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Supporting a multiple channel architecture design: the UML contribution in a virtual banking environment

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***Abstract*- Many retail banks – those institutions serving individuals and small corporate customers – are entering in the virtual banking arena. Financial services and products are available to customers almost everywhere through a multitude of alternative channels: phone, the Internet, automated teller machines, and so on. From a technological point of view the problem is to design, build and maintain a coherent information system (IS) infrastructure. Unfortunately, the "perfect" IS architecture remains an ever-moving target. Nevertheless recent developments in information system modelling (i.e. the Unified Modelling Language concepts) could give a valuable answer to crucial problems like the need to achieve and preserve long-run firm's adaptability to the technological developments and new business challenges. At the same time the model helps in building a coherent picture of the virtual bank and its delivery channels.**

I. INTRODUCTION: THE EMERGING ROLE OF ALTERNATIVE DISTRIBUTION CHANNELS IN BANKING

The old physical model of banking, with branches, proprietary products, and back room, is continuously being reshaped by technology developments and changing customer preferences.

Today we call *virtual bank* a bank where customers can operate without physically reaching the bank's premises.

The virtual bank can be considered the last step of a trend that encourages customers to run transactions without physical contact with the bank employee. The first step was the installation of Automated Teller Machines (ATM) which avoided the need for calling at a branch for trivial operations, then new functions were added to ATM: at first enquiry options and later money transfer orders and small loans. Surprisingly public acceptance of this new way of getting in contact with the bank was enthusiastic and encouraged further steps towards distant, direct or virtual banking.

The ease and comfort of the customer matched the interest of the bank. According to Booz-Allen and Hamilton [3], the cost of an operation performed via an ATM is .27 dollars compared with the 1.07 dollars of a traditional operation performed at the counter. Better performance can be achieved by the Internet that brings the cost down to .10 dollars per transaction.

As we said earlier virtual banking is the final stage of a trend where ATM is the first step.

The second step is the use of IT to convey financial services to customers. Even if it's evident that banks are oriented to improve multichannel architectures, according to the BAH research in ten years the order of importance of the distribution channels will be the following:

- Internet
- PC
- Telephone
- Smart Card
- Non traditional branch
- ATM
- Interactive television
- Traditional branch
- Screen phone.

Perhaps the word virtual is used improperly when referred to a bank. According to [17] the definitions used to identify the new kind of banks are not final and terms as home banking, electronic banking and virtual banking are used almost interchangeably, although these authors prefer at the end *virtuelle Bank.*

It can be said that the word virtual is proper when referred to the distribution channel and it derives more from a marketing approach when it is used to mention the nature of the organization.

Virtual bank is also a new concept and as it is for *virtual organization* it also lacks of a universally accepted definition.

Virtual bank is receiving increasing attention from the academic environment in every aspect and to a wide extent [18] even arrived at discussing the strong effects on the process of the performance creation caused by the application of new media as selling way in the financial service industry.

Faster cycles times and new customers' demand have led to the need of effective IS infrastructure. This infrastructure is a prerequisite for doing business globally [13].

A central question arises: how can the present information systems adapt to the technological developments and new business challenges? One of the possible answers to this problem lies in effectively model the IS infrastructure.

The purpose of this paper is to outline how new modeling techniques can offer significant benefits to a particular kind of financial institutions, as virtual banks are, supporting them

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in multiple channel design. A standard language (the so-called Unified Modeling Language, UML) will be analysed with particular emphasis to its "use-case" representation tools.

II. TOWARDS VALUE NETWORK

The global financial services industry is changing dramatically and old ways of doing business are disappearing rapidly. All the traditional segments of financial services are converging. Banks, securities firms and insurance companies are competing for the same customers, offering very similar products. The hotly contested prize is approximately $22 trillion in invested assets of US.

The race to capture these assets is accelerating. To date, traditional banks have been losing market share. Retail customers are moving their deposits out of traditional bank products like savings accounts.

By contrast, the newer players such as mutual fund companies and discount brokers, have no such commitment to physical presence. These companies do not view virtual delivery channels as an adjunct to physical presence; just the reverse, they view physical presence as an adjunct to virtual delivery channels. The task before these companies is to add physical presence in ways that allow them to achieve maximum results. They are creating a new business model, one in which customers are loyal to the company, not to an individual. To strengthen this loyalty, non-banks invest twice the amount of their bank counterparts in the areas of technology support and infrastructure to improve customer sales and service. Thus, they can create value networks and focus on «virtual» ways of conducting business [2].

Value networks are formed when banks and other financial services providers collaborate to offer their customers comprehensive financial services and products (Ernst&Young, 1997).

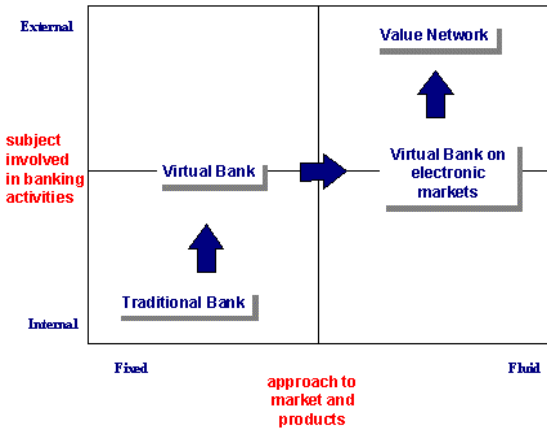

Fig. 1. Towards Value Network

A possible step for European banks towards value network has been represented in Figure 1. The innovation in distribution channels and the new role assumed by the customers require the development of new products or substantial changes of existing ones. The adopted strategies can go from a radical innovation to pure imitation. In the case of imitation which, at the end, proves to be the most commonly adopted solution by small/medium banks, the problem is to remain competitive by offering products and services in a faster way and at the best quality/price ratio. In this sense IT and strategies of dynamic external cooperation with other institutions, play an essential role and conduce towards value network.

As firms seek more «virtual» ways of doing business, the value network is becoming more of a reality for the financial services industry. Initiatives that expand product offerings, leverage third parties, and provide direct connection with customers are being implemented in most companies around the world.

Not just the players but the very playing field is changing. Anyone with access to the Internet and Web can present innovations instantly to a worldwide marketplace, obtain interactive market responses and readapt the innovation for specific user purposes. All innovators in the world thus become potential competitors [12]. Industry leaders are no longer positioned as product providers but as multifaceted companies. According to Smith Shi and Salesky [14] from the development of interactive home shopping channels three primary roles can emerge (italic ours):

- The merchandise (*product/service*) provider who is responsible for selecting and sourcing merchandise and for determining how best to price and present it.
- The shopping service provider who is responsible for managing applications that enable consumers to access and purchase the products offered.
- The shopping server distributor (*relationship manager*) who is responsible for providing consumers with access to service providers' applications.

Note that roles and activities may overlap across the business industry. Moreover a virtual bank will choose to play multiple roles often simultaneously according to the circumstances.

The development of value networks is growing and gathering momentum. Thus the first task for every institution is to create a vision, based on proactive choice to excel in one of three major roles.

III. MULTIPLE CHANNELS: RELEVANT IMPLICATIONS

The global competitive environment has led to four major changes in how organizations operate and are managed [13] all involve major *process* change; all heavily involve IT; and all are necessary to compete. The four types of process redesign affect:

- operational processes
- support processes
- managerial information flows

- network processes.

Here we are interested in analysing the former type because the integration of processes with customers and suppliers is having a major impact on virtual banking. From a virtual bank's standpoint the customer-oriented redesign initiatives are central to competitive strategy. This circumstance forces the firm to continuously reconsider its distribution channels decisions.

In addition channels have become dynamic means, compounding several ways to reach and serve customers. The channel design must meet the requirements of Anderson et al. [1] (italic ours):

- *effectiveness* (the capacity of the channel design to address customers' stated and unstated requirements);
- *coverage* (the level of customers' appreciation of the value in a firm's offering);
- *cost-efficiency* (greater strategic effectiveness and coverage imply a trade-off in cost-efficiency); and
- *long-run adaptability* (the capacity of the channel design in coping with a changing environment: i.e. handling new products and services incrementally and incorporate emergent channel forms to align them to customers' expectations).

Given the present business scenario, the most critical issue seems to preserve the long-run adaptability over the time. The question that arise is: How can a virtual bank appropriately manage the interaction with several (internal and external) users and partners in a borderless business?

We focus on the problem of providing banking services (information and/or transactions) to customers via remote channels: web, phone, interactive kiosks and so on.

The challenge is significant. From a business point of view it should be considered that the use of distribution channels differs by customer segment. For instance, while affluent customers do much of their banking by phone or by Web, many mass market customers prefer going to automated teller machines. Moreover, unlike the direct and traditional way of doing business where the interaction is essentially imposed on the consumer, remote channels imply consumers distributed across diverse locations to voluntarily visit an interactive Web site or to choose to use a dial-up service.

The ultimate virtual bank's goal is the development and maintenance of a bundle of complex information products and services. Software products could be assembled in cyberspace through distribution arrangements aligning them with the firm's competitive strategy. The channel design should incorporate this capability of adaptation to a portfolio of options.

In a virtual banking environment the user interface should create a metaphor that fills the gap between the requester and the satisfier. No matter what a strategy it adopts, bank should also consider that the device-based interface becomes the organization's interface. A given set of functional capabilities can be packaged for users in more than one way [15]. How a system's component appear to its users can play a determining role in how they use it and, therefore, how it affects their decision-making behaviour.

It is evident that service accessibility in virtual banking is not merely a technical computer system issue. To external customers, for example, accessibility goes beyond technical availability: it includes the ease with which they can access and manipulate information about products and services to suit their financial needs. In other words, a differentiated distribution system can be successful only if the value to customers is tailored to their individual requirements. This perceived value also depends on how the system appears to its users.

Thus it is important to provide features that enable the productive use (in terms of viewing, manipulating and accessing) of the same information resources by different categories of users. In this sense virtual banking differs from traditional banking environment not only because of the larger number of «third» parties (suppliers, financial service providers, business partners, outsourcers ….) which electronically interact with the information system. The other, more specific, factor refers to customer's characteristics.

For example a single Internet navigator who logs on to a bank web site may fall in four categories, according to his/her level of computer proficiency (novice/expert) and his/her status towards bank (prospect/already customer). It is evident that the traditional distinction applied to the practice of system design between novices and experts covers only partially the need to provide coverage of bank users' expectations. Moreover, the absence of brick-and-mortar branches implies that the percentage of prospects who approach the bank site from multiple, remote locations is greater than the number of actual customers.

To sum up, information system infrastructure in a virtual banking environment should manage complexity. Complexity can be defined through some basic dimensions falling into two categories: dynamic and static.

Dynamic dimensions are basic properties that are stable only in the short run. In our view decisions about distribution channels or product offering pertain to strategic management. Nevertheless these decisions should maintain congruence with the external fast changing environment. Multiple channel strategy often implies launching experiments or trials with many different means, often simultaneously [1]. At the same time the virtual bank must be quick to modify and reject changes that do not work.

Static dimensions pertain to the overall model of business characteristics. The number and variety of subsystems (fully of partially automated) that have to be interrelated and coordinated, the number of users (and categories of users) that access the information system should not be ignored in system modeling and design.

IV. UML USE-CASES AS MEANS TO REPRESENT COMPLEXITY OF A MULTIPLE CHANNEL ARCHITECTURE

Complexity represents important contingency for system design. Let us consider the role that new system modeling techniques (and in particular object-oriented techniques) can play. We will refer to this approach because it considers *both*

data and process as a package. Moreover the rationale of the object-oriented paradigm is that application problems often evolve around real-world objects and the ways in which they interact [16].

The Unified Modeling Language (UML), is a language for specifying, visualizing, and constructing the artifacts of software systems as well as for business modeling. The UML represents a collection of "best engineering practices" that have proven successful in the modeling of large and complex systems.

The main components of the language are:

- the metamodel or *logical* model; and
- the notation or *graphical* model.

The logical model contains the modeling fundamental concepts. It represents the semantic underlying the problem and constitutes the foundation of the internal structure of the data which means the basic exchange size for the tools (code generator, browsers, etc.).

The graphical model is a visual representation of the logical model. The graphical aspects (form, colors, size, position etc.) do not have a particular semantic but they are fundamental for human comprehension. The graphical representations are complete model projections. Several types of projection are possible.

All the metamodel concepts have a graphical notation: the so-called 4+1 view of the software architecture. The UML is conceived to be a means to express and to build the software architecture. Several views work towards the software architecture definition. Each view is an architecture perspective and refers to a class of reader. Kruchten [9] has introduced the 4+1 concept view presented in fig. 2.

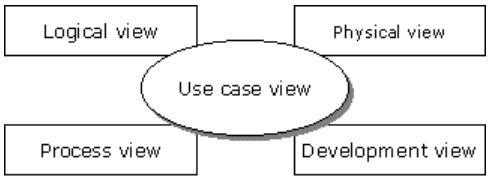

Fig. 2. The "4+1 view" approach

A use case is a sequence of transactions in a system in order to give a result of measurable value to an individual actor of the system [10].

Use cases assist the development process for capturing system requirements throughout the so called User Centred Analysis. User Centered Analysis is a process of capturing requirement from the users' perspective followed by analysis, which explores the connectivity and the consequences of different and potentially conflicting user requirements, and design, which maps the requirements into the software application to meet its needs.

The use case view:

- Depicts what services the system provides to the user;
- Provides information about the users (actors) of the system;
- Shows the nature of interactions between the actor and the system (use cases); and
- Relates actors and use cases.

Actor is not a user: actor represents a role that a user plays. User is someone playing a role while using the system. Each actor uses the system in different ways and each way the actor uses the system is a use case.

A use case describes transactions offered by the system and initiated by an actor. A use case may be called by another use case and different use cases can be combined for greater functionality. Use case represents what the system must provide, rather than how (when using the telephone banking channel, how the connection is made to another party is unimportant for the user that just wants to use the phone when necessary).

Use cases are not design documents or analysis documents. Nor they are scenario because they do not represent a record of a specific set of interactions between the user and the system. Use cases do come from scenarios where scenario is a session that an actor has with the system.

This session contains details of real data and actual expected output.

Potentially hundreds to thousands scenarios exist in an application and each scenario may be slightly different than the previous one, even though the user did essentially the same thing.

Scenarios are important as background information for discovering use cases.

Use cases represent a set of potential scenarios. Looking at a family of similar scenarios, it is possible to gather the essence of what is typically done, and similar scenarios will follow similar patterns of work and provide similar types of results.

Normally each use case focuses on a specific purpose (e.g. to obtain the current account balance).

A system is described by a finite set of use cases but potentially it has an infinite number of scenarios.

Every use case of a system must be enumerated, otherwise the system will not be functionally complete.

Let us apply these basic principles to a virtual bank environment:

The two following use case diagrams represent:

- Actors (depicted as a stick figure);
- Use cases (depicted as an ellipse with title inside or just below the ellipse);
- System (represented by the box with a title) and
- Actor to Use Case interactions (shown as a double-ended arrow).

Primary actors that initiate activity with the system and get some value in return are shown on the left side of the diagram. Secondary actors that are available when the system

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needs their help and they ultimately fulfil the needs of a primary actor, are shown on the right side of the diagram.

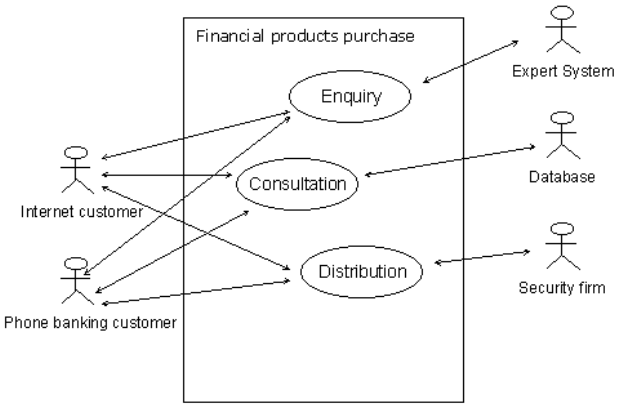

Fig. 3. Use case diagram depicting "statical complexity**"**

In the current virtual banking scenario request for financial products can derive from different actors (Internet customer, phone banking customer, ATMs users) and can be satisfied through different available services (databases, human experts or expert systems). The use case view (Fig. 3) allows to consider all the possible users (and categories of users) that access the information system coping with what we earlier called "statical complexity".

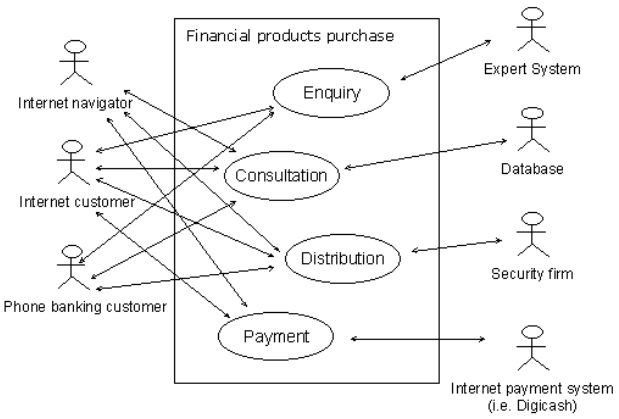

Fig. 4. Use case diagram depicting "dynamic complexity"

In a value network scenario both the requests and the set of available services vary dynamically. As observed by Mowshowitz [11] the assignement of these services to requests can be viewed as a many-to-many mapping of requests to services that changes over time.

In this situation (Fig. 4) the use case view allows to quick adapt and modelize the system to manager's expectations. Primary and secondary actors can be added, subtracted and migrated or their roles can be dynamically redefined. The possibility to maintain congruence with the external fast changing environment improves the organization flexibility.

V. CONCLUSIONS

This paper reports our personal view and comments on a new approach in building a coherent picture of the virtual bank and its delivery channels by UML.

Earlier in this article we mentioned Rockart's assumption about the four major changes affecting companies. We have observed that all involve relevant process change. In particular we did concentrate on delivery channels design due to its importance for virtual bank.

In the virtual banking environment the coexistence of multiple channels imposes logical separation of requirements from satisfiers. The "virtual" approach to the market implies the "dynamic assignment of available resources to requests" [11].

The current transition of financial intermediaries to a "value network" model can be explained by two sets of complexity dimensions. We defined them "static" and "dynamic". Both of them, in our opinion, should be considered in order to ensure long-run adaptability to the organisation.

The use case approach promotes a better understanding of requirements and results. It can easily and effectively describe relevant characteristics of a multiple channel architecture and UML can be used to represent a system from two different perspectives: managers' and IS professionals' point of view. A use case in fact is able to define the way how the system works without revealing to the manager the specific mechanisms of the entities involved.

On the other side for the IS professionals use case represents a basis to carry out design, analysis, and other tasks with an object-oriented approach adopting the UML framework. Moreover this fact seems particularly valuable due to two current tendencies that respectively refer to business and technological trends:

1. The emergence of the Internet as primary delivery channel in banking industry;
2. The advent of an object-oriented language as Java as "standard" that enables interoperability among Internet-based transactions.

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