The Development of a National Receipts Card: An Account of Scheme Adoption Rates and Risks in the Point-of-Sale Industry

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Abstract

The introduction of a citizen's Receipts Card in Greece has led to increased controversy between the public and local government authorities in regard to the benefits attempted to be gained from such an initiative. One of the main aims of the Receipts Card has been the rapid adoption of paperless transactions at Points-of-Sale (POS). This paper attempts to address the events that have led to certain adoption trends for the Receipts Card in the Greek POS market during the period of September 2011 until January 2012. In addition, pertinent risks to the Receipts Card scheme are highlighted through an investigation conducted on POS communications for software updates. Graphical depictions of POS software adoption rates of five banking institutions are compared with a prime focus to explore the causation of the adoption trends identified in Greek markets. The research also explores countervailing causative variables to trends identified.

Keywords - Receipts card; Point-of-Sale; financial transaction; POS network infrastructure; receipt card scheme adoption; risk management;

1. Introduction

Since 2009, Greek citizens have experienced drastic changes in the economic, political and social landscapes. Earlier attempts to limit credit exposure of Greek banking institutions to global markets, has led to national liquidity limitations. Nevertheless, by the end of 2010, the Greek government had already orchestrated a solution, widely known as a 'Receipts Card', in an attempt to combat tax 'fraud' and evasion. The aims and objectives of the new citizen's card scheme would be facilitated through the nationwide banking mainstream services of magnetic card provision and Point-of-Sale (POS) terminal availability at merchant locations.

Even though the idea of the development and distribution of a Receipts Card pre-existed since September 2010 (Kathimerini Daily Newspaper 2010), the Greek Parliament ratified the Receipts Card bill on May 24, 2011, which would later realise an unprecedented collaboration between the public and banking sectors to introduce a nationally distributed Receipts Card for use in financial transactions as well as its support through the channel of the Point-of-Sale industry. The main aim of the Receipts Card scheme would be for Greek citizens to make use of it through market exchanges involving financial transactions with merchants. In effect, all individually stored financial transactions on POS devices would be initially stored on a merchant's POS device; communicated and uploaded, via a telecommunications infrastructure, to the IT systems of the General Secretariat for Information Systems (GSIS) of the Ministry of Economy and Finance.

Greek banking institutions would provide the Greek citizen Receipts Card without any surcharge (Official Minutes of The Greek Parliament 2011). On October 3, 2011 the Receipts Card became available to the wider public (Kathimerini Daily Newspaper 2011).

In respect to the distribution of the Receipts Card to Greek citizens GSIS defines its practical use as 'a personal card of receipts collection of expenses that provides the opportunity to the taxable individual to collect and submit automatically retail purchase receipts and service provision, so that the individual receives the corresponding discount during tax return calculation, without any further activity.' (GSIS 2011). The following data is stored on the POS during the transaction process with a Receipts Card (GSIS 2011).

- Time of transaction;
- The merchant's Tax Code;
- The Receipts Card number with which the transaction was executed;
- The total financial amount of the transaction.

Under the scheme part of the plan was that all POS devices should align their functionality to the Receipts Card requirements on financial transactions tracking on an individual basis. The scheme involved Receipts Card services to be operational by January 1, 2012.

It is not within the scope of this paper to examine applicable POS security features such as 3DES, PCI/PSS and PCI/PED nor does it discuss the process with which a Receipts Card executes a transaction and uploads a transactions batch. The research in Section (2) focuses on depictions of network infrastructures available per bank for POS communications for parameters update from a Terminal Management System (TMS). Moreover, Section (3) graphically indicates the software update rates of five financial institutions in regard to the adoption rates of POS devices to support Receipts Card functionality and discusses the findings. Section (4) extends the discussion on findings by stating the associated risks that should have been taken into consideration during the nationwide implementation of the Receipts Card scheme. Lastly, the paper concludes with a reflection on the adoption rates generated from the five banking institutions in the Greek POS industry and a discussion of possible future improvements that would assist in an increased pace of national adoption of such a scheme.

2. Industry-Wide Infrastructure Analysis

Since the 1980s, the telecommunications networks of the Greek banking sector have been primarily governed by the X.25 network protocol architecture, capable of transferring data via packet switching. Packet switching has the advantage of collecting information from several devices and combining them into discrete data packets thus serving dial-up communications from POS devices as well. In addition, The X.25 protocol allows POS terminals on distinct public networks to communicate to a TMS of a bank through intermediary computers at the network layer. In that respect, the majority of POS devices within Greece have enabled capability to communicate over dial-up phone lines for either financial transaction authorisations or parameters updates. The former regards the maintenance of a transactional system whereas the latter the existence of a Terminal Management System (TMS). In addition, POS service providers or vendors, usually, tend to maintain a software update host where POS devices connect for software updates.

Further to dial-up communications, there are also other available network configurations for POS devices, provided the required hardware is pre-installed on them. For instance, it is possible to utilise the TCP/IP or Ethernet communications protocol for increased speed of data exchange thus minimising the communication time and in effect the risk of the POS being vulnerable to communication disruption, see Fig. 1.

On the other hand, GPRS POS wireless devices are preferred by merchants who cannot connect them to a telephony landline, such as road-side kiosks which flourish in Greece, or would rather avoid excessive cabling in-store or are forced to by means of being at a remote location. Even though GPRS devices are capable of addressing merchant locality issues and penetrate the aforementioned markets readily compared to other POS types, their impartial functionality depends highly on the availability and signal strength of a GPRS network. The rest of this section explains thoroughly the setup and characteristics of network configurations of five financial institutions taking into account POS communications.

The first case examines *ABank*'s POS network infrastructure has an additional NAC router for re-routing POS communications from the bank's network to a vendor's router which then assumes responsibility of transmission to the TMS, see Fig.3. The network topology at the vendor's site is the outsourced part of the network connected to TMS. Note that the depiction in Fig.3, concerns the parameters update process a POS terminal follows when connecting to a TMS.

However, ABank's network configuration is capable of serving GPRS POS communications as well, thus addressing the needs of a greater market share through the distribution of such devices to a number of merchants willing to acquire the *wireless* service. In fact, there are numerous advantages in the maintenance of hybrid network configurations which are able to serve POS communications for more than one POS type based on the aforementioned ones i.e. dial-up, Ethernet, GPRS.

In the case of BBank, an organisation acting as an intermediary in the provision of POS devices in the Greek market, the entire TMS environment is located and maintained at Printec Greece premises. The vendor is again regarded an outsourced environment but BBank's TMS and part of the network infrastructure is under the ownership, management and responsibility of Printec Greece. Moreover, it is notable to state that in situations when the service provider has direct control over a production system, remote access can be gained to the system which minimises system support and maintenance response rates, compared to TMS environments which are located in remote destinations and require travelling time. Similar to ABank's case, BBank utilises a router to transmit POS communications to Printec Greece's infrastructure and TMS server, see Fig. 4.

However, in this case the network configuration can support Ethernet communications only. Moreover, the deployment of such POS devices requires that there is the required Ethernet network infrastructure also available at the merchant site. In fact, this might suggest that the merchant might have already undertaken the task of setting up and investing in such an infrastructure. In terms, of POS device communications and POS fleet management this is the optimum network configuration for effectively monitoring and controlling the production environment as well as applying changes and updates whenever necessary. In fact, this is evident from the Receipts Card software update process applied to BBank's POS devices, see Fig. 8.

In another case *CBank*'s IT infrastructure and TMS environment are outsourced to a vendor's remote data centre. In this case, the network configuration deployed differs to all aforementioned setups. The network is configured to accept only dial-up POS communications which are directed to a USB modem located on the TMS server, see Fig. 5. It is worth mentioning, that CBank's infrastructure is the only environment not subject to a control and monitoring policy. This is explained by the fact that its location being outside the vendor's corporate network means it is not subject to the vendor's control and monitoring policies.

The *DBank* network configuration is predominantly a dial-up oriented infrastructure, see Fig.6. However, in DBank's case two TMS servers have been deployed at the bank site, so as to make available higher computing specifications with an aim to manage effectively a large number of POS communications.

Similar to ABank's infrastructure, the *EBank* network configuration is another example which can service both dial-up and GPRS POS communications, see Fig.7. However, in EBank's case there is also a set of 7 PCs deployed to serve exclusively POS communications. This occurs in terms of unconsolidated technology use.

The aforementioned network topologies deal mainly with the parameters update process. Following the trend analysis conducted in section (3) of this paper, the focus is on the software update process that POS devices committed to in a certain period of time. The software update concerns the process that follows the parameters update process since in almost all cases it regards an outsourced function. BBank is the only case where the parameters update process and software update processes are both outsourced to Printec Greece's premises. The illustration shown in Fig.4, covers also the network topology with which dial-up and Ethernet POS communications are attended during the software update process. It is noteworthy that it was not planned to update GPRS POS devices through the network topology depicted in Fig.4.

3. Trends Analysis in POS Update Rates

The analysis of software update rates in the Greek banking sector attempts to indicate the performance of managing to update massively POS production environments consisting of different POS device types with either dial-up or Ethernet driven capabilities. In general, one of the assumptions of this research is that financial institutions with large POS fleets i.e. in the tens of thousands, in the field require a greater extent of time for the Receipts Card software update process to be accomplished for the entire number of POS devices. Moreover, in Section (2), a correlation identified was presented in regard to BBank's network topology whereby an Ethernet governed infrastructure might result to decreased POS communication durations with fewer disruptions.

An extension to that view can be that Ethernet-driven POS network infrastructures tend to have POS terminals with higher communication frequency rates and limited number of attempts for connection to TMS as opposed to dial-up driven infrastructures where, in general, communication frequency rates tend to be low and multiple attempts to reconnect to TMS are recorded. In this context, when a banking institution decides to initiate massive production changes these can be reflected in production and Ethernet-driven network environments more promptly compared to dial-up environments which tend to have lower POS communication frequency rates. In respect to the aforementioned points it is worth considering the information shown in Fig.8 through Fig.13. The rest of this section presents a series of depictions supporting the assumptions made at the beginning of it.

It is worth mentioning that the graphical information presented has been produced based on Equ.1. An assumption of the measurements made in Equ.1, in regard to the trends analysis is that T(p) remains constant per bank throughout the period 1/9/2011 to 31/1/2012.

$$A = U(x) / T(p) \qquad \text{Equ.1}$$

where 'A' signifies the Receipts Card software (A)doption rate in the Greek market for the period 1/9/2011 through 31/1/2012,
'U(x)' symbolises the (U)nique POS devices number per bank communicating to the software update host per day, and
'T(p)' indicates the total number of VeriFone (P)OS devices present in a TMS per bank.

Firstly, the total percentage attributed to software updates of ABank terminals by the end of the period 13/12/2011 - 31/01/2012 was 49.28%, see Fig. 8. It is evident that the POS software updates adoption rate experienced a steep increase right after the end of the festive period on 08/01/2012.

Secondly, the total percentage attributed to software updates of BBank terminals by the end of the period 13/12/2011 - 31/01/2012 was 82,40%, see Fig. 9. Note that the results of Fig.9 correspond to the only POS network infrastructure with Ethernet-driven capabilities. In this case, the duration required to update the software of **82,40%** of the entire POS production fleet was two weeks. Even though, the results are commendable it should be stated that BBank's fleet constitutes just 1/20 of the total number of ABank's POS fleet and is comparably small in size. Therefore, it can be suggested that banking institutions with large POS fleets and POS devices with dial-up capabilities could potentially experience an extended period of software updates than expected which results to slower market adoption rates.

Thirdly, the total percentage attributed to software updates of CBank terminals by the end of the period 13/12/2011 - 31/01/2012 was 58.36%, see Fig.10. Notably, CBank's infrastructure is governed by a single modem see Fig.5, which leads to a single POS communication being active with the TMS at any moment throughout the day. This limitation coupled with the dial-up driven network environment and lack of proper monitoring and control of the uptime of the modem device receiving communications has resulted to a below par performance for CBank's POS devices whereby the adoption rate is just 58.36%.

Furthemore, the total percentage attributed to software updates of DBank terminals by the end of the period 01/09/2011 - 31/01/2012 was **69.12%**, see Fig. 11. DBank as one of the largest financial institutions within Greece commenced the POS software update process in October 2011.

In addition, the total percentage attributed to software updates of EBank terminals by the end of the period 01/09/2011 - 31/01/2012 was 35.27%, see Fig. 12. EBank being one of the largest financial institutions within Greece commenced the POS software update process in October 2011. However, the adoption rate of the new software in the market has been slower compared to DBank's slightly improved rate. The investigation on the available statistical information from the software update host revealed that the total number of POS communications are considerably higher for DBank rather than for EBank.

It can also be deducted, from Fig.13, that the festive period that occurred during the end of December 2011 and beginning of January 2012, has had a considerable impact on the adoption rates of Receipts Card software in the POS industry. More associated risks are described in section (4) in greater detail. However, it must be noted that the fragmentation of POS servicing systems and specifically the disparate architecture comprised of the parameters update, software update and transaction authorisation hosts, lead to uncertainty in the trend identification process.

For instance, as a result of this dichotomised architecture the assumption that T(p) is always constant in Equ.1, had to be obeyed which adds to measurement uncertainty. Therefore, according to the authors' view it is deemed necessary to introduce a maximum uncertainty of ±10.00% on the trend analysis results obtained. In addition to the aforementioned reason on this perspective, there is limited or no evidence as to the degree a POS device owned by a bank is active or inactive in the field. For instance, a POS might be conducting 500 transactions per day but rarely communicate to its corresponding TMS to receive any new parameters or simply be stored away at a merchant site and never be used. However, it will remain active in the TMS indefinitely. Therefore, including such POS terminals in the trend analysis has obvious repercussions on uncertainty deviation.

It is worth acknowledging that the BBank Ethernet POS devices required a single communication to be updated with the new software package. On the other hand, POS devices originating from dial-up oriented infrastructures experienced several retries for reconnection to the software update host. Lastly, note that the trend analysis conducted involves an investigation of VeriFone only POS device communications.

4. Forecasting Adoption Rates per Banking Institution

This section extends to the trends analysis conducted earlier in Section (3), and provides forecasts on all five banking institutions. Trend lines extended from obtained results in Section (3), indicate a strong inclination on the side of banking institutions to accomplish the projects supporting Receipts Card transactions within 2012. More specifically, ABank's forecast on full adoption is expected by the end of March 2012, see Fig. 14.

BBank's trend analysis indicates the fastest adoption rate compared to the rest banking institutions and can be expected to attain full adoption by end of January 2012, see Fig. 15.

CBank can be expected to reach its full adoption of receipts card application support by mid-March 2012, see Fig. 16.

Moreover, the trend line for EBank indicates the slowest adoption rate among the rest of banking institutions, with the completion forecast being in mid-July 2012.

Finally, the trend for DBank, having the largest POS network compared to the aforementioned institutions, signifies that by the end of April 2012 the adoption projects should be accomplished.

Findings in this section symbolise a particular dedication of Greek banking institutions in fulfilling their commitments towards the Greek government in regard to the adoption of a national receipts card scheme within 2012.

5. Associated Risks with POS Update Rates

This section attempts to identify the risks pertaining to information presented in earlier sections in regard to POS network infrastructures and adoption rates deducted after the examination of POS communications on software updates per bank that apply to specific periods in time.

Effectively risks should be categorised to determine the nature of each risk as different risks have different impact and different probability of occurence. The following areas of concern can be highlighted as the main risks identified and faced in the Receipts Card scheme implementation during the last semester of 2011 and the beginning of 2012.

1. Merchant Site

a. There are certain merchant outlets that operate on a seasonal basis. Such POS devices operate only during specific periods of time throughout the year. Therefore, being aware of the periods a POS device is really active in the field, besides its status in a TMS, is of prime importance since its entire software update progress is based on this valuable piece of information.
b. A certain percentage of the slow adoption rates in software updates can be attributed to risks materialising at the merchant site such as merchants unplugging POS devices from the power plug or telephony line, misuse of POS device.
c. The festive period during the end of December 2011 and early January 2012 meant that the software update process for all banking institutions was bound to be affected by vendors halting their activities on production systems as well as minimising risk due to increased transaction volumes in the POS market.

2. Telecommunications Infrastructure

a. In Greece, dial-up POS devices can attain optimal performance by operating with a specific telecommunications provider. However, there have been numerous cases recorded whereby the merchant has disregarded such a notice and has registered the telephony line to a non-conformant telecommunications provider.
b. In Greece, the POS communications flow from the originating device bidirectionally, to and from the system managing it, is primarily governed by dial-up telecommunications infrastructures. In fact, this means that data exchange rates, up to a point, tend to be conducted on 56K bandwidth analogue line communication protocols.

3. POS Device

a. Ethernet capable POS devices are still very limited in numbers in the Greek POS market.
b. The additional Receipts Card functionality required to be implemented in the industry challenged the already resource limited POS hardware. Therefore, immediate action was required to replace the existing POS device models, which increased risk of not operating according to market requirements, by upgraded POS hardware. Such a massive effort to upgrade POS device models with e.g. low memory capabilities, to device models with higher specifications involving the entire POS industry within Greece, had never occurred in the past at this scale.
c. The POS devices market at any given instance is not up-to-date to the latest software version provided by the POS vendor and approved for deployment by the bank. The fragmentation of POS devices in several software versions means that several upgrade packages had to be developed for a nationwide upgrade. Note, that once a software package is deployed in the market a two-week trial period is necessary to ensure that unexpected behaviour is not produced at any of the merchant sites.

4. TMS

a. In certain cases, TMS versions were not ready in terms of technological prowess to trigger a nationwide software update process for at least 100,000 VeriFone POS devices present in the Greek POS market (Imerisia Daily Newspaper 2011) without any planned upgrades to the TMS environments. The increased dependence on old technologies could potentially have led to a less effective governance model on the software update process.

5. Legal requirements

a. Banking institutions could potentially target software updates for POS devices with large financial transaction volumes and therefore claim a larger share of adoption rates of Receipts Card transactions in the market. However, on a nationwide scheme where all merchants should be equally treated, this phenomenon could lead to merchants with low financial transaction volumes being unethically treated and considered second class citizens.
b. The lack of feasibility studies conducted by the banking institutions due to time constraints on Receipts Card related projects, led to a series of projects commencing with an aim of adopting a Receipts Card oriented agenda but without any basic reference to a pool of data which ought to be available from the feasibility studies and which would assist in early risk identification and project pain areas.
c. Extremely strict time constraints on project schedules meant that there was limited time for POS vendors to assign teams of resources to architect, build and implement solutions that would be in line with specifications set by GSIS. A valid project management plan in the activities leading to the prompt adoption of a nationally coordinated Receipts Card scheme in the POS industry, should have taken into consideration the time POS vendors would require to deliver the newly orchestrated solutions according to GSIS specifications.

6. Conclusions

The POS market is one of the many transaction delivery channels in a typical core banking functional architecture[2]. Yet despite their relatively limited capabilities, POS devices tend to penetrate readily in markets governed by merchant outlets due to several reasons; some of them being due to the compact size of the device, ease-of-use with user interface, collection and redemption of points for merchant collaborative customer loyalty schemes, mobile phone top-up, bill payment, phone card purchase, etc.

The second semester of 2011 signalled a major milestone in raising awareness on the IT infrastructure upgrades necessary for POS devices to deliver increased POS software adoption rates in limited timeframes in regard to the implementation of the Receipts Card scheme required by the Greek government. The results of the research conducted in this paper extrapolate on the reasoning behind slow adoption rates observed in Greek markets and attempt to identify and propose a valid implementation period that such a nationwide initiative would require.

In effect, the trend analysis conducted in section (3) on massive software upgrades in the POS device fleets per banking institution, suggest that the adoption in new requirements from inception to implementation in POS production environments, have a strong correlation with the applied network topology, the POS type predominant in the production field of each of the financial institutions as well as the number of POS devices managed per bank.

Even though the assumption that banking institutions with large POS fleets in production require a greater extent of time for the Receipts Card software update process to be accomplished for the entire fleet, it is praiseworthy that two of the largest Greek banking institutions started the process in October 2011 and started the new year on January 1, 2012 with a considerable updated POS fleet.

However, it seems that the festive period during the end of December 2011 and beginning of January 2012, was not taken into account in terms of banks respecting a vendor imposed 'freeze' period; when any POS production interference or actions leading to massive updates is halted mainly due to the increased shopping traffic and transactional volumes experienced in the markets as well as organisational departments running on 'backbone' staffing.

Moreover, the legal requirement by the Greek government for Greek financial institutions to be ready to conduct Receipts Card transactions by January 1, 2012 lacked clarification as to the circumstances under which it would be considered liable in failing to meet requirements set such as the percentage of POS device adoption expected to be able to conduct such transactions. For instance, it was not certain whether a bank would be held liable for breach of legal requirements had it managed to update by January 1, 2012, the software of 30% of its POS fleet which represented 95% of daily financial transactions or whether it had updated the software of 80% of its fleet which actually corresponded only to 10% of its daily financial transactions. Setting such guidelines was of utter importance for the wider banking community in terms of directing activities that would have attained improved understanding and collaboration towards set targets among project stakeholders i.e. banking institutions, GSIS, POS vendors, service providers of POS vendors. Results in section (4), indicate that all banking institutions which form part of this research should have accomplished a full adoption on the support of receipt card transactions in the POS market by the end of 2012. Therefore, it is evident that a nationwide rollout on compulsory distribution of receipts cards to all Greek citizens for receipts card transactions could indeed be facilitated at the beginning of 2013. However, a major backlash to realising this to all Greek citizens is not possible since in December 2012 only about 60,000 receipt cards had been distributed to citizens in comparison to 50,000 distributed in December 2011. In fact, that is an increase of 16.6% but voluntary demand and adoption of the Receipt Card among citizens is extremely limited.

Finally, it is the authors' belief that financial institutions and POS vendors should collaborate to upgrade the current dial-up driven POS fleets to an Ethernet-driven environment whereby investments are guided by all stakeholders to build and maintain such an infrastructure. In this context, in the future, vendors and banking institutions can initiate such nationwide initiatives with greater certainty as to the extent of success sought in regard to the POS software update process. Of course such initiatives could lead to an increased need of financial investment on the merchant site to enable Ethernet infrastructures, on the banking institution's side to allow TCP/IP parameters updates as well as a refocus of POS vendors' activities in potential gains from building and maintaining such environments for large fleets.

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Figures

Fig. 1 – POS Ethernet communications flow for a vendor IT infrastructure

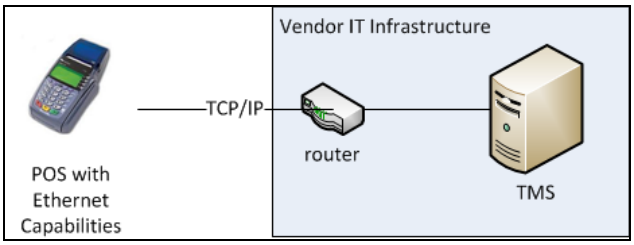

Fig. 2 – POS GPRS communications flow for a vendor IT infrastructure

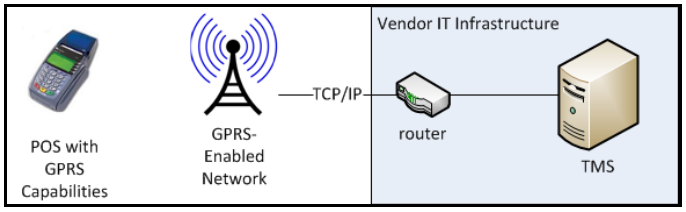

Fig. 3 – POS dial-up and GPRS communications flow for ABank IT infrastructure

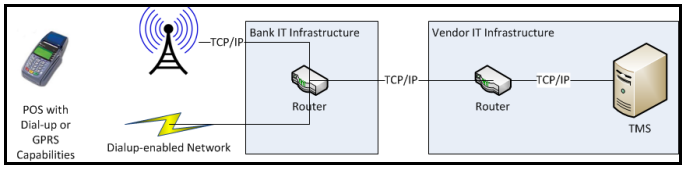

Fig. 4 – POS BBank communications flow for BBank IT infrastructure

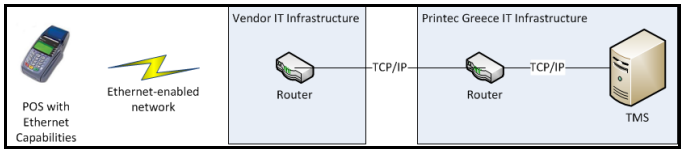

Fig. 5 – POS dial-up communications flow for CBank IT infrastructure

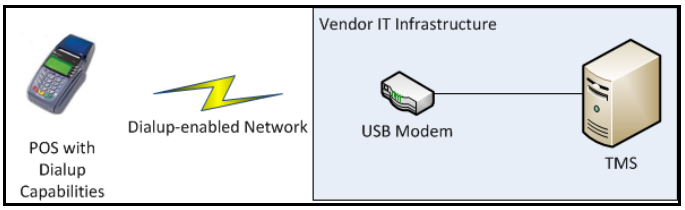

Fig. 6 – POS dial-up communications flow for DBank IT infrastructure

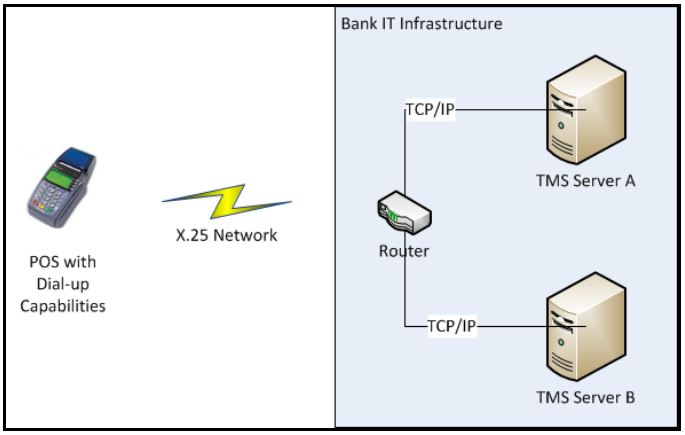

Fig. 7 – POS dial-up communications flow for EBank IT infrastructure

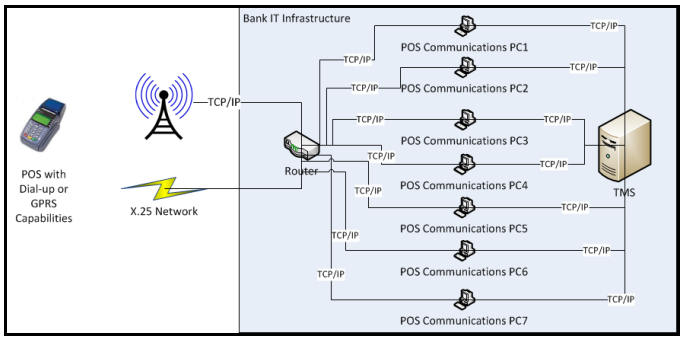

Fig. 8 - ABank cumulative POS communications (13/12/2011 - 31/01/2012)

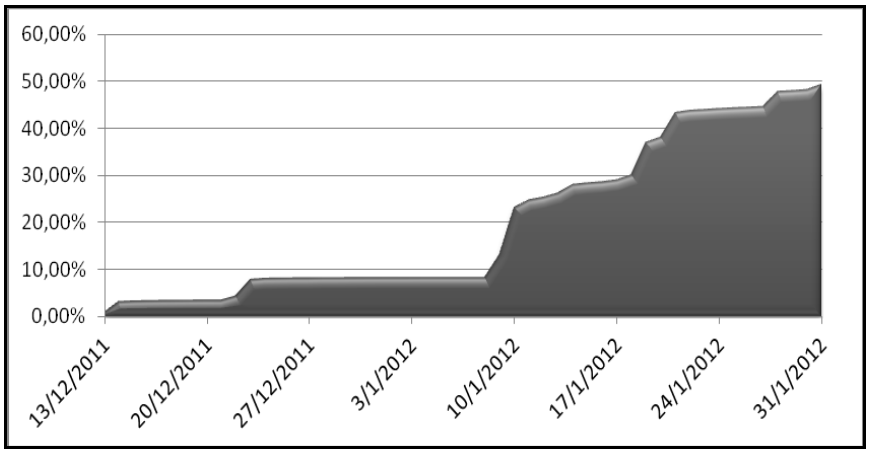

Fig. 9 - BBank cumulative POS communications (13/12/2011 - 31/01/2012)

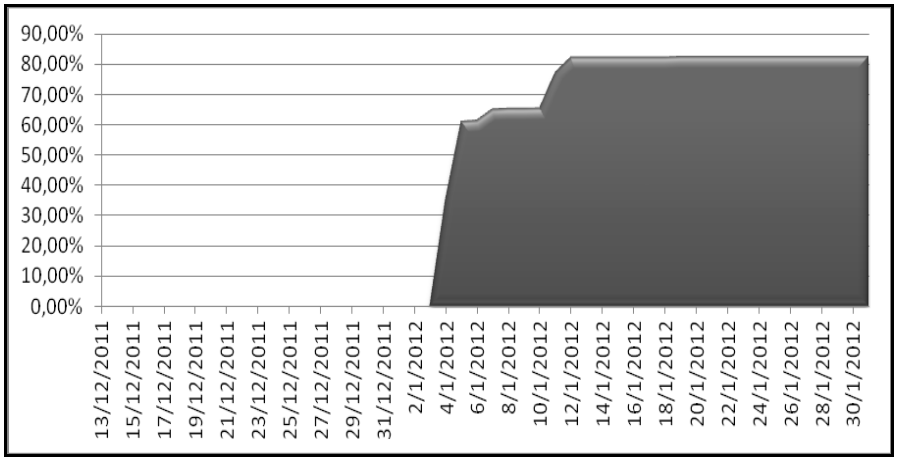

Fig. 10 - CBank cumulative POS communications (13/12/2011 - 31/01/2012)

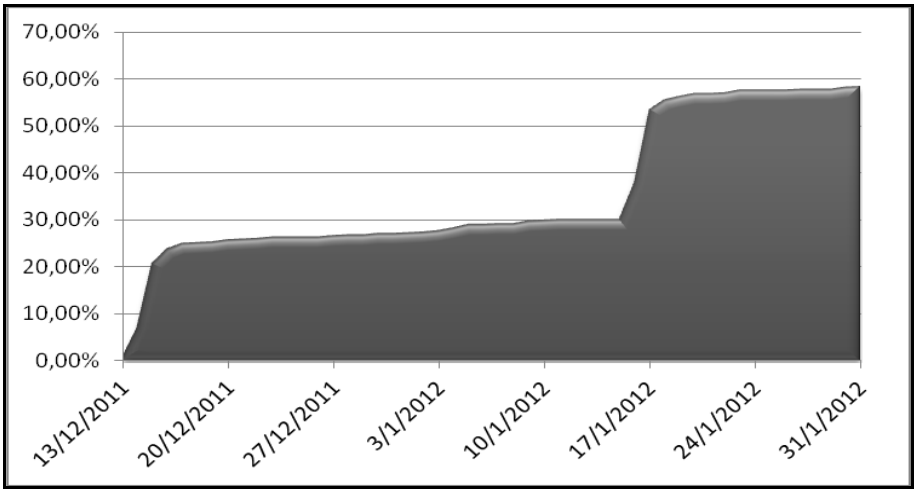

Fig. 11 - DBank cumulative POS communications (01/09/2011 - 31/01/2012)

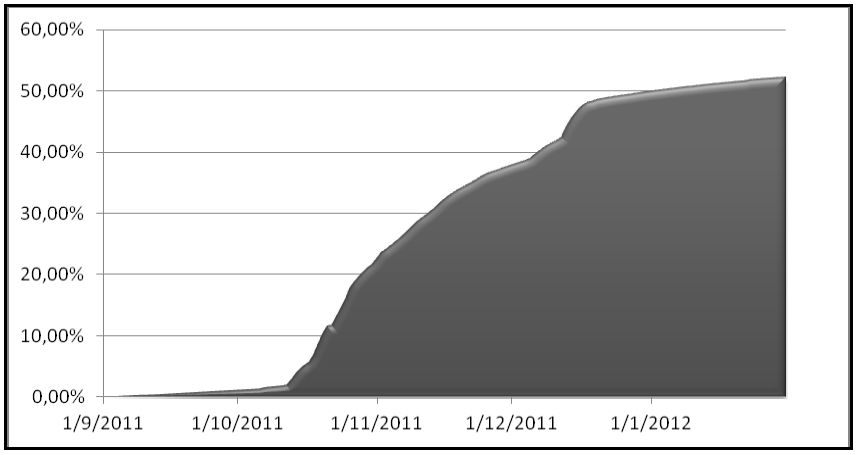

Fig. 12 – EBank cumulative POS communications (01/09/2011 - 31/01/2012)

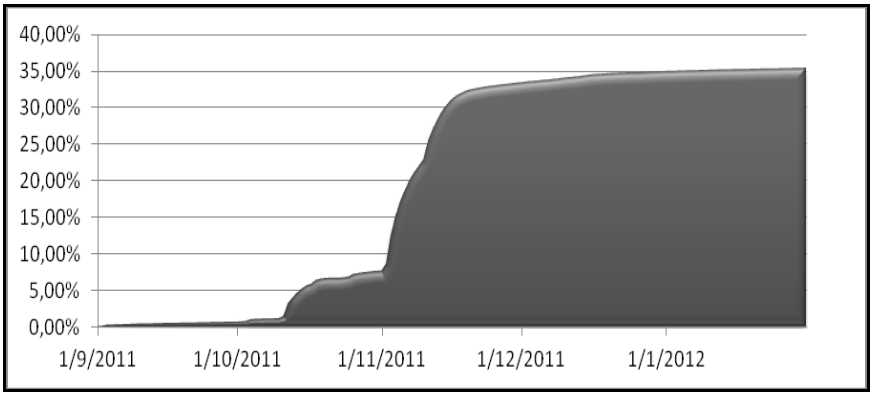

Fig. 13 – Collection of cumulative POS communications per banking institution (01/09/2011 - 31/01/2012)

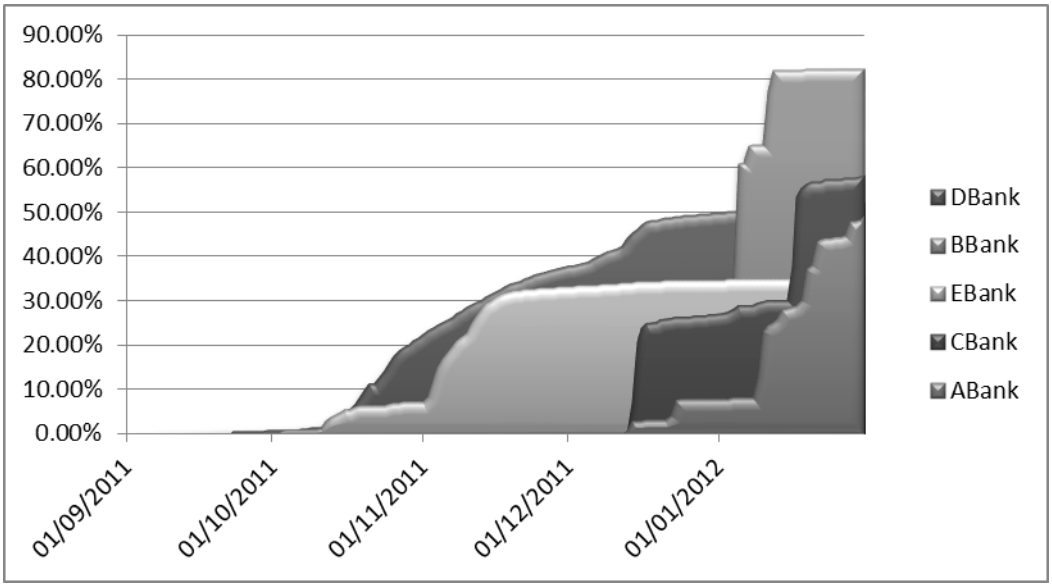

Fig. 14 – ABank Forecast for Full Adoption of Receipts Card Application Support

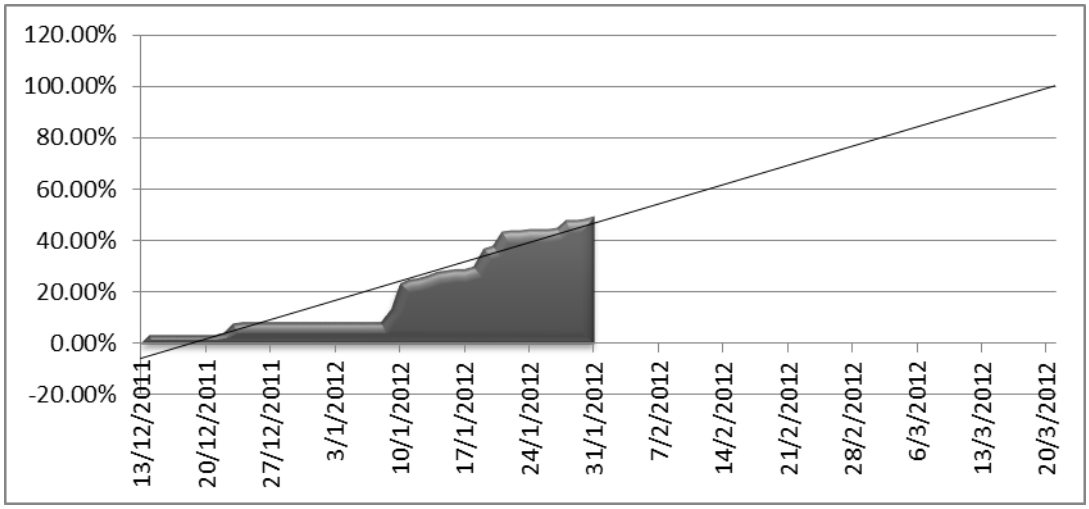

Fig. 15 – BBank Forecast for Full Adoption of Receipts Card Application Support

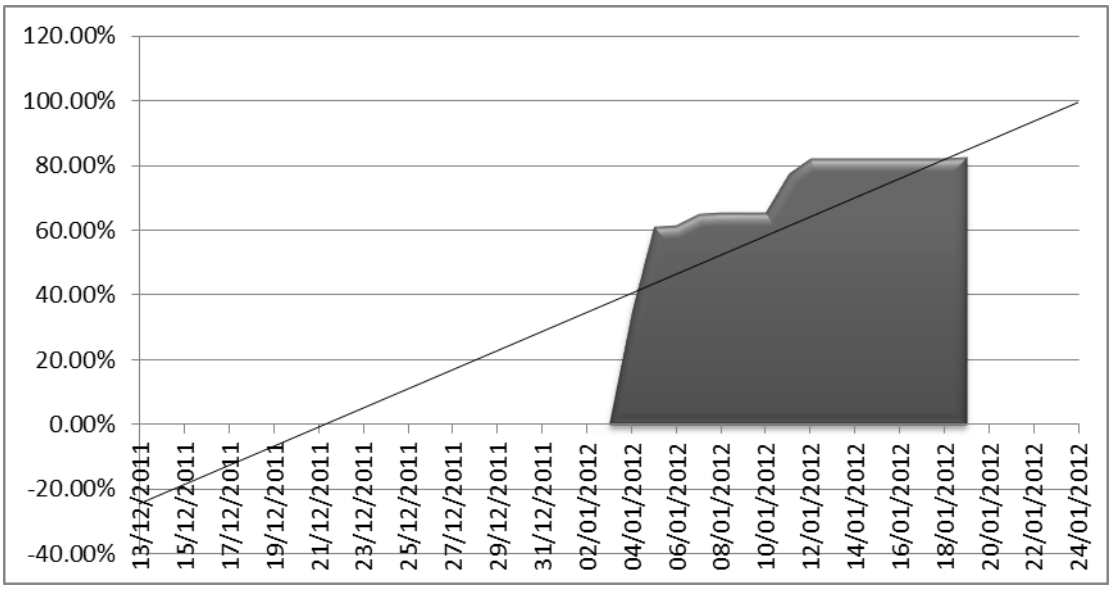

Fig. 16 – CBank Forecast for Full Adoption of Receipts Card Application Support

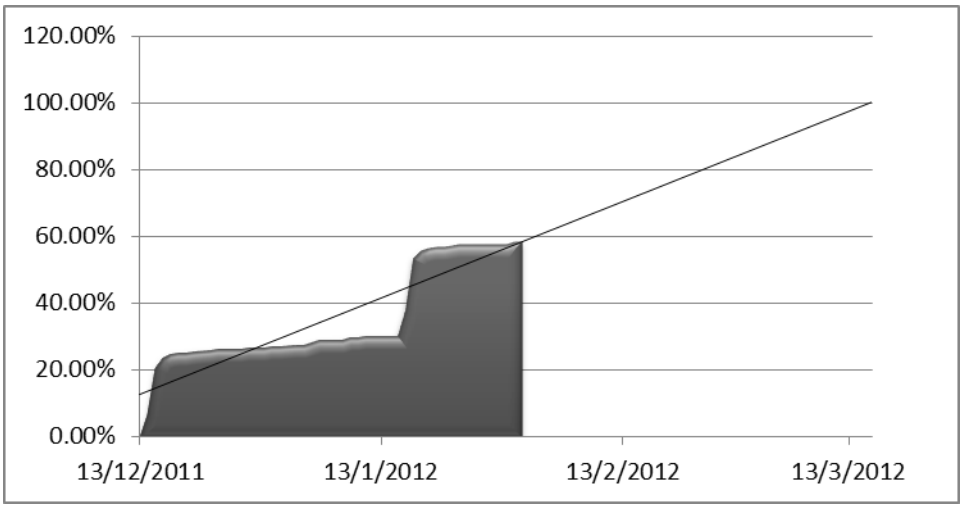

Fig. 17 – EBank Forecast for Full Adoption of Receipts Card Application Support

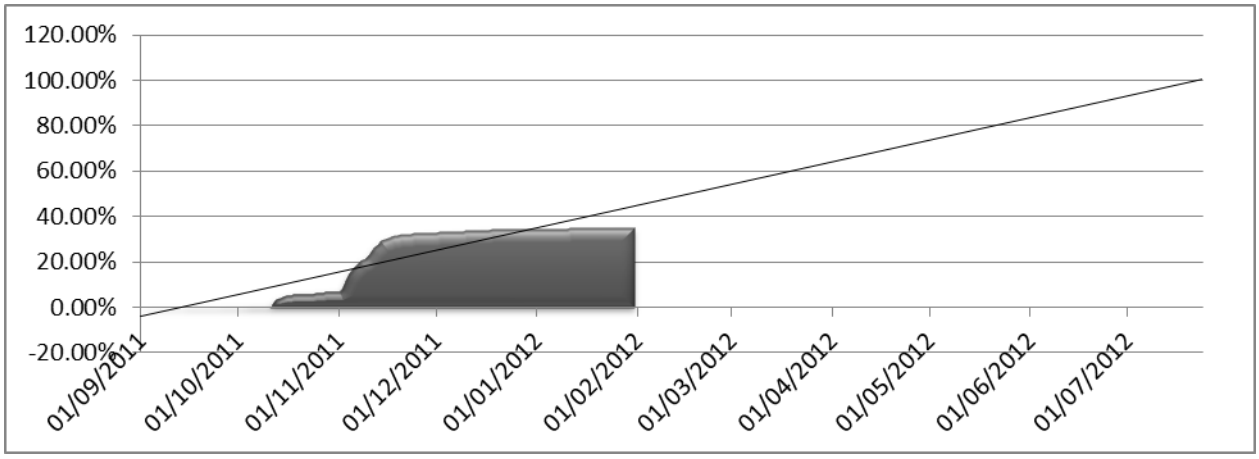

Fig. 18 – DBank Forecast for Full Adoption of Receipts Card Application Support