneous solution.

A bank's core banking system is a critical component to the ability to capitalize on new opportunities and to defend their business from new competition.

THE SOLUTION OVERVIEW

The CBS solution is designed to address business challenges so that banks can prosper in an increasingly competitive market. While the challenges of modern banking are significant, the design and modularity of the CBS system protects a bank's initial investment by allowing the system to expand and adapt as requirements change.

Designed on component business object techniques the CBS system is to support common core banking functions, such as the following:

- Customer relationship management
- Limits and exposures
- Collateral management
- Marketing notification and response
- Deposit processing
- Loans processing
- Contingent account processing
- Cash accounting
- Electronic funds transfer (EFT) switch management
- Debt collection
- Remittance reconciliation
- Correspondence management

WHO THE SOLUTION WILL BENEFIT

This solution was developed for retail banks. It supports external users (retail and business customers) and internal users (bank employees, business managers, and information suppliers). The ability to scale from the smallest institutions

running a single branch, to the largest multi-national banks, uniquely positions the CBS product.

CBS SOLUTION BENEFITS

The key benefits the CBS solution provides are:

Reduced risk—Separate, stand-in databases reduce the possibility of loss by the bank. Continuous operation **with f**ull functionality and data, as well as 24-hour real-time updates provide a consistent view of customer position. This solution eliminates the possibility of loss by the bank due to the use of separate stand-in databases.

Enhanced customer relationships—A single inquiry delivers a full picture of a customer's relationship with the bank and with other customers—with the ability to drill down to specific account details. This enhances the customer's view of the bank, the bank's view of the customer relationship, and allows improved customer service and selling of additional value-added services.

Increased return on investment—Delivers flexible scalability as transaction volumes increase. CBS is designed to provide high performance to handle transactions well in excess of the requirements of most banks. This gives banks a comfort level of knowing that the increased transaction and growth rates will not be limited by the system choice.

Streamlined time-to-market for new services and channels— CBS is designed as a highly parameterized system. It enables front-end delivery channels to be created and implemented quickly—even overnight with little need for testing. The business code is independent of the front-end delivery channel (such as ATMs, EFT, and POS devices), so new channels can be implemented rapidly. The system is Highly flexible through the use of parameter-profiling

tables. This greatly improves the time-to-market in comparison with traditional time-consuming requirements associated with implementing new features.

Platform and database independence—CBS is to allow banks to choose the best and most cost-effective platform. Banks can choose their database. Microsoft* SQL Server* 2000 and Oracle*9i** are to be supported database management systems. Implementations can be based on the best performing and most affordable technologies.

Delivery channel adaptable—CBS is designed as a message-based system. The business code need to be independent of the front-end delivery channel—such as automated teller machines (ATMs), electronic fund transfers (EFTs), and point of sale (POS) devices—so new channels could be implemented rapidly.

The design facilitates to deliver application-programming interfaces that enable integration to the corporate general ledger portions of other banking products.

Lowered cost of ownership— CBS is to run on Intel® Xeon™ processor family-based servers, which allows customers to avoid expensive enterprise server upgrades. No new or proprietary programming skills are necessary to configure the solution. In most cases, configuration utilities employing simple graphical user interfaces allow enhancement without any programming.

FUNCTIONAL BUSINESS CONCEPT

The CBS solution is designed as the retail banking system for a financial institution. It can interface with a wide variety of front-end delivery channels and back-end database systems within the bank. A flexible retail banking system is essential in enabling new front-end delivery channels to be added quickly, and in allowing a bank to introduce “best-of-breed” systems for other applications within the bank or connecting to external organizations.

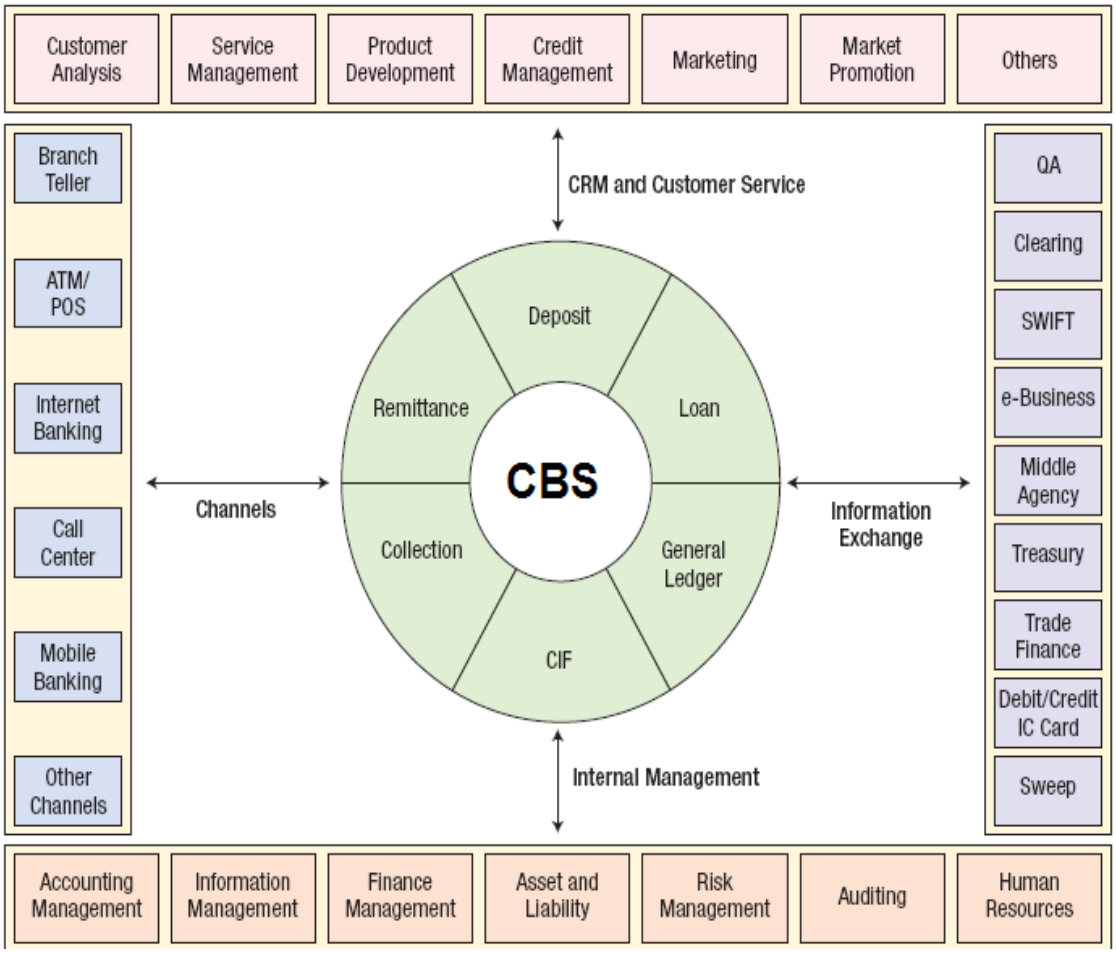


Fig 1 – Perspective Overview

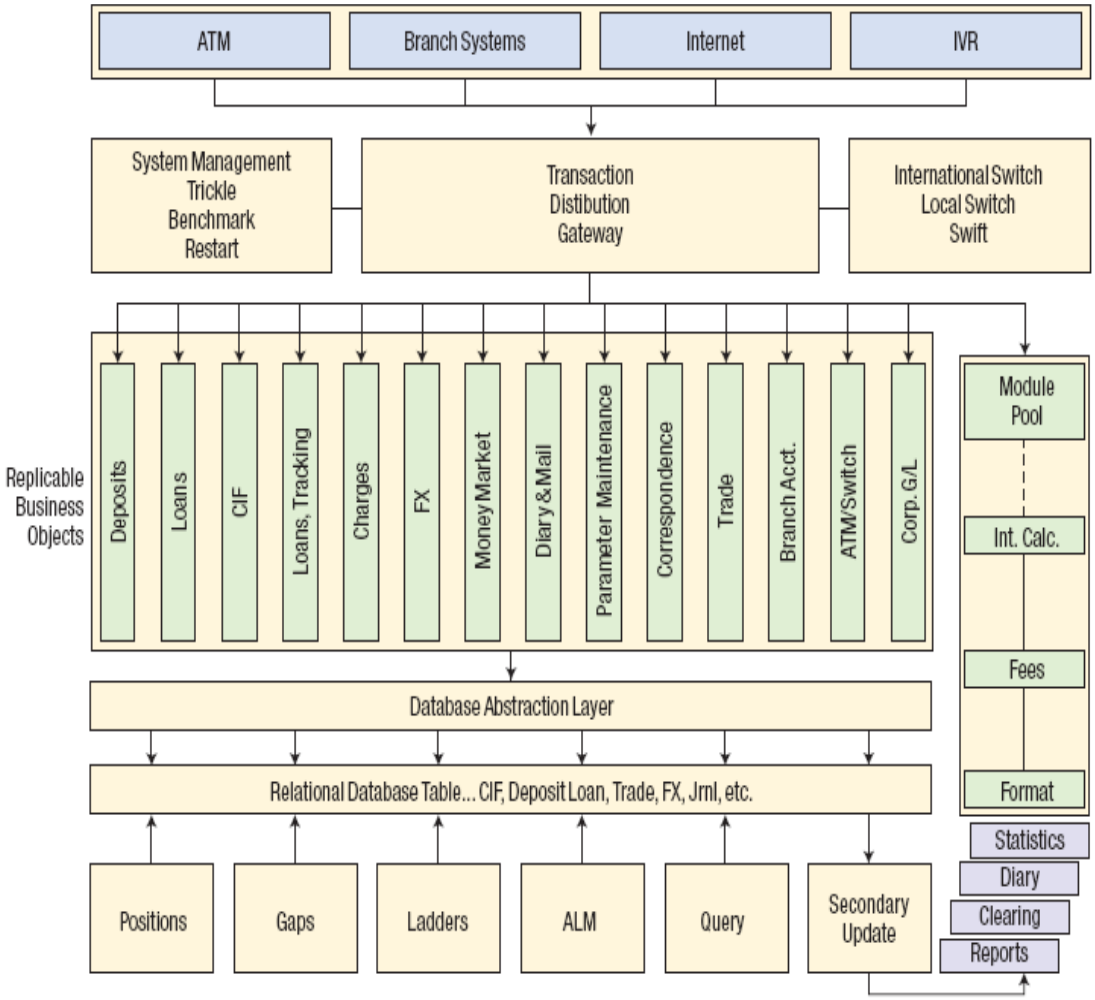


Fig 2: Functional Overview

SOFTWARE ARCHITECTURE

The CBS is designed on a three-tier architecture that keeps the business logic separate from the delivery channels and the underlying data structures.

This allows a banking system implemented with CBS to be easily adapted as technology evolves. Interfaces to the system are based on messages. Messages are delivered to the application by means of message-based middleware or through message gateways. The message-based system allows for easy integration with other systems and channels, such as Microsoft.NET* application framework. The presentation tier is separated from the application tier through

the use of dynamic hypertext mark-up language (HTML) pages. All screen definitions are to be built into extensible mark-up language (XML) for run-time processing, and COM+ controls could be used to provide additional functionality.

The central business logic in the application tier is to be controlled by means of parameters. The use of parameters allows a financial institution to easily customize the system for a specific environment, and enables streamlined creation of new products and services, fees and charges, and more. The business logic is also independent of the database management system. Standard SQL relational database systems could be used in the database tier. With appropriate security controls, data within the operational database is accessible using standard query tools. The standard transaction-processing monitor approach to application management is to provide a “container” within which CBS can run. Windows is the container provided as part of the CBS system, and is most commonly used.

Containers are replicated to scale the software architecture of CBS. This allows CBS to take advantage of the processing power of very large symmetric multiprocessing (SMP) systems, whether scaling up (increasing the number of processors in a server in the application tier) or scaling out (clustering additional servers in the application tier).

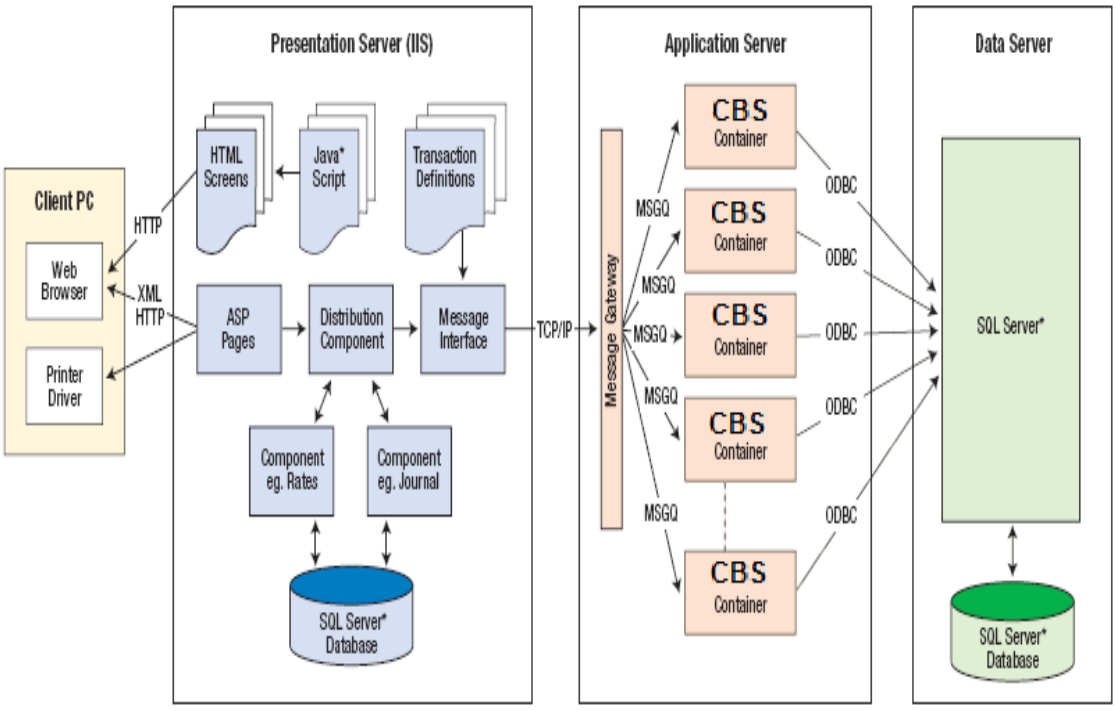


Fig 3 – Software Architecture

The basic functions provided by the CBS container are:

• **Transaction control—**The CBS container opens a new transaction for each method invocation. The transaction is either rolled back or committed by the container if an error occurs in processing. CBS is always to operate within a transactional environment.

• **Management of state—**It is normally the best practice for server applications to not track client state. The CBS container is to maximize scalability by supplying a resource pool of stateless components that can execute on behalf of any client. Resource pooling allows the components of the container to be stateless and is not associated with specific clients or database connections.

• **Management of shared context—**Management of shared context is very important in large OLTP systems to allow maximum scalability. The CBS container to use “coarse-grained methods,” which allow client systems to focus

on the chore they need to perform, but do not require them to be aware of how it actually gets done. Since CBS solutions are heavily parameterized, a large amount of contextual data must be available in memory at run-time. The different components of the CBS container can access transaction data in Windows' shared-memory area. The access facility is called Central Parameter Manager (CPM).

• **Component scheduling—**The transaction-processing (TP) monitor to provide methods for locally and remotely invoking components. The messages are received by a listener thread and scheduled for execution by the TP monitor.

• **Logging—**The CBS container is to provide:
– Standard logging of incoming transactions (automatic)
– Journalizing of update transactions (parameterized)
– Audit logging (coding required)

• **Security—**The CBS container invokes security at three levels:
– User group security, or security based on a user's role
– User security level, or security based on an individual user's identification
– Method security level, or transaction level security

Security values from 0-16 may be defined for each level of the security system. In addition to the container level of security, there is also an additional parameterized level of security for customer or account. This security can be used to ensure that the user has rights to access particular customer or account records.

The CBS solution also to work with externally provided security for various channels, such as personal identification number (PIN) security for ATM and EFT or POS devices, as well as secure socket layer (SSL) security for Internet banking.

• **Data abstraction—**The CBS container is to use open-database connectivity (ODBC) technology to provide a data abstraction layer to isolate the business logic from the underlying data storage. The advantages of using ODBC are:

– The physical structure can be optimized for performance, and the logical structure can be configured to meet the programming needs.

– The application becomes portable across database management systems.

– Better control is achieved over the use of structure query language (SQL) commands, which can be tuned at a higher level for performance.

SUMMARY

The CBS is a core banking software solution that is designed to automate every aspect of a retail bank's operational requirements—regardless of size—delivering cost effective services and bringing new services and channels to market quickly. This solution is to offer banks the ability to use a common platform for all systems, and deploy highly reliable, scaleable solutions to meet current and future requirements. The unparalleled value and performance of current day servers enable banks to successfully implement this solution and tune performance to meet individual response times and throughput needs. As customer growth accelerates, the CBS could be economically scaled to meet and exceed customer performance expectations.

Chapter 5

Modeling Anti- Money Laundering Systems

Abstract

Money laundering and terror financing transactions are a major concern for banks and other financial institutions world over. Global regulations such as the FATF recommendations, USA Patriot Act, FSA guidelines and KYC norms mandate banks to implement anti-money laundering programs -- or face financial risk and loss of reputation.

The presentation in this chapter includes

1. A detail study on Money laundering, the attempts initiated to counter Money laundering and terror financing

2.Logistics on bringing out a solution to the money laundering problem by modeling computer oriented knowledge based systems to provide the banks with the foundation to achieve regulatory compliance, mitigate risks, safeguard reputation and retain customer loyalty.

AML system **[Maruti P. & Jani N.N- 2007-a]** is designed to enable banks to "Know your Customer" better and efficiently monitor every transaction to detect money laundering activities.

Key words:

FSA -- Financial Services Authority
GDP -- Gross Domestic Product
KYC -- Know Your Customer

FATF -- Financial Action Task Force

FI of England -- Financial Intelligence of England

FDI -- Foreign Direct Investment

GAFI -- The **Financial Action Task Force on Money Laundering** (FATF), also known by its French name *Groupe d'action financière sur le blanchiment de capitaux* (GAFI),

OFAC -- Office of Foreign Assets Control

NCCT -- Non Cooperative Countries and Territories

UN -- United Nations

FBI -- Federal Bureau of Investigation

SDN -- Specially Designated Nationals list

MAS -- Monetary Authority of Singapore Act

CTR -- Currency Transaction Report

JSP -- Java Server Pages

Introduction:

Money laundering (ML) is the disguising or concealing of illicit income in order to make it appear legitimate. Money laundering deprives governments of some tax revenues, thereby raising the relative burden of honest citizens. Money laundering may look like a polite form of white collar crime, but it is the companion of brutality, deceit and corruption. Because of rapid movements of large amounts of money, normally stable financial institutions become destabilized, threatening savings accounts and retirement funds of innocent citizens.

Money Laundering is the processing of the proceeds of criminal activity in order to disguise its illegal origin. It involves disguising the sources, changing the form or moving the funds to a place where they are less likely to attract attention. This enables criminals to enjoy the profit from their activities without jeopardizing the underlying activity or the persons involved. Traditional activities include illegal

arms sales, smuggling, drug trafficking and prostitution Definition of Money Laundering includes, tax evasion, purchase and sale of “illegal” businesses . Criminal conduct now includes any offence which is committed and where benefit is gained, of whatever size, for any person.

Currently, ML is estimated to be the world’s third largest industry. The IMF(International Monitory Fund) suggests that money laundering could be somewhere between two and five percent of the world’s GDP. This would equate to somewhere between US$ 590 billion to US$ 1.5 trillion. The lower figure would be roughly equivalent to the value of the total output of an economy the size of Spain. Refer to www.unodc.org/money_laundering.html and www.egmontgroup.org.

Thus, Money laundering is defined as converting criminal income into assets that cannot be traced back to the underlying crime. It is conventionally divided into three stages; the placement of funds derived from crime, the layering of those funds in order to disguise their origins and the integration of the funds into the mainstream economy.

Money Laundering

Money laundering generally refers to ‘washing’ of the proceeds or profits generated from:

- Drug trafficking
- People smuggling
- Arms, antique, gold smuggling
- Prostitution rings
- Financial frauds
- Corruption, or
- Illegal sale of wild life products and other specified predicate offences

initial phase where illegal profits are entered into the financial system

Money Laundering Process

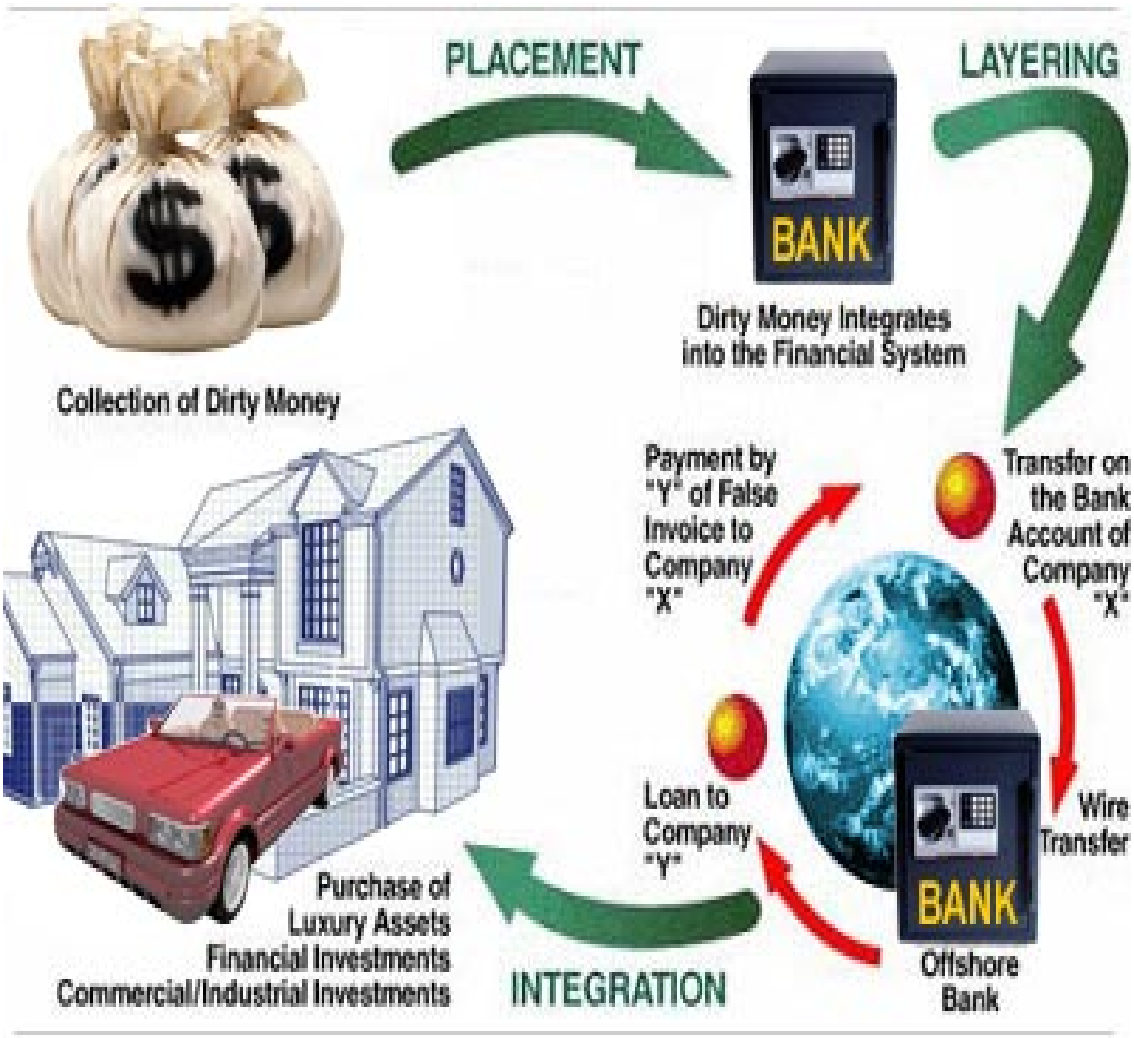
Money Laundering consists of three stages:

1. **Placement**: The first stage involves the Placement of proceeds derived from illegal activities – the movement of proceeds, frequently currency, from the scene of the crime to a place, or into a form, less suspicious and more convenient for the criminal. In this initial phase, illegal profits are entered into the financial system

2. **Layering:** It involves the separation of proceeds from illegal source through the use of complex transactions designed to obscure the audit trail and hide the proceeds. The criminals frequently use shell corporations, offshore banks or countries with loose regulation and secrecy laws for this purpose. Thus “Layering” involves a series of conversions or movements of the funds, such as the purchase and sale of investment instruments, to distance them from their source

3. **Integration.** It represents the conversion of illegal proceeds into apparently legitimate business earnings through normal financial or commercial operations. Integration creates the illusion of a legitimate source for criminally derived funds and involves techniques as numerous and creative as those used by legitimate businesses. For e.g. false invoices for goods exported, domestic loan against a foreign deposit, purchasing of property and co-mingling of money in bank accounts. Thus “Integration” is used for re-entry of the funds into the legitimate economy by, for example, investing the funds in real estate, luxury assets or business Ventures

Money Laundering Process:



Typologies/ Techniques employed for ML:

- Deposit structuring or smurfing
- Connected Accounts
- Payable Through Accounts
- Loan back arrangements
- Forex Money Changers
- Credit/ Debit cards

- Investment Banking and the Securities Sector
- Insurance and Personal Investment Products
- Companies Trading and Business Activity
- Correspondent Banking
- Lawyers, Accountants & other Intermediaries
- Misuse of Non-Profit Organizations

Terror financing transactions

Terrorist Financing is the reverse procedure of Money Laundering. Here the money earned from legitimate sources is used for illegitimate activities i.e. financing terrorism. Funds earned by Political bosses, Industrial organisations etc interested in such activity is supplied to extremist organisations for carrying out their motives. Terrorist financing is converting of White money to dirty money and Money Laundering is converting of dirty money into white money.

Financing of terrorism

- Money to fund terrorist activities moves through the global financial system via wire transfers and in and out of personal and business accounts. It can sit in the accounts of illegitimate charities and be laundered through buying and selling securities and other commodities, or purchasing and cashing out insurance policies.

- Although terrorist financing is a form of money laundering, it doesn't work the way conventional money laundering works. The money frequently starts out clean i.e. as a 'charitable donation' before moving to terrorist accounts. It is highly time sensitive requiring quick response.

Macroeconomic impact

- Money laundering can have a range of severe macroeconomic consequences on countries.
- IMF has cited unpredictable changes in money demand, prudential risks to the soundness of banking systems, contamination of legal financial transactions, and increased volatility of international capital flows and exchange rates due to unanticipated cross-border asset transfers.
- The economic and political influence of criminal organizations can weaken the social fabric; collective ethical standards and ultimately the democratic institutions of the society. Organized crime can infiltrate financial institutions, acquire control of large sectors of the economy through investment, or other bribes to public officials and indeed governments
- Money Laundering can also have a dampening effect on FDI (Foreign Direct Investment) if a country's financial sectors are perceived to be under control and influence of organized crime.

Money Laundering Risks

- Reputation risk
- Legal risk
- Operational risk (failed internal processes, people and systems & technology)
- Concentration risk (either side of balance sheet)
- All risks are inter-related and together have the potential of causing serious threat to the survival of the bank

Anti-Money Laundering

Anti-money laundering (AML) is an activity which prevents or aims to prevent money laundering from happening. Such activities include introduction of a requirement for the financial institution to identify their customers, maintaining

records of the customers, cooperation with the law enforcement agencies and training of the staff with respect to laws etc the breach of which result in money to be laundered.

Indian anti-money laundering law encompasses the money generated from numerous different crimes – e.g., drug trafficking, murder for hire, racketeering, and embezzlement. The word laundering is used for cleaning dirty clothes. Money Laundering is used to clean the dirty money. Just as soap and water are used for cleaning clothes in the same way Placement, Layering and integration could be made check points for Cleaning Dirty Money

Attempts to combat money laundering

The Financial Action Task Force on money laundering GAFI -- The Financial Action Task Force on Money Laundering (FATF), also known by its French name *Groupe d'action financière sur le blanchiment de capitaux*, (FATF/GAFI) established by the G-7 Summit in Paris in 1989 to develop a coordinated international response. It is a multi-disciplinary body that brings together the policy making power of legal, financial and law enforcement experts from its members.

The FATF is an inter-governmental body which sets standards, and develops and promotes policies to combat money laundering and terrorist financing. It currently has 33 members: 31 countries and governments and two international organizations; and more than 20 observers: five FATF-style regional bodies and more than 15 other international organizations or bodies. A list of all members and observers can be found on the FATF website at http://www.fatf-gafi.org/Members_en.htm

Financial Action Task Force has produced the forty and eight Special Recommendations in 1990, revised most recently in June 2003. They are a comprehensive blueprint for action against money laundering and cover the criminal justice system, law enforcement, the financial system and its regulation and international co-operation. The FATF Forty and Eight Special Recommendations have been recognized by the International Monetary Fund and the World Bank as the international standards for combating money laundering and the financing of terrorism.

Based on the Recommendations, Financial institutions (and designated non - financial business and professions) should develop programs against money laundering and terrorist financing

These programs are expected to accomplish the following:

- Verification of identity (name and residence) subject to exceptions
- Know Your Customer (KYC)
- Record keeping
- Internal controls, policies and procedure
- Training
- Appointment of a Money Laundering Reporting Officer (MLRO)
- Report suspicious transactions

Advantages of KYC norms

- Sound KYC procedures have particular relevance to the safety and soundness of banks, in that:
- They help to protect banks' reputation and the integrity of banking systems by reducing the likelihood of banks becoming a vehicle for or a victim of financial crime and suffering consequential reputation damage;

- They provide an essential part of sound risk management system (basis for identifying, limiting and controlling risk exposures in assets & liabilities)

The meaning of KYC:

For the purpose of designing a meaningful system, we need to understand the meaning of "Know your Customer" in the following terms:

- Customer: One who maintains an account, establishes business relationship, on who's behalf account is maintained, beneficiary of accounts maintained by intermediaries, and one who carries potential risk through transactions
- Your: (Who should know?): Branch manager, audit officer, monitoring officials.
- Know: (What you should know?)

1. True identity and beneficial ownership of the accounts
2. Permanent address, registered & administrative address

KYC facilitate in developing the knowledge on the following:

- True identity and beneficial ownership of accounts;
- The sources of funds
- Nature of customers' business
- What constitutes reasonable account activity?
- Customer's customer (if any)

Core elements of KYC

- Customer Acceptance Policy
- Customer Identification Procedure- Customer Profile
- Risk classification of accounts- risk based approach
- Risk Management
- Ongoing monitoring of account activity

- Reporting of cash and suspicious transactions
- Risk based approach

The potential risk that a customer carries depends on:

- Identity of the customer including beneficial ownership
- The nature of customer's business and his product profile-jewels, precious metals, arms, antiques
- Location of business
- Products and services offered
- Customer's customer or clients; their location & business

High risk customers

- Non-bank financial institutions (money transmitters, cheque cashiers, full fledged money changers, sellers of stored value cards, security brokers & dealers etc.)
- Travel agencies / Property dealers/ builders
- Professional and consulting firms
- Exporters or importers of goods and services
- Cash intensive business e.g. Retail stores, restaurants, gambling casinos, second hand car dealerships etc.
- Off-shore corporations, banks in secrecy heavens
- Non-profit organizations e.g. charities

High risk products & services

- Wire transfers
- Electronic banking services which includes services offered through internet, credit cards, stored value cards
- Private banking relationships
- Correspondent banking relationships

Cross border accounts-deposits

- All KYC procedures to be observed
- Third party verification of documents through Correspondent bank which is committed to KYC regime and is willing to share KYC information on demand
- Verification of document during visit to India
- Remittance through banking channels

Payment gateways/ wire transfers

- Both domestic and cross border wire transfers carry potential risk of money laundering
- Payment gateways facilitate wire transfers for customers of banks located anywhere in the world
- Whether AML/ KYC compliance level
- Ascertain whether it is regulated at the place of incorporation
- Insist on complete originator information with wire
- Make payment to beneficiary through account or DD
- Keep record of transactions

Measures to deter money laundering

- Board and management oversight of AML risks
- Appointment a senior executive as principal officer with adequate authority and resources at his command
- Systems and controls to identify, assess & manage the money laundering risks
- Make a report to the Board on the operation and effectiveness of systems and control
- Appropriate documentation of risk management policies, their application and risk profiles

- Appropriate measures to ensure that ML risks are taken into account in daily operations, development of new financial products, establishing new business relationships and changes in the customer profile
- Screening of employees before hiring and of those who have access to sensitive information
- Appropriate quality training to staff
- Quick and timely reporting of suspicious transactions

Initiative on Modeling AML Systems:

Anti-money laundering guidelines came into prominence globally after the September 11, 2001 attacks and the subsequent enactment of the USA PATRIOT Act.

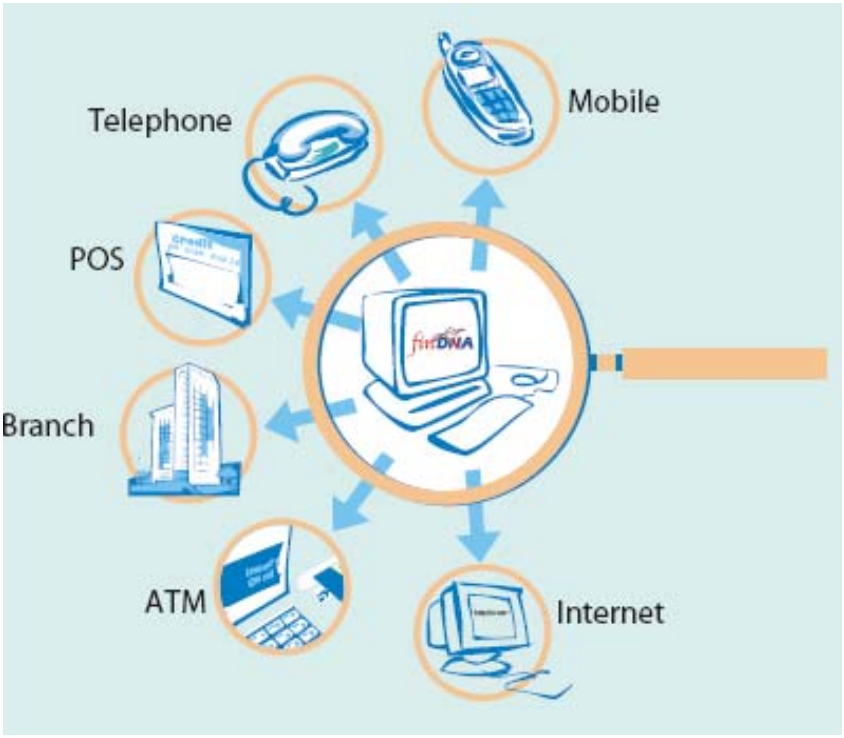
Today, all financial institutions globally are required to monitor, investigate and report transactions of a suspicious nature to the financial intelligence unit of the central bank in the respective country. For example, a bank must perform due diligence by having proof of a customer's identity and that the use, source and destination of funds do not involve money laundering.

Modeling Anti-Money Laundering System

The Goal of the AML System:

The AML System is to enable banks to monitor and analyze millions of transactions from virtually any source. It is to 'intelligently' calculate risk score and assign risk profiles to each customer, based on a range of parameters and account usage patterns. Risk-based profiling is to determine the diagnostic level for transaction monitoring that enables close tracking of known high-risk customers.

Sources of transactions may be from any of the following:



Techniques for Detection of Suspect Transactions:

The AML system is to apply complex detection rules to identify suspect transactions. The techniques include:

- '**Hot list' scanning** against OFAC(Office of Foreign Assets Control), NCCT(Non Cooperative Countries and Territories), UN(United Nations), FBI (Federal Bureau of Investigation) and internal watch-lists
- **Threshold violation** to detect transactions violating regulatory limits

- **Statistical analysis** to detect transactions deviating from expected trends
- **Pattern recognition** to unearth known money laundering typologies
- **Behavioral analysis** to detect transactions that do not conform to customers' account usage patterns
- **Link analysis** to uncover links between customers based on transaction pattern and CIF details
- To minimize chances of false alerts, the AML system is to employ the artificial intelligence capabilities of the **neural network.**

AML Design Overview:

In the following presentation, AML is referred as a product and formulated the step by step process building up the product with details on providing Anti money Laundering solutions with suitable techniques: The product details are presented as follows:

- **AML - Product Overview**
- **AML – Anti-Money Laundering**
- **AML - Technical Architecture**
- **Conclusion.**

1 AML - Product Overview

1.1 Business Challenge

Money laundering and terror financing transactions are increasingly becoming a Major concern for banking and financial institutions across the world. Money laundering is an attempt to disguise the proceeds of illegal activity to make those Funds appear to come from legitimate sources and activities. In contrast terrorist Financing often involves the use of legally derived money for illegal activities. Global attention is now focused on preventing terrorist financing and money laundering activities. This is because such transactions have adverse effects on

the economic, social and political climate of any country. To curb such transactions and mitigate their effects, the banks need to do continuous due diligence of their customers. This translates into verification of the customer's identity before opening the account and monitoring all his transactions for any suspicious activity. In addition to enforcing new policies and regulations for staff at front desk, the banks need to implement an IT solution at the backend to enable monitoring of large volume of transactions in real time and batch mode.

1.2 AML – Anti-Money Laundering Solution

Over the past 3 decades, many companies have worked with number of banks on large technology projects and acquired in-depth knowledge of the IT systems within financial institutions. Anti Money Laundering (AML) system enables banks to comply with all AML regulations mandated both globally and specific to each country. AML works on a philosophy that is similar to that of DNA fingerprinting. Similar to the uniqueness of an individual's DNA, the financial nature of every customer is also exclusive. Using artificial intelligence, AML attempts to unravel the financial DNA of every customer and creates a character profile for each customer, which is then used to detect anomalies from expected behavior. AML is a web based solution, catering to the regulatory requirements of the bank in the country of deployment and the bank's branches in various countries around the world.

AML has component based architecture with each component catering to a specific functionality. The core provides the necessary functionality common to each component.

Thus each component of AML can be implemented as a stand-alone system.

1. AML Profile Engine (Refer to Section 2.1 for details)
2. AML Rule Engine (Refer to Section 2.2 for details)
3. AML Watch List Scanner (Refer to Section 2.4 for details)

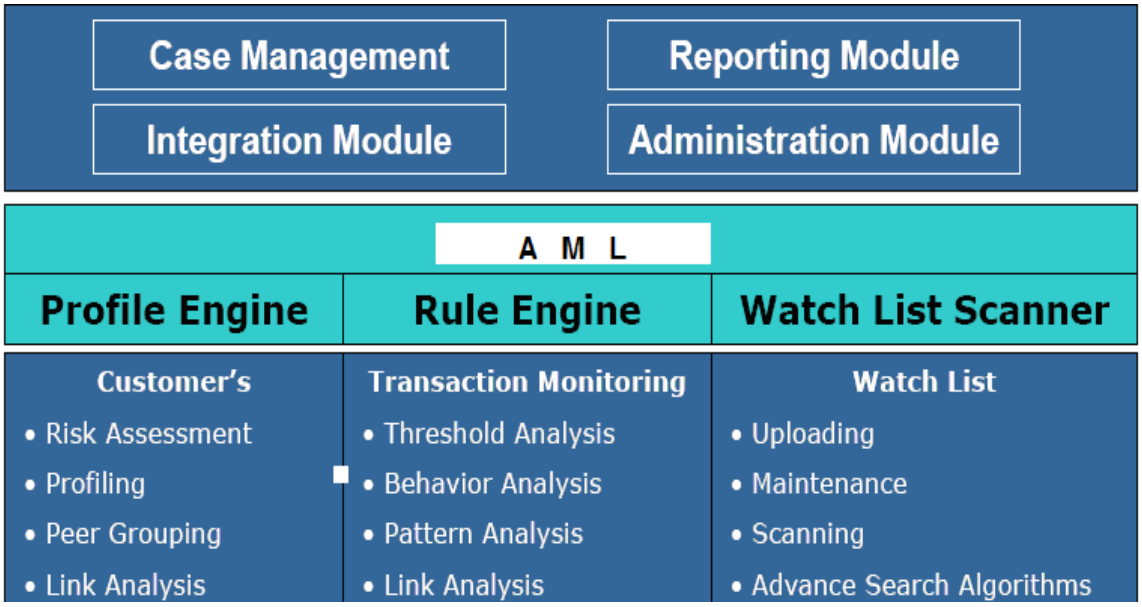


Figure 1: AML Components

2 AML – Functionality

AML provides the bank the feasibility in detecting money laundering activities and suspicious transactions carried on in their institutions. Its primary task is to analyze the transactions, detect any suspicious activity and report it. To facilitate quick and effective transaction monitoring and minimizing the number of false alerts, it enables customization of transaction monitoring logic based on customer's perceived risk and behavior. AML communicates with bank's customer and transaction systems for respective data feeds.

AML handles watch list scanning, thus enabling the bank to scan regulatory and internal watch lists before approving a new account application and before processing transactions involving entities which are not their customers. AML provides rich analytical capabilities which can be utilized in the investigation of system generated alerts. The compliance officers are equipped with tools to create cases from the alerts and perform quick checks on customer's background and expected behavior. If deemed necessary, the alerts can be reported to regulatory authorities as well as to bank's management team, in the form of pre-specified or ad-hoc reports.

AML enables banks to proactively report suspicious activities to regulatory authorities as well as respond to their queries. The case specific audit trails enable the bank to reconstruct the historical transactions and provide sufficient supporting documents for the action on each case.

AML provides end-to-end functionality for AML monitoring. The functionality can primarily be categorized into 4 segments:

- Customer Profiling
- Transaction Monitoring
- Alert Investigation
- Watchlist Scanning

Provided below is the functional architecture of AML.

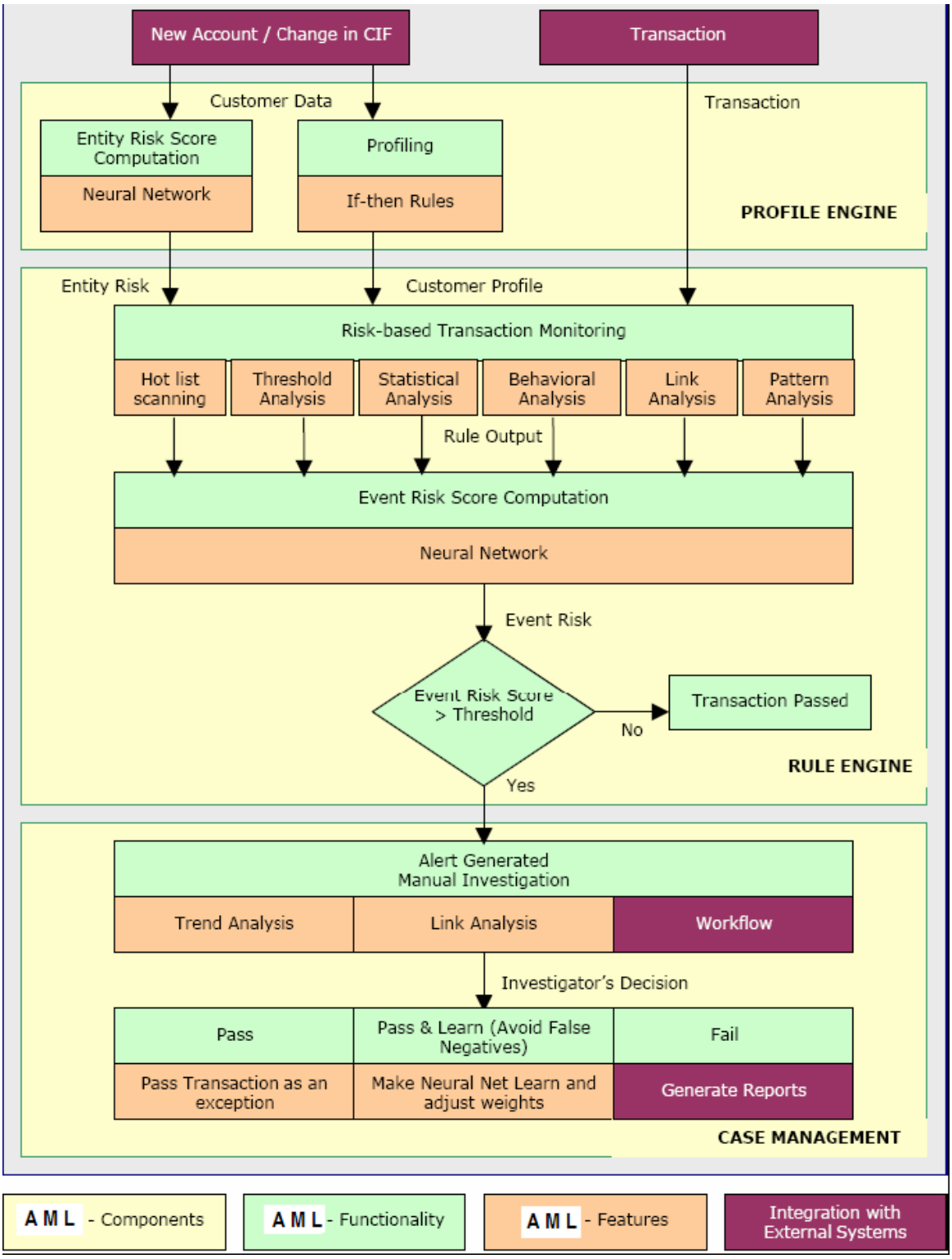


Figure 2: AML Functional Architecture

2.1 Customer profiling

An AML solution is expected to monitor each transaction of every customer. This would result in excessive load on the system as well as large number of false alerts. AML addresses this by profiling the customers based on CIF(Customer Information File) parameters, like the Line of business, Nationality, Age of relationship with the bank etc, and by customizing the transaction monitoring logic based on customer's perceived risk and expected behavior.

AML computes customer's **Risk Score/Rating** and identifies each customer's suitable **Peer Group**. The customer Risk Score/Rating is used to determine the risk quotient of each transaction, while the customer Peer Group is used to customize the business rules. AML identifies the **linked accounts** of a customer. Some of the links can be multiple accounts of a customer within the bank, customers sharing same address/phone numbers etc. The linked accounts are used to monitor transactions to detect attempts of money laundering at group levels. Typical ML typologies that involve linked accounts are structuring, circulation of funds etc.

AML ascertains customer's **expected behavior** by analyzing his transactions. It defines the transactional behavior by the following empirical parameters - **value, velocity** and **volume** in accounts. For a new customer, the stated behavior automatically becomes the expected behavior. But for an existing customer the expected behavior is determined by analyzing the past transactions of the customer. Any deviation from the expected behavior is alerted for investigation. The compliance officer may modify or create exception for the system generated expected behavior, if deemed necessary. This facilitates in reducing the number of false alerts.

2.1.1 Approach / Set up

AML's **Profile Engine** is a vital component in the entire setup. It is highly customizable, enabling bank's business users to:

• Maintain CIF parameter reference list.

• Define customer risk scoring/rating logic rules.

• Define customer peer groups either by creating group definition rules manually or by using the data mining tool to identify groups using the historical data.

• Identify the types of links significant to AML monitoring.

2.2 Transaction Monitoring

AML monitors every transaction by subjecting it to various business rules. The monitoring is done at multiple levels:

- In isolation - The transaction is subjected to value based threshold checks
- In combination with historical transaction of the customer – Threshold analysis for velocity, Statistical Analysis and Behavior Analysis is conducted over the set of transactions
- In combination with transactions done by group of customers – Links analysis based monitoring for structuring etc is conducted. Typically, the transaction monitoring techniques of AML can be categorized into 2 segments:

  * Standard techniques
  * Advanced techniques

2.2.1 Standard monitoring techniques

The standard detection module monitors transaction of a customer for threshold analysis and statistical analysis checks. These include violation of currency transaction thresholds defined by the regulatory bodies (for filing of Currency Transaction Reports) or monitoring the accounts for deposit to withdrawal ratios etc. Other rules like the analysis for bounced checks, frequent deposit of

soiled/round/small bills, high volume transaction, and high velocity of transactions are built in this module. Regulatory Threshold Violation module Reporting of transaction beyond defined regulatory limits like cash deposits greater than US$10,000 Simple Statistical Analysis module Using statistical tools over combinations of credits and debits (for different product types and events) to detect ML activities.

2.2.2 Advanced detection techniques

Advanced detection module monitors transaction of a customer and his linked accounts using techniques like behavioral analysis, link analysis and pattern analysis.
Behavioral Analysis module: Transactions inconsistent with past account usage/peer group behavior, business requirements or individual's profile.

Link Analysis module Identifies static (based on CIF details) and dynamic (based on transactions) links. Transaction monitoring for all linked accounts can be done to detect ML activities like structuring using associated accounts. ML

Pattern Analysis module: To detect known ML typologies like structuring, frequent wire transfers etc.

2.2.3 Set Up /Approach

AML's **Rule Engine** is a vital component in the entire setup where the transaction monitoring logic can be programmed by bank's business users. AML comes with a repository of pre-built **Rule Templates**, which form the skeleton base for creating the final **Business Monitors (BM)**. Each rule template has a set of parameters that needs to be defined while programming the transaction monitoring logic for a type of transaction (event). Once the

transaction monitoring logic for an event is programmed, it is customized for each peer group defined in the Profile Engine.

Refer to Figure 3 for the rule engine framework.

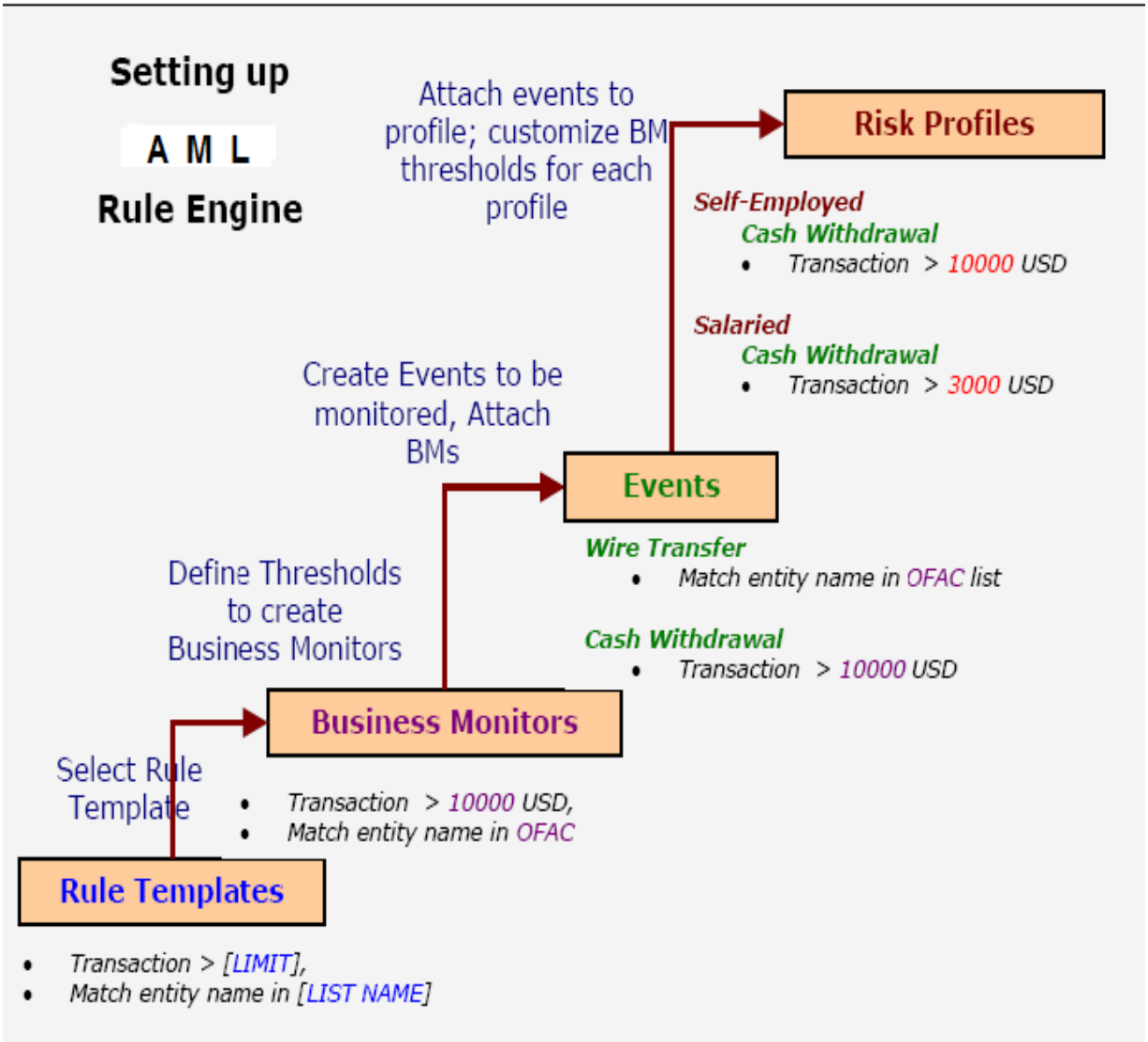


Figure 3: Rule Engine Framework

In AML, each transaction is subjected to various BMs. The output of each BM is used to determine the **Event Risk Score,** which when compared with the event

specific acceptable thresholds results in generation of alerts. The event risk score can be computed in two ways:

1. By computing the weighted average of the outputs of all the BMs, where the weights are assigned by the business users
2. By using **Neural Network (NN)** based artificial intelligence to arrive at the risk scores.

The former method requires manual intervention, every time system needs to be customized, while using NN, the system can be customized without the users having to compute the new weights manually. When coupled with customer level exception list, NN prevents repetition of false alerts, thereby reducing the work load of the compliance officer.

In case the historical data is not sufficient or the number of BMs attached to an event is large, the BMs can be grouped together to create 'Scenario'. For example, there can be a scenario for structuring, watch list scanning, circulation of funds etc.

Grouping of BMs would lead to the multiple alerts for a single transaction. On the other hand if the BMs were attached without grouping, the system would generate a single alert for each transaction.

2.3 Alert Investigation

AML provides rich analytical tools to Compliance Officers for detailed investigation of alerts. There can be single or multiple alerts for a single transaction depending upon the setup of Rule Engine. The Case Management module of AML provides the facility to create cases for a group of alerts, e.g. all alerts for a transaction can be combined to open one case; similarly all alerts for a customer can be combined to open another case.

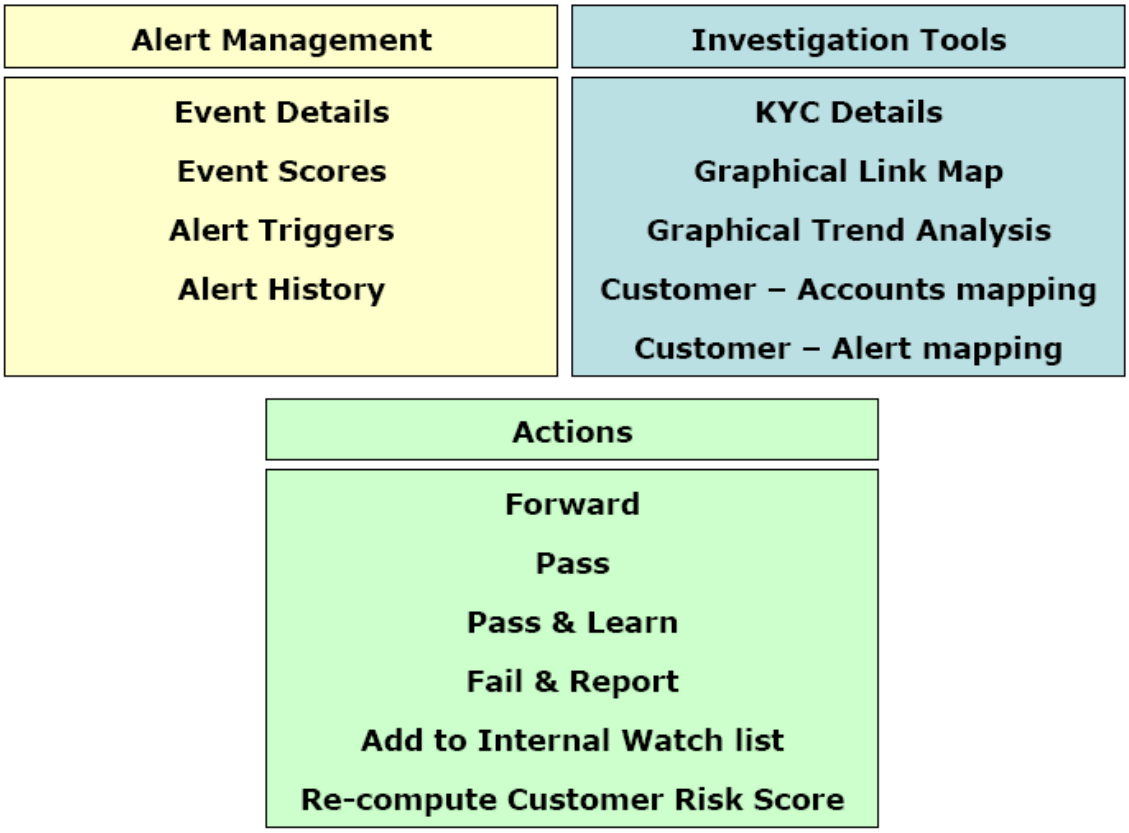


Figure 4: Features of Case Management

The features of Case Management can be broadly classified into four sections:

1. Alert Management
2. Investigation Tools
3. Actions
4. Reporting

2.3.1 Case/Alert Management

A single window presents all the details of a case/alert. The officer can access details of all the alerts assigned to a case and of all the transactions behind an alert. For example, a single transaction can result in a threshold violation alert for Currency Transaction Reports (CTR), while the structuring related alert would have many underlying transactions.

AML provides drill down facility for all the business rules applied over a transaction. For example, for Watch list scanning rules, the officer can see the list of matched records. The alerts generated by the system are routed to the concerned authorities for investigation. The workflow cycle for investigation is product and country specific, and is set by the business users while programming the Rule Engine. AML integrates with the bank's existing workflow system to provide this functionality. To prevent internal fraud and to enable reconstruction of case for regulatory inquiries, AML maintains audit trails for all alerts.

2.3.2 Investigation tools

The analytical capabilities of AML enable the compliance officer to view all the details for all the customers, transactions, alerts and cases. The **Graphical Trend Analysis** tool and **Link Maps** enable the officer to scan the historical behavior of a customer for any deviations and to view all the accounts/customers linked to this customer.

The compliance officer can generate reports from the searches and attach them to the case as supporting evidence to his/her actions.

2.3.3 Actions

The Compliance Officer can perform the following actions, based on this investigation:

1. Pass the transaction as one-off incident.
2. Pass and Learn to make NN learn. This would result in readjustment of event risk scoring computation logic, thus preventing repetition of similar false alert.

3. Forward it to next level for further investigation. Case Management also provides automatic escalation of alerts based on predefined timelines and escalation paths
4. Fail the transaction and generate report. The officer can select all relevant reports, both regulatory and management. The reports are preformatted into the system minimizing the manual inputs from the compliance officer.
5. Add to Internal Watch list for more stringent monitoring. This effectively leads to more alerts for the customer thus more manual investigation for his activities.
6. Re-compute customer risk score or move customer to different group/sub-group. If deemed necessary, the compliance officer can manually reassess the risk of customer, thus overruling the system's risk assessment logic.

2.3.4 Reporting

AML provides both regulatory and management reporting capabilities. It leverages the existing reporting engine of the bank by integrating with it for report generation and distribution.

a). Regulatory reports

There are country specific regulatory reporting requirements. Thus, the standard regulatory reports are built in AML during the implementation phase, though AML comes with the pre-built reporting for US specific Currency Transaction Reports (CTRs) and Suspicious Activity Reports (SARs).

AML can integrate with regulatory bodies systems for automatic submission of reports to concerned authorities.

b). Management reports

The management reports are dependent on multiple parameters, like banking products, country specific banking operations etc. There are two types of management reports, Standard and Adhoc.

- Standard reports are treated as the regulatory reports and would be built in the system during the implementation phase.
- Adhoc reports can be generated from the GUIs provided to the compliance officers and other authorized users. The users can search all AML related data, i.e. customer, transaction, alert and case, on various parameters and can format the reports as per the need. The search results can be exported in report formats to be retained for future reference.

2.4 Watch-List filter

Watch List filter module is a stand alone module of AML. The watch list filter performs the string search functionality against the various lists provided by the regulatory bodies. These lists can be either 3rd party lists or bank's internally maintained lists.

a). 3rd party watch lists

AML can accommodate any 3rd party list. These include global lists like NCCT, OFAC-SDN, UN etc or country specific lists like FBI, MAS, Bank of England etc. At the time of implementation of the system, the various watch lists are identified based on the country of operations of the bank. The system is then customized to handle (upload and manage) each list separately.

b) Internal watch lists

AML also has the additional functionality to maintain bank's internal watch lists (typically fraudster's lists etc). The transactions can be configured to be screened against the internal watch lists along with the 3rd party watch lists. Names can be added/modified/deleted to the lists from dedicated GUIs as well as directly from the Case Management module.

2.4.1 Uploading of lists

The lists provided by the regulatory bodies can be handled in 2 ways, based on banks' requirements. These include:

1. Downloading the lists from the regulatory body's system and then uploading these into the AML database in pre defined format.
2. Directly integrating with the regulatory body's system (or bank's other systems) and uploading the lists into AML's database automatically, e.g. the FTP based access to OFAC's systems.

2.4.2 Maintaining the watch lists

AML provides the flexibility for the users to add/delete/modify the names in the Watchlists, both internal and 3rd party, using a simple GUI. For any modification to the lists, the modified lists can either be uploaded into the system manually or directly from the interfacing system.

2.4.3 Screening mechanism

AML system is parameterized to allow screening of all the entities involved in the transactions (like account holder, beneficiary, intermediary etc). The system searches the names of all the existing customers in batch mode and in real time

mode for names of all new customers during the application approval cycle. Parameterized approach also enables transaction information to be scanned against the relevant lists only (depending on the type of transaction, source or destination of the message, nationality of the account holder/beneficiary, location of the branch or any other criteria that the bank may desire).

2.4.4 Approach

AML deploys the phonetic based search logics for screening the entities and their details. Fuzzy logic based search provides the confidence level for the matches identified. AML performs the search based on the combination of both the search techniques.

• **Phonetic Search**

Phonetic Search method is used in identifying similar sounding words. The algorithm used here is the ***Double Metaphone algorithm***; in this the strings are transformed to their phonetic equivalents before searching.

• **Fuzzy Logic Search**

The fuzzy logic search is based on the ***Edit Distance algorithm***. It provides the confidence level of match based on the additions, deletions and modifications of each of the characters in the string to obtain a similar string in the watch list. AML performs scanning for the parameters like name, address, date of birth, PAN no etc. these parameters are customizable based on the bank's choice. Bank's business users can configure the list specific searches by specifying relevant primary and secondary search keys.

2.5 Deployment options

AML provides multiple deployment architectures, based on the scope of bank's operations. Two main factors to be considered in AML deployment is:

1. Mode of operations – online/batch
2. Data storage – internal/external

2.5.1 Mode of operations

AML operates on customer and transaction data, which it receives from bank's external systems. Based on the requirements of the bank, AML can be setup to integrate with these systems and operate on the data in both online and batch mode. For online checks, the bank would have to customize its transaction processing systems to accept AML specific checks from AML before processing the transactions. This may lead to time delays thus affecting the Straight Through Processing. AML provides the functionality to perform only mandatory checks, like watch list scanning, in online mode and all other checks in batch mode.

2.5.2 Data storage

As stated above, AML operates on customer and transaction data it receives from bank's existing systems and adds some AML specific information to the input feed. There can be two options for storing the data:

1. Externally – AML accesses the data from the source. The primary drawbacks of this approach are that the customization required in existing systems increases and the load on the systems increases as the data is accessed both during transaction monitoring and investigation.
2. Internally – AML stores all the data internally. This would lead to duplication of data and increase in hardware sizing and database management efforts.
3. The approach taken in AML is to access the data from the bank's systems only once. But instead of replicating all the data internally, it stores only the AML specific data items, thus minimizing the time required to fetch the information and also the extent of duplication of data.

3 AML - Technical Architecture

3.1 Core Components

AML has a multi-layered, component based architecture. Various layers interact with each other via standard, open APIs. Multi-layer and component-based architecture provides the system the flexibility, scalability and robustness. Architecture uses open and proven industry wide standards like MVC design pattern, J2EE etc. Various layers of architecture are depicted in the diagram below and explained thereafter.

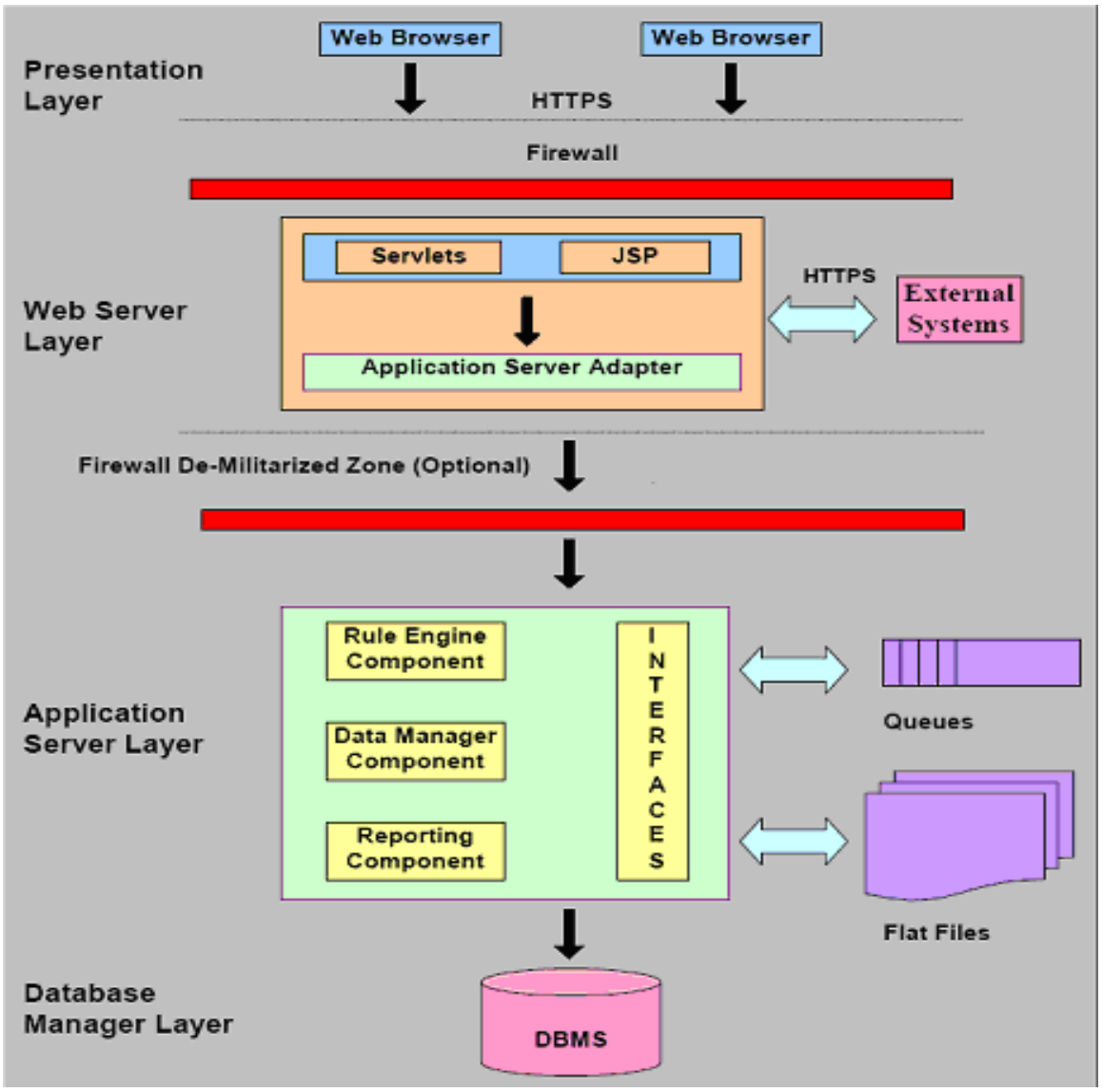


Figure 5: AML Technical Architecture

Presentation Layer

Web browser forms the presentation layer of architecture. The basic function of this layer is to present hypertext pages to the user and to perform some basic validation using java script. There is an in house built framework for HTML and JavaScript coding. This framework:

1. Provides common functions for domain validations
2. Establishes the flow for event processing
3. Provides common functions for event handling

Web Server Layer

Web Server layer forms the next layer of architecture. Function of this layer is to construct hypertext page using JSP/Servlets. Being thread based, this layer is highly scalable. This layer uses MVC design pattern to construct the JSPs. There is a controller. All the browser requests come to this controller first. This contains code for common functionality like authorization, filtering etc. Based on the request type and parameters, it invokes certain helper classes. Helper classes, in turn route the requests to appropriate component at the Application Server. Application Server sends the results back, which are stored in message classes. Message classes represent the model component of architecture. After storing the message classes, helper classes pass the control back to controller. Controller then passes the control to appropriate view classes (JSPs) using Request Dispatcher forward. View classes use the message classes to generate the pages.

Application Server Layer

Application Server layer forms the next layer of the architecture. This is the layer where business logic resides. Business logic is encapsulated in well-defined components. Helper classes at Web layer use the services of these components. Componentization makes the system highly configurable, flexible and easy to maintain.

Database Manager Layer

DBMS forms the last layer of system. The system is to support on any RDBMS.

Integration between components of multi-layers

A multilayered architecture need to be used and incorporated. Components at each layer need to interact with component at lower layer. Browser interacts with Web Server. Web layer uses Application specific APIs to interact with components at Application level.

3.2 Software Components

Browser: IE/Netscape
Web Server: Apache
Application Server: Apache/WebSphere Enterprise/ WebLogic Enterprise
DBMS: ORACLE
Operating System: SunOS, AIX

4. Conclusion

This chapter [**Maruti P. & Jani N.N- 2007-a]** deals with the discussion on Money laundering & terror financing transactions in the banking and financial institutions and evolve a design of component-based architecture with each component catering to a specific functionality. Knowledge on customer's perceived risk and behavior, watch-lists, alerts and warnings help in great deal to counter money laundering. It gives the banks with the foundation to achieve regulatory compliance, mitigate risks, safeguard reputation and retain customer loyalty.

AML is designed to provide the end-to-end functionality to address the AML and KYC requirements. It is designed to be flexible that can be easily be tailored by the bank's business users.

Concluding remarks

The issue of AML is one that continues to present a challenge for banks. From ensuring the appropriate tone and profile is set by senior management, to the alignment of operational processes across a complex business, the challenges faced by banks continue to evolve, as do the regulatory environments in which they operate.

A more sophisticated approach, focusing on risks, by banks and regulators to tackle the issue, together with better cooperation and feedback between the public and private sectors is necessary in the continued fight against money laundering, terrorist financing and wider financial crime. The challenges that banks encounter are even more acute in the less familiar area of counter-terrorist financing (CTF), and there are compelling reasons for governments internationally to work more closely with banks in finding pragmatic mechanisms to disrupt and prevent terrorist financing networks.

In the past three years, there have been meaningful steps in this direction in a number of countries, and there are strong and compelling reasons, along with widespread willingness, for this momentum to be maintained.

Chapter 6

KNOWLEDGE DEVELOPMENT MODEL FOR CREDIT RISK MANAGEMENT SYSTEM

Abstract:

This chapter presents an overview of risk management in the financial services industry along with the Basel II regulations and formulate important components that could be used for modeling the knowledge based Risk Management system. **[Maruti P & Jani N N – 2007-b]**

1. Introduction

The last twenty years have been marked by substantial financial deregulation. Accompanying this deregulation has been a plethora of methodologies and technologies for managing the risks/rewards created by this deregulation.

The art of managing risk is more challenging than ever. Risk managers face a wide range of demands, from working with multiple variables to finding technology solutions that generate comprehensive risk analysis. Real-time access to accurate, updated market information is a critical component in the process. Even more critical is a highly flexible and parameterizable framework that can quickly integrate into a company's existing infrastructure.

Over the past decade or so, the markets have seen one debacle after another, each of which has brought its own set of lessons from some of which the markets have learned and from many of which the markets still need to learn!

Enterprise risk management is about optimizing the process with which risks are taken and managed. It has become a burning issue because organizations have started suffering huge losses- often from the risks they never should have taken in the first place. Examples (www.wallstreetandtech.com) include the following:
:

- **Orange County (November 1994):** Orange County's investment pool lost $1.7 billion from the structured notes and leveraged repo positions. The treasurer took positions from oversight from the county's five person board of supervisors. Members of the board of supervisors claim that they did not receive critical information that would have indicated the risks taken.
- **Baring Bank (February 1995):** Baring Plc. Lost $1.5 billion because a Singapore based trader, Nick Leeson, took unauthorized futures and options positions linked to the Nikkei 225 and Japanese government bonds. At the height of his activities, Leeson controlled 49% of open interest in the Nikkei 225 March 95 contract. Despite having to finance margin calls as the bank lost money, the Barings' board and management claim to have been unaware of Leeson's activities.
- **Sumitomo Corp. (June 1996):** Sumitomo's head copper trader, Yasuo Hamanaka- popularly known as "Mr. Copper", disguised losses totaling $1.8 billion over a ten year period. During that time, Hamanaka performed as much as $20 billion of unauthorized trades a year. He was able to hide his activities because he headed his section and had trade confirmations sent directly to him, bypassing the back office.

All these examples illustrate two common characteristics. Each one:

- Was directly caused by the actions of one single individual
- Could easily have been prevented through appropriate oversight

Today banks and financial services companies (FSCs) operate in increasingly complex, competitive and global markets. The ability to manage risks across geographies, products, asset classes, customer segments and functional

departments is of utmost importance. The incapability to manage these risks can cause damages in more than one way. Mergers, acquisitions, consolidation, globalization and changing regulations have posed inestimable exceptional challenges for the financial services industry.

A research report from Tower Group believes that the new standards will require sizable investments in information technology. This will be particularly true of larger institutions that have complex organizational structures and have shown a stronger appetite for risk. The report predicts that investment in comprehensive technology developments for risk management in the financial services industry will outpace other information technology spending and will amount to an estimated total of US$21 billion in 2005.In addition to enhancing traditional risk management systems, FSCs will have to align their IT investments in a manner that maximizes business value by reducing capital requirements and lowering the overall exposure.

This chapter defines the major risks from the perspective of financial services industry, the components of Enterprise wide risk management and the role of technology in risk management. This chapter also looks at the qualitative and quantitative sides of risk management and defines a risk management framework based on both these aspects.

2. Overview of Risk Management

2.1 WHAT IS RISK?

Risk is exposure to uncertainty. Thus, risk has two components: Uncertainty and exposure to that uncertainty.

For example, if a man jumps out of an airplane with a parachute on his back, he may be uncertain as to whether or not the chute will open. He is taking a risk

because he is exposed to that uncertainty. If the chute fails to open, he will suffer personally.

In this example, a typical spectator on the ground would not be taking risk. They may be equally uncertain as to whether the chute will open, but they have no personal exposure to that uncertainty. Exceptions might include:

- A spectator to whom the man jumping from the plane owes money
- A spectator who is a member of the man's family

Such spectators do face risk because they may suffer financially and/or emotionally should the man's chute fail to open they are exposed to the uncertainty. The financial services industry is primarily concerned with financial risk which is financial exposure to uncertainty

2.2 TYPES OF RISKS

Some of the most significant risks which organizations face are highly subjective.

These include:

Credit Risk: Credit risk is risk resulting from uncertainty in counterparty's ability or willingness to meet its contractual obligations. Examples include:

- A broker executes a trade on the behalf of an investor. If the investor is a margin client, it is possible that he might fail to make the payment on the settlement day. Thus the broker faces credit risk.
- A housing finance company extends a housing loan to a client. Because the client could fail to make timely principal or interest payments, the housing finance company faces a credit risk.

Credit risk is highly subjective; it is the risk that occurs due to uncertainty in a particular counterparty's ability to meet their contractual obligations. Credit risk can also be divided into many forms; this is because there are a variety of counterparties and obligations. This complicates the way in which the risk is

measured, monitored and eventually managed. An organization must take into account the following aspects when dealing with credit risk these are:

- Default Probability
- Credit Exposure
- Recovery Rate

Default probability is the possibility of the counterparty to equivocate on their obligations. This can happen at any time over the life of the agreement. This is also known as the expected default frequency.

Credit exposure is to do with the outstanding debt once counterparty defaults. When a counterparty defaults there will be some unfulfilled obligations and this amount which is outstanding on behalf of the counterparty is the credit exposure. Greater the default larger is the credit exposure.

Recovery rate is calculated on the amount than can be recouped after counterparty defaults. Usually some sort of bankruptcy proceedings or settlement proceedings are initiated to occur which can then recover some fraction of the credit exposure.

When dealing with credit risk, it is worth mentioning about credit quality. Credit quality is defined as the ability of counterparty to perform on an obligation. This takes into account both the default probability and the anticipated recovery rate. As risk is defined in terms of exposure to uncertainty, credit exposure justifies as the exposure component and credit quality justifies the uncertainty component. Credit quality is assessed by a method known as credit scoring. Banks use this method to grant loans to individuals and small businesses. A credit score is arrived at by applying formulae and algorithms and then the party is assessed. Based on this score the institution will extend credit to the concerned organization.

When credit risk is applied to larger institutions, the process again, becomes more complicated and the term credit analysis is preferred to credit scoring. This method consists of credit scoring; nevertheless it doesn't use an algorithmic way of assessing the counterparty. Credit analysts are employed and there is more human judgment as compared to a computer-based rating. Credit analysts will review information about the institution as well as the current economic environment. Based upon the analysis a credit rating is assigned and the decisions are based on this rating.

Popular financial organizations like ABN Amro, Standard & Poor (www.stanadardandpoors.com), Moody (www.moodys.com) are considered for studying about the risk in various financial products. The following page illustrates an example of credit ratings used by ABN Amro Bank. There may be some variation with other banks however the majority of them are the same, alongside the ABN Amro's rating reference (www.abnamro.com) is the Standard & Poor's reference and Moody's reference.

ABN Amro Bank's rating reference:

UCR (Uniform Credit Rating)	Description	S&P	Moody's
1	Investment Grade	AAA/AA-	Aaa/Aa3
2+	Investment Grade	A+	A1
2	Investment Grade	A	A2
2-	Investment Grade	A-	A3
3+	Investment Grade	BBB+	Baa1
3	Investment Grade	BBB	Baa2
3-	Investment Grade	BBB-	Baa3
4+	Below Investment Grade	BB+	Ba1
4	Below Investment Grade	BB	Ba2
4-	Below Investment Grade	BB-	Ba3
5+	Below Investment Grade	B+	B1
5	Below Investment Grade	B	B2
5-	Below Investment Grade	B-	B3

Rating Grades

	Moody's	Standard & Poor's
Investment Grade		
Highest quality (Best quality, smallest degree of investment risk)	Aaa	AAA
High quality (Often called high-grade bonds)	Aa	AA
Upper medium grade (Many favorable investment attributes)	A	A
Medium grade (Neither highly protected or poorly secured)	Baa	BBB
Speculative Grade		
Somewhat speculative (Have speculative elements)	Ba	BB
Speculative (Generally lack characteristics of a desirable investment)	B	B
Highly speculative (Bonds of poor standing)	Caa	CCC
Most speculative (Poor prospects)	Ca	CC
Imminent default (Extremely poor prospects)	C	C
Default	C	D

Operational Risk: During the 1990s, financial institutions started to focus attention on the risks associated with their back office operations— what came to be called operational risks. Having already focused on managing market and credit risks, a number of institutions broadly defined operational risk as all risks other than market or credit risks. Others have defined operational risk more narrowly as risk associated with human or technology failure. Under either definition, some examples of operational failures are:

- A broker's back office fails to catch a discrepancy between a reported trade and a confirmation from the counterparty. Ultimately, the trade could be disputed, causing a loss.
- A trading floor burns down. (This happened to Crédit Lyonnais in 1996.)
- Before the compulsory dematerialization, a broker could suffer losses due to bad delivery resulting from the signature difference and/or fake certificates.

Market Risk: Market risk is the financial risk of uncertainty in the future market value of a portfolio of assets and/or liabilities.

Institutions can actually reduce these risks simply by researching them. A brokerage firm can reduce market risk by being knowledgeable about the markets it operates in.

One of the fundamental challenges of enterprise risk management is the fact that individuals who take risks on behalf of an organization are not always the same people who suffer the ultimate consequences of those risks**.**

2.3 COMPONENTS OF ENTERPRISE RISK MANAGEMENT

Corporate Governance: It is the responsibility of the top management to ensure that an effective risk management program is in place. This includes:

- Defining organization's risk appetite in terms of loss tolerance, risk-to-capital leverage and target debt rating.

- Ensuring that the organization has required risk management skills and risk absorption capability to support its business strategy.
- Establishing an organization structure and defining the roles and responsibilities for risk management.
- Implementing an integrated risk measurement and management framework for credit, market and operational risk.
- Establishing a risk assessment and audit processes as well as benchmarking company practices to industry best practices

Line Management: In the pursuit of new business and growth opportunities, line management must align its business strategy with the corporate risk policy. In executing that business strategy, the risks of business transactions should be fully assessed and incorporated into pricing and profitability targets.

Risk Transfer: To support portfolio management objectives, risk transfer strategies should be executed to lower the cost of hedging undesirable risks. To reduce undesirable risks, management should evaluate derivatives, insurance and hybrid products on a consistent basis and select the most cost effective alternative. For example, corporations such as Honeywell and Mead have executed alternative risk transfer (ART) products that combine the traditional insurance protection with financial risk protection. By bundling various risks, risk managers have estimated 20-30% savings in the cost of risk transfer.

Risk Analytics: The development of advanced risk analytics has supported the quantification and management of credit, market and operational risks on a more consistent basis. In addition to the quantification of risk exposures and risk-adjusted profitability, the same technique can be used to evaluate risk transfer products such as derivatives and insurance. For example if management wants to reduce its risk exposure, say from a value-at-risk (VaR) of Rs.100 crore to a VaR of Rs. 50 crore, risk analytics can be used to determine the most cost effective structure to accomplish that risk objective.

Data and Technology resources: One of the greatest challenges for the enterprise risk management is the aggregation of the underlying portfolio and market data. Portfolio data include risk positions that are captured in different front and back office systems. Market data include prices, volatilities and correlations. In addition to data aggregation, standards and processes must be established to improve the quality of data that are fed into the risk system. With respect to risk technology there is no product that provides a total solution to enterprise risk management. Organizations are required to build or buy-and-build the required functionality.

2.4 RISK MANAGEMENT FRAMEWORK

Measuring and monitoring risk at a firm wide level has increased the focus on quantification and the need for a consistent firm wide approach. Apart from the quantitative components required for effective risk management, policies, guidelines, limits, checks and balances are vital components of effective risk management.

Quantitative Side

VaR was pioneered by major U.S. banks in the ’80s, as the derivative markets developed. The birth of derivatives represented a new challenge for risk management because traditional measures of exposure were clearly inadequate. For example, two derivative contracts with the same notional value could have very different risks. With VaR, banks had developed a general measure of economic loss that could equate risk across products and aggregate risk on a portfolio basis.

Another important stimulus to the development of VaR was the move toward mark-to-market, both for cash instruments and derivatives. Prior to that, the emphasis was on net interest income, where the common risk measure was

repricing gap. As trading increased, duration analysis took over, but duration's inadequacies led to the adoption of VaR.

Definition of VaR

VaR is defined as the predicted worst-case loss at a specific confidence level (e.g., 95%) over a certain period of time (e.g., 1 day). For example, every afternoon, J.P. Morgan takes a snapshot of its global trading positions to estimate its Daily-Earnings-at-Risk (DEaR), which is a VaR measure that Morgan defines as the 95% confidence worst-case loss over the next 24 hours due to adverse market movements. The elegance of the VaR solution is that it works on multiple levels, from the position-specific micro level to the portfolio-based macro level. VaR has become a common language for communication about aggregate risk taking, both within an organization and outside (e.g., with analysts, regulators, rating agencies, and shareholders). Virtually all major financial institutions have adopted VaR as a cornerstone of day-to-day risk measurement.

Limitations of VaR

VaR is not a panacea for all risk management and measurement issues. Many of the financial losses were caused by failures that a VaR measurement system would not have prevented. Numbers do not tell the whole story. Time series does not include all the market information, because market efficiency is not perfect. For example, in 1993, the US fed fund rates were flat, at 3% for the whole year. If one uses only historical price data of US short term debt securities, VaR will tell that there is very little risk in US interest rate market, since the historical standard deviation of the price series had been heading lower and lower as the Federal Reserve held the short term interest rates fixed. In February 1994, fixed income markets blew up! If in addition to historical price data, the analysis had included factors like inflation, employment, growth and other macroeconomic factors, one

would have heard a lot of noise coming and known that there was a potential storm brewing.

Qualitative Side

A calculation like VaR is necessary but not sufficient to assess the risk of complex instruments or complex arbitrage strategies. Qualitative input is just as important. In fact, the two must be used in tandem for best results. Appropriate policies, procedures, limits, controls as well as checks are essential. A critical focal point of effective risk management practice is the proper allocation of responsibilities among front, mid and back office as well as high-level risk oversight functions. The aim of a risk manager is not to nullify risk but rather to increase adequate risk-adjusted returns and to reduce as much as possible what he or she cannot control and is beyond risk management.

To compensate for the limitations of VaR, firms must design and implement risk management add-ons to address the inherent weaknesses. Most users combine VaR with stress testing to address questions such as “How much do I expect to lose the other 1% of the time?” As no risk measurement model is without limitations or implied assumptions, it is helpful to understand what will happen should some of the underlying assumptions break down. Stress testing is the catchall term for doing a series of scenario or what if analyses to investigate the effect of violating some of the basic assumptions underlying the risk model. As with VaR, the quality of the answer depends on the inputs, including the financial engineer’s ability to select appropriate scenarios. Events such as the European currency crisis, the Gulf War and September 11 demonstrated that predicting factors such as maximum volatility is difficult and that correlation can change substantially during extreme market moves.

Performance evaluation

To date, trading and position taking talent have been rewarded to a significant extent on the basis of total returns. Given the high rewards bestowed on outstanding trading talent this may bias the trading professionals towards taking excessive risks. The interest of the firm or capital provider may be getting out of line with the interest of the risk taking individual unless the risks are properly measured and returns are adjusted for the amount of risk effectively taken.

To do this correctly one needs a standard measure of risks. Ideally risk taking should be evaluated on the basis of three interlinked measures: revenues, volatility of revenues, and risks.

The firm or the capital provider has to do a trade off between the risk, expected revenues and the volatility of the revenues. Thus, instead of measuring the performance based only on revenues, the performance should be measured based on the targeted risk ratio, efficiency ratio and Sharpe ratio.

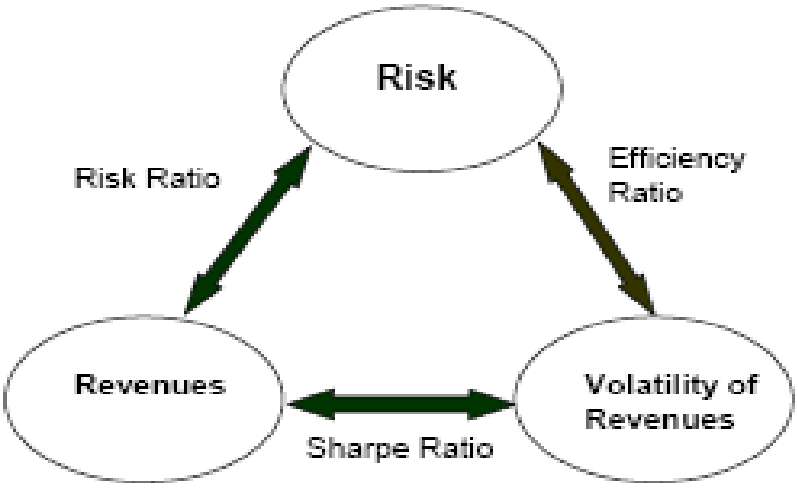


Figure 1. Ratios

3. Role of Technology in Risk Management

For many institutions such as banks, investment management firms, insurance companies, brokerage firms, technology is a critical component of any risk management initiative. For institutions which rely heavily on technology, there is always a risk technology becoming the focus of risk management. It is important to recognize that the risk management is primarily about people – how they think and how they interact with one another. Technology is just a tool. In the wrong hands, it is useless, but applied appropriately, it can transform an organization. A good approach would be to start by planning a risk management strategy focusing on procedural and cultural issues of risk management. Once a strategy is formulated, then one can determine how and where technology needs to be incorporated or where it can enhance strategy. Technology can reshape corporate cultures and facilitate innovative procedures. Here is how…

3.1 DATA AGGREGATION

Information is to form the very basis of risk management. This is critical in today's age of information overload. However, before it can be processed, analyzed or acted upon, the right information must first be made available at the right time to the systems and individuals who need it. In each of the examples given in the introduction, the debacle could have been prevented if the decision-makers had the right information at the right time!

Automation can play a valuable role by reducing or eliminating the need for manual intervention in processes such as deal capture, confirmations, reporting, funds transfer and most importantly monitoring of limits. This, however, is just one of the benefits of automated transaction processing and generating data for control and reporting.

Managing such risks as organization's total yield curve exposure, or its total credit exposure to counterparty is impossible without comprehensive information about those exposures.

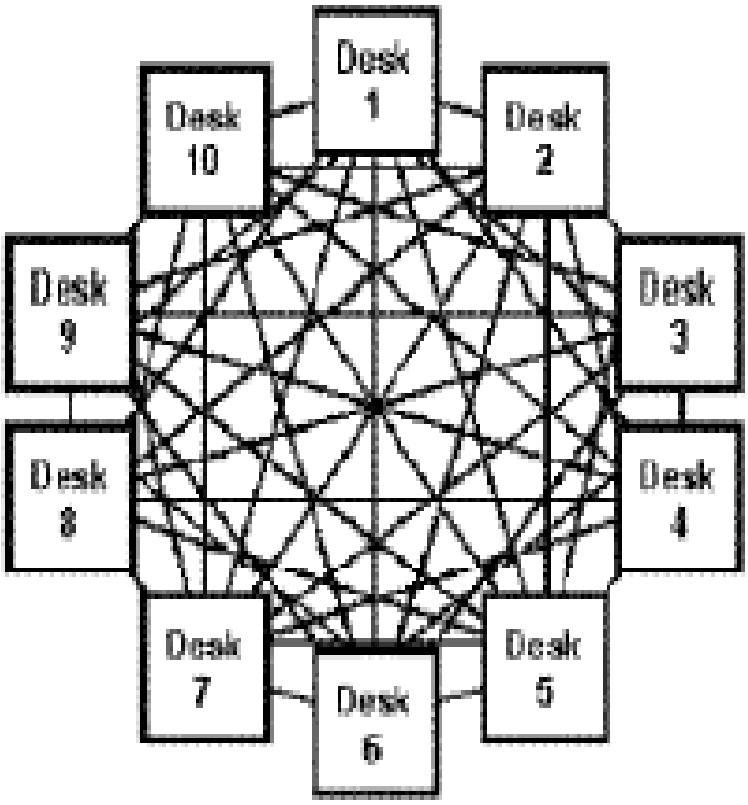
Before an enterprise can attempt to manage risk on an enterprise wide basis, it first must collect and communicate all necessary information relating to those risks. Consider the example of a Securities firm which has just two trading desks. For these desks to cooperate in managing risks there would be just one line of communication. Suppose, however, that the securities firm has not two but ten desks. In this case, the line of communications needed would be forty five. Trying to manage risk across forty five lines would become a monumental task. Add to this the differing conventions that might exist on each bench, the need to coordinate desks in multiple time zones, and the task of also communicating with the back office, sales and risk management – the problem becomes insurmountable. Exhibit 1 and 2 illustrate the complexity involved in communicating between multiple desks.

Two Desks, One Line of Communication

Exhibit 1

Ten Desks, Forty-Five Lines of Communication

Exhibit 2



Source: Enterprise Risk Management by Glyn A. Holton

FIGURE 2 Desk to Desk Communications

Today, technology makes it possible to effectively communicate information – across desks, across departments and across globe. This technology is called data aggregation.

3.2 RISK ANALYSIS

“How much risk are we taking?” This question is so simple – and yet so profound.

In one form or another, it underlies enterprise risk management. In the past, organizations would look at Profit & Loss statement to answer the question. Volatile profits meant high risk. A problem, however, is that profit & loss is a retrospective and historic indicator of risk. Indeed, for many risks, profit & loss statement may reveal little or no information.

In order to manage risks, organizations need to be able to measure those risks prospectively. They need to know, based on their current position, how much risk are they taking. Organizations are addressing this challenge with statistical risk measures. For market risk, value at risk is being used. For credit exposure, measures such as expected exposure or maximum exposure are being used.

Institutions are turning to more powerful systems to support their risk analysis. Distributed systems which run the simulation simultaneously on multiple systems offer much potential. When these are used in combination with the latest simulation techniques, many sophisticated forms of statistical risk analysis can be performed in near real time.

3.3 AUTOMATED OVERSIGHT

With the statistical risk measures and the ability to assign a precise number to risks, oversight can be automated. The process starts by assigning each department, each desk and each trader explicit authority to take specific risks. For example a foreign exchange trader who trades in three different currencies,

might be given a risk limit for each currency. The risk management system would track the trader's value at risk arising from exposure to each of the currencies to ensure that the trader remains within the pre determined limits. In addition to trader specific limits, there would be overall limits for each desk and total limits for the entire trading operation.

When a limit structure is supported by risk measurement technology risk oversight becomes automated. If a trader exceeds the limits, it is immediately reported to the manager. In this way a clear standard is set for appropriate behaviour. The manager is thus alerted and can take immediate steps to reduce the exposure and mitigate the risk.

4. Trends in Risk Management

Today risk managers are struggling to understand, and even quantify, the impact of waves of mergers, acquisitions, restructuring, and competition that are sweeping their organizations. The Internet is increasingly becoming the environment of choice for extending risk management systems where they are needed.

Operational risk management, an emerging discipline, attempts to quantify risks not only in products, but also in processes, technology, organizations, and strategic opportunities. For example, organizations now rely heavily on computer systems, which are vulnerable to power failures, network outages, operator errors, hacking, software glitches, etc. While there are numerous software packages that track and measure issues such as creditworthiness and financial risks, solutions addressing wider operational risks are also beginning to appear on the market.

4.1 SHIFTING RISK MARKET

As the market shifts to include new tools and new platforms, many executives believe that their risk management systems are inadequate. Systems may be incomplete, inflexible, and not easily analyzed, with too slow response times. Today's derivatives software is based on spreadsheets and relational databases and may be difficult to adapt to market variables.

4.2 OPERATIONAL RISK MANAGEMENT

Early adopters in the financial services industry are now looking to incorporate operational risk tools into their risk management systems, extending the discipline of risk management to every business unit. To meet this need, leading risk management software vendors are incorporating operational risk components into their offerings. Most provide tools to measure the impact of transaction processing errors, business continuity strategies, and business processes and controls.

In some respects, risk managers may increasingly borrow techniques and methodologies from other industries. Many of the software tools available for risk management in other industries may be useful in financial organizations. These tools include collaborative applications, project management software, and asset management systems.

Another trend reshaping the architecture of risk management packages is the rise of the Internet and World Wide Web as an application and communications platform. Risk management applications are now configured for Internet usage, and many are now being written in Java, the language that can run across any system attached to the Web. In addition, the Internet has increased the amount of information resources that can be accessed by risk management professionals. Often, the Internet can be used to obtain global information

updates (at no charge). Several Internet resources monitor the captive, offshore insurance, reinsurance, and risk financing markets.

4.3 INTEGRATION WITH OTHER SYSTEMS

Robust risk management systems require relational databases and client/server systems. Those institutions that have risk management systems in place report that more powerful database technology and distributed computing are underpinning their systems. Many also employ data modeling. Advanced systems--such as neural networks and knowledge-based systems--are virtually nonexistent to date, but some early adopters are looking into these technologies. Straight-through processing capabilities, integrating front-office, back-office, accounting, and workflow systems have become essential features of a brokerage solution.

Accessing and analyzing huge volumes of data that arise from transactions have always been a challenge for banks. Operational database systems were not designed for tracking historical data. Data warehouses help risk managers to address the need to be able to examine large quantities of data and do year-to-year or month-to-month analysis. For example, in a real-time risk management warehouse, trade transactions are entered into workstations, sent directly to the warehouse, and incorporated with data such as exchange rates or treasury yields. Data warehouse also include "data cleansing" technologies that remove errors from historical market data and therefore improve the quality of analysis. In addition to internal company data, a primary characteristic of risk management systems is that they also integrate the latest market and external data.

An illustration of the impact of technology can be seen on a typical trading floor. Until recently, traders filled out paper trade tickets that were entered into back-office accounting and control systems. A report would follow. Now, with distributed computing networks, trades can immediately interface with risk management systems. Technology has also enabled risk managers to develop

new derivatives instruments tailored to meet the requirements of individual investors (institutional & high net worth). It also increases access to available information about the potential risks and returns of portfolios. In addition, a new generation of PC-based tools and applications has made it possible for smaller banks to now access the same technologies that formerly were only available to the largest financial institutions.

5. BASEL Regulations

5.1 OVERVIEW

The Basel II Accord marks a significant step in improving the risk processes in banks worldwide and is expected to provide more stability to their operations. Banks see this as an opportunity to allocate risk capital optimally and to improve their profitability as they encounter an increase in interest rates and a squeeze in margins. As banks worldwide race to comply with Basel II regulations as stipulated by regulators in respective countries, they will encounter many hurdles on the way. The nature and scale of the challenges that banks face in complying with the regulations vary with their size, the number of business lines they have and the geographic spread of their operations.

The advanced notice of proposed rulemaking – the Basel II guidelines released by the Federal Reserve Board, the Office of the Comptroller of the Currency and the Federal Deposit Insurance Corporation – mandates banking organisations to implement the advanced internal ratings based (AIRB) approach for credit risk. It will require banks to calculate regulatory capital based on their own internal risk estimates for probability of default (PD), loss given default (LGD), exposure at default (EAD) and maturity with separate formulas for corporate and retail credit exposures. At a high level, Basel II has increased risk sensitivity with differentiated effect on risk-weighted assets (RWA) by type of exposure, obligor, tenor and collateral.

A Basel II implementation in a medium to large bank is a complex amalgamation of many different projects and initiatives across the organisation. One of the largest components is the aggregation of finance and risk information from the various lines of business of the bank across regions to measure the three categories of risk – market, operational and credit. Data capture processes and integrity checks are required to ensure the availability, quality, standardisation and integrity of data.

5.2 BASEL II IMPLEMENTATION IN A LARGE BANK – KEY CHALLENGES AND BEST PRACTICES

The implementation of Basel II impacts a wide range of functions including finance, risk, corporate, management and regulatory reporting, legal/compliance and IT. A large number of projects in different areas that form part of the business process chain contribute to significant programme complexity. These initiatives are very interdependent and often have aggressive timelines. Banks need to address certain key challenges to effectively rollout a Basel II programme (Figure 3). While these challenges are described in the context of Credit risk, they could be equally applicable to other initiatives under Basel II. These challenges – along with the best practices – are described in detail below.

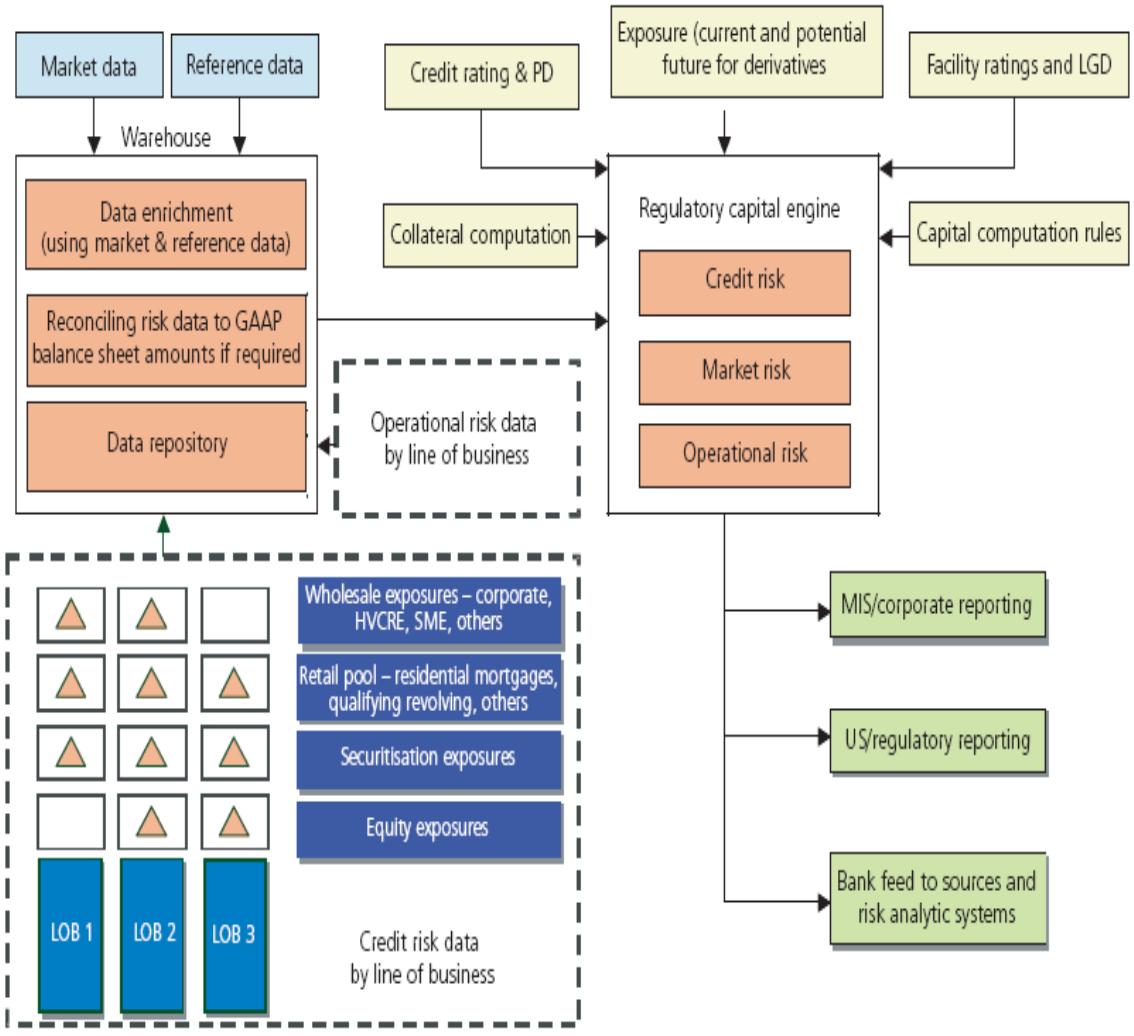


Figure 3 Illustrative Basel II end-to-end view

End-to-end integration

Given the component-wise implementation of a Basel II programme, banks need to ensure that the various components tie in from an end-to-end perspective and that the interactions between projects are seamless.

- Identifying and plugging gaps between accord requirements and current state – banks would have to assess the functionality in the accord that can and cannot be delivered within the timelines stipulated by national

regulators. The assessment should look at the availability of data, upgrade the existing processes to support new functionality and the time and cost implications of plugging the gaps. These should be prioritized on business criticality of the missing link and feasibility in terms of cost and timelines.

- End-to-end architecture – there are two aspects to architecture, business architecture and technical architecture. On the business architecture front, banks should define boundaries for the various business process interactions from start to finish. The business architecture team must also review requirements of individual projects to check the fit with the end-to-end flow. Technical architecture must address tool, platform, and package selection and technology implementation of the business flow across platforms, and technical specifications and standards. This cuts across different business lines and legal entities of a bank and requires senior management commitment to bring them together.
- Defining enterprise-wide standards – given the numerous components, defining and implementing enterprise-wide standards in business processes and data is the key. These standards are critical to bring in information from multiple organizations, systems, processes and regions, and would be defined around customer, product, collateral, risk and finance entities. Making the organization conform to the standards is an even greater challenge.
- End-to-end testing – the importance of testing of the end-to-end flow cannot be overstated in such a large and complex project implementation. The preferred mode is to test a proof of concept towards the beginning of an implementation to capture issues upfront. Every component must undergo multiple rounds of testing on an independent and integrated mode as additional components keep getting developed. The end-to-end testing should involve users from product control groups and business units to test the seamless flow of data across different modules to deliver reliable results of RWA and reporting data points.

Data management

Managing data is regarded as one of the most pressing challenges in a Basel II implementation. An enterprise data initiative such as the Basel II implementation requires managing diverse data from multiple product systems and business lines either through a central warehouse or regional data marts. Data from source would undergo many enhancements at different stages to tie requirements to raw data. Erroneous or missing data from source system feeds has a multiplier effect and the calculation of key risk indicators can be way off the mark.

Basel II imposes extensive data requirements on banks in their credit risk computation. For example, in the AIRB approach for credit risk, data is required at the granular level of a transaction or a position for all credit sensitive exposures across the bank's business units, which would be a staggering volume for a globally active bank.

Though banks have historically captured ratings performance data, including default and so on, very few today have data on all three risk indicators: PD, LGD and EAD. Even if the data is collected, the bigger question needs to be answered: is it of high quality and in a ready-to-use format?

Data complexity is compounded by the multiplicity of product systems and business lines that capture and store data in local formats. Data gaps or data non-availability should be addressed upfront through enrichment or substitution of data. Another hot issue is the cost of inaccurate or unreliable data from an internal decision-making standpoint as well as regulatory penalties. Data profiling is initiated early in the life cycle of the project to facilitate data quality planning and set up data governance mechanisms to ensure the client focuses resources on addressing the quality issues at the outset, rather than at the very end. The overall objective of data management is to establish a continuous cycle of

tracking, resolving data issues and incorporating learning into the data governance structure (Figure 4).

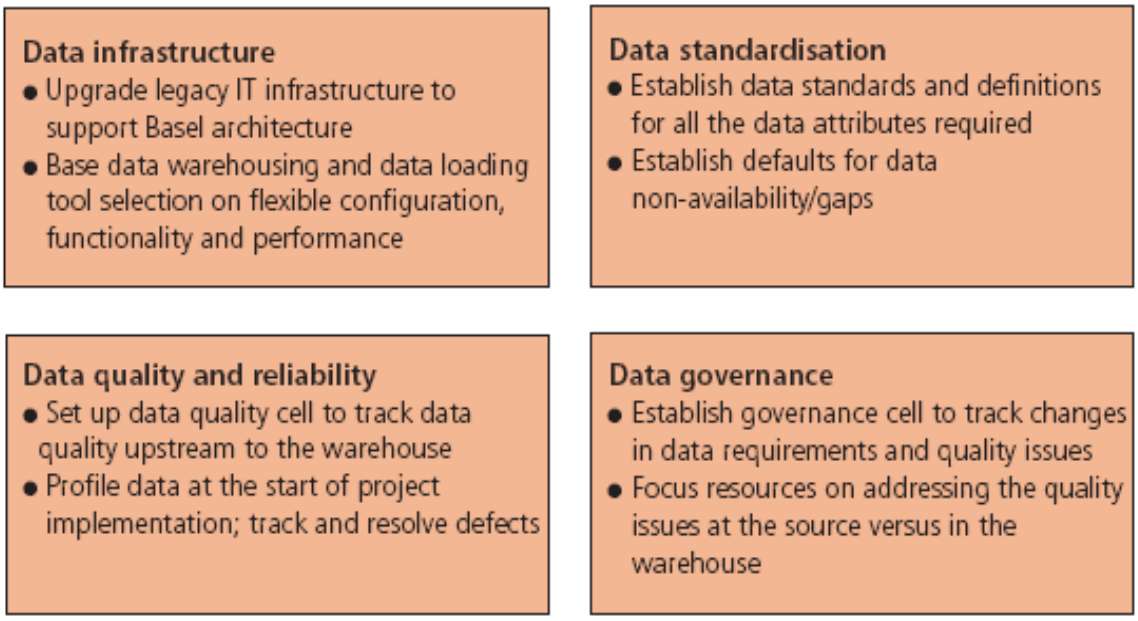


Figure 4 Data management strategy

Effective programme management

Since Basel II involves many parallel projects spread globally across the banking organization, this could result in multiple releases and roll-outs across geographies. Typically, this translates into tens (sometimes hundreds) of independent teams of varying sizes, who work in their own silos. A programme of this scale with global teams, aggressive timelines and interdependencies creates significant management challenges.

Robust programme management is needed to ensure not only that the individual projects deliver, but also that the overall programme is progressing towards meeting the bank's goals. Focus should also be on optimizing the return on investment for the millions of dollars that banks have committed. It requires

increased and frequent monitoring and reporting to senior management and to regulators.

Adding to the complexity are the ever-changing and evolving regulatory guidelines. Details of various aspects of the Basel II framework are still being defined by the regulators in different countries. Managing the uncertainty requires strong communication channels, change-management mechanisms and processes to address and resolve issues and conflicts.

Given the significant commitment of financial and human capital, many banks seize this opportunity to achieve other strategic objectives in addition to Basel II compliance. This could include standardization of processes, retirement of old systems and improvements in business intelligence.

For instance, many organizations like Infosys are programme-managing a large initiative to develop strategic data infrastructure to meet financial, regulatory and management requirements for the corporate and investment banking division of one of the largest financial services conglomerates. Key to success here is achieving a balance between short-term tactical wins and long-term strategic goals. Additionally, assessing the impact of change in data, processes and enhanced functionality across the organization provides insights into key focus areas for successful programme execution.

Home-host issues

Home-host issues for a globally diversified bank arise when Basel II calculation methodology stipulated by home-country regulators (banks' headquarters) differ from the rules in the host country (the local country). The Basel II framework allows for a limited degree of national discretion in the way the accord may be applied locally to adapt to conditions of national markets.

Many global banks adopt a hybrid end-to-end architecture model that establishes a balance between global initiatives and individual country initiatives. The centralized/ decentralized decisions would be around components for sourcing data, RWA calculations and reporting. The right balance would ensure optimal utilization of resources and IT infrastructure. The host countries typically prefer more decentralization to meet local regulations under the following circumstances:

- The regional deadline is before the home-country deadline.
- Approaches (advanced or standardized) or calculation of certain parameters, such as defaults, are different between home and host countries.
- There is a regulatory requirement for higher frequency of report generation for local reporting (daily versus monthly).

While the hybrid model will be suitable for a majority of the situations faced by global banks, the implementation places significant demands on programme management skills, requires a flexible end-to-end architecture and sharing of best practices across the teams.

5.3 BASEL FINALE

The challenges, uncertainty and complexity that banks face in their efforts to be compliant with the Basel II regulatory guidelines are many. Hand-in-hand with compliance objectives, Basel II offers banks the advantages of better risk management; superior risk-based pricing of products and potentially competitive advantages. To manage challenges effectively and to realize the most benefit from a Basel II implementation, banks need to focus on the broad theme of planning and programme-managing the various pieces from an end-to-end perspective (Figure 5).

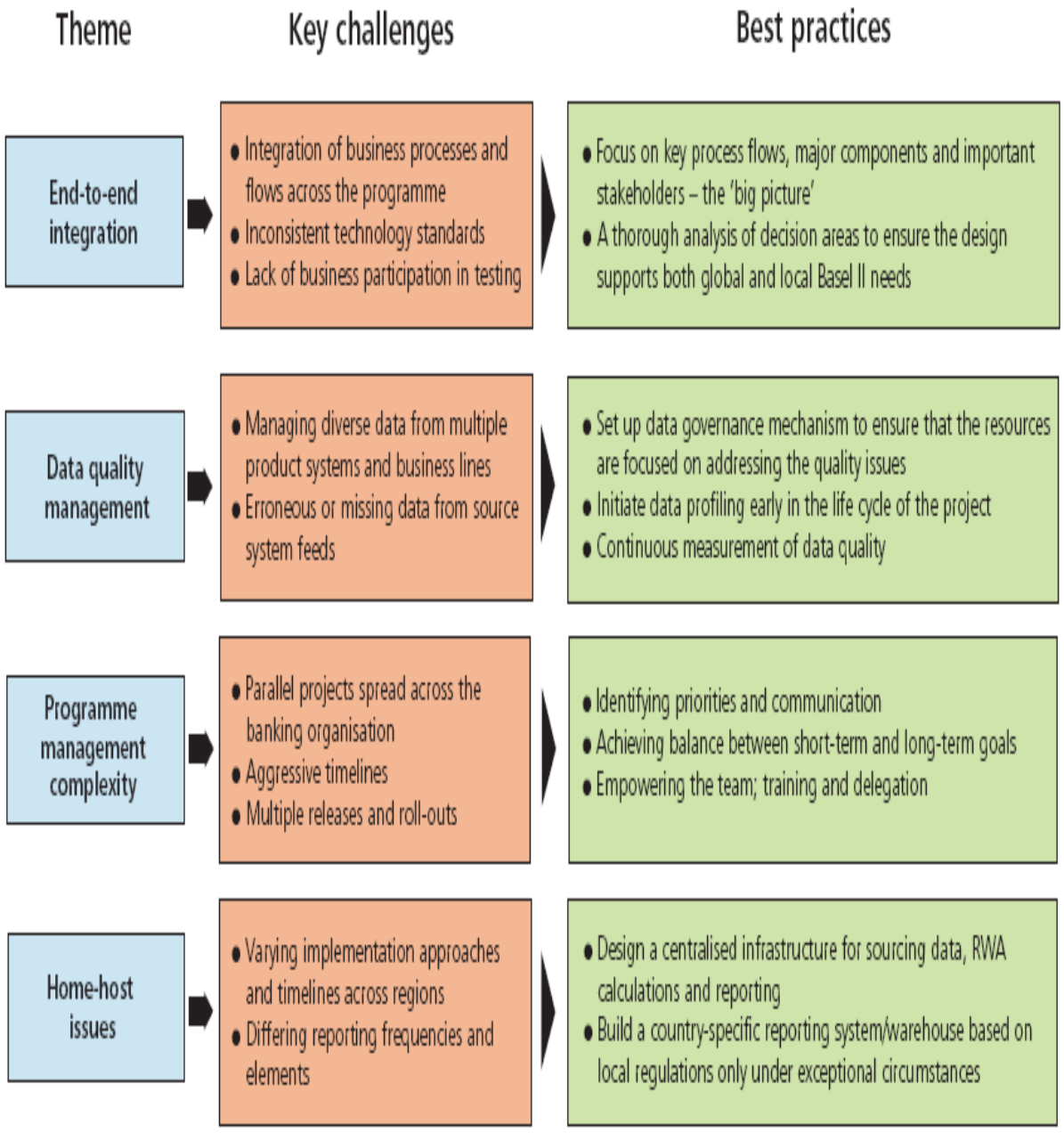


Figure 5. Summary of the key challenges and best practices in Basel II implementation

6. Components of Risk Management Software

The challenge is building systems that can handle potentially thousands of computations, measuring transactions, interest rate curves, volatility sets, and correlation sets. This requires a distributed architecture that consists of networked workstations or servers. Add to the picture a business involving many currencies, many products, and clients resident in many countries.

Considering the study presented in the previous sections, we identify the following appropriate components which form the basis for building the knowledge based Credit Risk Management system:

- Credit risk measures, models, and exposure simulation
- Market risk measures, models, and exposure simulation
- Fraud risk measures, models, and exposure simulation
- Value-at-Risk, historic simulation, and Monte Carlo simulation
- "Greek" risk calculators (beta, delta, gamma, Vega, theta, rho)
- Instrument coverage (such as fixed income, equities, commodities, derivatives)
- Modelling & Scenario generation
- Stress testing and time simulations
- APIs and toolkits for interfaces to other systems
- Spreadsheet add-ins

7. Summary & Conclusions

This chapter on Credit Risk Management, presents an overview of risk management in the financial services industry along with the Basel II regulations and formulate important components that could be used for modeling the knowledge based Risk Management system.

Risk management is a continuously evolving mix of science and art. Losses are inevitable, but one must keep learning from the past. Risk itself is not bad, but risk that is misplaced, mismanaged, misunderstood, or unintended is bad. Each institution needs to assess which method best suits its objectives, its business, its view of the world and its pockets. A clear distinction should be made between risk management and risk taking. Risk management oversees and ensures the integrity of the process with which risks are taken. To maintain the objectivity, risk management cannot be a part of the risk taking process. Individuals who manage risk need to be completely independent from individuals who are responsible for taking risk.

Chapter 7

Enterprise Knowledge Models
For Document Management System

Abstract

Documents get created in different forms in an organization. Many of them exist in isolation. It is envisaged to have systems that help in over all management of Documents in an enterprise. Having presented the detailed discussion on the importance of Documents in an organization, this Chapter presents the Knowledge based models that highlight the document Management system (DMS).

1. **Introduction:**

"Document Imaging" is an information technology category for systems capable of replicating documents commonly used in business. Document Imaging Systems can take many forms including microfilm, on demand printers, facsimile machines, copiers, document scanners, Computer Output Microfilm (COM) and archive writers. In the last 15 years, Document Imaging has been used to describe software based computer systems that capture, store and reprint images. Document Imaging is part of the set of technologies within the Enterprise Content Management category.

In the early days of content management technologies, the term "Document Imaging" was used interchangeably with "Document Image Management" as the industry tried to separate itself from the micrographic and reprographic technologies. Organizations like National Micrographic Association (NMA) and American Records Manager Association (ARMA) started inventing new

ways to describe these new archive and library tools. The 'NMA' became the Association of Image and Information Management.

In the late 80's and early 90's, a new document management technology emerged: Electronic Document Management. This new technology was built around the need to manage and secure the volume of electronic documents (spreadsheets, word processing documents, presentations) created in organizations. Electronic documents can change constantly and those changes require security authorizations and tracking, which are the core functionality of an EDMS (Electronic Document Management System). EDMS is not limited to native word processing and spreadsheet files but extended to scanned images also.

2. Objectives of Modeling Document Management System in an Enterprise:

- Gain better control over Business Critical Information by seamlessly integrating electronic documents with business process
- Get Information on demand leading quality decision
- Cut down cycle times of information processing thus optimizing investments and ...
- Get the best quality customer service with least response time

3. APIs

Rich set of Application Programming Interfaces (API's) to provide variety of customized solutions specific to each customer . They can easily plug into workflow automation and transaction processing

4. The Models that highlight the Document Management System:

Different organizations create, edit, refer, archive and use their documents in their own style. Having studied the requirements on Document Management, we identify and evolve the following features for knowledge models that are envisaged for comprehensive management of documents in any enterprise:

- Easy and powerful search facilities to retrieve, view and print documents using keywords, references etc.
- Image annotating features like notepad, stamping etc
- Built-in (optional) OCR facility for text recognition
- Comprehensive text search facility
- Comprehensive electronic filing cabinet system
- Extensive archival management facilities
- Security, both at functional level and document access level
- Can be coupled with optical disk platters, CD and RAID (Redundant Array of Independent Discs) to store large amount of data
- Multiple document interface viewer
- Open ended object oriented design which facilitates customization with scalability to meet specific user requirements
- Compressed file storage compatible to CCITT G4 (Comite' Consultative International Tele'phonique et Telegraphique which is presently referred as International Telecommunication Union) & JPEG (Joint Picture Expert Group) standards
- Supports number of peripherals for document capture, storage and printing

5. Organizations that can benefit by the above models of DMS

- Banking, Finance and Securities
- Government
- Healthcare
- Insurance
- Manufacturing
- Aviation
- Consultancy and many more….

6. Important Features of DMS

The enterprise wide Document Management System should be built to provide all the following important features, among several others:

6.1. Security and Access Control:

DMS should provide multi-level security such as document-level, folder-level, user-level, group-level and at the database-level.

6.2. Scanning

DMS should support over 300 different types of scanners in the market including high speed ADF scanners like HP, Fujitsu, Ricoh etc., and provides a flexible scanner control.

6.3. Image Compression

All scanned documents in DMS are to be stored in compressed format, thus saving valuable disk space. The images are to be automatically decompressed while viewing.

6.4. Archival

Helps saving disk space further by enabling archival of large amount of data to optical disks, CD and RAID.

6.5. Flexible Retrieval

DMS to provide various methods for retrieval by using the in-built ISAM based Database server by giving a unique system generated id, a reference to each document, keywords based on the document content and also provides user defined field query using the DMS form builder. QBE on the database is also to be supported. Content based text search facility after performing OCR is also to be supported.

6.6. Database

DMS is to be built-in with an advanced ISAM based DB engine thus enabling faster scanning and retrieval.

6.7. Easy Integration with other Applications

DMS should be developed with modular and open-ended design so that it can easily be integrated with other applications. It is also to provide scope for image enabling with other applications.

6.8. Viewer

- The viewer in DMS should provide facilities to rotate, zoom, scroll, append, lens view and lock/un-lock the documents for selective modifications.
- MDI Viewer to view multiple documents.
- Annotation features like ‘Highlighting’, ‘Redlining’, ‘Hot spots’ etc.

6.9. Utilities

DMS should have facilities for data & document export and import.

6.10. Fax Support

Fax support could be an optional feature to DMS which can be provided to any FAX server using an API.

6.11. OCR & Text search (Optional)

- Lead tools OCR is an optional feature in DMS for character recognition.
- Text search includes facilities for capturing Multiple Domain keywords from the document for building text index for content based search.
- Audit trail, Logging support for Logins, Viewing, Deleting and Updating documents is also available.

6.12. Filing Cabinet

- DMS should provide an electronic filing cabinet in a hierarchical fashion.
- Documents are also to be filed automatically in multiple folders with drag/drop facility.
- DMS to support automatic filing, based on different filing schemes while registering the document.

6.13. Mailing

DMS should have built in Mailing System that enables users to mail documents with messages within the DMS network. DMS should also support Pop mail.

6.14. Workflow

DMS should incorporate a Workflow facility, using which, any user can initiate an action oriented document routing process to route documents to other users in the network. The user will also be able to keep track of documents and their flow when they move from one user to another.

6.15. Importing

DMS should include facilities to import documents from any DOS/MS Windows based application software packages like Word Star, MS Word, Excel, etc. without changing the native format of the document.

6.16. Indexing

- DMS database facilities include indexing documents based on attributes like ID No., Reference, Keywords, and the Number of document type specific attributes.
- Facility for automatic indexing based on the document content using OCR.
- Facility to index word processed/text documents based on the content.
- DMS has User-wise, Group-wise, Date-wise report generation facilities.

6.17. Object Oriented Design

DMS could be developed using Object Oriented methodologies. This makes DMS, easy to customize and integrate with other software systems.

6.18. Enterprise-wide Solutions

DMS can be implemented in a PC LAN as an entry level for the dept. level requirements in an organization and can be expanded to support multi-server and multi-user network to cater to the organization wide imaging requirements.

6.19. Scalability

It should be Scalable to meet on-going requirements of archival, retrieval & management of documents.

7. Summary & Conclusions:

Having studied in detail about verities of documents in different organizations, an effort is put in, to analyze and identify the required knowledge models that are envisaged for different purposes in an enterprise. In this chapter, a good number of visualized features that help in dynamic management of documents are presented as knowledge based models for Document Management System. Each feature can be taken up as an innovative project for implementation.

Chapter 8

Knowledge Based Workflow Management System

Abstract:

Workflow Management System (WMS) is required in each organization to define and control various activities associated with a business process. In this chapter, WMS architecture is proposed and important workflow features are presented to build knowledge based Workflow Management System

1. Introduction

Organizations deal with several processes and in majority of the cases documentation of the work flow related aspects is either missing or it is not sufficient for reuse. Clear cut definitions of some of the processes are inadequate in several organizations. Knowledge gained by Individuals with several years of experience, is not modeled in several places. The rules that are effectively used at a particular instant are not traceable for the new comers to the organization and one comes to square one when the senior persons leave the organization. It is essential to model the Knowledge on all aspects of workflow in every organization in order to build effective workflow management system. Many monitoring functions and control functions of WMS can be integrated with other systems used by an organization such as Document Management Systems, Databases, e-mail, production applications, used by an organization and so on. This integration provides structure to a process which employs a number of otherwise independent systems.

2. WMS Architecture

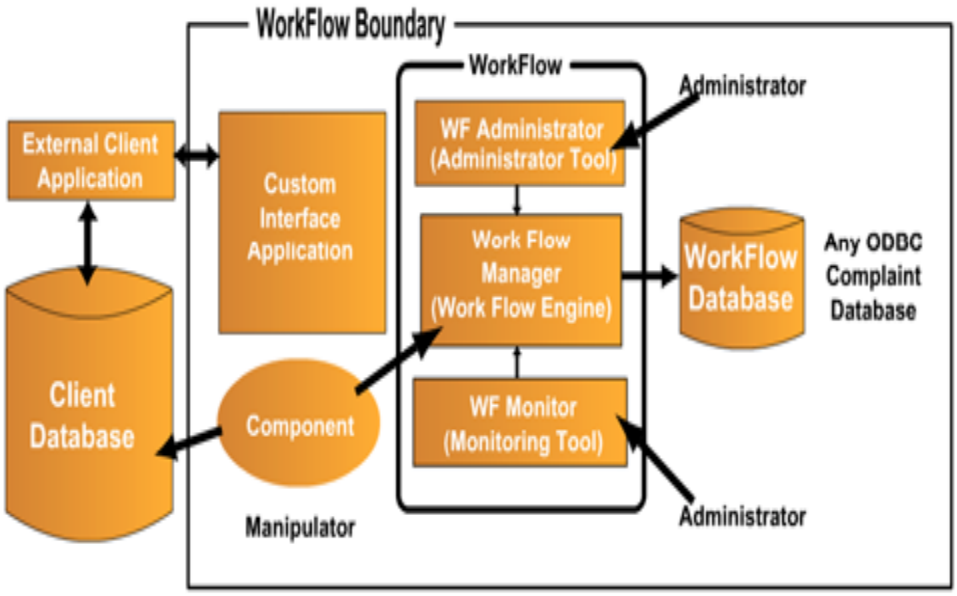
The key modules that make up WMS are:

The **WMS Manager** houses the Workflow Engine, which is the primary tool, used for allocating works for different users and for moving the works from start to completion in a workflow. It comprises of various components such as Workflow Connector, Rule Manager, Rule Executor, Workflow Server, Work Manager, Slot Manager, Workflow Information Manager, and Client Information Component.

WMS Administrator is an administrative module used for populating the workflow data sources such as user information and dynamic information like work and the stages associated. Also stores Static information like workflow, stage and rule information in the form of XML. The Administrative Tool, which enables definition of workflow, its stages and associated rules, makes use of the Rule Builder to parse the rules associated with a stage and convert it to XML.

WMS Monitor is the Monitoring module for monitoring the workflow system when it is up and running. This gives the feature of finding the status of a work, a session established by a user and other such administrator related tasks. It also generates reports for the efficiency of the workflow system

Architecture



4. SRA'S WMS

SRA's WMS provides the framework to integrate its powerful workflow engine with existing applications, to enhance the efficiency of business processes by systemizing processes, to establish accountability and optimally distribute workloads in a cost-effective manner.

WMS allows to define and manage complex, multistage business processes, ensuring that important business assets have the necessary authorizations, staging and integrity procedures performed on them quickly and securely across the enterprise.

WMS is an easy-to-configure, user-friendly workflow enabling solution that spans the entire organization. WMS's enterprise ready workflow engine provides direct access to databases, easily integrates with line-of-business and other host applications, and lends itself to be distributed across multiple platforms. Translation of business logic into a workflow application is supported by intuitive GUI. The GUI provides the means to graphically map out a business process and build rules for execution without need to write a line of program code.

5. Workflow Features

Based on our study of different organizations and their processes, we identify the following important features, that are to be planned and characterized systematically for achieving the goal of effective Workflow Management:

5.1. Basic Definitions:

• Define Workflow by stages and tasks under each stage
• Define Workflow Rules for movement of work through the business process stages
• Define users, their accessible stages in a workflow and their roles for each workflow
• VISIO integration for easy definition of workflows and organization chart
• Saving of workflow definitions as templates to quickly derive new workflow templates
• Workflow template inheritance of stage and rule properties allows easy modification in creating new templates

5.2. WMS Rule Definition

Workflow Management System should facilitate in building rule based environment with less technical jargon. We recommend the following aspects to facilitate in that direction:

• Easy to build expression based rules - no programming knowledge.
• Rules to enforce that mandatory data are entered for completion of a work.
• Rules could also be defined based on data from the external application(s) to which WMS is integrated.

5.3. WMS Monitoring

The following aspects are essential for effective monitoring of Workflow Management System:

• Maker-checker facility prevents unauthorized access of workflow modification and also tracks every change whether authorized
• Revoke a user session so that the current session of the user is cancelled and further activities cannot be performed using that session
• A User's standard privilege for a specific workflow stage can be temporarily revoked for a specific piece of work, if it is required that it should not be performed by the concerned user
• Standard work time setting for each stage is used for work timeouts so as to release work if incomplete in given time.
• Active slot maintenance feature allocates slot and monitors active status on user log in, so as to release a set of works of a user if inactive for a certain time or the session crashed.

5.4. WMS Processing

The following processing features are essential for building an efficient WMS:

• Request for work for a workflow returns relevant set of works & relevant inputs for each work.
• Load balancing algorithm to optimally allocate only a subset of the user eligible work upon user requests for work, so as to prevent work overloads for a user.
• Work prioritization feature permits works allocation based on the priority, with additional facility to dynamically change priorities.
• During a processing stage, allows two way flow of work specific data from and to the external application database to which WMS is integrated.
• Allows work allocation based on geographic code.
• Allows Parallel Processing of workflow items if defined.
• Optional inputs / process may be skipped at earlier stages but through warning levels settings can be trapped, so as to prevent further stage movement beyond a certain stage.
• Facility to move work across workflow stages without going through normal defined processing.
• Works can be added only to any of the source stages of a workflow

5.5. Logging & Security

The following features are recommended for building modules on Security aspects of WMS:

• Log on user authentication.

• Privilege class setting to restrict logged on user's access to defined roles & functions.

• Audit trail for every process like creating workflow, modifying workflow, modifying access rights, etc.

• Version number associated with every workflow and rules / every work.

5.6. Reports

The following features are required for house keeping purposes:

• Standard reports regarding workflow activities like performance, work history, etc.

• Query Builder facility for easy building of ad-hoc user defined queries

6. Summary & Conclusions:

In this chapter, WMS architecture is proposed and important workflow features are presented to build knowledge based Workflow Management System. Modeling "knowledge based Workflow Management System", is expected to allow organizations to define and control various activities associated with a business process. It is a continuous activity to improve the business processes on regular basis, so that an environment is created for capturing knowledge in many forms. The WMS architecture that is proposed could be implemented with the recommended features for WMS. Many monitoring functions and control functions of WMS can be integrated with other systems used by an organization such as Document Management Systems, Databases, e-mail, production applications, used by an organization and so on. This integration provides structure to a process which employs a number of otherwise independent systems.

CONTRIBUTIONS TO THE STUDY AND MODELING OF KNOWLEDGE DEVELOPMENT SYSTEMS

Summary of the thesis

First chapter on Knowledge perspectives forms the foundations to understand the philosophy of Knowledge management and importance of modeling knowledge development systems in the present context of new age enterprises. Presentation in chapters two through six, highlight the study of domain knowledge and models that are designed for developing a variety of knowledge based solutions for the new age requirements in the banking sector, on global connectivity. Chapter seven and eight are related to document management and workflow management functions, which are useful in almost every enterprise. Thus, this thesis forms a basis for modeling Knowledge Development Systems.

While the Knowledge Development phases described above represent business processes, there is an underlying knowledge cycle that will remain the core of any enterprise. Knowledge cycle begins with formal product concepts and ideas that are refined and formalized into product feature specifications. Each feature is directly linked to all the related and supporting knowledge, scheduled and prioritized within the over all conceptual plan, and finally assigned to the appropriate resources for implementation. In each process, from concept through validation, specific knowledge is essential to development which can also be used for future projects.

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