Banking system process management enhanced by technology upgrades

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Abstract: Paper analyses possibilities of upcoming technologies for banking systems and what changing for end users it means. Current processes in banking systems relates on human controlled triggers or pre-defined behavioral responses. Possibility of usage is strictly limited against banking host system, its connection speed and overall performance of infrastructure. New technology in networks (5G) will bring new age for live fraud detection systems, remote banking branch in front of the ATM or changing cardholder bank account limit just using POS terminal. Change of existing processes driven by technology increase variety of use, brings new banking products into human live. Banking products industry should recognize new possibilities of technology and enhance adaptability for application support.

Key words: business process, process management, process reengineering, automated teller machine (ATM), point of sale (POS), process driven organization, 5G networks, banking system

1. Introduction

Enhancements in technologies are truly most common reason for thinking about business process management. Work in bank industry represent various scope of standards, process management, security, application of risk management, responsibility over privacy and other important aspects. But bank industry also represent very strict environment with slow dynamic of changes in business process and banking systems are usually marked as legacy systems. Nevertheless banking core system could be enhanced by various technologies on devices level where payment transactions are processed so whole coexistence of system parts could be extended by new functionalities which backward reflect the necessity changes of business process. The paper has the ambition to refer to similar changes in the processing caused by technology innovation.

Acquiring of financial transactions and processing solution, bank marketing, internet commerce, payment solutions, data analytics, fraud solution, mobile commerce, point of sale (POS) network management, automated teller machines (ATM) management and processing and other customer solution in bank industry got implications with banking processes. Processes needs to be analyzed to achieve integration with new technology. Also the objects of bank industry should support new solutions. For merchants we can talk about implementation of RFID chips to enable electronic cash desk without operating staff, end consumers using mobile technology to perform transactions using smart phones, POS networks could implement new type of online transactions, technology providers will support NFC technology to enable new transaction processing and mobile networks bring brand new possibilities into live banking devices where technology enables new segment for end users so processes are strictly involved (PUSCHEL, J, et al., 2010), (MATULEVICIUS R., WEYNER T., 2015.)

Most of spoken functions directly relates with communication technology. So basic hypothesis is about performing effective utilization of communication technology to drive enhanced usage of banking industry devices. Effect of such integration could be various and it depends also with flexibility for business process reengineering.

2. Baseline environment for banking systems

Banking environment are using two main subjects of communication which is marked as “Issuer” who owns and deploy payment cards and then operate customers’ private bank accounts. Issuer is legal entity with appropriate licenses maintaining relation with cardholder of the issuer bank. Issuer processes credit or debit payment cards on behalf of cardholder. “Acquirer” is legal entity with appropriate licenses maintaining relation with merchants. Acquirer processes credit or debit payment
cards on behalf of merchants and providing its own banking devices including infrastructure to allow cash or cashless transactions.

Both subjects could be even same if customers use only devices of same issuer bank but no other devices at all. However, in reality this is not really possible so between issuer and acquirer there are few other authorities like processing host and payment card scheme. Between Issuer and Acquirer there is daily ongoing process called transaction settlement.

![Figure 1. Relationship between acquirer and issuer banking system during settlement](image)

This process ensures that all transactions made with issuer payment cards on acquirer devices are balanced on regular basis through authorization servers. Process baseline could be undertaken from Figure 1, where red circle areas represent relationship between merchant’s and their acquiring bank and cardholder (bank customers) and their issuer – home bank.

All players in this process must be in line with all legal requirements, local regulations and Payment Card Industry standards which is also known as PCI rules (PCI Security standard, 2016). These rules describe what is necessary to meet by all relevant parties. Also these rules define security level for communication between devices and payment host server defines privacy of end user's data and other requirements. POS and ATM bank devices use very sensitive device known as keyboard which is encrypted. Keyboard is truly sensitive because cardholders enter their own personal identification number (PIN) through this device, so we can call it as Encrypted PIN pad. So one security PCI standard exactly describes which type of PIN pad could be in production environment, when is lifetime date to replace such devices, which version of PIN pad firmware ensure proper security standard etc. And this is just a keyboard used on payment device. All other components of banking acquirer devices must be in line with related PCI rule with relevant lifetime process. This is about legal framework and standard which payments industry have to follow. As been mentioned on the other part there are banking host, or processing company. This is part of bank infrastructure and of course part of information technology enabled unit. As we could see in many other business segments, within bank payment industry there are strong engagement with IT support and relevant business process support.

In a relation with business processes in payment industry we can talk about 1st line services, 2nd line services, development support, change management, risk management, fraud detections, incident management, all components based on service layer agreements and process driven support beyond these segments. Important part where technology brings truly new possibilities are marketing campaigns using banking devices. This segment was in use usually for internal requirements for particular bank products but new technology open brand new options also here. Dynamic marketing
and proactive detection of end user behavior enable banking products to be more customized and driven through the marketing channels to provide exactly specific offers for the people. Not only for specific bank products but space for marketing communications could be sold for third party companies. All spoken changes need to be covered by proper processes due to fact we are still in strictly controlled banking industry products.

New technologies change processes in banking systems with greater scale than any attempt to artificially develop bank products with a lateral goal - to increase profits, gain more market share and similar business-oriented goals. In next text you can find more examples how technology influence bank process management. What we can do to reflect such trends and what implications it means for end user customers or banking products.

3. Business process management implications

Banking system process management related with all internal information needs of particular bank subject plus every process have to be in line with external environment controlled under PCI. What is real limitation of usage in banking industry is production operations of legacy systems running on legacy infrastructure. Based on previous information there is also clear that banking devices got its own technology limitations which are age of banking devices, application drivers, application software, infrastructure and communication technology.

Point of sale terminals also known as POS are frequently changed in real life. Price of such devices is not high and frequently usage means also depreciation of hardware. So common lifecycle of POS terminals is between 2-4 years. Other situation we have in automated teller machines (ATM). These devices are quite expensive, usually contains expensive safe for money and much more human interface components as touch sensitive display, encrypted PIN pad, receipt printer, cash dispenser, cash detection sensors, deposit module etc. PC cores life time within the ATM is often in years and operating system usually embedded Windows in older version.

Both POS and ATMs usually running on legacy type of communication devices. Of course it could be driven using bank LAN networks, DSL connections and GPRS mobile technology. The last spoken type of communication is widely used because of cheap operating cost and easy handle setup for new devices or service intervention. Additionally, for GPRS communication we do not need the agreement commitment of the service so it could be use on different location without additional costs. POS and ATMs are usually using extremely old standards of communications like CDMA (2G) or EDGE (2.5G). Old communication standards mean better stable connections against newer 3G or LTE but line speed and responsiveness usually not meet application requirements for new ideas. For standard transaction communication CDMA or EDGE represent sufficient speed due to fact that transaction size is just in bytes. Significant problem using legacy infrastructure is future bank device possibilities and new bank products. If bank transaction is not the only purpose as use case it’s necessary to think about future possibilities, usage scenarios and effectiveness of bank process on the background. All new possibilities could be marked as value added services (VAS) and requires collaboration of surrounding systems and process driven management customized for new technologies.

Aspects of developments could be described in many value added services enhancement. Use case for contactless transactions, advance monitoring system of bank devices, cash with code as a new type of transaction, security enhancement, using standard ATMs as teller machines for buying 3rd line services as toll services, paying invoices, creating bank accounts or other applications. Marketing and Security are two areas which would be good as an example to shown differences in technology changes and aspects of business process management.

3.1 Marketing on banking infrastructure

Marketing is the area where technologies provide major difference from current possibilities. Marketing and direct marketing especially is essential part of customer communication for commercial banks. For purpose of this paper marketing itself it’s not a topic and classic way of marketing in bank branch will not be considered. Interesting is how banking systems and banking devices are able to help marketing departments to communicate details about products, news or offers to bank cardholders (SHUMAILAY., 2012)

Present possibilities use bank devices as view option for commerce and marketing. During standby mode ATM or POS terminals uses their display to rotate specific number of screens in loop to present very limited information for cardholders. Such marketing campaigns are mostly static. During the
transaction there is usually one or two static picture with marketing information and at the end of transaction cardholder can get a receipt printed by device which contains marketing special offer. ATMs also using product which is called CRM campaigns which contains usually dedicated offer for limited group of cardholders? Every bank customer owns and use payment card (this is reason for term cardholder) and card contains PAN number which is Payment card number. Prefix of this 14-16 digit PAN number contains information about issuer bank, so banking devices are programmed to identify this code. Based on this prefix code such specific CRM campaign know who is dedicated group of cardholders so it uses such information for aimed marketing shown for specific group of cardholders only. Limitation is technology so devices are able to shown only basic information. In this case business process set who will be target group of marketing CRM campaign, what dedicated time length of the campaign is and which bank product or offer will be presented. Business process defines such request for the operations in the bank and request will be actioned within few days after its creation.

Now let's consider we have proper software application, sufficient performance of infrastructure and communication able to work together providing dynamic marketing. This is about application of dynamic interaction which could change current static marketing into much customized way for offering new products or services.

Such solution needs strong focus for data privacy, personal information privacy and safety beyond transaction history. If above conditions meet banking system and surrounding system, it’s possible to think about proper marketing online solution. This is surrounding system in parallel use with authorization system which could evaluates, measure and operate dynamic marketing. Dynamic system directly relates with communication and information technology and enable store and process all transaction information, location where cardholder performing its transactions and customized focus of cardholder interest.

In this case business process has to react much quicker, it must know various production implications and cardholder interest has to be evaluated online.

Marketing information background is not from specific bank only but it could be in use by 3rd line customers who would like to use such information channel in much customized way. During processing of bank transaction cardholder will be able to see offer from shop in walk distance from the ATM, or will see video advertising for new internet banking etc. The real benefits of dynamic marketing are much wider. Classic withdrawal ATM could change scope of use case scenarios from balance enquiry or cash withdrawal into device which could be used for communication with bank branch or contact call center just using ATM machine. Use the machine to create new bank account or ask for new payment card. It’s also change of thinking and use possibilities of communication technology together with bank devices on a different level.

Another important reason to applicate new communication and information technology to drive such solutions is unused marketing potential of growing ATM networks across the countries which are visible from table 1.

Tab 1. Development of ATM networks across EMEA. Number of ATMs devices, Year-to-year comparison of production systems.

<table>
<thead>
<tr>
<th>Year / Locations</th>
<th>2014</th>
<th>2015</th>
<th>2016</th>
<th>2017</th>
<th>Y-Y average</th>
</tr>
</thead>
<tbody>
<tr>
<td>CEE</td>
<td>2502</td>
<td>2881</td>
<td>3363</td>
<td>3680</td>
<td>13.77 %</td>
</tr>
<tr>
<td>SEE</td>
<td>675</td>
<td>663</td>
<td>784</td>
<td>923</td>
<td>11.40 %</td>
</tr>
<tr>
<td>UK</td>
<td>864</td>
<td>877</td>
<td>914</td>
<td>824</td>
<td>-1.37 %</td>
</tr>
<tr>
<td>UAE</td>
<td>--</td>
<td>584</td>
<td>615</td>
<td>482</td>
<td>-5.44 %</td>
</tr>
<tr>
<td>Total :</td>
<td>4041</td>
<td>5005</td>
<td>5676</td>
<td>5909</td>
<td>13.79 %</td>
</tr>
</tbody>
</table>
Absolut number of installed ATMs growing by almost 14% annually which is strong reason to implement new strategy and new business processes. Also banking systems development brings new options so process reengineering is about further discussion.

In the meaning of business process management we can talk about behavioral system pattern. As been described business processes are about to adapt new possibilities mainly in area of supporting processes. Other way of thinking. Previous supporting processes will be “new” future key processes and other supporting processes will be established to support them. Similar adaptation has been described within methodology for modelling and analysis of business process by Řepa (Repa, Bruckner 2015) In this meaning methodology describe gap within modelling principles so behavioral patterns should be supported by set of new supporting processes to meet business goal. In this meaning adaptation is about reflection new requirements into new model where supporting processes are also significantly important. Key principle is about changes driven by responsible analysis of its application into technology improvement environment. We can talk even about process reengineering driven by technological changes and/or by new possibilities.

3.2 Changes in Security process

Security and especially fraud detection are Business processes with strong implication in technology changes. As an example there are two specific security areas. Transaction security and ATM devices security

Transaction security nowadays consists with set of rules which are applied as reactive security rules. It means that authorization system where banking transactions are processed remember cardholder customer behavior and compare it with previous period of time. This system controls number of transactions during the month, amount of transactions, physical places where transactions have been made plus few more indicators. System compares cardholder common behaviors with current transaction. If some indicators go out of remembered parameters automatic rules show an alert for the human operator who follows agreed business process. Call to the issuer bank is result of process to check status of cardholder payment card. Or even direct call to cardholder perform and check last 10 transaction of cardholder so based on investigation process operator could decide to manually decline transaction or approve processing. Problem of this process is responsiveness time and human interactions itself. Standard response times with such level of fraud monitoring are within minutes (Svatos O. 2017)

With new level communication infrastructure transactions will be immediately check by the system itself in proactive level of risk evaluation. Feedback will be provided by automatic system based on artificial intelligence and whole system will be able automatically send feedback directly to banking device. Cardholder or possible invader will immediately see result of declined transaction so feedback will be in seconds. Business process will be changed from reactive to proactive evaluation of risks and actors with the system change from human operators to automatic system. This is close future as application level of proactive fraud detection already exists, but infrastructure is not yet fully ready for such dynamic approach. It’s clear that an implication for business process is strong as it changes the basics of previous reactive business process.

ATM Device security currently consists with few tier protections. First of all: the cash. Money is always secured with proper safe and we can call it physical security. This part of ATM is secured by safety alarm circuit and relevant code lock. ATM as a banking devices contain bottom case which is spoken safe and upper case containing ATM computer and all human interface devices. Upper part of ATM could be secured by another safety alarm and another code lock. Upper part also contains plenty of sensors for cash dispenser, card reader unit, receipt printer, encrypted pin pad, secure camera and monitor. Significant difference is version of devices drivers in ATMs which are also known as XFS communication layer. This layer could be unsecured with open communication between each other, or communication could be encrypted by terminal master key to ensure right level of security. Unsecured open internal communication is not a case today because as a part of PCI rules there are always encrypted communication between payment device parts and internal computer to avoid abuse. Also the number of security issues detected in the past where invaders simulated ATM computer by own computer which send commands to cash dispenser, so they were able to stole the money. This kind of attacks is known as black box attacks.

Also other types of attacks are sensitive, such as physical damage to front of ATM, damaged cash dispenser or try attempts of opening ATM safe by unauthorized persons. Type of attacks could be
Various but all attempts have one mutual attribute. Bank system does not detect any attempt of unauthorized use until ATM is not really damage, marked as out of order.

Current business process is about creation of alert for the physical security company after detection of malfunctioned ATM so just after the visiting of ATM location security usually detect improper use or attempt for robbery. Proactive detection or remote management is missing completely or do not have feature for fraud detection. Crucial part of such detection is time. Using new type of infrastructure, we can talk about active device monitoring. It’s fair to mention that complex security solution must be driven also from application layer which drives payment device itself.

Monitoring (which is not always only for monitoring purpose) applications like NCR Aptra Activate, KAL or ESQ are able to use ATM sensors, error codes and alerting to automate the way of fraud detection. Remote monitoring brings huge difference for device security and fraud monitoring are detected in real time. Such advantage helps to protect the devices so they could be safer for cardholders use. Attackers could be detected online using built-in cameras and police or physical security company could be on ATM location in few minutes after detection.

Business process change is in detection of issue from failure detected status to potentially unauthorized use attempt with online alerting functionality. Important change in process is evaluation of error logs immediately reviewed by monitoring system from the devices with proper interpretation for the security operator. This is another example how telecommunication and infrastructure enhancement driven by latest technology help to save the time for running processes effectiveness to be activated much quicker and correctly made decision for upcoming process activities.

Aim of business processes is all about to improve supporting processes into near-live responsiveness systems able to evaluate risk by predefined or learned behavior situations. Business process in such environment requires precise analyzing of all relevant triggers which are creating security alerts so relevant task’s on process level will require working detailed BPMN models. Similar approach has been described within Evaluation of BPMN according of the Enterprise Architecture methodology by Repa (Repa, 2012), (Alexa, Repa, 2017).

4. Value added services driven by technology

Existing technology 3G or LTE already got enough data bandwidth to support all spoken value added services above. Problem is availability of the network and latency. Another problem is voice prioritization on each mobile network. It’s a standard in mobile data networks that voice communication got higher priority than data transfer. Banking systems got one important transaction process rule which is transaction time limit for one single online payment transaction. This transaction communication has to be responded within 60 seconds otherwise it will be reversed (declined). Second fact about LTE represents this service as data oriented aimed for speed but latency and service aggregation is not on the best levels. Imagine places where mobile data communication is highly used like shopping centers or city public areas, squares with high aggregation of people. Plus keep in mind already mentioned voice prioritization problem. If there are high requirements for mobile BTS station, then always voice got higher priority than data. In such places LTE do not offer enough stability for bank system devices so that’s the reason to keep the usage of legacy infrastructure still in payment devices. Old mobile routers usually driven by 2G networks are using frequency bandwidth which is not in use for voice anymore so it’s much suitable for payment systems. Big trouble of such legacy solution is connection speed and availability. Mobile network always preferring voice communication so data transfers has to be on 2nd row, that’s another fact why LTE is not sufficient in shopping center or public areas where many people using voice services.

5G network generation technologies promise a wide range of features, which are beneficial for all groups of people including bank industry. It’s a technology to gather all networks on one platform which is more effective and efficient. 5G will provide a huge broadcasting data in gigabits and will support more than 60,000 connections. This seems to be solution for voice priority problem. Network specification of 5G promise easily manageable back compatibility with previous generation of networks so old banking devices will be backward compatible with existing mobile networks and be possible to provide uniform, uninterrupted, and consistent connectivity over the world.

Importance of backward compatibility is understandable requirement due to availability of mobile technology for banking industry. ATM devices are always online banking devices opposite to POS terminals which creating connections with host server only during processing transactions or in batch...
processing communication. Network stability and relevant speed offered by 5G will be responsible for future enhancement of value added services for the next level.

Marketing area or security is just two examples. Examples has been chosen to indicates major changes in business as key process changes as well as supporting processes. Area of implication could be wider like enabling remote bank communication with cardholders using existing network of payment devices to enable mobile branch..

5. Business process implications, Conclusion

Banking system process management driven by new communication technology is about application of business process modelling. Value of communication technology evokes the changes in process management, and various value added services change scope of supporting trends.

Business processes are essential part of business management and together with IT system, technology, methodology and human interaction they build together working entity.

Described examples of telecommunication enhancement into banking system and devices with major functional upgrades shown technology solution so used technology determine implementation options. With relation to processes in banking systems we can talk about abstraction of business processes. It’s a transformation from structural thinking into process thinking. Objects are data including their functions so what it’s possible to gather and how we can use it for significant results on future implementation?

In relations with Business Process Management it’s about principle of modelling, principle of abstraction and principle of three architectures. Used as methodology MMABP (Svatos, Repa, 2016). Principle of three architectures helps us to understand implications of banking system environment too. First layer is conceptual model which represent abstraction of banking system. Importance is to understand basic relations within key process, existing environment and organisation of system component to gather conceptual level of the system. With highest possible abstraction view it’s important to identify scope of the system driven by new information and communication technology.

Second layer is technological architecture which describes model of new system including possibilities of new technology plus organization model description. This layer should answer how the content of the system will be used by technology and which enhancement it’s possible to achieve by technological proposal.

Third implementation layer is also known as physical model of the system. It’s a model of technology specification including description of system components, new system features and other specifics.

Proper analysing of legacy system could answer content of the system, so object view of system which represents structure of reality as conceptual model. Which information we have about cardholders and what relations we are able to detect between the data structures. Process view represents behaviour of future banking system. What will change when data content will be used for another use cases, so what will be new behavioural patterns of the system. Which effect of implementation we can applicable by new technology? How great economic effect will be as a result of new reinvented process? Analysis of current system could help detection of right events which generate actions so how much attributes we need to monitor over existing structure to develop new actions.

By physical layer it’s important to detect required support for ecommerce, mobile payment, marketing, using biometrics sign, security enhancement and beyond standard banking system function. Analyses of events, on time presentment of data in functional way cause activation of enhanced process management in this case driven by technology enhancement. As been mentioned technological changes are common drivers for business process management changes. Without proper understanding of the environment there is no chance to advice responsible steps for improvements and make changes in comprehensive way.

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