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Procedia Economics and Finance 20 (2015) 268 – 276

Procedia Economics and Finance

www.elsevier.com/locate/procedia

7th International Conference on Globalization and Higher Education in Economics and Business Administration, GEBA 2013

The particularity of the banking information system

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Abstract

In this article our purpose is to emphasize the characteristic feature of banking information systems from an integrative, multidisciplinary perspective, including elements related to economic informatics and also organizational management, marketing and international affairs, applied in the context of banking institutions by identifying and reasoning their place, role, evolutions and perspectives.

Banking information systems' architectural analysis integrates multiple delimitations, bringing together different perspectives which underline the high level of complexity requested by the nature and diversity of those activities performed by banking institutions, outlining some characteristic models according to aspects regarding applications localization, connectivity type and operation environment.

There have been emphasized especially banking activities having the highest complexity in information transfer, namely, banking payments and settlements activities, underlining their mechanisms, as well as the specific architecture of Romanian electronic payment system.

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Peer-review under responsibility of the Faculty of Economics and Business Administration, Alexandru Ioan Cuza University of Iasi.

Keywords: banking information system; banking architecture; electronic payment system

1. Introduction

In our society based on knowledge, information has an essential role and making the most of it is achieved by

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Peer-review under responsibility of the Faculty of Economics and Business Administration, Alexandru Ioan Cuza University of Iasi.
doi:10.1016/S2212-5671(15)00074-X

using information systems at an economic entity level.

From the organizational management perspective, information system can by defined as a collection of data, information, information flow and circuits, procedures and also means of handling information, meant to help establish and accomplish organizational objectives (Nicolescu, Verboncu, 2006).

Corroborating definitions in literature, which describe information system making reference to its basic components, and in the same time, taking into consideration its role and matter at an organizational level, we can assert that the information system represents a collection of components that ensure data processing for the purpose of obtaining information, throughout collection, manipulation, process, storing, organization and distribution activities, in order to ensure decision support to accomplish organizational objectives.

It is mandatory, in the context of the present economic evolution, but also of society in general, to underline the remarkable importance of a well-developed information system, having a proper information support, in banking institutions, but also other organizations, regardless their nature. Economic activities globalization, evolution towards a society based on information and knowledge, competition emphasis, increasingly stressed dynamics of technical and technological progress, represent trends which impose high requirements within banking institutions, by lining up with the new realities of the environment they operate in.

Along with banking sector development and increasing demands regarding customer care improvement, performance providing, transaction efficiency and security, internal processes optimization, increasing complexity level of products and service, banking information systems have known a continuous evolution. Currently, banking information systems need to meet high standards, in the context of specific challenges, which are increasing substantially, and are especially related to costs pressure, more and more complex resource management or to ensuring information security.

Therefore we can talk about a serious mutation at the level of banking transaction channels, while transactions are being processed, more and more throughout automation systems like ATMs, self-service terminals or online banking. Furthermore, it cannot be denied the fact that data volume, which have to be processed and stored, has increased, considering banking activities have augmented. Data security and accuracy represent a sensitive aspect especially for financial banking sector, considering data massive integration process.

Therefore, banking information systems evaluation should take into consideration, apart from information aspects related to automated information processing, also an assessment of the value generated by those systems at an organizational level. Hence, a series of quantitative indicators – for example, indicators that compare activities efficiency from the commercial point of view (rate of return, rate of profit, value added, etc.) or quantitative indicators – for example, indicators for consumers satisfaction level (clients loyalty, level of trust in banking institutions, commitment towards clients, clients perception on relational benefits) can be taken into consideration. Essentially, it is necessary to integrate them according to the objectives and strategy adopted and consistent with the current business environment requests.

2. Banking Information Systems - Characteristics

Information system – or the IT component of banking institution – has a determining role at the internal environment level, but also at the level of relations with the external environment. Generically speaking, an information system includes a hardware component and a software component – systems and applications which ensure data entering, processing and storage and are operated by specialized personnel.

At a financial banking sector level, the role of an IT component is more complex, considering it is an information intensive sector, from the products and services information content point of view but also taking into account its place within the value chain - as it can been seen in the figure below.

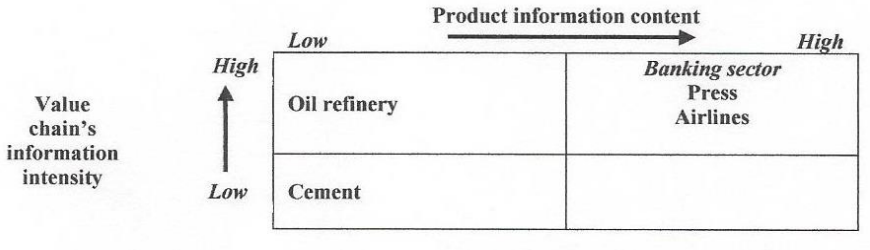

Fig. 1. Information intensity matrix - Source: Rajola, F. (2013), "Customer Relationship Management in the Financial Industry: Organizational Processes and Technology Innovation", 2nd Edition, Springer, Berlin, p. 10.

The figure illustrates the necessity for a well-developed IT component, consistent with information needs incorporated in the value chain or in the final product, bringing some characteristic examples form different areas of activity. Hence, this necessity grows, on one way correlated with information intensity increasing within the value chain, and on the other hand, with the information content increasing of products offered on the market.

It is thus underlined, especially for the financial banking sector, the necessity for advanced information systems, which allow for a high volume of information, in different stages of processing, to be operated. Further, for banking institutions and their clients, aspects regarding continuity, accuracy, security, and data availability – which increase automation contribution, achieved throughout information systems in financial banking sector, are essential.

Therefore, within ***banking institutions***, the nature and complexity of activities performed impose the assimilation of information systems designed to automatize a large number of activities and ensure the necessary information for the decisional process. Mainly, banking institutions perform commercial, investment and deposit activities, among which: attract financial resources from the population and economic operators in the form of term or on sight deposits; grant loans; payments and settlements operations in lei and foreign currency; foreign currency operations: currency exchange, foreign currency biddings.

Banking institutions' information system must ensure that these specific activities are performed, but in the same time, that some basic requests are being met, which refer to (Wijnhoven, 2009):

- ensuring all system's components are compatible – adequate hardware and software elements must be operated by authorized personnel in order to provide communications, applications, data management services and standards, etc.;
- integrating with systems for which they provide the support – mainly from the accessibility point of view – ensemble of points that can be interconnected and range - ensemble of activities that can be performed and shared at different levels of access;
- offering support for organizational strategy – an essential aspect, but rather difficult to accomplish, which can be explained by the lack of a common language between the management and information domains. An efficient method in this respect is the "Balanced Scorecard" – implies defining key aspects which must be considered, from different perspectives, allowing an integrative approach for organizational development, as it is exemplified in the next figure.

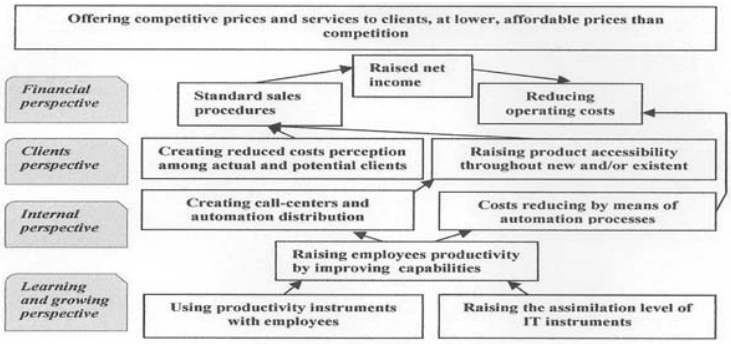

Fig. 2. Using "Balanced Scorecard" method to integrate a banking information system - Source: Wijnhoven, F. (2009), "Information Management: An Informing Approach, Routledge, New York, p. 125.

Balanced Scorecard – as a strategy planning and management system used at a large scale in various organizations, in order to line up activities with the vision and strategy of the organization, enhancing internal and external communication and monitoring performance in achieving strategy objectives (Balanced Scorecard Institute, 2010) – is frequently used in banking system, for various processes and projects (Makhijani, Creelman, 2011).

In a functional approach, characterized by being client-oriented, as a prevalent feature at the banking sector level – but also at the services level in general – the information system provides support for all components of structural and procedural organization, as it can be seen in the Fig. 3.

The main components roles can be synthetized as follows:

- *Nucleus* - represents the modules which offer necessary data functions and structures to other modules, as well as banking structure, territorial dispersion, exchange rates, banking calendar, etc.;
- *Operations* – include a wide range of activities, specific to banking institutions, linked to loans, current accounts, deposits, credit cards etc., whose functioning must be ensured through corresponding applications, which allow permanent data introduction, storage, update and evaluation;
- *Credits* – implies administrating loans granted by the bank, including risk assessment for each contract.
- *Clients* – implies administrating data regarding the clients, in correlations with the other systems which regard banking operations performed for each client;
- *Human resources* - handles human resources at banking institution level;
- *Legal* – regards mainly loans in litigation, which engages the banking institution in a series of corresponding pleadings;
- *Accountancy* – ensuring the necessary support in performing accounting activities specific for banking institution;
- *Management* – implies the necessary support for leading activities in banking institution, directly or indirectly correlated with all other components, which in general, can be defined mainly by making reference to essential parameters regarding activity efficiency, represented by profit and risk (Barangă, Barangă, 2007);
- *Marketing* – takes into consideration ensuring marketing activities according to financial banking services sector, by efficiently combining within the marketing mix components related to product, advertising, price, distribution, personnel and physical evidences (Cetina, 2011).

The bank activity considered to have the highest complexity regarding the information transfer is the payments and settlements activity. The payments and settlements system presents the economic activities that are based on the existence of financial flow between operators. These flows are carried out in the form of cash or other payment instruments. Interbank settlement is the most rapid and can be undertaken by the information system. Usually, electronic interbank settlement is processed following the algorithm:

- banking units debit the client's bank account and send to the central bank files containing data regarding payments towards clients of other banking units;
- each unit takes from the central bank transactions representing payments addressed to it and then credits accordingly clients' accounts.

Electronic settlement allows rapid transfer of funds between payer and beneficiary (in the same day) and integrally automates back-office operations. Interbank settlement is more complex because different banking units are involved, and additionally, a third institution: National Bank of Romania. Therefore NBR focused on developing electronic payments systems.

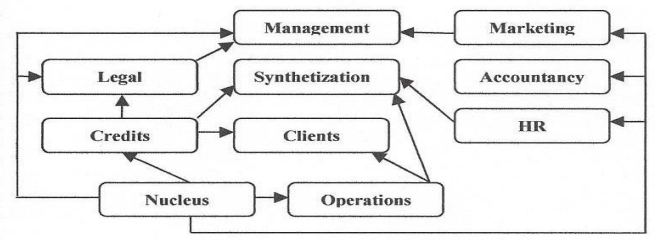

Fig. 3. The role of information system as support for structural and procedural banking components - Source: Luca, S. C., Luca L. (2004), "Directions in the evolution of banking information systems", Tibiscus University from Timisoara Annals, Series Informatics, Vol. I, fasc. II, p. 131.

The literature offers various definitions for ***payments system***, which is a complex, evolutionary concept. A synthesis, focusing on the main elements common to the majority of the definitions, can define payments system as an assembly of instruments, banking procedures and rules which assure funds transfer among the participants in the system – mainly credit institutions or financial institutions. Funds transfer are realized based on a specific technical infrastructure, and on an agreement between the participants in the system and the system operator.

In Romania there are three payment systems:

- a system for large-value payments in lei (ReGIS);
- a system for retail payment in lei (SENT);
- a system for large-value payments in Euro (TARGET2 – Romania)

There are also a system of deposing and settlement of government securities and certificates of deposit issued by the central bank (SaFIR) and systems of clearing/settlement of mobile values RoCLEAR and SIBEX, that settle in ReGIS system.

ReGIS system is the national real-time gross settlement system of payments in domestic currency provided by the NBR. The system is used for the settlement of central bank's operations, interbank transfers, as well as of urgent or large-value payments in Romanian Lei (above 50,000 lei). Real-time processing (on a continuous basis) is ensured and the settlement in the central bank money, with immediate finality.

ReGIS processes credit transfers in Romanian Lei, at national level. The types of payment transactions processed via ReGIS are as follows:

- payments related to central bank operations (monetary policy operations, currency market and lending operations, cash operations, etc.);
- settlement of net positions calculated within auxiliary systems processing payments in Romanian Leu (SENT, RoClear, VISA, MasterCard, DSClear);
- urgent or large-value (above 50,000 lei) interbank and customer payments;
- payments for the settlement of funds related to operations with securities;
- direct debiting of fees related to the participation in the three components of the electronic payment system
- ReGIS, SaFIR şi SENT (BNR, 2013).

SENT is an electronic system for multilateral clearing of interbank payments in lei currency, low value and large volume payments, during several sessions each day. The system processes credit transfers, interbank direct debit and cheques, bills of exchange, promissory note. SENT ensures:

- the exchange of payment instructions among the participants running continuously
- multilateral netting of the participants' payments instructions;
- automated initiation of final settlement in ReGIS system of net positions at the end of each clearing session
- automated management of settlement guarantees via automated interfaces with ReGIS and SaFIR systems.

Trans-European Automated Real-time Gross settlement Express Transfer system - TARGET2 represents the real-time gross settlement (RTGS) system for payments in Euro, offered by the Eurosystem (the European Central Bank and the central banks of the Member States that have adopted Euro).

The system is used for the settlement of central banks operations - including the operations of monetary policy of the Eurosystem, large-value interbank transfers in Euro, as well as other payments in Euro. Through the system, the funds transfers related to auxiliary systems -payments systems and clearing-settlement systems of the operations with securities, are also settled.

The system provides in real-time the processing of payments and settlement in accounts opened in central banks with immediate finality, offers harmonized services and a common technical infrastructure, with increased efficiency form the economic point of view. The system was projects to allow ulterior modification because of the technological evolution, the continuous process of development of the Eurosystem. TARGET2 system is structured as a multitude of national payment systems, referred to as national TARGET2 components, with harmonized operating rules.

3. Banking Information System Architecture

Taking into account the nature and diversity of activities performed by banking institutions, information systems providing support have a high degree of complexity rendering it difficult to clearly delimitate their architecture. A probative approach, a literature landmark, generically delimitates characteristic models for banking institutions based on criteria regarding: applications localization, connectivity level, connectivity type and operating environment.

A delimitation based on applications system localization takes into consideration the necessity of data massive centralization, specific for banking institutions, especially state institutions, by storing in data center, among which a real time synchronization is realized. For that purpose, data centers usually located in central banks, are considered the main locations for data storage, and only intermediary or data or those who have a low level of significance – are not related to basic bank activities, are stored in subsidiaries.

Therefore, a specific architectural model is framed, based on *data centralization*, as it appears illustrated in the figure below:

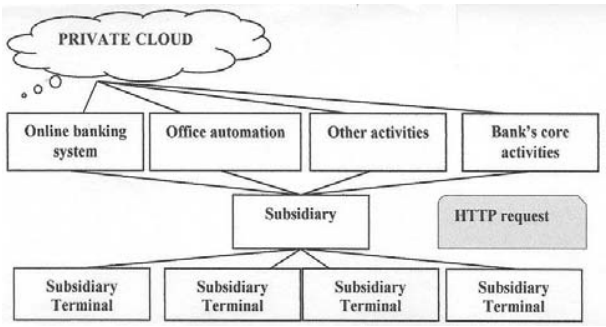

Fig. 4. Data center centralization model - Source: Mingfei, Y. (2008), "Next Generation Information System for the Banking and Finance Sector. A guide to ADN Planning", F5 Networks, Beijing, p. 10.

Within this model, the application system is centralized, all data are stored in a data center and users have a direct access, from terminals, subsidiaries and local data centers. Applications access the web server or the applications server from the data center, usually using Browser to Server method.

Another architectural model, based on *data decentralization*, is the one illustrated in the following figure:

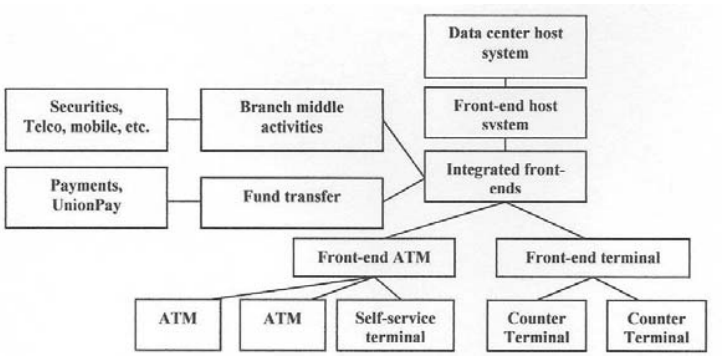

Fig. 5. Branch front-end servers - Source: Mingfei, Y. (2008), "Next Generation Information System for the Banking and Finance Sector. A guide to ADN Planning", F5 Networks, Beijing, p. 11.

Within this model, subsidiaries' applications systems for front-end servers are considered the central system of banking activities and data regarding the base activity are accessed according to the following sequence: terminal – front-end subsidiary – front-end data center – storage server. As a general rule, a Client to Server (C/S) structure is used, namely a specific software, dedicated to clients, and communication with subsidiaries front-end servers is realized by means of TCP protocol.

Both models have advantages but also limits, resulting from the specific architectural construction. Therefore, the architectural model based on data centralization in a data center allows easy adjustments and upgrades, changes being implemented rapidly, cu significantly low costs, at the data center level - as opposed to the model based on data decentralization. In the same time, in the case of centralized model, the data center access, at the terminals, subsidiaries and local data centers level, is rendered difficult due to the high volume of data transmitted. The situation is different in the case of decentralization model which offers the advantage of facilitating data transmission.

2) One of the most important delimitation criteria for modern banking information systems is the ***connectivity level***. Thus, the following types of banking information systems can be identified:

- information systems with no connectivity based on the existence of independent work-stations;
- information systems with global connectivity having computers connected to a LAN
- information systems with global connectivity based on WAN

3) The specific character of bank activities enables also an application systems delimitation according to ***connectivity type*** and to whether it uses Browser to Server (B/S) or Client to Server (C/S) structures.

The structure *Browser to Server (B/S)* implies a system of applications accessed directly by the users, throughout the server, using platforms such as Apache, IBM WebSphere, MS IIS, BEA WebLogic, etc. The specific architecture of this kind of model is illustrated in the figure below:

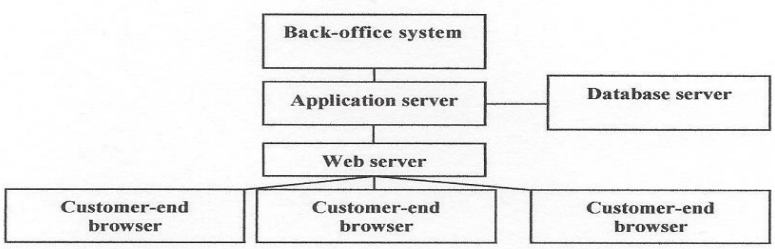

Fig. 6. B/S structure - Source: Mingfei, Y. (2008), "Next Generation Information System for the Banking and Finance Sector. A guide to ADN Planning", F5 Networks, Beijing, p. 11.

We can notice that the structure Browser to Server (B/S) include, at the back-office level, three components: Web server – where users requests, applications server and back-office data base are being are received and towards whom these requests can be directed All B/S activities are realized throughout short connections, using HTTP protocol.

A Client to Server (C/S) structure implies a series of developed activities, by every bank, in general, and communications between client terminal and server is realized with a TCP connection, short or long – as in the following figure:

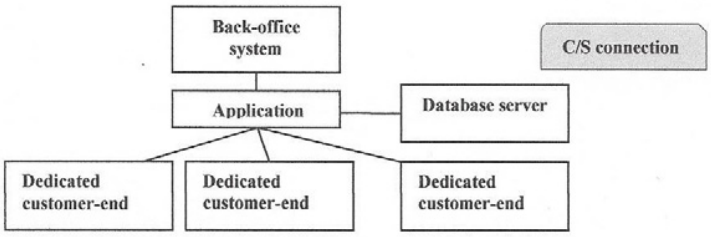

Fig.7. C/S structure - Source: Mingfei, Y. (2008), "Next Generation Information System for the Banking and Finance Sector. A guide to ADN Planning", F5 Networks, Beijing, p. 12.

Within a short connection C/S structure, connection is closed after each transaction, waiting for other transactions, the model being efficient in the case the volume of activity is reduced. On the other hand, within a long connection C/S structure, after establishing the connection, it is not closed; therefore, several transactions can be performed, and this allows sustaining a higher volume of activity.

4) Architectural models corresponding to different banking activities may be delimitated also according to their ***operating environment***: closed and open – although in reality a big part of those can be included in both categories. At a banking institution level, a closed operating system may be considered the one linking the branch to the subsidiaries. An illustrative example for an open system is the online banking system, within which a part of the activities are performed via Internet – clients can access the system and perform transactions, also checking the current account and transfer funds. A rather important issue regarding this kind of systems is related to transactions security, making mandatory the use of SSL or other encrypting methods to ensure a secured connection between the client and the server.

Global trends regarding the architecture development of banking information systems show an evolution from decentralized models based on Client to Server (C/S) structures with limited connectivity – in which data consolidation was realized by means of regular replication of data base at a central level, in a network - towards centralized models, available online. These models centralize the applications software, data bases and servers, which can be accessed online by the users throughout a national network, and which uses a back-up center realizing a copy of the data bases. This evolution is visible since the beginning of the 21st century, along with the progress registered in the area of telecommunications infrastructure and broadband network development as efficient

centralized system were created to allow performing operations at a decentralized level (Dener, Watkins, Dorotinsky, 2011).

4. Conclusions

Our purpose was to underline the specific character of banking information systems starting from the definition of informational system, information system and banking information system concepts. Comparing and corroborating existent definitions we concluded that information systems represents an assembly of components which ensure data processing for the purpose of obtaining information, throughout collection, manipulation, process, storing, organization and distribution activities, in order to assure decision support to accomplish organizational objectives The IT system represents that component of the information system where specific activities are performed by means of instruments and techniques pertaining to information technology.

In recent years, client's relationship improvement, ensuring efficiency, effectiveness and security of transactions, internal processes optimization, raising products and services' complexity degree led to a fast development of banking information system.

Activities performed by means of banking information systems are attracting financial resources from the population and economic operators in the form of term or sight deposits; offering credits; payments and settlements operations in lei and foreign currency; currency exchange, foreign currency biddings. Taking into account the fact that the most complex banking activity related to information transfer is considered to be the payments and settlements banking activity we made a short presentation of the main electronic payments systems available in Romania.

Regarding the banking information systems architecture, the literature generically delimitates models characteristic to banking institutions based on criteria such as: applications localization, connectivity level, connectivity type and operating environment. We have presented several architectural models according to the aforementioned criteria, considering both their advantages and disadvantages.

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