

## Cross organizational standardized business process integration and its application in Saudi Arabian banking system regulation: A case study of advanced IRB regulation

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### Abstract

The idea for this paper came after the recent financial crisis, its global consequences and specifically how it affected the banking sector. Financial institutions and regulators are – from a technical point of view - not fully integrated and automated yet. The inaccuracy in banks' data and the long set interval period, quarterly, to send the information to the regulators leads to delays interventions by local supervisory regulators. Most of the banks are using an Internal Ratings Based (IRB) approach that allows them to use their own methods to calculate the credit risks, which makes it difficult for the regulators to verify and validate the banks' data without adopting fully automated connectivity for the regulatory reporting system through sophisticated tools. The importance of this issue, for the central banks as well as the global economy, encourages us to investigate and to find solutions for the problem at hand.

This paper is focused on the Advanced Internal Ratings Based (A-IRB) approach to evaluate credit risk due to the importance and the sensitivity of this approach on the banking sector. The flexibility of the A-IRB approach allow banks to use their own method to calculate the credit risk without regulators having the right tools to validate the data is a major issue . The second issue with the A-IRB approach is that the report is only delivered quarterly to the regulator (SAMA). This period is too long as decisions can be taken based on data that is almost a quarter old. Therefore, evaluating the existing framework and solving the issues concurrently is essential to improve the regulatory reporting system.

To examine the situation of the regulatory reporting system, first, we reviewed literature on the Basel II&III regulations and the financial crisis, including impacts and responses. The second, we reviewed

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factors impeding the implementation of Basel II&III, including solutions to increase coordination and integration and a holistic approach that can mitigate the outstanding issues for the Regulatory Reporting System for the local banks in Saudi Arabia. We also evaluated the current system and the proposed system in two workshops and found that the proposed system showed considerable improvements of more than 100% in some areas and hence should be implemented.

Our result is a framework solution that integrates a private cloud computing network with automated and integrated features such as a Business Process Manager, a Knowledge Management Engine, a SLA Lifecycle Manager, a Business Rules Engine and a Data Quality Regulator and the Enterprise Service Bus for communication and integration between the banks and SAMA.

Keywords: Business Process, Business Rules, Bank Management

## 1. Introduction

The last financial crisis, which overwhelmed the entire world, completely changed the mindset of the regulators (Central Banks). This shift in mindset is mainly attributed to the intensity of this crisis, the great momentum of the crisis propagation from one country to another and the ill-timed information acquired by the regulators regarding the health of the banks, as measured in terms of the three pillars of the Basel II accord, i.e. Minimum Capital Requirements, Supervisory Review and Market Discipline. These impediments were mainly induced from the fact that the regulators do not have the right information at the right time in order to optimize proactive intervention and deter the impact of the financial crisis. This was attributed to the bank to regulator reporting period, which was mainly on a quarterly basis; the business processes of both the banks and the regulators were hardwired for this type of information exchange model. As such, even when regulators made a vain attempt to change the information exchange model, it was impeded by the rigidity and disintegration of the business processes of both parties. Consequently, in this research project, to resolve this issue, we first examined and evaluated the opinions of academics and experts by reviewing some of the major elements particular to IRB data quality and timeliness that might restrict the fullness of Basel II. Such challenges include obstacles, impacts, efficiencies and integrations. Second, re-designed the business process value chain that include Bank Procedures Approval and the Regulatory Reporting System as to-be models and evaluated the current model and compared with a new system that offer solutions for the existing system. Finally, we proposed a full automation and integration of regulatory business processes between the Central Bank (SAMA, Saudi Arabian Monetary Agency) and the banks in Saudi Arabia, including framework and Business Rules Systems.

## 2. Literature Review

The Basel II accord (set of standards), announced in 2004, is aimed at managing banking supervision and the regulatory framework released by BCBS [5] as an international banking standard. This framework is an improvement to replace Basel I and to develop standards to help regulate banks' capital adequacy supervision and exposures to the risk of default in order to minimize risk failures in banking and financial institutions. Many firms and regulators were struggling and in decline during the recent financial crisis due to certain factors, the main one being the failure to comply with standardizations. Our investigation will focus on regulatory reporting mechanisms in relation to data quality and timeliness.

The recent financial crisis disclosed various frailties in the banking regulation supervisory system. It raised many important challenges, such as accuracy, data quality, validation, consistency and timeliness in fulfilling Basel II regulators' requirements. These challenges, combined with other factors, resulted in a massive impact on the regulation system as well the worldwide economy. In this literature review, we will answer some relevant questions and elucidate this picture.

### *2.1. The financial crisis and Banks regulation*

The recent financial crisis originated from US subprime market mortgages, when the Federal Reserve lowered the interest rate to supplement the economy to help it recover from recession after the terror attacks in 2001. Then, after rising house prices through mortgage lending and fueled credit growth, the subprime market mortgage in the US, lending to households without limitations to loan repayment, ignited the crisis. According to Naudé [28], about US\$1.3 trillion was lent out in subprime mortgages in a short period and so the fast growing economy and incentive salaries led executives to ignore the signals, as stated by Citigroup Chairman, Chuck Prince, after the crisis. Thus, the spark originally went up from the mortgages, then spread to credit and local and interbank stock markets; the exposure to interbank loans worsened the case globally. Consequently, the global financial market correlation rapidly spread the fear causing recession and shrinking investments. Naudé [28] summarizes the reasons, saying, “easy credit, bad loans, weak regulation and supervision of complex financial instruments, debt defaulting, insolvency of key financial institutions, a loss of credibility and trust, and financial panic and mass selling-off of stocks and a hoarding of cash by banks and individuals”. Hildebrand [13] points out that using leverage excessively amplified the shocks to the financial system and it has been the main participator in the current financial crisis. Therefore, it is necessary to revise leverage policies, re-evaluate risk-weighted capital requirements and protect banks with a minimum capital buffer. Frankel and Saravelos [29] examine and conclude in a valuable paper the most significant factors linked to the crisis. The international reserves and the overvaluation of the real exchange rate are recognized as the obvious indicators of the latest financial crisis, among others factors that have not yet been proved. In fact, the disaster appears to have affected all economic sectors due to inaccurate and backward information and lack of integration and standardization among the banking systems worldwide.

### *2.2. Saudi Arabian Banks and Regulatory reporting problems*

Currently, many supervisory(s) and banking regulatory reporters are non-integrated, which clearly identifies one of the causes behind the crisis. The Saudi Arabian Monetary Agency (Saudi Arabian Supervisory) (SAMA) and local banks are examples of non-integrated business processes within the regulatory reporting system where most of the transmissions, preparations and communications of regulatory reporting are lacking integration. Usually, inquiring information requires a great deal of time to be submitted to the supervisory regulator, thus delaying decision makers to intervene appropriately, which might prevent worsening of individual cases. One reason for this is the lack of a common network that offers exchange data and instant pull-push information or a standard framework for all banks to automate systems that can offer simultaneous access of information by both sides for interaction and updating of data.

On the other hand, regulatory reporting systems face intra-organizational challenges that immobilize and prevent improvements to the system. The different perspectives of each department involve the completion of tasks and the absence of procedures and roles impels the overlap of competencies and responsibilities, which are factors in loss of professionalism in improving regulatory reporting systems. Another issue is the loss of productivity and utilization due to the wrong employees being in responsible positions in organizational departments. For instance, in SAMA, as our case study, the regulatory reporting systems are being monitored by different departments, such as Banking Supervision, Banking Inspection, Statistics and the Information Technology department, which usually results in interferences and ineffective utilization of employees' expertise, leading to inefficient processing of daily tasks.

### *2.3. Regulator and supervisory responses*

The recent crisis was destructive due to various factors, such as lack of data transparency among institutions, low cross-border interbank communications and inadequate standardization. However, the current regulations of Basel II assisted and mitigated the impact, but still did not reach expectations. Thus, the Basel Committee on Banking Supervision

responded to the financial crisis by presenting key measurements to strengthen the regulation, supervision and risk management of the banking sector and mitigate the severity of any economic financial devastation [11]:

- Raise the quality, consistency and transparency of the Tier 1 capital base.
- Introduce a leverage ratio as a supplementary measure to the Basel II risk-based framework with a view to migrating to a Pillar 1 treatment based on appropriate review and calibration.
- Introduce a minimum global standard for funding liquidity that includes a stressed liquidity coverage ratio requirement, underpinned by a longer-term structural liquidity ratio.
- Introduce a framework for countercyclical capital buffers above the minimum requirement and review an appropriate set of indicators, such as earnings and credit-based variables.
- Issue recommendations to reduce the systemic risk associated with the resolution of cross-border banks.

In fact, the defects in the regulatory banking systems are a combination of internal and external issues. The external issues that the Basel committee endeavored to confront, such as inconsistency and variation of the data and the interpretation of the regulations among the financial institutions, are necessary but not sufficient without tackling the internal issues, such as providing incomplete or false information to regulators in order to reserve capital and increase liquidity. Another issue is using different credit risk methods or using a manual method to aggregate data, which may lead to distorted information and affect decision making. In addition, when banks have inadequate systems or resources to handle the processes, discrepancies and inaccurate information is presented.

#### *2.4. Banking crisis impact*

This study points out the impact on banking sectors and where the defects and the solutions should be. Shedding light on the problems will give us the opportunity to control and avoid similar situations in the future. Since the crisis arose, banking sectors worldwide, from large to small banks, have been affected in various ways. Loan payments, SME and employment were deeply affected by banking investment during the crisis [25]. The bankruptcy of big names and interdependent global markets is shrinking the economy with low cash flow, thus corporate loans for firms are heavily damaged and fall back more than those for households, where the problem originated, which indicates the dimension of the crisis and the further aggravation to the economy. Therefore, asset quality and less corporate income will decrease bank capital [19]. The impact of the financial crisis went beyond loans and credits to loss of confidence in the worldwide market. The different interests among regulators and banks and the absence of standardizations directed them to respond by fighting fires. As a result, improvements to the control and monitoring of the banking sector are essential to avoid another crisis. Imposing rigorous policies and standards for all organizations that invest in financial services is needed to stabilize the international economy. This will not occur without a combination of integrated and automated systematic frameworks between regulators and local banks.

#### *2.5. Basel II and Credit Management*

Basel II (the New Capital Accord) was initially published in June 2004 as a capital adequacy framework for banks. It replaced the first version that was issued in 1988 as the Basel Capital Accord by the Bank for International Settlements Basel Committee on Banking Supervisions (BCBS) [6] in Basel, Switzerland. It was designed to assist banks in implementing an integrated, more comprehensive, mature, and risk-sensitive approach to calculate regulatory capital. It aspires to formulate consistency and consolidation in the way banks and banking regulators

approach risk management globally. The new framework provides a range of options for determining the capital requirements for credit risk and operational risk to allow banks and supervisors to select approaches that are most appropriate for their financial market infrastructure and their operations. The New Capital Accord has been accepted, even though it was delayed because of the recent financial crisis of 2007-2008 and yet there are opportunities to improve its instruments and mechanisms. One of the advantages of Basel II is it gives the host supervisory or regulatory agency the flexibility to enforce the rules that fit their business.

## 2.6. Basel II/III Role

Basel I was a good start to stabilize the financial institutions and increase banks' capital but it lacked risk sensitivity that distorted economic decision making. Therefore, Basel II was released to systematically expand the regulators and propose three pillars (capital adequacy, supervisory review, market discipline) instead of one to measure capital with a variety of approaches and great risk sensitivity [18]. Basel II emphasizes increased credit risk management by assessing the borrower's credit worthiness and measuring how much risk is involved when processing a loan [10]. The new accord is required to start on consolidated and proactive financial standards. However, it highly depends on each supervisor to fully align Basel requirements with subsidiary banks or those in the same jurisdiction [22].

The framework of the accord consists of three pillars to calculate risks (BIS):

Pillar 1- Minimum Capital Requirements: focuses on calculating risk-weighted assets, which supports capital charges more closely with the basic risk. It offers a specific treatment for risk measurement, securitization and management techniques. This pillar sets three options:

- a. Credit Risk: consisting of three category approaches to measure credit risk: Standardized, Foundation Internal Ratings Based (F-IRB) and Advanced Internal Ratings Based (A-IRB)
- b. Operational Risk: consisting of three category approaches: Basic Indicator, Standardized and Advanced Measurement
- c. Market Risk: Value at Risk (VaR)

Pillar 2- Supervisory Review: deals with regulatory response to the first pillar to increase supervisory power and assess internal economic capital adequacy positions for banks and process the quality of risk management.

Pillar 3- Market discipline: targets the promotion of higher stability in the financial and the increase of public disclosure requirements and transparency of capital adequacy and bank risk, which facilitate assessment of the bank by others including investors and analysts, providing good corporate governance.

After the financial crisis (2007-2008), the new accord, Basel III, announced in 2010 to overcome the previous accord shortcomings [4]. Basel III pursues enhancement and consistency in banking regulations to deal efficiently with financial and economic turmoil. The new release focuses on strengthen risk management, improve transparency and disclosures and enhance capital buffers in rigorous measures [16, 4]. Despite these improvement measures, Chorafas [8], arguing that Basel III would not achieve its objectives under the current complex relationships in the banking sector. Chorafas in his comprehensive book, calls for a holistic plan to tackle enormous banking threats also offer dynamic methods for intervention. Therefore, adopt sophisticated technologies would facilitate more robust communications and integration among the regulators and the banks.

## 3. Using BPM techniques in Basel II/III

During the financial crisis, many of the banks' reporting regulatory systems provided inaccurate and asymmetric information; as well, they were unable to provide timely information

due to lack of appropriate mechanisms. Therefore, regulators and supervisors were not able to intervene and share the same information to respond to the crisis. As a contemporary tool, business process management (BPM) can solve some of the problems experienced in banks' reporting systems and enhance automated processes in order to efficiently comply with Basel II/III regulatory policies and prevent any new crises that might occur. In fact, the business process approach can measure and distinguish the performances of the available processes, which provide management with a best practice tool to evaluate outcomes.

Business Process Management has been defined by many practitioners and business experts over the past 20 years. Hammer (2010) clarifies that the foundation of the BPM concept originated from "two primary intellectual antecedents": the first is from the work of Shewhart and Deming, statistical process control and Six Sigma, which advanced the modern quality movement, and the second is from Hammer's work on business process reengineering. Therefore, Hammer defined BPM as "a comprehensive system for managing and transforming organizational operations, based on what is arguably the first set of new ideas about organizational performance since the Industrial Revolution". That means that BPM is the entire set of processes and tasks that drive the work. Burlton (2009), the founder of BPTrends Associates, added that BPM is "the discipline that improves measurable business performance for stakeholders through ongoing optimization and synchronization of enterprise-wide". To simplify this definition, BPM is the control and measurement of continuing business activities in organizations; however, this is not an adequate explanation for our purposes. The definition that we feel best fits with the regulatory reporting business process is that by Manouvrier and Menard [1]:

"BPM is an approach that groups the complete set of methods, tools and services for modelling, executing and optimizing business processes in the enterprise, i.e., the processes in the value chain that are horizontal to the organizations in the enterprise, and that further extend to the partners of the enterprise, including suppliers, clients, banks, etc."

This definition is a comprehensive explanation that clarifies the purpose of the phrase "Business Process Management" and lists the elements and factors that lead to its success.

The BPM lifecycle offers process identification, modelling, analysis, improvement, implementation, execution and monitoring/controlling [20]. The BPM approach helps organizations to build and chose their organizational strategy, manage processes and continually improve in a contemporary and effective way. The phases improve the automation of regulatory reporting systems in such way that enhance the accuracy of the quality of the information that will be delivered. For example, during the analysis stage, firms can identify the best and most efficient processes and eliminate any waste. Even during the implementation and execution stages, it is still easy to redesign and evaluate the whole process, which gives the organization full control to include or omit processes at any time. Another important feature is the flexibility and dynamics of the business process framework, which offer the ability to work on or change any phase without affecting the other processes.

#### **4. The root causes of the financial crisis**

Although Basel II enhanced credit risk flexibility and instruments, the financial crisis still had catastrophic consequences for the regulatory system and the central banks due to the issue of different banks implementing the regulations differently and using various capital risks calculations. Banks took advantage of the flexibility of the credit risk policy to minimize their capital requirements in order to increase liquidity. This resulted in increased expand investments and thus complicated the validation and verification process by the supervisory. As a result, inaccurate data is created and the release of information delayed.

## 5. Timeliness and Accuracy data problems

Regulatory reporting systems are affected by delays in delivering data in a timely manner [27]. This is a common issue among banks worldwide. The many approaches to integration still tend to deal only with the exchange of information between applications and these approaches are diverse and inefficient [1]. The aims of integration are mainly business aims and do not consider the technical aspects. However, enhanced service quality will improve the management of data transmissions to all recipients under the umbrella of BPM. Consequently, implementing enterprise business process integration for regulatory reporting systems offers harmonious correlation among applications and processes, including efficiency and timeliness. Manouvrier and Menard [1] insist that if the “modernizing” handle used by the business processes include operation and function by the suggested top-down approach and satisfies the completion criteria, then a beneficial outcome is ensured. This approach can offer standardization and integration and eliminate process variations.

## 6. Accuracy and Timeliness challenges in applying Basel Regulation

Regulatory reporters usually do not completely recognize the constraints of the required data for the reporting system, while the compiler lacks the information that is need to appraise the reported data because of misunderstood requirements (Murphy, 2010 ). This issue is caused by informal procedures, no documentation or little contact; thus, more interaction and proactivity would enhance the output of the data. Wharmby [26] raises significant challenges that the complexity of the environment of the international financial system sets no single indicator to determine the status of the corporation. The other challenge is that gaps in data quality are due to not all the information objects being processed by all banks. Therefore, having clear policies and clearly defined tasks are important for integration and the exchange of information among institutions.

Other challenges determined by Gregory [12], such as inconsistent historical data and lack of collaboration, result in misleading and inaccurate reporting. The provision of incorrect and insufficient data is an important challenge that will return deficient information and reflect erroneous financial situations in businesses (Chakrabarty, 2011). The Bank of England (2011) acknowledged that the challenge in minimizing data error is to maintain clear statistical reporting direction, interaction with reporting institutions and data refinement. Ndung'u (2008) insisted that the value and accuracy of data reporting is the core of market discipline. Many financial institutions and firms hesitated to intervene immediately during the crisis due to inaccurate information, resulting in loss of valuable time. Consequently, to facilitate the use of a regulatory reporting system, we need to ensure accuracy, verification, relevance and standardization.

Murphy (2010), explicates that, in the UK, more arrangements are required to close the gap created by the economic crisis by ensuring timely, high quality data to mitigate ambiguity for the decision maker. The Economic and Financial Committee (April 2001) stresses the importance of unified and coordinated decision making processes between supervisors and Central Banks, especially regarding inter-bank troubles or global financial crises. Further, it is critical to ensure that the supervisory authorities can guarantee that management information systems of financial institutions are able to produce accurate information at short notice. Decision makers depend on constant and truthful business information (PricewaterhouseCoopers, 2011). KPMG [15] stresses that having insufficient and irrelevant data will result in weak and unconfident decision makers in organizations, which presents a significant challenge. This advice by the committee was helpful during the recent financial crisis but still more enhancement and coordination needs to be put into action, especially in assigning a single channel to make decisions and facilitate interventions.

According to KPMG [15] instant response to the challenges can keep companies from intervening with regulation requirements and help them to manage risk appropriately. Akhtar [3] and KPMG [15] adds that the biggest challenge in the regulatory reporting system is not only

to improve the automation of the data, but to provide quality and well-timed reporting of the information. The Economic and Financial Committee (2001) warns that time is valuable, particularly in a crisis; therefore, we must be prepared to deal with such situations and sustain the timeliness of data by performing stress tests. We have to manage resources and provide accurate information with respect to time to help organizations to properly intervene in crisis situations.

Haldane (2009) examines the recent financial crisis and points out that providing insufficient data and late predictions leads to loss of control and timely intervention. The challenges are in local bank formats for submitting reports, such as currency fluctuations, stock exchanges and the reconciling of figures in standard formats, on a timely basis, to the reporting system [12]. The Bank of England (2011) further explains the timeliness challenge by reducing the period between publishing the data and the release date of the first estimate. However, Wharmby [26] states that aggregating data in different time periods is significant, but to have this data relevant and updated in each phase is challenging. Thus, to achieve this, we should continuously monitor changes to enable the regulators to provide mature and standard bases to the end users and also actively ease decision making to reduce market complexity.

## 7. Factors affecting Accuracy

The conflict of interest between local banks and the regulators is a common challenge in relation to statistical measurement in credit risk and adequate capital [5]. Specifically, prejudices and overstated calculations by financial institutions to minimize credit risk affect the reporting systems. The recent financial crisis reflected how financial institutions in the USA behaved to attract borrowers, which finally led to the crisis. When corporations did not grasp the escalation in the market and tried to aggregate asset ratios and minimize risks, it created deceptive information and misperceptions [14]. When banks intended to adjust the capital ratio (tier1 $\geq$ 6%) to be in the range of 6% to gain more liquidity, intentional behaviours affected the regulators' accuracy and surely reduced the quality of decision making in organizations.

Christophe Cadiou and Monika Mars [9] stated that allocating independent and competent people to validate the information is an important issue in completing the regulatory requirements of the authority. Particularly, allocating tasks to the appropriate staff is the solution to facilitating the work. Gareth Murphy and Robert Westwood [11] studied the recent financial crisis and suggest that combined comprehensive information transmitted to the regulators and supported by a sophisticated system would be beneficial in mitigating the consequences of an economic disaster. SAS [2] highlights that the most challenging factor in improving the reporting system would be placing standardization first and then enhancing the implementation of technology to assist in the distribution of reports. A case study done by Fujitsu (2011) in the Bank of Spain [24] indicates that using designated tools, such as XBRL or Web services, would accelerate the process of the validation while decreasing human involvement, which provides flexibility to the process of communicating to regulators and other financial institutions. On the other hand, Akhtar [3]. Governor of the State Bank of Pakistan, stated:

The success of Basel II depends exclusively on the accuracy and reliability of good quality data. We need adoption of the international financial accounting and reporting systems. We need to assess the risks accurately. And there has to be intellectual honesty in reporting all this. It has to be acknowledged that the data stream currently available is not fully comprehensive to serve our requirements. So it is not just about developing information flows; it's about changing the quality and the timely reporting of this data.

IMF [14] insured that incomplete and insufficient information through low-skilled members pushes them to provide inconsistent and misleading data quality. In summary, the accuracy of the data results in non-intentional issues which we must deal with to improve the regulatory reporting system. These include human interaction, technology and computational models, involvement of procedures and operational risk. The Bank of England (2011) indicated some



elements with which to measure and ensure the accuracy of distributed data, such as monitoring, cleansing, validation, auto process checking and scaling through balance sheet size. These factors are valuable in verifying and detecting abnormal data and reducing errors, if attached to the appropriate tools and policies.

## 8. Factors affecting Timeliness

Consolidating and integrating the information throughout the system reduces the interruption of the processes and effectively validates the data (Murphy & Westwood, 2010). **The Bank of England (2011)** considers:

Other things being equal, the sooner the data are published the more valuable for users, and in this sense timeliness is a simple indicator of data quality. However, there will be a trade-off between the benefits of greater timeliness for users and of more time for reporters and compilers to ensure fuller coverage and more thorough plausibility checking.

The key factors to produce timely high quality reports are through fixed interval reporting that interacts globally with different institutions and regulators and smooths the progress of knowledge transfer throughout the organization [21]. Using developed technology, such as XBRL and Web services, is a good solution to support the reporting process and reserve resources (**PWC, 2011**). In addition, re-engineering the processes by changing the static forms and manual processes to offer dynamic applications that ensure proactive analysis and can accelerate the transmission of the report is recommended. According to IFC (2004), technology plays an important role. However, if we use only technology to accommodate information then the information will be corrupted; standardized multipurpose software is the answer for a regulatory reporting system. Andrew Gracie and Andrew Logan (2002) examine the differences between cross-border banks and regulators in terms of aggregating and consolidating data and admitted the importance of these factors locally; nevertheless, the benefits for inter-banks still need more analysis and investigation. Consequently, to improve timeliness we should have tight global integration between institutions, full process automation, access to skills and resources and an effective operational strategy.

## 9. Reference Model Solution

Correlation between regulatory supervision and the banks for communicating and submitting regulatory reports requires the establishment of an efficient automated system that enables the presentation of information by both sides in an accurate and timely manner. There are many reference models available for the different approaches; however, a sophisticated model is required to consolidate the regulatory reporting system to high levels of standardization and integration.

The focus of business integration was laid out by Ross et al. (2006) as, making use of business practices in different setup arrangements through the development of a two-dimensional model with four quadrants. This allows a multitude of companies to find themselves positioned in one of these quadrants based on their approach of productivity and revenue generation.

In existence there are thus models of applicable usage which is generalised as four types:

1. Diversification (low standardization, low integration).
2. Coordination (low standardization, high integration).
3. Replication (high standardization, low integration).
4. Unification (high standardization, high integration).

Therefore, financial institutions get to choose an applicable business model at the enterprise level, which is a different operating model at each level, depending upon the hierarchy of

choice. Further, the ability to decide the quadrant where the organization or its business unit feel to be in the right place depends on:

1. For the successful completion of the business deals involved in one business unit, the size of its dependencies such as the accessibility, precision, and punctuality of other business units' data.
2. The point of benefit for a company when proceeding with their operations in identical way for the business units.

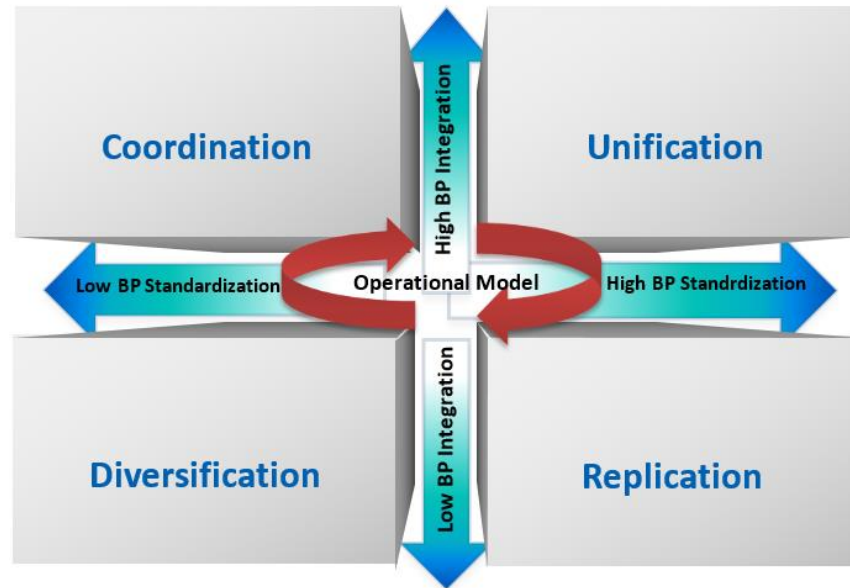


Figure 1. Operational Reference Model (Elicited from Enterprise Architecture as Strategy, Ross, 2006)

Ross et al. (2006) explores the future of operating models as, Individual business strategies don't tend to very much give a company proper direction for development. In lieu, focus on the operating model adds IT and business process capabilities. A bank's administration characterise the business process standardisation and integration in the routine decision making and actions when selecting an operating model. In such a way it becomes a stable foundation and enables IT to become a driving force in eyeing future strategic plans. However, in regulatory systems the unification model has to be tailored to fit well and elaborate the system.

## 10. Alignment to a Business Process Maturity Model (BPMM)

In order to reach a level of standardization in the business process, we need to measure and appraise the existing business process, which enables us to set up a measurement framework. Moreover, to understand and improve the business relationship, it is necessary to identify an organization alignment maturity model by linking technology and business to optimize the processes [17]. Thus, to achieve alignment in regulatory reporting systems, a dynamic response and high priority ranking from top management is required, along with cooperation among all members of the organization. Therefore, using a Business Process Maturity Model as a reference model will allow the banks to easily measure improvements in their business process. Rosemann and Bruin [20] added that the targeted goal of BPM alignment is based on process architecture, which links the vital business processes with support processes to reach the strategic goals and policies of the organization. However, BPMM does not mean aligning only strategies and processes, but also people's behaviours and performance management, change management and communication. By applying the Delphi study, we can assess the BPM alignment capabilities from the five principle capability areas. Accordingly, in order to align with BPM, banks and regulators need to start from stage 3 then move to achieve stage 4 as a

minimum level and targeting the optimization towards high level of standardization. The stages are described as follows:

**Stage 1: Initial state**

The initial state is the intention to approach BPM maturity and little effort may have been made.

**Stage 2: Repeatable**

Organizations finished the first step by building BPM capability and increase the involvement of high and top management focusing on BPM maturity with more initiatives.

**Stage 3: Defined**

At this stage will experience increased momentum in its quest to develop BPM capability and expand the number of people looking at the organization from a process perspective, implementing formal training and less use of external expertise.

**Stage 4: Managed**

Organization now will benefit from having BPM firmly aligned with business processes and merge and integrate processes also may maintain standards through establishing Management of Centre Excellence.

**Stage 5: Optimized**

In this stage, an organization will enhance the strategic and operational management within workplace such as accountabilities, standardization and incorporation and unification system.

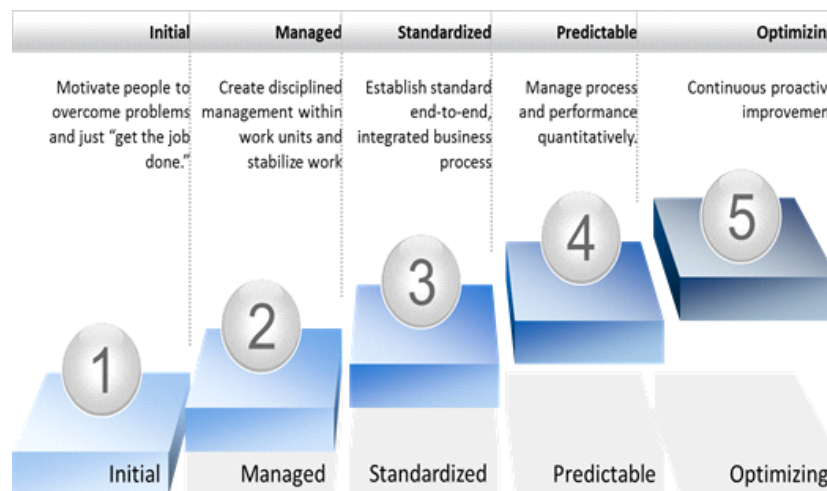


Figure 2. Business Process Maturity Model (BPMM) depicted from [20].

## 11. Business Rule Engine Solution

Business Rules engines are the pluggable software components that execute business rules that have been externalized from application code as part of a business rules approach. This externalization of business rules allows the business users to modify the rules frequently without the need of IT intervention. Therefore, BRE can play important role to control and manage bank data and verify and validate in multiple data model with full integration with banks system.

## 12. Inter- and intra-organizational business process integration

Since we know how to tune the regulatory business process system through unification, service oriented architecture (SOA) is an approach to maintain interoperability in architectural design and to guide all business process components to be managed and used as a complete set [23]. It is planned to accomplish loose coupling with other software agents to interconnect the sharing of information through flexible and standardized architecture. It also offers business process unification by building large applications as an ad-hoc set. This approach helps regulatory banking systems to integrate and unify by utilizing resources efficiently. Manouvrier and Menard [1] define SOA as an approach for providing larger agility through distributed and heterogeneous information systems by manipulating and integrating the application segments. It has matured with the appearance of new technologies associated with Web service offerings, decoupling interface and implementation of components, standardizing protocols and exchanging formats and function in a synchronous request/response mode. In fact, SOA does not rely on the presence of BPM, and BPM has developed without the collaboration of SOA; thus, combining them will yield supreme benefits [7]. Therefore, the importance of SOA is integrating asynchronous event-based management to play as services orchestrator for executing business processes at different available physical points. In addition, the function of the SOA model in BPM is to offer resources to be available for reuse wherever possible, thus supporting efficient integration in banking business processes, especially the regulatory reporting systems.

While BPM defines business processes and offers the essential capabilities to monitor and manage the business processes, SOA decouples the processes from the implemented application to minimize the gap between the modelled processes and application, which rapidly enhances the existing business processes. Moreover, SOA can tackle the discrepancies that occur during sharing and executing information in different systems to provide reliable and manageable services [7].

## 13. Basel Reporting Value Chain Business Process

The business process value chain has two phases: the Bank Procedures Approval and the Regulatory Reporting System. The processes of the regulatory reporting system consists of three stages that allow the banks to comply with the Basel Committee on Banking Supervision [5] regulations and SAMA rules for banking operations and reporting data. As the scope of the research project is limited to a focus on the banks' credit risks, the process phases outlined below will deal with the following:

### 13.1. IRB Bank Procedures Approval (BPA)

This is considered the initial stage for a bank to get approval of a business rule that requires developing a method to calculate the credit risk, using the bank requirements that were elicited from the Bank Procedures Approval Modelling:

- When the package is received from SAMA, the data entry operator creates/edits the business rules (BR) to meet the regulator requirements within the allowed time limit; otherwise the operator delegates the task.
- Then next activity is for the authorized staff to verify the BR.
- If the BRs have been verified they will be sent to the CFO to be signed, or otherwise they will be returned with the request for them to be edited.
- The CFO signs the BRs and posts them to SAMA for approval within the allowed time limit (1 hour); otherwise, the CFO delegates the task



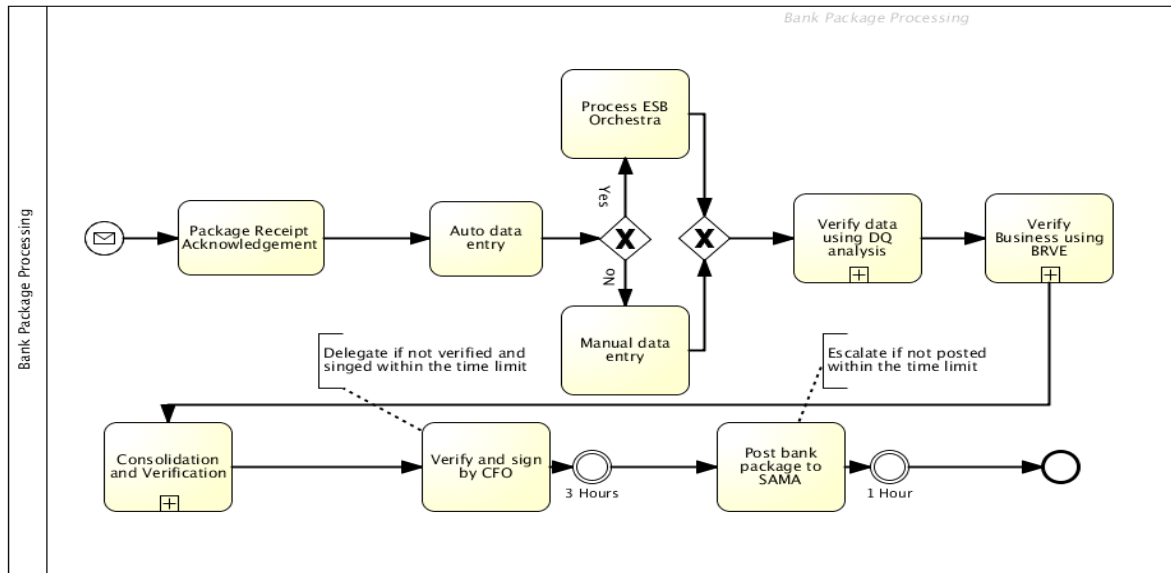


Figure 4. Bank Package Processing Process Model

### 13.3. Package Verification and Reconciliation (PVR)

This is the last step to ensure the packages are compliant and that they have been received from the banks and validated as the final data package. The processes at this stage are: comprehended verification, analysis and comparison, validation, consolidation and simulation statistics, and finally, confirming and loading the data to SAMA systems. The processes are listed as follows:

- The system locates and categorizes the bank’s package.
- The data for each bank is to be verified within the allowed time limit (0.5 hour); otherwise delegate the task.
- The business rules for each bank are to be verified within the allowed time limit (0.5 hour); otherwise delegate the task.
- Using the previous data for the bank, compare and analyse the bank’s data.
- Simulate the data by using Monte Carlo software for each bank.
- Consolidate and verify the data for all banks in appropriate format.
- Reconcile the data into the banking system within the allowed time limit (1 hour); otherwise escalate the task.
- Generate ratio and KPI parameters to measure the data within the allowed time limit (0.5 hour); otherwise escalate the task.
- Verify the ratio and KPI parameters within the allowed time limit (0.5 hour); otherwise escalate the task.
- Post the data to the warehouse, the Executive Information System (EIS), and generate statistical reports.

The as to-be process model below illustrates the package verification and reconciliation, and explains process specifications, roles, and responsibilities:

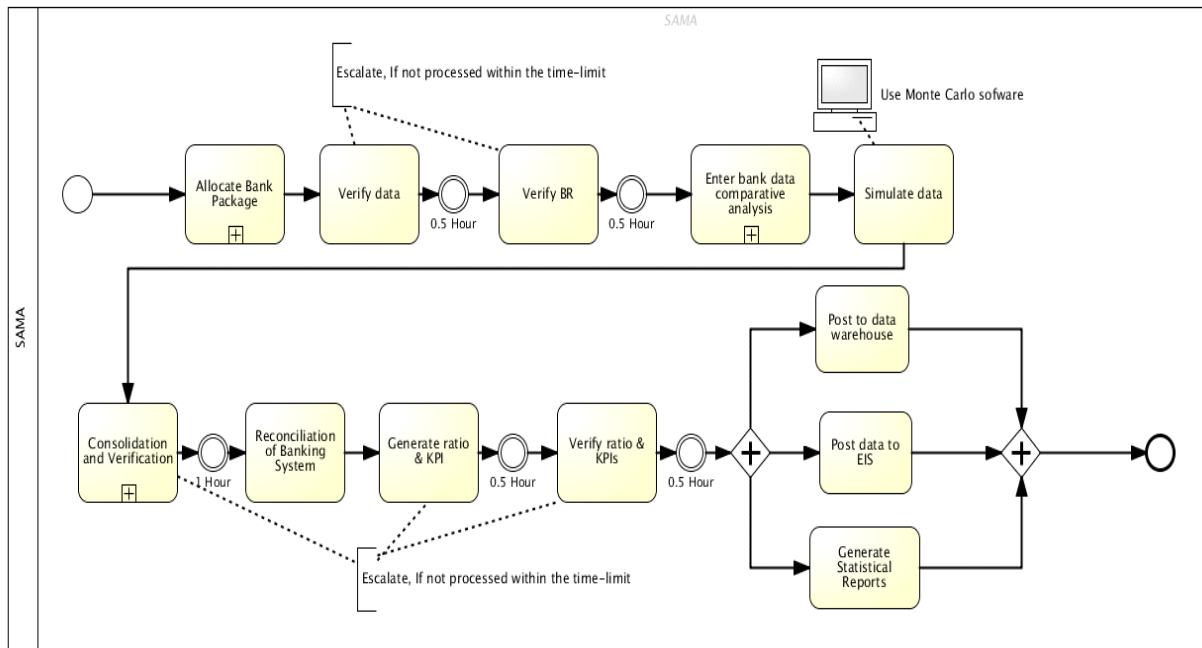


Figure 5. Package Verification and Reconciliation Process Model

#### 14. Framework Architecture of the Basel II&III Regulatory System

The proposed model (figure 7) to solve the issues with the Basel II Regulatory Reporting System is implemented as follows:

- The architecture framework encompasses the solution components
- Models two BPM processes engineering for IRB Procedure approval, and Basel Reporting Value Chain to standardize the banks' processes. It also offers agility and improvement to the reporting system.
- Proposes a Data Quality Regulator that can check and validate the accuracy of the data and believability in the new reporting system.
- Offers Business Rule Engine that facilitates the transmission of the package by allowing the banks to validate their embedded data in the BRE and also enables SAMA (Central Bank) to verify the data using the banks' procedures that are stored in the BRE.
- Offers Knowledge Management system that interacts with the Business Process Management System and handles the variations that occur due to the execution of processes by different people. High turnover rate problems are handled by using closed loop organizational automated learning as well as by supporting the banks and SAMA staff with the standardized information.
- Suggests SLA Lifecycle Manager that communicates with the BPM system to enforce the operational policies and to intervene quickly in a case of any anomalies. Ensures that there is a consolidated automated auditing system for all banks on a standardized platform.
- Proposes Enterprise Service Bus solution to enable the banks to enter the initial data from their core IT infrastructure, thereby decreasing data entry errors and decreasing data entry time.

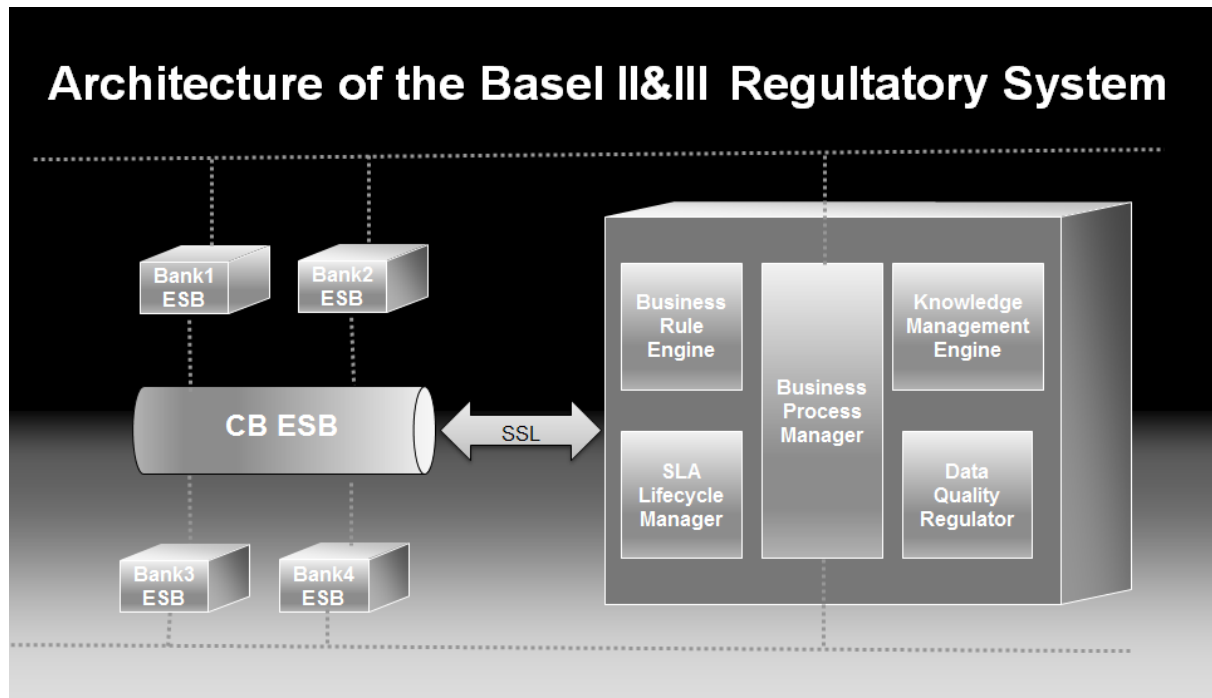


Figure 6. Framework Architecture of the Basel II&III Regulatory System

## 15. Conclusion

The recent economic crisis was an overwhelming catastrophe that induced the re-valuation of many financial regulations throughout the world. The Basel II&III regulations are one of the most important banking regulations in effect due to the high number of financial institutions that are working with Basel II. We propose an operational framework with a high degree of process standardization and integration the Ross model. The proposed reference model consolidates the regulatory reporting system to that effect and propagates a standardized and integrated system for all banks. We found the reasons for the current problems with timely availability of data (timeliness) rooted in the concepts of waste and variations. Use of insufficient resources, involvement of different departments, inexperience and staff movements and lack of automated systems are examples for these categories. The factor that affects the quality of the regulatory report is the inaccuracy of the available data, which mostly stems from human mistakes and the absence of automated auditing systems that verify the data instantly. Therefore, these defects can be successfully addressed by using the Ross operational model that can standardize and integrate these processes.

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