

A National Model to Supervise on Virtual Banking Systems through the Bank 2.0 Approach

Mehrpooya Ahmadalinejad ¹ and Seyyed Mohsen Hashemi ²

¹ Department of Computer and Information Technology Engineering
Qazvin Branch, Islamic Azad University
Qazvin, Iran
Mehrpooya@qiau.ac.ir

² Software Engineering and Artificial Intelligence Department
Science and Research Branch, Islamic Azad University
Tehran, Iran
hashemi@srbiau.ac.ir

Abstract

Banks and financial institutions in the modern business world play a crucial role in business dynamics. On the other hand, progress in Information Technology has brought significant changes which resulted in emergence of new type of banking called virtual banking. Virtual banking is based on computer software and systems that require minimum manpower, yet lack of required infrastructures for implementation of such banks throughout a country or region has brought twofold challenges. One is lack of focus of current models on virtual banking and the other is lack of integrated approach for governance, risk and compliance in current models. This paper firstly introduces a specific domain of virtual bank and defines top-level concepts for definition of governance, risk and compliance and finally proposes a model for developing a system that could facilitate virtual bank supervisory. Then necessary Evaluations are conducted for the model via qualitative Evaluation and capability model of Open Compliance & Ethics Group (OCEG). In the final sections, we conclude that the model is comprehensive and acceptable and some ideas for future research are discussed.

Keywords: *Virtual banking, Core Banking, GRC, Banking Supervisory, Electronic Commerce.*

1. Introduction

Virtual banking is on the one hand influenced by economic crisis and on the other it is affected by customer needs and emergence of new technologies. Many virtual banks have appeared in the market since the dawn of the concept but they were not viable as a third of established banks during 1998 to 2008 went bankrupt [1]. Moreover, lack of sufficient supervision for these banks has made Stakeholders and politicians skeptics [2]. Supervisory systems have been around for years and the role of central banks have changed from coordination to supervisory systems since 1930. Yet, existing supervisory systems are appropriate for banks that are deploying man-based methods rather than process-based or systems-based. Therefore, it is not possible to use such supervisory

methods for virtual banks as these banks tend to minimize human deployment in their operations.

A national model would encourage virtual banks to establish under supervisory and regulatory frameworks, conduct financial transactions, survive with confidence and constantly adapt to customer needs and new technologies. Indeed, the role of national model could offer an understanding from a central bank in a country or region that is run systematically and on the one hand provides stability for virtual banks and on the other conforms bank performance to supervisory technologies, customer needs and criteria. As technologies such as internet and related channels have emerged, the biggest issue, nowadays in the realm of financial domain is how to supervise virtual banks. Existence of a national system for establishing virtual banks could fill many regulatory gaps existing for their development and stability.

The main inquiry of the paper is “what factors should virtual banks include considering bank 2.0 approaches and what supervisory tools should these banks adopt for more stability?”

Bank 2.0 is a general concept related to modern banking approaches which typically comprises reengineering of bank processes. For instance, Brett King believes that bank 2.0 is a fundamental change in banking that takes bank processes from procedure-oriented to customer-oriented approach [3] or Ana Bucur refers to new cloud computing approaches in banking 2.0 [4]. Based on past research on bank 2.0, this paper is defined in three areas [5, 6]:

- Customer oriented and advanced customer management
- Reducing IT costs along with increasing flexibility
- Risk management and regulatory compliances

It has to be noted that there are many studies in the first two fields and this paper focuses on the third area and other areas possess higher abstraction levels.

National model defined in this research is a model for supervisory of a central bank on virtual banks that deploy modern technological approaches. Governance, Risk and compliance technology (GRC) is a recent technology that provides a basis for supervision on organizations. These systems implement on organizations similar to organizational planning systems but they are responsible for organization supervision [7]. Moreover, virtual banks have unique characteristics and design GRC accordingly. The main purpose of this paper is firstly to propose a supervisory model according to virtual bank needs throughout the country or a region so that establishment of these banks are facilitated and secondly to introduce further application for GRC systems.

Research method of this study is based on proposed method of design-based research by Ken Peffers that is used in information systems and many studies on computer sciences and IT have deployed this method [8]. Compared to behavioral studies, design-based research is a concept for searching past research considering the environmental limitations. Design science considers business needs by constructing and assessing research tools and explores causal relations by analyzing current information systems [9]. The method comprises six stages (Figure 1):

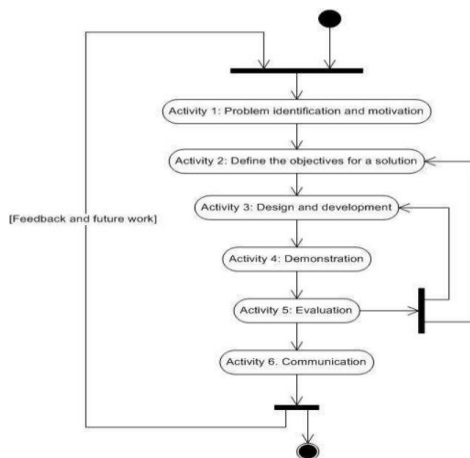


Figure 1: Design Science Research Methodology for Information Systems Research [8]

This paper is divided into five sections. The first section introduces research subject, motivations and goals that cover the first two stages of research method. Second section reviews research background including definitions of related subjects. Next, conceptual model is presented and model requirements are discussed in the third section which covers the third and fourth stages of the research method. In the fourth section, required Evaluations of the model are conducted and qualitative Evaluation and OCEG

capability Model is conducted. The final section presents the conclusions on the model and future research suggestions are discussed that addresses the sixth stage of the research method.

2. Research background

2.1 Virtual Banking

Bank 2.0 is a recent approach in banking literature that covers all activities that banks deal with in the modern world. Required changes typically include transition from old procedure-based approaches to customer-oriented approaches [3]. Yet, nowadays society has experienced vast amount of changes that increasingly leads customers into electronic processes and avoiding physical presence [10]. E-banking today have been successful to some extent to reduce physical referring to banks but it could not conduct through banking operations in non-physical way. Virtual banking addresses this challenge. It is a banking approach that has emerged in mid-90's in which the whole bank is a computer system and there is no branch, teller and physical structure [1, 11, 12, 13, 14]. These banks do not have physical address and possess legal address solely [15,16] and all services are facilitated by computer systems and servers [17]. Every aspect of banking is present in a software system and there is no branch, tellers, physical intermediaries and employees [18]. This reduces time and money spent significantly [14, 19]. Many banks are nowadays conducting virtual banking globally in a way that all branch and administration operations are conducted without need to human efforts and via a software system. In countries that are developed in the field of banking, high investment costs for branch opening, marketing efforts and employee expenditures led to trend toward establishment of virtual banks. Despite establishment of new banks in World, they are mostly using traditional banking and consider electronic facilities solely for limited uses in customer channels. Virtual banking could be defined as "a banking method that lacks physical branches and uses internet as the basis of transactions; in other words virtual banking could be considered as only a software system."

2.2 Banking Systems Models

The first step in realization of virtual banking is Core banking systems that support this kind of banking. Until today many companies and organizations have offered models for development of such systems but the reference models of BIAN and MIRA-B are the most important ones. Several companies, which are active in the field of technology and banking, developed BIAN in 2008 and would develop the final model in 2015. BIAN is for establishment, enhancement and providing common framework for banking special applications. BIAN have 42

member companies among which are Microsoft and SunGard. The goal of BIAN is to improve programs interactivity in order to further relate banks and financial institutions. There is BIAN service domains solution to address service operations. These services are grouped into service visions and there is a scenario for a set of services. Along these three elements, there are facilitating tools such as metamodels, glossaries, design instruction and complementary documents [20]. MIRA-b shows the banking architecture on the Microsoft technology and services platform. MIRA-B provides logical architecture of credit institutions for use in design purposes. The architecture is more or less compatible with BIAN. By having its own technology platform along MIRA-B, Microsoft offers a comprehensive architecture of banking [21].

2.3 Bank supervision

Many financial crises and deficiencies in banking systems are rooted in bad performance. Hence, in the time of crisis, managing crisis and developing structural modifications to create a stable financial system that prevents future crisis is the top agenda for policy makers. The main goal of effective bank supervision is to maintain the stability of financial system and enhancing trust through reducing risk for depositors and creditors. Hence, supervision seeks to assure that banks and financial institutions conduct safe and sound and possess enough capital and pool to tackle future risks. Stressing the unique characteristics of banks, bank supervision agenda could be:

- Maintaining banking system health and stability and preventing crisis
- Supporting customers (depositors and service users)
- Preserving public trust to banks
- Preventing and reducing financial crimes

Supervision is regarded as an organization feedback. The main purpose of supervision and inspection is to make sure of good performance of the organization on different levels and to collect information on functions' deviations compared to acceptable or approved principles. Hence, supervision and inspection is twofold:

Continual supervision on functions: system function is clearly understood through continual supervision. Moreover, deficiency and fault reasons are identified. Then, necessary arrangements are provided to prevent fault and correct problems.

Preventing function deviation: efforts are made to check functional deviations whether real or claimed. For actual deviations, procedures are followed. On the other hand, central bank should receive reports from banks to supervise. Supervising items that should be covered in these reports are as following:

Capital adequacy: Capital makes for critical part of bank resources or in other words, the more the capital the

stronger the bank structure is and there will be less risk and consequently stakeholders' benefits are more protected. Yet, deposit benefits form a huge amount of bank resources and since banks can create secondary deposits by granting banking facilities, bank capital is always reducing related to total resources. When this decrease is steady, bank is under threat so central bank put some rules in place so that the bank should follow a certain capital to total assets ratio and generally capital adequacy ratio is critical factor for Evaluation of bank health. Banking rules and supervision on banking operations committee regard initial capital and declared pools as the main pillar of capital and use it to calculate capital adequacy ratio.

Risk management: There are different types of risks that bank management need to protect against. For many banks, the main risk is credit risk but there are many other risks that supervising authorities should notify banks about related criteria and require them to follow.

Information: Bank information is the only performance measurement tool, hence central banks should have access to necessary information to supervise and be sure of the accuracy of the data. Since banks tend to keep private information and they are unwilling to exchange information or disclose them with their competitors, and considering the huge number of loan takers, establishing a center as a banking information center makes supervision easier. The information could include customer information, transaction data, etc.

Assets management: In order to address customer day-to-day need to withdraw liquidity and deposit, banks should keep a minimum amount of liquidity assets.

Regulatory requirements: According to regulations and provisions that are issued and enforced by central bank, there would be a need to reports that show bank functions meet central bank requirements.

2.3.1 Existing models for bank supervision

FMI: Financial market infrastructures (FMIs) that facilitate the clearing, settlement, and recording of monetary and other financial transactions can strengthen the markets they serve and play a critical role in fostering financial stability. However, if not properly managed, they can pose significant risks to the financial system and be a potential source of contagion, particularly in periods of market stress. Although FMIs performed well during the recent financial crisis, events highlighted important lessons for effective risk management. These lessons, along with the experience of implementing the existing international standards, led the Committee on Payment and Settlement Systems (CPSS) and the Technical Committee of the International Organization of Securities Commissions

(IOSCO) to review and update the standards for FMIs. FMI Contains 24 Principles [22].

Basel: Bank CEOs of member countries of Group 10 gathered in BASEL, Switzerland in 1975 and established BASEL Committee and set supervision procedures for supervision bank activities. The committee issued documents in 1988 that was named International convergence of capital measurement and capital standards and was called BASEL Capital Agreements. These regulations include 25 principles to protect bank health and security toward maintaining depositors and owners' equity interests. There is specific attention to capital adequacy and assets quality in protecting bank health and security. During late 90's it was clear that BASEL I was coming short for international banking that led to preparation of BASEL II. This edition firstly increased bank flexibility to choose various capital structure strategies and secondly planned for new activities under supervision agencies to assess internal performance of banks to insure capital and risks. The third goal was two new agreements among members to disclose bank capital and risk taking status compared to other players in the global money market. Another sections of the document address risk management stability and integration that relates to customer understanding plan. Overall, BASEL II follows BASEL I and there are three principles for it:

Principle 1: determining minimum capital required in order to cover credit, market and operational risks.

Principle 2: establishing inspection processes.

Principle 3: compulsory disclosing of information.

The aftermath of the late-2000 financial tsunami continues impacting the global economy and financial systems. In response to the deficiencies of the financial system structure and individual bank's risk management revealed by this financial crisis, greater regulatory efforts are being made from the perspectives of micro-prudential and macro-prudential regulations. From the perspective of regulating individual banks (i.e., micro-prudential regulation), [23] was published to emphasize the principles for sound liquidity risk management and supervision. Further, an international liquidity risk management framework (i.e. Basel III) is being developed there were some shortages in supervision aspects of BASEL II after financial crisis in 2007 and 2008 and the committee revised the agreement. Some important modifications were as following:

- Banks are required to establish a unit to give correct and exact information to customers
- Any bank with assets more than \$50b should possesses a precautionary fund to be able to tackle crisis
- Banks should set up preventive alarm system for managers and customers

d. Should a bank goes bankrupt, least amount of loss should affect customers, depositors and other financial institutions

e. Up to 2018, capital adequacy ratio is determined to be %10.5 of which \$4.5 should be in liquidity

f. Stressing on corporate governance, supervision and transparency and total protection of customer and depositors interests [24], [25].

IFW: In 2006, IBM introduced a framework for banking supervision called IFW. The framework is comprised of three parts [26]:

Information models: connects bank data to organizational level information domains which results in banking database. The database puts banking data into specific groups that facilitates their use in analysis and reporting.

Process models: relates banking business processes to business process reengineering fields.

Integration models: relates business services to service-oriented architecture.

Data extraction in IFW is illustrated in figure 2 in which information is extracted from integrated banking systems, front office operations, accounting systems, customer information, market data and other sources and is used in BASEL supervision items, global accounting standards, corporate governance and customer Insight [27].

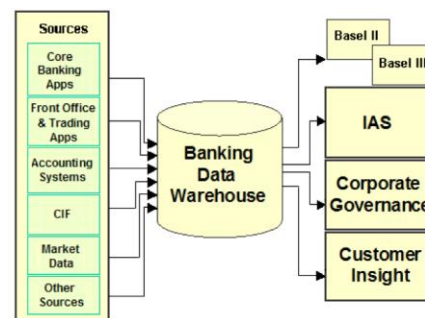


Figure 2: consolidation of data from a financial institution's Multiple source systems in the central BDW data hub [27]

IFW's database groups data into the following groups each of which include information items:

- Risk Management
- Regulatory Compliance
- Profitability
- Investment Management
- Relationship Marketing
- Asset & Liability Management
- Wealth Management [27].

2.4 GRC

Banks and financial institutions nowadays seek more supervision solutions for their IT systems so it seems necessary to use GRC measure. GRC is not a new concept

rather it is a specific combination of supervision terms which were used previously by banks, financial institutions and other organizations in various forms [28]. These systems are not merely an approach to conduct business rules rather they are solutions to integrate regulations with organizational structure as well as alignment with daily business processes [29, 30]. It has to be noted that GRC is not separate from ERP and is implemented on ERPs [7]. The best definition of GRC is provided by Racz et al [31] “governance, risk and compliance is an integrated and comprehensive approach for governance, risk and compliance throughout organization that is defined to ensure that the organization is conducting according to risk taking capacity, inner-organizational policies and external regulations consistent with strategies, technology and people”. This was the first definition of these systems and the first scientific model of these systems was introduced by Racz et al (figure 3) [7, 32].

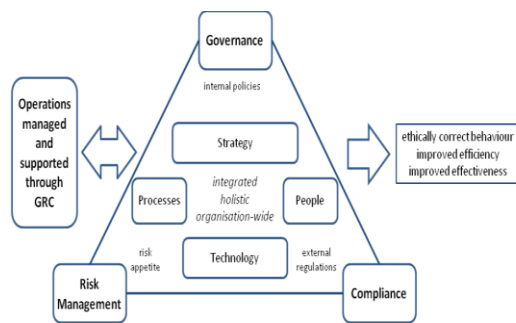


Figure 3: Frame of reference for integrated GRC [32]

Elements of the system could be defined as following [7, 32]:

Governance: is a set of activities that are conducted to execute strategy, proper implementation of policies and procedures, relation between policies, assessing policies in practice, assessing and updating policies and providing frameworks to observe regulations in an organization.

Risk: includes set of activities that are required to identify and manage risks that are related to business and reducing the risk of not observing regulations through apt regulations.

Compliance: refers to execution internal and external regulations and standards that are defined for the business. GRC results in covering policies and control, compulsory observance of regulations, accumulations of information that leads to business agility, establishing system to manage the business effectively and inferring competitive advantage from extracted risks [30].

GRC capability model is the most important framework for a GRC system that was developed by OCEG group (figure 4) [33]. OCEG is a nonprofit organization that helps other organizations with utilizing common culture and GRC integrated systems' processes. The model comprises eight

factors and 29 sub-factors for each of which there are sub-activities defined (Figure 4).

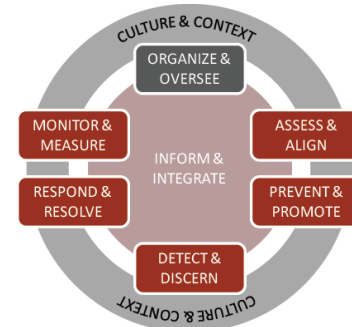


Figure 4: GRC Capability Model [33]

3. Proposed Method

Considering the requirements for establishment of virtual bank and bank 2.0 solutions, virtual banks should possess specific approaches such as risk management and regulatory compliance to increase stability. In order to develop the supervisory model, initial requirements should first be identified and then the model should be developed considering these requirements. There were two sets of studies to identify requirements. One was study on commercial architecture of Core banking systems and reference architectures such as MIRA-B and BIAN to develop a structure for virtual bank and the other study was on IFW framework, BASEL principles and FMI to identify the required supervisory information and finally the model was proposed by using GRC tools.

These items distinguishes the model from previous approaches:

- Link between a virtual bank and Central Virtual Bank

- Adding GRC approach to bank supervision field

On the other hand, the proposed model includes virtual banking which includes:

- Banks without branches and ATMs.

- Some services such as check, drafting and other physical securities.

- Minimum use of human resources

- Basically is based on IT tools and system approach.

Following necessary studies on concepts of virtual banking, centralized banking systems, governance systems, risk management, compliance as well as bank 2.0 concepts, the conceptual model is developed that shows the model boundaries. Usually through illustration and limited sets of words, conceptual model is developed by information systems experts to set the domain of the model in the real world. With the model domain, one could show complex problems in smaller space so that the limited space helps to solve wider problems [34]. In the proposed model (Figure

5), since the problem includes a national dimension, problem domain is twofold:

- Virtual banks throughout the country
- Central Virtual Bank that supervise them

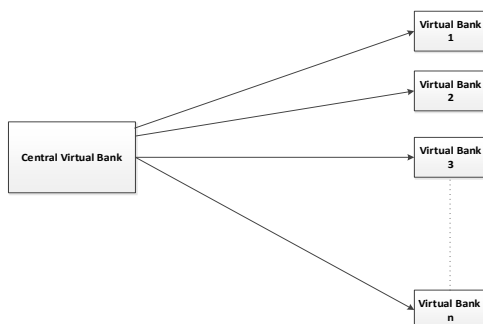


Figure 5: Conceptual View National Model

3.1 Conceptual model of a virtual bank

Considering the definitions and concepts discussed in the previous section, a detailed definition of the virtual bank is developed. Considering the reference framework of BIAN Service Landscape 3.0, MIRA-B reference model introduced by Microsoft, some reference models of centralized banking and requirements of bank 2.0, a reference model for virtual banks is defined. It has to be noted that smart computer agents play the role of bank employees (Figure 6).

Virtual Bank

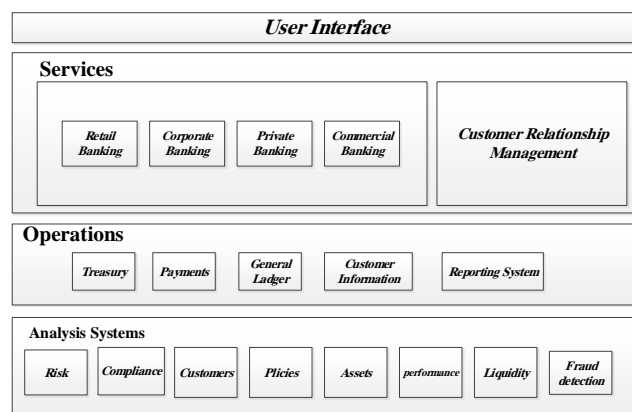


Figure 6: Architecture of a Virtual bank

User Interface: includes all touch points of virtual bank with customers that could be implemented through channels such as internet and mobile. It has to be considered that branch and ATMs are not considered as customer channels due to virtual bank characteristics.

Customer operation: this part of virtual bank includes sales and services and CRM systems. Sales and services covers commercial, personal, micro and corporate banking and CRM covers internal system and customer relationship management with social customers.

Banking operations: this part covers counter, bank treasury, IT development, regulations management, customer validation, data transformation, ledger operations, customer information, payments and transactions and dashboard and report maker which are briefly defined.

Analysis systems: this part of virtual bank addresses bank supervision activities which, according to academic definitions, is a software module that uses data analysis tools such as business intelligence to control bank activities [35]. Following figures help to understand systems better.

In order to conduct banking operations, it is necessary to develop the model based on the related frameworks, therefore, the proposed model is consistent with supervisory frameworks Such as FMI, Basel and IFW.

3.2 Central Virtual Bank conceptual model

Central Virtual Bank is conceptualized according to supervising, regulatory and protective requirements.

Operations: this part addresses required activities by Central Virtual Bank on virtual banks. Setting regulations, managing facilities, establishing the platform for national information and dashboard and reporting and national payments management are among these activities (Figure 7).

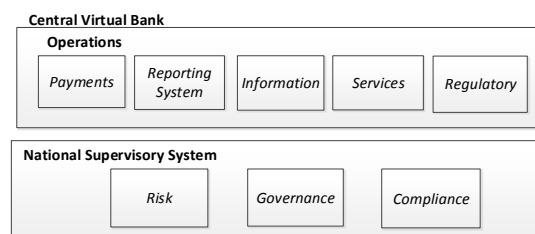


Figure 7: Architecture of Central Virtual Bank

National supervision model: This section puts a system for required controls on virtual banks throughout country that extracts all analytical system information of banks and classifies them into three information classes of risk, compliance and governance after validation. GRC approach allows managers to get more dynamic and explicit control reports from banks under supervision.

3.3 Presenting National supervision model

The presented model includes extraction of supervision information from virtual banks and classifying them in order to prepare reports and log them in management dashboards that exist in central bank. Supervision information should be extracted from virtual banks hence we first demonstrate supervision modules use cases in any virtual bank and GRC system located in Central Virtual Bank and then we show class diagram of GRC located in

Central Virtual Bank. We represent our model with UML diagraming tools.

3.3.1 Supervision modules Use cases diagram

Each virtual bank functions in a way that virtual banking systems extracts information from CRM, treasury, ledger, contracts and payments and generates report according to a comparison between these numbers with supervision checklists (illustrated in Figure 8).

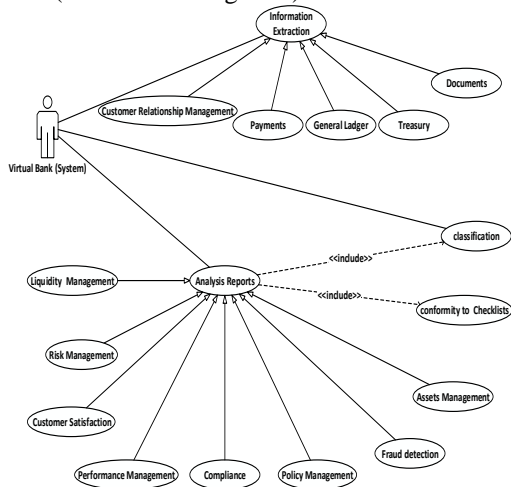


Figure 8: Virtual Banks use case diagram

Supervision fields are the following:

Risk management: analytical system to measure risk taking of banks according to predefined regulations.

Customer satisfaction: this part measures customer satisfaction through CRM system.

Liquidity management: comprehensive reports on debts and liquidity are generated in this system.

Compliance with rules and regulations: compliance reports are generated through audit according to criteria defined by Central Virtual Bank

Fraud Detection: is an analytical system that monitors all activities and reports any derogation.

Performance management: this part generates comprehensive performance reports.

Asset management: quality of bank assets is analyzed in this part and related reports are generated.

Policy management: this section compares bank policies with existing condition and generates report.

3.3.2 GRC system located in Central Virtual Bank

Central Virtual Bank uses GRC system for more coherence. GRC system extracts required information for supervision on virtual banks from analytical modules of the bank and classifies them under governance, risk and compliance classes after validation. Upon classification, information could be presented through case studies,

dashboards and alerts to super-banks of a given country to make the appropriate decision (illustrated in Figure 9).

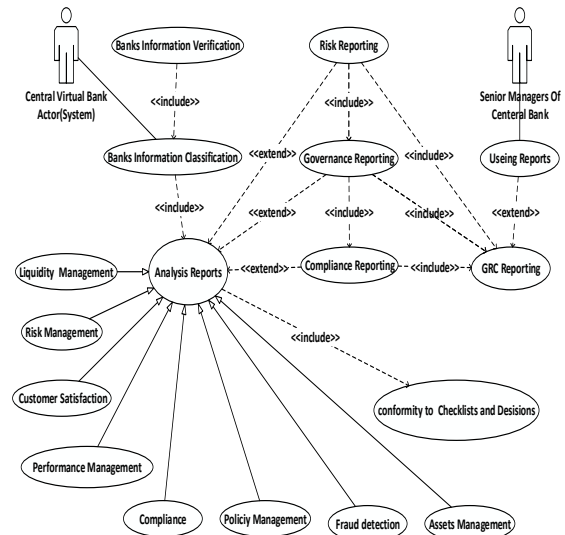


Figure 9: Central Virtual Bank Use case diagram

3.3.3 GRC class diagram

Based on the previous use case diagrams and figure 9, it is visible that proposed national model gathers information of banks under supervision in an integrated set. This integrated information set is supported by bank supervision systems and virtual banks data. In order to verify gathered information, analyzed data of banks is compared with their raw data to make sure of data accuracy. Each of GRC classes should receive required data based on the table 1 so that they could address information needs of senior bank managers on national level based on the domestic regulations, BASEL, IFW, FMI, etc. the Class diagram illustrated in Figure 10.

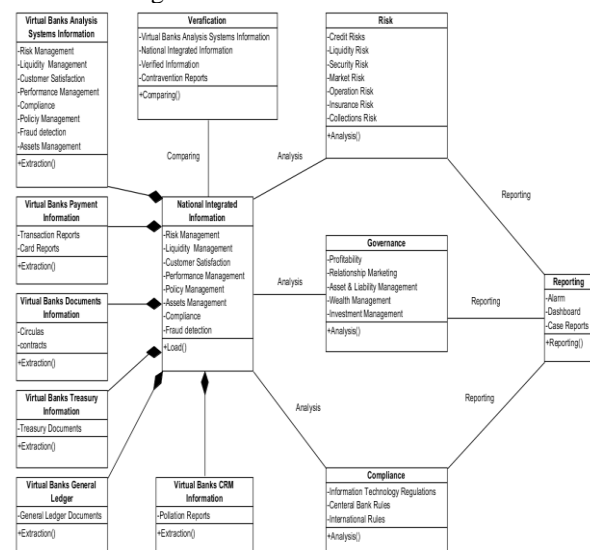


Figure 10: GRC Class diagram

Risk class: stored information is put in this section according to supervisory frameworks of central bank such as BASEL, etc. Information stored in this section includes items that are proper for risk-related reports. These items could include supervision frameworks such as BASEL, FMI, etc.

Compliance class: stored information is put in this section according to compliance frameworks of central bank such as BASEL, etc. Information stored in this section includes items that are proper for compliance-related reports. Compliance items include rules and regulations related to IT, codified regulations of Central Virtual Bank and international rules and regulations.

Governance class: stored information is put in this section according to governance frameworks of central bank such as BASEL, etc. Information stored in this section includes items that are proper for governance-related reports. Governance items include report items that are closely related to decision makers. Upon required categorization, categorized information should be used for reporting. Reports that are prepared for senior managers are in the form of alerts, dashboards and case reports. (table 1)

Table 1: Aligning GRC With Analysis Mudols

Module	Governance	Risk	Compliance
Risk management	*	*	
Liquidity management	*	*	
Customer Satisfaction	*	*	*
Performance management	*	*	*
Policy Management	*		
Assets Management	*	*	*
Compliance	*		*
Fraud detection	*	*	*

4. Evaluation the proposed model

Based on the research method introduced by Ken Peffers, this section substantiates and assesses the model. There are two types of Evaluation in this research. Similar method of evaluation was implemented in Pedro Vicente and Miguel Mira da Silva [36] study in evaluation of Conceptual Model for Integrated Governance, Risk and Compliance. This method has two section:

- Evaluation based on the OCEG capability model
- Qualitative Evaluation by experts of the field

4.1 Evaluation based on the OCEG capability model

Since the proposed model in the research is towards realization of a GRC system, it is compared with OCEG capability model [34]. As mentioned earlier, OCEG Capability model includes 8 Components and 29 factors. table 2 illustrates the Evaluation of the proposed model

with OCEG capability model and Figure 11 illustrates a general scheme of the capability model.

Table 2: Comparing Components of OCEG capability model with proposed model

Components Of OCEG capability model	Detail	Proposed model
Monitor and Measure	This part includes all operation of monitoring content, performance, system improvements and assurance	This part is presented in all analytical modules and illustrated in dashboard.
Respond and Resolve	Includes reviewing, consulting with third party, corrective controls, response and recovery and response to crisis and remedy and order.	Managers upon giving information to senior managers implement this part.
Inform and Integrate	Documentation and management of information, internal and external communications and infrastructure and technology are among elements of this part.	The proposed model is capable to store and document.
Culture and Context	Internal and external content of the business, culture, and values are put in this category.	This part is suggested to managers through proposed model.
Detect and Discern	Notifications and red lines, solutions and recognizable controls are grouped in this section.	The model includes alert items in the dashboard.
Organize and Oversee	Results and commitments, roles and responsibilities and approaches and accountability are considered in this section.	All responsibilities of subsystems are defined in the model.
Assess and Align	Identifying risks, analyzing risks and optimizing risks are conducted in this section.	Subsystems related to risk are present in the model.
Prevent and Promote	Behavioral principles, policies, preventive controls, education, human resources motivation, stakeholders' needs and investment and risk assurance are considered in this part.	The basis of the model is on preventive activities. On the one hand definitions and assumptions of the model are compatible with policies and behavioral principles and consistent with stakeholders' needs. But due to lack of human resources, there is less stress on education and human resources motivations.

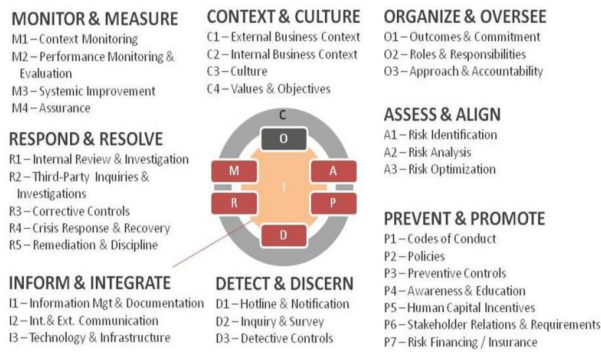


Figure 11: Components and factors of OCEG capability model

4.2 Qualitative Evaluation

In order to assess the model qualitatively, first we should identify the proper method for Evaluation and then collect experts' views and qualitatively assess the proposed framework. The conventional research method comprises review of literature to select the proper theory, development of hypotheses and statistical analysis of them. In contrast, for the qualitative research method there might be no related study or the researcher might not be interested in confining his/her work to existing works. Hence, qualitative method could be deployed to develop new theories to explain phenomenon or describe new patterns emerging in data. It is necessary for quantitative approach to have clear and exact data hence the collected data would be quantitative. But for the qualitative approach, the stress is on quality and richness of data so the collected data are essentially qualitative [37]. These researches are usually exploratory and seek concepts, models and framework development and final findings are not clear beforehand [38]. Finding necessary factors for assessing national model of establishment of virtual banking systems was conducted qualitatively as there were no previous framework such as theory or model and the model was completed and accepted based on the collected information. To conduct research, past research was first reviewed to provide a comprehensive view of the existing condition and make grounds for initial framework.

Sample population is ordinarily not random. A sampling method that was used was purposeful sampling. The assumption for this method is that the researchers' knowledge is useful to select samples. When the researcher does not know all group members to become samples, he/she could use snowballing sampling which is another non-random method. In this method, researcher starts with identifying a group or person and reaches other appropriate members through them. This method is especially useful when identifying sample members is not easy for the researcher [39]. Therefore, experts of this research are selected with non-random method with combination of

purposeful and snowballing sampling. Hence, 15 people were identified as appropriate for research sample.

Samples had several features:

- They were bank software analysts
- Senior manager/consultant of IT in banking industry

4.2.1 Qualitative Evaluations of the information models

We should select several factor to assess in order to be able to assess the proposed model so based on the studies we concluded that we could assess our model by data models Evaluation framework. Moody and Shanks first developed this model in 2003 [40]. Then Moody developed the factors. There are 8 main factors in the model with 29 general criteria. Figure 12 shows main sub-factors of the model.

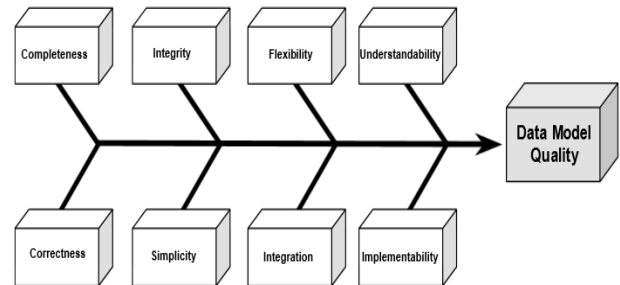


Figure 12: Data Model Quality Factors [40]

Factors are defined as following [41]:

Completeness: this factor checks whether all requirements of the user are covered.

Correctness: defines whether the model complies with modeling technics or not. These regulations could be transformations, naming, definitions, normalization and articles.

Integrity: refers to business regulations that are derived from user needs.

Flexibility: shows the extent of compatibility with changes in rules and regulations of the business.

Understandability: Shows the extent of the model being understood by audience.

Simplicity: Model uses minimum number of entities and relations.

Integration: integration of the model in the totality of the organization.

Implement ability: determining whether the model is implementable based on budget, time and technology.

4.2.2 Qualitative Evaluation results

Based on Evaluation steps, a questionnaire with 8 questions based on qualitative Evaluation of the data models [41] was sent to select experts that challenged the model in 8 factors. After executing qualitative Evaluation,

average results of responses were calculated that is shown in the spider diagram in figure 13.



Figure 13: Qualitative Evaluation

Moreover, reliability of the questionnaire was measured by Cronbach's Alpha which was 0.787 for this research that is acceptable. It is visible that respondents provided favorable views on factors related to proposed model which refers to acceptability of the model.

5. Conclusion and future works

National model of establishment of virtual banking is a reference model to categorize requirements and factors needed for establishment of these banks. First we studied concepts and identified challenges and gaps in the business environment of the banking industry related to establishment of virtual banks and then solutions were developed based studying research background and making comparisons. National model was studied with the concepts of virtual banking, bank 2.0, bank supervision solutions, GRC systems and integrated systems in mind and a compatible model with these concepts was developed. We seek to use standard approach for model development therefore class models were used. Finally, the model was assessed by factors as well as qualitative Evaluation. Evaluations revealed that the proposed model is compatible with subject criteria and the experts of the field approved it.

Banking rules and regulations are changing as banking processes are changing by new technologies and customer approaches. Yet, transparency and accuracy of information that is appropriately categorized and reported could increase stability and avoid financial, legal and other risks. GRC concept along with concepts such as bank 2.0, BASEL supervision frameworks, FMI and IFW could yield favorable transparency.

Upon research and development of the model, Evaluations showed that the model was compatible with criteria and qualitative Evaluations revealed advantages and weaknesses of the model as well as suggestions to improve the model. The result of the present research, as stated in the first chapter, is to identify requirements needed to

propose a national model and then development of the model which were achieved.

The developed model is a conceptual and reference model that defines a system for establishing virtual banks on national level. Since the concepts such as virtual banking, GRC and bank 2.0 solutions are recent, the model could be a starting point for research in the field of bank supervision. Yet, according to requirements on country level and global level in increasing bank supervision level, the model could be used as a reference for development of bank supervisions software.

References

- [1] Krishnan Dandapani and Edward R Lawrence, "Virtual bank failures: an investigation," Managerial , vol. 34, no. 6, pp. 399-412, 2008.
- [2] Euronews, "eu turns spotlight on shadow banking sector", October 2013, <http://persian.euronews.com/2013/09/04/eu-turns-spotlight-on-shadow-banking-sector/>.
- [3] Brett King, BANK 2.0: How Customer behaviour and technology will change the future of Financial Services.: Marshall Cavendish, 2012.
- [4] Ana bucur, "Banking 2.0:Developing a Reference Architecture for Financial Services in The Cloud," Delft University of Technology, Master Thesis , 2011.
- [5] Infosys, the future core banking, 2012 [Online]. <http://www.infosys.com/finacle/solutions/thought-papers/Documents/the-future-core-banking.PDFg=AFQjCNGv7RYRopmFGS68d>.
- [6] IBM Corporation, Core Banking Modernization, 2012 [Online]. http://www-05.ibm.com/cz/businesstalks/pdf/Core_Banking_Mode rnization_Point_of_View.PDF.
- [7] Nicolas Racz, Johannes C. Panitz, Michael Amberg, Edgar Weippl, and Andreas Seufert, "Governance, Risk & Compliance (GRC) Status Quo and Software Use: Results from a Survey among Large Enterprises," in Australasian Conference on Information Systems, Brisbane, 2010.
- [8] Ken Peffers, Tuure Tuunanen, Marcus A. Rothenberger, and Samir Chatterjee, "A Design Science Research Methodology for Information Systems Research," Journal of Management Information Systems, vol. 24, no. 3, pp. 45-77, Winter 2007.
- [9] Ken Peffers et al., "THE DESIGN SCIENCE RESEARCH PROCESS : A MODEL FOR PRODUCING AND PRESENTING INFORMATION SYSTEMS RESEARCH," DESRIST, 2006.
- [10] Aliakbar Jalali and Ali mahmoodi, "Virtual Age: Next Wave of Change in Society," in International Joint Conferences on e-CASE and e-Technology, 2009.
- [11] YA YUEH SHIH and KWOTING FANG, "Effects of Network Quality Attributes on Customer Adoption ," Total Quality Management & Business Excellence, 2006.

- [12] Muzhir Shaban Al-Ani, Rabah Noory, and Dua'a Yaseen Al-Ani, "Billing System Design Based on Internet Environment," *International Journal of Advanced Computer Science and Applications (IJACSA)*, vol. 3, no. 9, 2012.
- [13] Karen Furst, William W Lang, and Daniel Nollel, "Who Offers Internet Banking?," *Quarterly* , vol. 19, no. 2, 2000.
- [14] Shaoyi Liao, Yuan Pu Shao, Huaiqing Wang, and Ada Chen, "The adoption of virtual banking: an empirical study," *International Journal of Information Management*, vol. 19, pp. 63-74, 1999.
- [15] Serkan Akinci, Safak Aksoy, and Eda Atilgan, "Adoption of Internet banking among sophisticated consumer segments in an advanced developing country," *International Journal of Bank Marketing*, vol. 22, no. 3, pp. 212-232, 2004.
- [16] Wendy W.N. Wan, Chung-Leung Luk, and Cheris W.C. Chow, "Customers' adoption of banking channels ," *International Journal of Bank Marketing*, vol. 23, no. 3, 2005.
- [17] Krishnan Dandapani, "Success and Failure in Web-based Financial Services," *COMMUNICATIONS OF THE ACM*, vol. 47, no. 5, May 2004.
- [18] Clifford Gomez, *Financial Markets, Institutions", and Financial Services.*: PHI Learning, 2010.
- [19] Andrea Carignani and Marco De Marco, "Supporting a multiple channel architecture design: the UML contribution in a virtual banking environment," in *Proceedings of ECIS*, 2000.
- [20] Network Banking Industry Architecture, 2014 [Online]. <http://www.Bian.org>
- [21] Microsoft Industry Reference Architecture for Banking (MIRA-B). Microsoft Corporation, 2012 [Online]. <http://download.microsoft.com/download/C/5/F/C5FC CA52-1056-427B-B29C-9F00A28180C5/Microsoft%20Industry%20Reference%20Architecture%20for%20Banking%20-%20May%202012.pdf>.
- [22] Principles for Financial Market Infrastructures, Bank for International Settlements, 2012. www.bis.org/cpmi/publ/d101a.pdf.
- [23] B. Committee, "Principles for sound liquidity risk management and supervision," BCBS, September, 2008.
- [24] B. C. o. B. Supervision, Basel III: International Framework for Liquidity Risk Measurement, Standards and Monitoring: Bank for International Settlements, 2010.
- [25] Wu, Xiaoyu, and J. Leon Zhao. "A financial analytic based service architecture: decision support under the Basel III framework." *Service Systems and Service Management (ICSSSM)*, 2013 10th International Conference on. IEEE, 2013.
- [26] Whitepaper. IBM Corporation. , 2006, May [Online]. ftp://170.225.15.40/software/eg/fss_ifw_gim_2006.pdf
- [27] Whitepaper IBM Corporation , 2011, May [Online]. ftp://170.225.15.40/software//data/sw-library/industry-models/sBDWBasel23_WhitePaper_v84.pdf
- [28] ANTHONY TARANTINO, *GOVERNANCE, RISK, AND COMPLIANCE HANDBOOK.:* JOHN WILEY & SONS, 2008.
- [29] Christof Menzies, *Sarbanes-Oxley und Corporate Compliance: Nachhaltigkeit, Optimierung ,Integration.* 2012 [Online]. <http://www.gbv.de/dms/bsz/toc/bsz250745674inh.pdf>
- [30] Mike Krey, Bettina Harriehausen, and Matthias Knoll, "Approach to the Classification of Information Technology Governance, Risk and Compliance Frameworks," in *UKSim 13th International Conference* , 2011.
- [31] Nicolas Racz, Edgar Weippl, and Andreas Seufert, "A Frame of Reference for Research of Integrated Governance, Risk and Compliance (GRC)," *Communications and Multimedia Security*, vol. 6109 of LNCS, pp. 106-117, 2010.
- [32] Nicolas Racz, Edgar Weippl, and Andreas Seufert, "A Process Model for Integrated IT Governance, Risk, and Compliance Management," in *Ninth Baltic Conference on Databases and Information Systems , Riga, Latvia., 2010*, pp. 155-170.
- [33] Open Compliance & Ethics Group, *GRC Capability Model. "Red Book" 2.0., April, 2009.*
- [34] V.K. VAISHNAVI and W. K UECHLER, *Design Science Research Methods and Patterns: Innovating Information and Communication Technology*, 1st ed. Boca Raton, FL, USA: Auerbach Publications, 2008.
- [35] Maryam Marefati and Seyyed Mohsen Hashemi, "Business Intelligence System in Banking Industry Case Study of Samam Bank of Iran", *Software Engineering Research, Management and Applications 2012 Studies in Computational Intelligence Volume 430*, 2012, pp 153-158.
- [36] Pedro Vicente and Miguel Mira da Silva, "A Conceptual Model for Integrated Governance, Risk and Compliance," in *International Conference on Advanced Information Systems Engineering (CAiSE)*, 2011, pp. vol. 6741 of LNCS, 199–213, CAiSE'11, Springer.
- [37] Hussey J. and Hussey R, *Business Research*. London, England: Mac Millan, 1997.
- [38] Baumard P. and Ibert J, *What approach with which data; In Doing Management Research: a Comprehensive Guide*. London, England: Sage, 2001.
- [39] M.Saunders, P. Lewis, and A. Thornhill, *Research methods for business students*, 3rd ed. Harlow, England: Prentice Hall, 2003.
- [40] Daniel L. Moody, G. SINDRE, BRASETHVIK T, and A. SØLVBERG, "Evaluating the Quality of Information Models: Empirical Testing of a Conceptual Model Quality Framework," in *25th International Conference on Software Engineering, ICSE*, Washington, DC, USA, 2003, pp. 295–305.
- [41] Daniel L. Moody, "Measuring the Quality of Data Models: An Empirical Evaluation of the Use of Quality Metrics in Practice," in *European Conference on Information Systems - ECIS*, 2003.