RISE OF SMART PAYMENTS

MAPPING THE GLOBAL FUTURE OF PAYMENTS

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CSC Papers 2014

ABSTRACT

"Do not be afraid of confrontation ... Even the planets collide and from chaos the stars are born."
— Charlie Chaplin

"The battle for the future of mobile money really took off – and, because the opportunity lies at the meeting point of mobile phones with banking, payments, retailing, media and analytics – the stakes are high."
— Visa Europe Annual Report 2012, Business review, CEO's foreword

The payments sector was considered structured, stable and steady, but in the last couple of years it suddenly attracted investment and flourished with innovations. We are witnessing a new Gold Rush era in payments. It's estimated that between 2010 through to mid-2011, more than 700 companies brought about USD $3.4 billion in funding for innovations related to the payments sector [27]. The annual research & development funds of Samsung are USD $8.2 Billion, Google USD $4.8 billion, Apple USD $2.5 billion. [62] Meanwhile, financial institutions are keeping pace with new entrants. They are actually spending more on IT than any other industry. [78] 7.3% of the revenues goes into information systems against 3.7% in other industries. But is this money well invested to be on the front row of future banking? That's a question we'll be addressing in this paper.

A true economical war is upon us. Fierce battles of innovation are already taking place and shaping the future of payments. The advent of Internet allowed for the creation of virtual markets and the rise of electronic commerce. The deployment of mobile phones and smartphones, which combine the power of Internet and telecommunication means, are introducing fascinating new ways of making transactions.

The technological innovations are bypassing the systematic structuring measures taken around card schemes. Europay Mastercard Visa (EMV) with smartcard chip-and-pin security measures, in addition to the panel of 3D Secure norm and Payment Card Industry (PCI) standards such as PCI DSS, haven't been globally deployed and have already become insufficient to cover the needs of keeping pace with the new payments innovations.

This Paper will assess mobile payments (m-payments), contactless payments, smartphones payments with diverse technologies, biometric security, the advent of virtual currencies such as Bitcoins, new transformation of smartphones into card acceptance terminals, etc. In addition to all those innovations, the competition between Payment Service Providers and Banks is starting to create a motion towards innovative inter-banking schemes that would allow for better reachability, improved porting, and stronger control of fraud rates.

This paper takes also on the challenge of mapping the global payments innovations and attempts to help forecast the future of payments, or at least bring an educated guess to the Rise of Smart Payments.

Keywords: Payments, smart payments, ewallet, virtual currency, biometric, fraud, contactless, BLE, BYOAD, mobile banking

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CHAPTER 1 — MAPPING GLOBAL PAYMENTS

1.1 FORECASTING METHODOLOGY

In order to make an educated guess about the future of the payments industry for the next 10 years, this paper is inspired by 5 scientific methods. It starts by mapping the industry's landscape, modeling its dynamics and constituting future scenarios. It then applyies game theory to the model and sorts the scenarios using a probabilistic approach. This scientific methodology sets the solid basis in order to reach credible results.

1.1.1 MAPPING PAYMENTS GLOBAL LANDSCAPE

In order to create a model of the payments sector, we need first to map the space and time in which it's evolving and identify the landmarks and obstacles that the terrain possesses. This also means identifying the actors, the markets, etc., in a basic learning process that leads to a correct understanding of the market and its fragmentation.

1.1.2 PAYMENT INNOVATIONS

This approach allows us to understand the industry's dynamics. In order to complete and animate the big picture, we need to analyze the relations between the payments actors and the interactions between the industry's markets.

In addition, this paper collects information about the state of the art in payment technologies that are shaping the future. The elimination process will allow us to suppress the innovations that are not viable by demonstrating the reasons to the reader.

1.1.3 STRAIGHT-LINE PROJECTIONS

As a basic statistical method, projections might be interesting to give certain trends in the near future, but they are not a reliable method in a changing environment. They ignore logical new events or thresholds that will make changes in the trends.

The prediction report of the US National Intelligence Council about "Mapping the Global Future" at 2020 from 2004 notes that "While straight-line projections are useful in establishing a baseline and positing a mainline scenario, they typically present a one-dimensional view of how the future might unfold." [23]

1.1.4 IDENTIFYING FICTIONAL FUTURE SCENARIOS

This study constructs scenarios based on a probable series of events applied against the model of the industry. This method is inspired from the US National Intelligence Council attempt in 2004 of "*Mapping the Global Future"* in the year 2020. Identifying and developing fictional future scenarios offers *"a more dynamic view of possible futures and focus attention on the underlying interactions that may have particular policy significance. They are especially useful in thinking about the future during times of great uncertainty, which we believe is the case for the next 15 years*". This statement applies also to the current era of the payments industry.

1.1.5 GAME THEORY

In order to build a scenario based on possible events and market actions, Game Theory is useful in determining the equilibrium scenario given certain circumstances.

Game Theory is a "branch of applied mathematics that provides tools for analyzing situations in which parties, called players, make decisions that are interdependent. This interdependence causes each player to consider the other player's possible decisions, or strategies, in formulating his own strategy. A solution to a game describes the optimal decisions of the players, who may have similar, opposed, or mixed interests and the outcomes that may result from these decisions." [24]

1.1.6 TOWARDS A PROBABILISTIC APPROACH OF THE FUTURE

Finally, in order to sort the sequence of events and complete credible scenarios, the probabilistic approach is very handy. The scenario's development process can articulate for us the possible outcomes of a dynamic system, which is essential to identify the future possibilities. But when there are many possibilities of progress for several sub-domains in payments, the compilations of all possible global outcomes can become quickly very large (like a mathematical operation such as factorial, arrangement or combination).

A probabilistic approach can help us reduce the range of our forecast by estimating the likelihood of each event and then of each scenario.

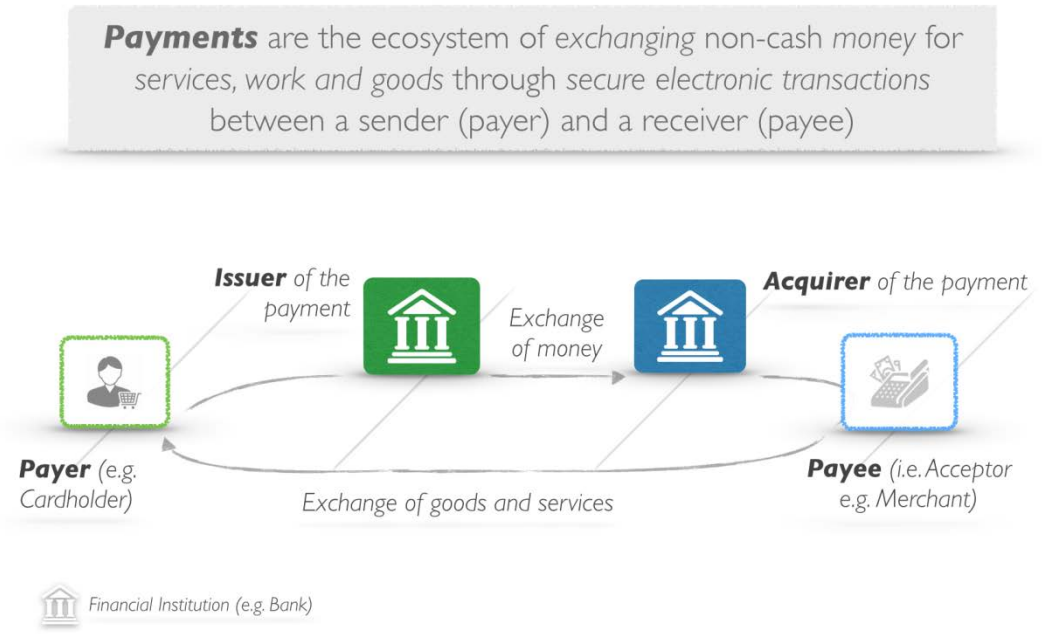
1.2 MAPPING OF THE GLOBAL PAYMENTS LANDSCAPE

This paragraph presents a mapping of the Global Payments Landscape up to the end of 2013. We'll try to produce in the following paragraphs a snapshot of the current situation in order to be able later to animate it in a motion picture depending on several potential scenarios.

1.2.1 WHAT ARE PAYMENTS?

The global payments industry can be defined today as the worldwide ecosystem of exchanging non-cash money for services, work and goods through secure electronic transactions.

The "non-cash" characteristic restricts the payments industry to fully electronic transactions, excluding thus untraceable point-to-point payments using physical notes or coins. The reason for this restriction is a convention to target "modern" payments providing full traceability of a given transaction. For example, checks and cards are part of the payments industry, while banknotes and coins are excluded by definition.



1.2.2 PAYMENTS INDUSTRY ROLE-BASED ACTORS MODEL

The payments industry can be mapped through a role-based Actors model. The four main payments actors are: the **Payer** (*e.g.,* cardholder) and the **Payee** (*i.e.,* Acceptor, *e.g.,* merchant) backed by their own financial institutions, and the **Issuer** and the **Acquirer** (*e.g.,* a bank issuing the payment or acquiring it). The Regulators and Payment Service Providers (PSP) are the complementary key actors controlling and executing payments.

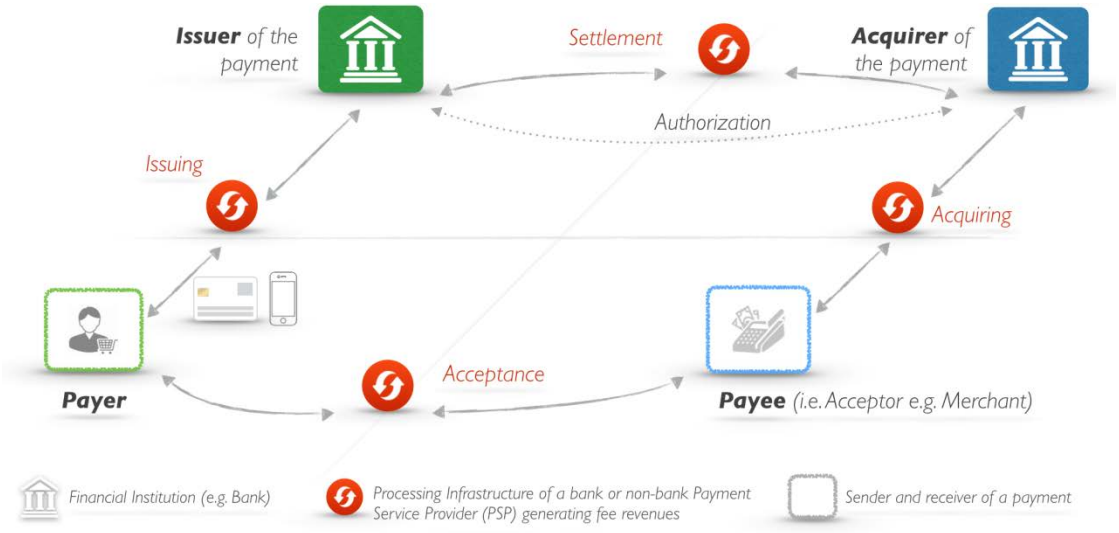
The *Issuer* in payments is the financial institution that directly supplies the *Payer* with payment services by releasing branded payment products associated with his account, *e.g.,* issuing a credit card, branded by Visa or MasterCard, of premium class services. The name is derived from the fact that it issues payment to the acquiring bank on behalf of its customer (the purchaser in the transaction).

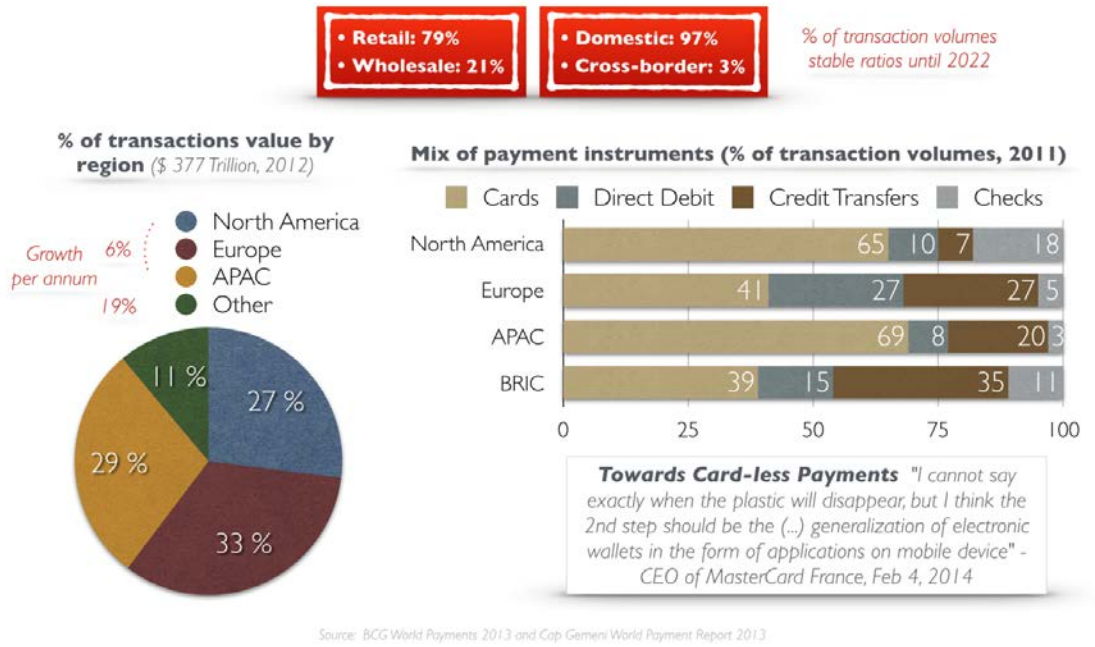
The Issuer guarantees the payment to both the Acquirer and the Payee (acceptor). He offers added-value services to the payer (traditionally the cardholder) *e.g.,* professional cards, credit cards, debit cards, premium services, and e-banking services such as e-mandates can be considered in the issuing perimeter.

The acquirer (traditionally the merchant's bank) is the payments actor that allows crediting or assimilated actions of money for the payee by exchanging data with the payer's bank, called the issuer. [2]

The acquirer offers services to both the payer and the payee. Payments' acquisition is becoming a strategically valuable domain of the payments value chain. It empowers the payee to accept a payment, according to the client's choice, over several instruments such as Self Service Terminals (SST) *e.g.,* automated teller machines (ATM), electronic payment terminals, cards or direct debits, ecommerce payment gateways, e-wallets, and now over smartphones in the case of Bring Your Own Acceptance Device (BYOAD). It provides also the payee with essential services such as guaranteed payments, fraud prevention, currency exchange, analytics, etc. The payer can enjoy a richer buying experience, thus facilitating the purchase act using the utility and channel of his choice.

In a traditional four-party pattern, a transaction flows between the consumer/payer, the merchant, the acquirer and the issuer. This is the model followed by card schemes (*e.g.,* Visa, MasterCard, etc.). Sometimes the acquirer is also the issuer, such as in the traditional model of American Express and Discover, where the model becomes a three-party pattern. Unlike the four-party pattern, a three-party pattern of card networks is not based on a bank-member structure but, rather, operate independently, dis-intermediating the relationship with the cardholder as his issuer and the merchant as his acquirer. In practice, the payers' or the merchant's financial institution often contract with third party financial institutions to outsource part of all the functions associated with merchant-acquiring services.





1.2.3 MEASURING PAYMENTS - METRICS AND ECONOMICS

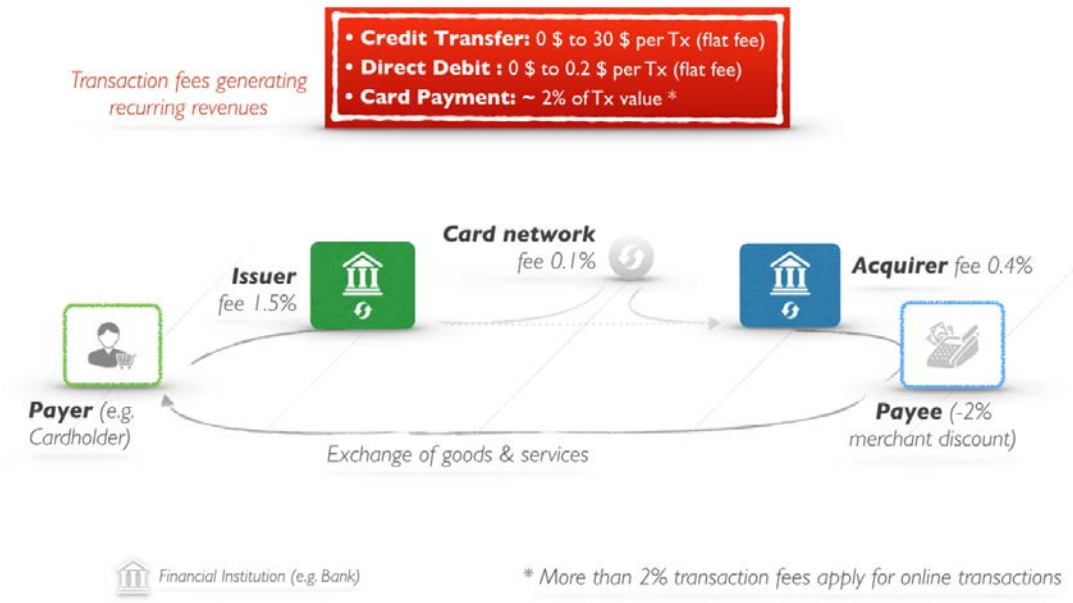
The size of the global payments market is too large and too important not to be studied thoroughly and scientifically. The vitality of the payments industry can be evaluated using the following metrics: ***volumes***, ***values***, ***revenues*** and ***fraud rates***.

The revenues in the payments industry to all market participants are today mainly accumulated through transaction processing fees. These fees are growing faster than overall banking revenues and they will almost double in the next 10 years. In 2012, the global payments market totaled a **volume** of 364 billion transactions processing USD $377 trillion in **value** and generating USD $524 billion in **revenues**, with USD $6.6 billion of **fraud**. In 2022, it's forecasted that volumes will reach 722 billion transactions of USD $712 trillion in value, USD $1.14 trillion in revenues and USD $23.6 billion of fraud. See 1.3.8, [85] and [86].

	Volumes (Tx)	Values	Revenues	Fraud
2012	370 Billion	$ 377 Trillion	$ 0.5 Trillion	$ 6.6 Billion
2022	722 Billion	$ 712 Trillion	$ 1.1 Trillion	$ 23.6 Billion

In addition to revenues from providing services and installing terminals and hotlines, financial institutions and PSPs generate revenues from processing transactions for a fee. From the merchant point of view it's called the ***merchant discount*** and on average is around 1.5 to 3.5 % of the payment value. This fee varies depending on the channel used for payment, the amount, the merchant size and situation with the bank, whether it's a smartcard vicinity transaction or a less secure online card payment, etc.

In general, the merchant discount can be broken down into three fees (issuer, network and acquirer): for example, when a payer is debited by USD $100 the consumer-to-business (C2B) payee is credited by USD $98 while USD $1.50 is paid to the issuer through interchange fees defined by the network; then USD $0.10 goes to the payment network (like Visa or MasterCard), and finally USD $0.40 goes to the acquirer, who remits to the merchant the remaining USD $98 with a *merchant discount* rate of 2% (rate charged to the merchant).



1.3 DYNAMICS OF THE PAYMENTS INDUSTRY MODEL

1.3.1 INTERNET PENETRATION

In 2012, the world population exceeded **7.012 billion humans** [1]. The United Nations estimates that the world population will reach 7.284 billion in 2015 and 7.656 billion in 2020 (medium variant scenario) [26].

A comparative statistic estimated that the electric grid covers 80% of the global population, while the wireless grid already reaches 85% of humans around the globe [31]. The noble endeavor of connecting and bringing all people to the information age is accelerating but is still far from accomplished. This constitutes an important impact on the progress of the electronic age of money as demonstrated below.

The penetration of Internet worldwide increased from 360,985,492 Internet users in 2000 to **about 2.405 billion internet users in 2012**, an increase of 566.4%. This corresponds to an Internet penetration rate of only 34.3% of the world population. [1]

A different source estimates the penetration rate today to be 39%, corresponding to 2.793 billion Internet users in 2013. [74] [75]

The penetration rate is growing strongly in Asia (841.9% increase between 2000 and 2012). Some 1.077 billion out of 3.922 billion Asians are now connected with Internet. This is excluding the Middle East countries, where the growth of the Internet penetration in the same period is 2,639.9 % for a population of 223.61 million.

The same applies for Africa, which witnessed an exponential growth of Internet users of 3,606.7% between 2000 and 2012. Some 167.33 million out of 1.07 billion Africans are today connected to the Internet.

If we consider a straight-line projection we find out that the number of Internet users can reach **3.296 billion in 2015 and 4.630 billion in 2020**. These estimations are computed taking into account population increase, but do not account for the democratization of smartphones (mobile generated 13% of Internet traffic in 2012 [2]). They are given only in order to set future guidelines.

To update these figures we need to account for PC and tablet growth rates and especially of their adoption in emerging countries. Gartner estimates “More than 1 Billion PCs in Use Worldwide and Headed to 2 Billion Units by 2014 (…) we expect emerging markets to account for approximately 70% of the next Billion installed PCs.” [32].

1.3.2 MOBILE PENETRATION

In 2012 there were about 5 billion mobile phone owners out of 6.7 billion mobile subscriptions. [2] This corresponds to a mobile **penetration rate of 71.2%** of world population. The current ratio of mobile owners to subscriptions is 74.63%.

The recent research *Mobile Factbook* (April 2012) forecasted that mobile subscriptions will reach 7.696 billion in 2015. [25] By projection, mobile subscriptions could bypass 9 billion in 2020. But the *Mobile Factbook* considered wrongly that the Mobile Penetration rate will bypass 100% in 2014, mistaking the number of subscriptions with the number of mobile owners. In addition, their estimations didn’t take into account the potential changes in mobile technologies and how the subscriptions might evolve. This paper only retained their estimation of the subscriptions growth.

If we apply the current ratio of owners (74.63%) to the base of subscriptions we find out that the number of mobile owners out of the projected population can reach: **5.743 billion mobile owners in 2015** out of 7.284 billion and **6.72 billion mobile owners in 2020** out of 7.656 billion. These correspond to the mobile penetration rates of 78.84% and 87.77% respectively.

1.3.3 SMARTPHONE PENETRATION

In the end of **2012 there were 1.1 billion smartphone owners** and 1.3 billion smartphones in use worldwide [2]; the smartphone penetration rate in the world population was 15.69%. A different source estimates that there were 1.556 billion mobile broadband subscriptions in 2012 (which includes 3G USB keys in addition to smartphone subscriptions). [76]

Let’s call *replacement-rate* the frequency of the renewal of feature phones to smartphones.

The first important driver of mobile growth is the sturdy competition between smartphone constructors. This growth driver brings down prices and increases the rich functionalities of feature phones as well as smartphones, and might have an important impact on our future scenarios, especially with the potential advent of low-cost smartphones.

The second growth driver is the cost per megabyte, which plummeted from USD $0.46 in 2008 to an estimated USD $0.01 in 2015. [25] In Africa a new low-cost smartphone Yolo, developed with Safaricom, started in Kenya in 2013 at USD $125 [2]; such low-cost products might accelerate the mobile penetration rates as well as the *replacement rates*.

Annual smartphone shipments reached 420.3 million in 2011 and overtook PC shipments. [28] More than 549 million smartphones were shipped worldwide in 2012 (an increase of 10.1% on 2011). [2] [26] Note that 50% of the current 1.1 billion smartphones were deployed in a single year (2012). By straight-line projection we learn that smartphone shipments can be expected to reach 909.3 million in 2015 and 1.586 billion in 2020.

Until Q3 2013, cumulative iPhone sales reached about 400 million devices (98% of them are in use). [80] Since the announcement of the iPhone 5S and 5C in September 2013, Apple crushed expectations by selling 9 million new iPhones in the first 2 days alone. [79] Total cumulative iOS users (iPhone, iPad and iPod) are quickly bypassing 700 million devices during Q4 2013. [81] This is to be compared to 1 billion Android devices worldwide over the same period (500 million new users in on year). [82]

A recent study by ABI Research estimated the global distribution of smartphone operating systems for the end of 2013 to reach 1.4 billion devices (excluding tablets 3G and WIFI): 798 million Android

smartphones, 294 million iPhones with iOS, and 45 million Windows Phones. [83] These figures correspond to our estimations (relatively low to average scenario).

Based on the **accumulated smartphone shipments** from [25] and by projection, smartphones in use worldwide can reach 3.812 billion smartphones in 2015 and 10.388 billion smartphones in 2020. Part of them accounts for the *replacement-rate* of feature mobiles, another part accounts for the mobile penetration rate increase, and another part for renewal of part of the smartphones' old park.

Smartphone penetration has already exceeded 70% of the population in many developed countries (Euromonitor *Smartphone Penetration report, 27 September 2012*) [27] and smartphones' share of mobiles park will become 78% in 2016 [29]; that is more than 4.49 billion smartphone holders, but this estimation can be calculated more accurately, as this paper will demonstrate.

Given the ratio 74.63% of holders versus subscriptions, and given our estimations that global mobile subscriptions might reach 7.696 billion in 2015 and bypass 9 billion subscribers in 2020, we can estimate that smartphone holders might reach **5.74 billion smartphone owners in 2015 and 6.72 billion smartphone owners in 2020**. (These approximations are calculated in order to give a baseline for the future. They do not take into account different scenarios of new innovations and events.)

1.3.4 MOBILE PAYMENT PENETRATION

Despite its current limited success, few doubt that m-payment can become an alternative for cash and check. [25] The limited success of m-payments is due to several obstacles: lack of a scalable and viable business model, lack of standards, and fragmented and incompatible commercial efforts that are competing and mutually exclusive.

Worldwide mobile payment users were about 141.1 million in 2011, a 38.2% increase from 2010. Worldwide mobile payment volume in 2011 is estimated to be USD $86.1 billion, up 75.9% from 2010. [21]

Users worldwide will reach 245.2 million in 2013, up from 200.8 million in 2012. Transaction values will attain USD $235.4 billion in 2013, increasing by 44% from USD $163.1 billion in 2012. Gartner is "forecasting a market worth $721 billion with more than 450 million users by 2017." [37]

Based on a different source (*Portio Research*), there were 158.1 million users in 2011 and an expected 684.3 million mobile payment users in 2015. [25] By projection, the number reaches 3.985 billion mobile payment users in 2020.

But first, these estimates do not account for application store purchases of smartphones. Most smartphone downloaded applications are free of charge. The average price for the top 100 iOS non-free apps is just USD $1.4731. Strategy Analytics suggests that the average spending per smartphone app will fall to USD $0.0832 by 2017. [29]

Second, the prior assessments of m-payment users are baseline projections and do not take into account any innovation scenario in mobile payments, and therefore we maintain the more accurate projections mentioned earlier and based on [28].

An estimate from our prior evaluations of smartphone owners is about 5.74 billion in 2015 and 6.72 billion in 2020. Higher ratios of these figures can become m-payment users depending on certain innovation scenarios. For example, 4 out of 5 users of smartphones use them for shopping in the US.

1.3.5 CARD PENETRATION

Estimates show that cards in use worldwide exceeded 8.0 billion cards in 2010 and are projected to become 10.1 billion by 2015. [5] The true payment cards penetration rate should be computed based

on the number of cardholders out of the count of cards owned and in circulation worldwide. This paper tries to estimate this rate based on several sources.

China's UnionPay became the largest payment card scheme in the world with around 2.4 billion cards supplied in 2010, which represents a 29.2% market share. [5] But **Chinese cardholders are estimated to number about 1 billion** between 2005 and 2013 [6] out of the 1.344 billion Chinese. That's a payments card penetration rate of 74.4% of the Chinese population.

We note that the annual rate of payment cards issuance is slightly decreasing in mature regions (especially in North America and the European Union). [5] The European Central Bank reported that the number of cards issued decreased from 727.163 million cards in 2010 to 726.572 million cards in 2011. [8] But the ECB report mistook that there are 1.44 payment cards per EU inhabitant. [9] This is irrelevant because it implies that cards' penetration is above 100%. Actually in 2012, Visa Europe estimated that 83% of the Europeans own a payment card. [7] **That is about 681,362,310 cardholders** out of 820,918,446 Europeans (2012).

In the US the Census Bureau (Federal Reserve) estimated that 1.4 billion payment cards were in circulation in 2011 and that **there are 181 million cardholders** out of the 311 million Americans, with an average of 7.7 cards per cardholder. [10] We conclude that cards' penetration in the US was around 58.2% in 2011.

In India, only about 2% of the population owns a payment card. [11] That's about **24.82 million Cardholders** out of the 1.241 billion Indians (2011 population census, Wikipedia 2013).

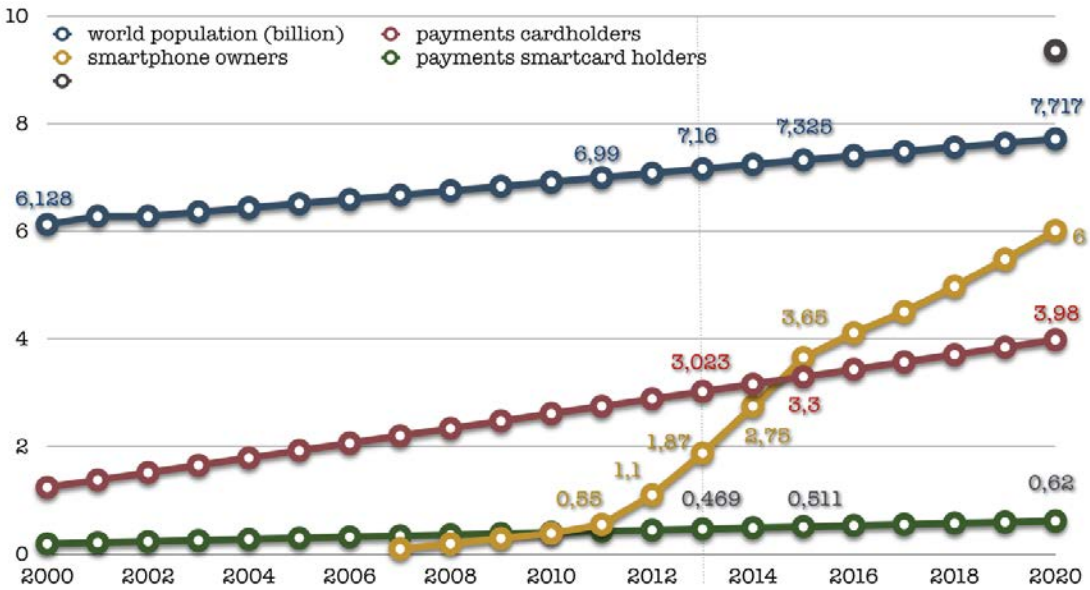
In Africa, where the population is about 1.073 billion, only about 50 million Africans have actual bank accounts. Credit card penetration remains very low in Africa, where 95% of the population relies on cash-based transactions. [12] Based on these figures, cardholder penetration in Africa is around **43 million cards** or about 4% of Africans. In South Africa, cards' penetration is much higher at 16.5% of the population in 2008 (with 43.2 million cards in 2011, Euromonitor International).

Brazil is the world's second largest payment card market, with 687 million payment cards in circulation [14] for the 196.7 million Brazilians (2011). The number of cards went from 171.6 million to around 195 million by 2013. [13] The payments card penetration rate in Brazil can be estimated around 93%.

For a population of about 5.184 billion (Europe, US, Africa, China, India, Brazil) payment cards penetration is about 2.113 billion cardholders, which is roughly 41%. **Therefore we can extrapolate that the worldwide number of cardholders is about 2.8 billion cardholders in 2012** out of the 8.8 billion cards in use (ratio of 32.6%)**.**

How many smartcards are there out of the 8.0 billion cards in 2010 and the projected 10.1 billion by 2015? There are more than 1.24 billion smartcards in 2010 around the world [40] and therefore there are about 15.5% smartcards out of the payment cards. Straight-line projection gives 1.56 billion smartcards in 2015, but the current circumstances of EMV implementations in the US and abroad may push for higher growth.

Certain regions such as the Eurozone might discontinue the practice of accepting magnetic-stripe cards. The European Payments Council (EPC) announced in 2009 that it might ban magnetic stripe cards within the next couple of years due to fraud rates and compatibility issues. [40]



Comparative Penetration Rate of the number of cardholders, smartcard holders and smartphone holders. (Source: CSC)

1.3.6 PAYMENT TERMINALS DEPLOYMENT

In the European Union, the European Central Bank accounted for **437,400 ATMs** for the 502,908,915 EU citizens in 2011 (stable number, +0.94% per year). This corresponds to 869.74 ATMs per million inhabitants. [8]

The European Central Bank also accounted for **8,843,290 payment terminals** for the 502,908,915 EU citizens in 2011 (+3.24% after a slight decrease in 2010). This corresponds to 17,584 payment terminals per million inhabitants. [8]

In Australia there are more than **707,000 payment terminals** and more than **28,000 ATMs** (2011) [15]. In the beginning of 2012 there were 751,097 point-of-sale (POS) terminals and 30,841 ATMs. [19]

In the US, end of 2009, ATMs numbered 425,000 and POS terminals more than 5,175,500. [19] By crossing the information between several sources [18] we can estimate at 6.6 million the number of payment terminals in the US for 2011. The Nilson Report provides a much higher estimation at 15 million POS terminals. [40] The ATM counts can be considered globally stable.

By compiling the number of ATM and payment terminals in China, Turkey, Russia, Japan, Mexico, Korea, India, Brazil, Canada, South Africa [19] with the above mentioned figures, we can extrapolate the terminals' worldwide deployment to be **about 2.9 million ATM** and **payment terminals ranging between 36 million to 46 million terminals**, out of which only 18.74 million accepted smart chip cards in 2011. [40]

During 2012, Ingenico had a park of 15 million terminals distributed across 125 countries. [16] In one year this number jumped to **20 million terminals deployed worldwide** with 40% of the newly sold terminals equipped and activated for contactless payments. [17] That is 2 million terminals in 2012 equipped for EMV contact and contactless cards that should be accounted for in the replacement-rate of terminals. Taking into account Ingenico's competitors' figures, the number of new generation terminals can be above 21 million EMV terminals worldwide.

1.3.7 NUMBERS AND VALUES OF TRANSACTIONS

Estimates show that the number of non-cash transactions in 2010 were: 81.4 billion in Europe, 116.6 billion in North America, 27.1 billion in mature APAC and 33.1 billion in BRIC. Worldwide estimation for 2011 adds up to **283 billion non-cash transactions**, up from 283 billion in 2010 and estimated to reach 306 billion in 2011. [20]

Transactions global value rose by 22% between 2010 and 2011 to reach **USD $4.6 trillion** by the end of September 2011. [20]

Based on the above, a straight line projection shows that the numbers might **reach 384 billion** non-cash transactions in 2015 and **486 billion** non-cash transactions in 2020.

The corresponding amounts rocket to USD $10.2 trillion in 2015 and USD $27.5 trillion in 2020. Based on medium growth we find USD $8.6 trillion in 2015 and USD $13.7 trillion in 2020. In another estimation based on [22] we find **€9.4 trillion in 2015 and €11.9 trillion in 2020**.

Check-based transactions accounted for 35.7 billion operations out of the 306 billion non-cash transactions; thus there were about 270.3 billion electronic transactions in 2011.

In ecommerce, *e*-payment transactions were estimated to be 22.5 billion transactions in 2010, and 28.3 billion in 2011. [20] That's 9.25% of non-cash transactions and 10.47% of electronic transactions in 2011. The forecast for 2013 was 31.4 billion e-payment transactions (growth of 20.0% a year in 2009-13). The aggregate value of global e-payments was €824 billion in 2010 and was expected to reach €1.4 trillion in 2013. [20]

Also in ecommerce, *m*-payments accounted for 7 billion transactions in 2011 and a forecasted 17 billion transactions in 2013. [20] The number of m-payment transactions is expected to grow 48.8% per year.

In values, global m-payments reached €62 billion in 2010, and are expected to grow annually by 52.3% from 2009 to 2013, putting global m-payments at €223 billion. [20] [22]

Other sources show for the end of 2011 that in the Eurozone, there were €274.2 billion (non-MFI), and for e-money: €1.740 billion on card-based products and €0.919 billion on software- or network-based products. [19]

Gartner says, "We expect global mobile transaction volume and value to average 35% annual growth between 2012 and 2017, and we are forecasting a market worth $721 billion with more than 450 million users by 2017." [35]

1.3.8 SECURITY AND FRAUD RATES

"Fraud is like a balloon – if you squeeze it out of one scheme, or one country, it bulges somewhere else" — Martin Warwick, FICO's fraud chief for Europe

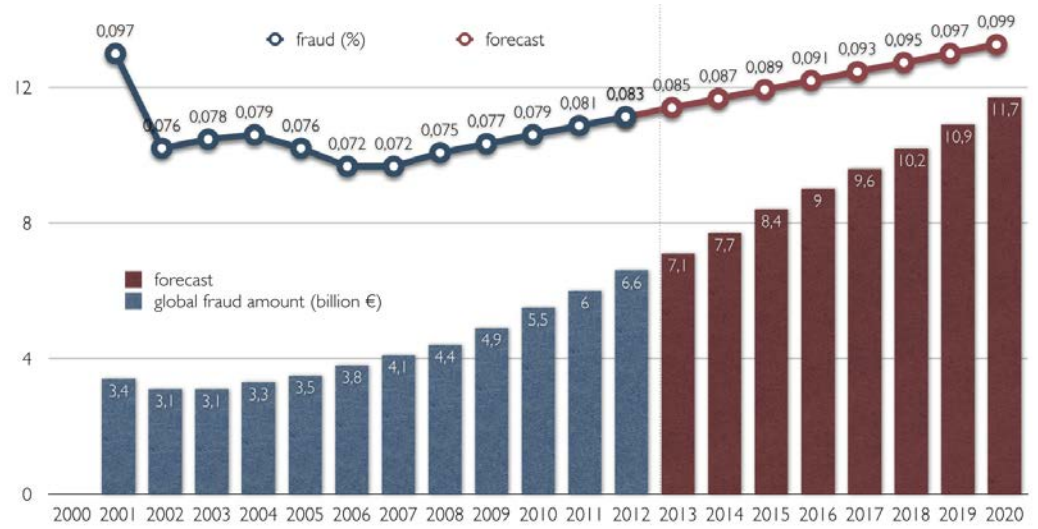
Let's consider the example of France, a pioneering country in payments security and innovations (invention of the smart chip card in 1974). Between the years 2005 and 2007, the total French card fraud rate was under control at 0.064% to 0.062% in value of transactions. But from 2008 until the present, card fraud rates have been increasing each year and have reached 0.080%; this is an increase of 29% in 5 years and is almost undoing all the benefits of EMV deployment back to the year 2002. In this same period, the value of card fraud increased by 67.8% from €268.5 million in 2007 to €450.7 million at the end of 2012. [72] [43]

In 2010, for example, a closer look reveals that fraud on remote card payments (0.262%) was 21 times greater than vicinity transactions (0.012%). The problem is that the 8.6% of number of transactions constitute 62% of transaction amounts. That is €308.8 billion out of €498.2 billion in 2010.

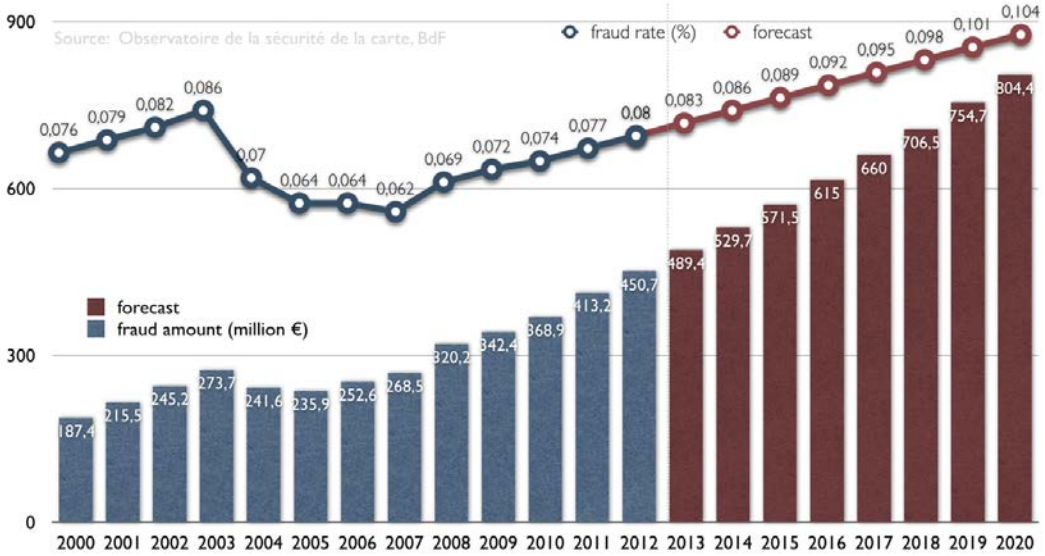
In addition, these 8.6% are growing fast. The growth rate of value and volumes of remote transactions was 23.8% in 2010 (18% in Europe).

The major fraud reason in payments is due to identity theft, especially over remote transactions. [43] [63] In France, the country where the smartcard was invented, losses due to identity fraud are growing exponentially, from €6 million in 2006 to about €320 million in 2012. Card-stolen fraud is stable, averaging at about €100 million between 2006 and 2012. Although EMV is the standard in France, counterfeit cards fraud is also growing rapidly, causing about €10 million losses in 2012. [65]

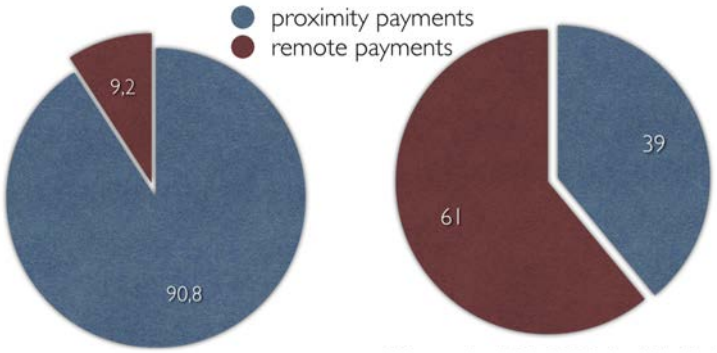
In Europe, fraud losses are rising from €1.363 billion in 2006 to €1.480 billion in 2012, up 5.8% since 2011. [67]



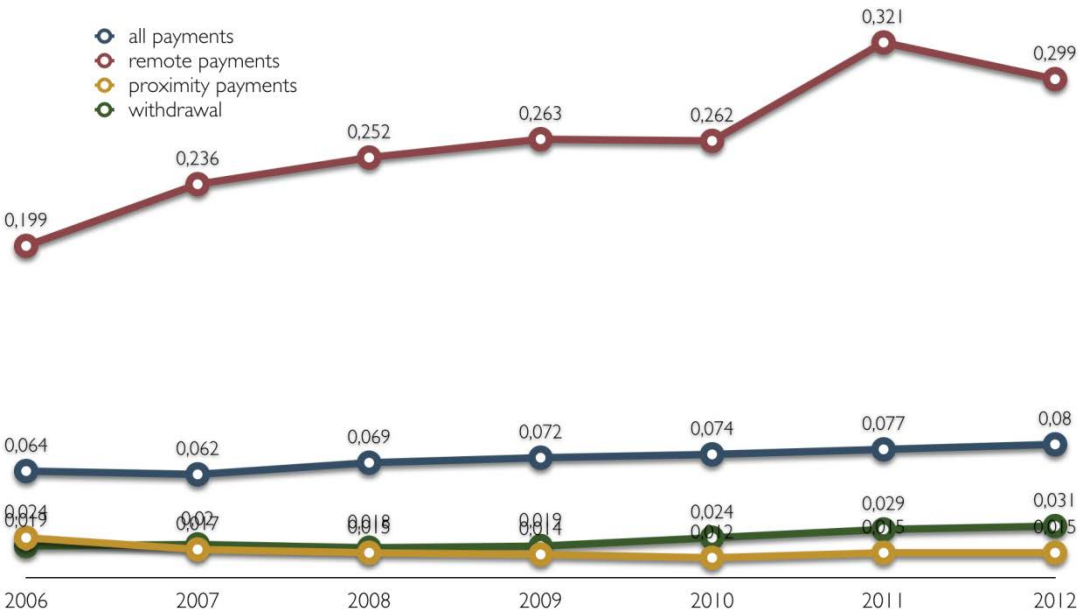
Global fraud value of electronic payments low fraud estimations scenario (in billion € and percentage of the fraud rate) (Estimations between 2001 and 2009 are based on the World Payment Report, Capgemini analysis, 2011)



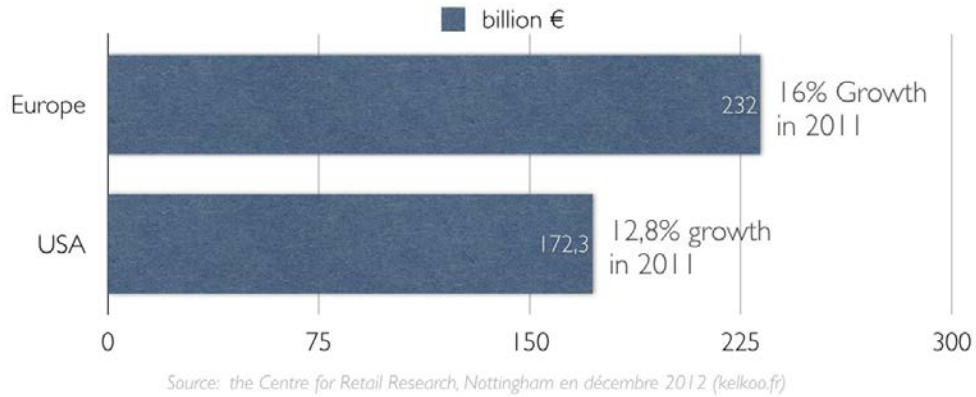
Fraud value of electronic payments in France (in million € and percentage of the fraud rate)
(Source: Observatoire de la sécurité de la carte, Banque de France)



Percent of remote transactions (darker) versus vicinity transactions in number (left) and in amounts (right), France, cards all type, 2010
(Source : Observatoire de la sécurité de la carte, Banque de France)



Portioning of all types of payment fraud rate in France (blue curve). Fraud percentages by type, France, cards all types, 2010.
(Source : Observatoire de la sécurité de la carte, Banque de France)



Growth of remote transactions in amounts for France, Europe and US, 2010

Payment cards are designed for vicinity payments and are less suitable for remote payments. Great efforts have been made to adapt and secure online card transactions (PCI DSS, 3D Secure), without success in lowering fraud of remote transactions.

Verizon estimated that 79% of organizations were not compliant with the PCI DSS requirements during certification assessments in 2010 [64], and 96% of the merchants being breached by fraud are not compliant with PCI DSS. [65]

Double digit growth of remote transactions in number and in amounts of transactions—24% growth in France in 2011 and 18% in Europe—implies a large increase in fraud.

Globally, the fraud amounts lost from non-cash transactions totaled €4.9 billion out of €6.4 trillion in 2009 (fraud rate ≈ 0.0766%), up from €4.4 billion in 2008 and €3.4 billion in 2001. [22] Global e-payments volumes are expected to grow by 20.0% in 2013 as e-commerce revenues surge. [20]

The 2010 projected global card fraud amount is about €5.5 billion out of €7 trillion of global cards transaction values (fraud rate ≈ 0.0786% includes all ecommerce transactions).

According to Aite Group, card fraud costs the US card payments industry about €6.6 billion or USD $8.6 billion per year (2011). According to The Nilson Report, the loss is expected to reach USD $10 billion by 2015. [40]

Although the deployment of EMV and smartcards is continuing to reduce fraud on vicinity transactions, card fraud is expected to grow dramatically due to card-not-present (CNP) fraud.

The security of mobile phone payments depends largely on the technology of payments over the device. Usually the fraud on smartphone payments is accounted for in the global non-cash transactions fraud within global card fraud. Today the majority of mobile e-commerce transactions is card based.

The other potential threat can originate from a viral or malware attack on the operating systems of smartphones. A recent study by Lookout estimates that, globally, the probability of an encounter with known malware over Android smartphones was low at 4% in 2011 and may be dropping. The same probability is negligible over Apple devices. [31] [33] The market share for Android bypassed 75% of smartphones in 2012. [34]

The probability of an encounter is not necessarily a malware infection that executes a harmful charge on the smartphone; the encounter means that the user is exposed to a potential attack that might be stopped by default configurations of the smartphone security. The largest bulk of malware are adware that collect private information for advertisement purposes mainly.

Even smartcard schemes are attacked. A Cambridge paper about cloning EMV cards with the pre-play attack [60] pointed out how an exploit can be made by harvesting authentication codes from points of sale, which enable a “clone” of the card to be used later in ATMs and elsewhere.

1.4 STATE OF THE ART IN PAYMENTS INNOVATIONS

What are the innovations shaping payments’ future? Here is a selection of the most significant ones according to the major payment sector actors.

Some innovations intend to marry cards with smartphones, either swiping the card over a smartphone, or swiping the smartphone instead of the card on the terminal. Other dream or dematerializing the card and putting it inside the smartphone either by dropping the plastic and inserting the smart-chip into the phone or by totally virtualizing the card into an e-wallet (with or without a limited budget). Finally some innovations are dropping the whole idea of card payments. In a card-less world, you become the card and the smartphone becomes the terminal.

1.4.1 EMV CONTACT AND CONTACTLESS CARDS

EMV smartcards count today more than 1.24 Billion cards and can be accepted in 15.4 million POS terminals (source EMVCo [40]).

Based on a chip and PIN security scheme, EMV contact and contactless card have proven their efficiency in dropping the fraud rates. A transaction-unique digital seal or signature in the chip proves its authenticity in an offline environment and prevents criminals from using fraudulent payment cards.

In addition to being more hygienic, they are practical at points-of-sale by reducing the waiting line, accelerating the checkout process and thus increasing the revenue capacity at peak times in stores.

That said they don’t bring that ground breaking innovations and they do not solve the problem of remote transaction security. As a reminder the remote transactions such as internet shopping have 20 times higher fraud rates due to the weakness of card based payments online. Contact or contactless they are simply unfit for remote payments unless associated to a secure program and a special payment terminal that should certified to the strict requirements of Payment Application Data Security Standard.

Cost of adoption of EMV

In a country like the US, it’s required to replace 15 million POS terminals [40], more than 425,000 ATMs, and 1.4 billion payment cards.

Javelin Strategy & Research estimated the total cost for deploying smartcard payments in the US to about **$8 billion**: $6.75 billion on terminals, about $500 million for ATM upgrades and *$1.4 billion to issue smart chip-compliant cards*.

But for the latter estimate, given that a typical magnetic-stripe card costs about $0.15, when a chip-based card can cost $3 on average [40], we can re-estimate the cost of issuing smartcards to be about $4.2 billion alone. Moreover, if all smartcards should be contactless, the additional cost per card is between $1.23 and $1.54. [39] This is an additional cost ranging between $1.7 billion and $2.1 billion.

The cost of issuing contactless smartcards is about $6.1 billion in the US alone each 3 years (since a card expires within 3 years on average).

Hence the total cost for deploying smartcard payments in the US becomes about **$13.35 billion**. Part of this sum will be compensated by the reduction of fraud, which was about $8.6 billion in 2011.

1.4.2 NEAR FIELD COMMUNICATION VS. BLUETOOTH LOW ENERGY

Gartner reported that 71% of mobile transactions are of the direct transfer category and that NFC share is only 2% of mobile transactions in 2013. The lack of adoption of NFC as a payment mode is clear although most Android smartphones are equipped with this technology.

Some ongoing NFC pilot deployment in stores didn't report success or adoption by customers. In a recent statistic, 32% of superstore merchants believed that *mass NFC adoption* will be reached within 2 to 3 years from now; 27% think it will take 3 years and above. But 41% of the merchants think that mass NFC adoption is at hand and that it will take less than 2 years, so that's before 2015.

Gartner reduced by 40% its prior optimistic estimations about NFC; in 2017 NFC might win a 5% share of mobile payment transactions. Gartner estimate that money transfer will still be dominating mobile transactions with a share of 67% in 2017.[35] [37]

Another argument is that Apple is not integrating this technology in its iPhones and iPads [36]. Although Apple had been awarded patents mentioning NFC, and there is information about a partnership with NFC heavyweight Gemalto to develop a "virtual SIM" card [36], it will take the market many years before a critical mass of Apple's customers become equipped with new iPhones featuring NFC.

Those who were betting for higher adoption of NFC as a vicinity payment mode are most probably disappointed.

In addition, at a Black Hat security conference, Charlie Miller, a smartphone hacker, demonstrated NFC security weaknesses and exploits in several Android phones; he said that NFC "*certainly increases the risk that something could go wrong. It opens you up to a lot more than you would think*." [36] In information technology, whenever something can go wrong it usually goes wrong. In end of 2013, Google and PayPal started to rely less on NFC contactless technologies for payments.

On the other hand, Bluetooth Low Energy (BLE) is a more promising technology. It's already available in all major smartphones. As opposed to the passive technology of NFC, BLE is an active technology. It communicates by pushing the information to the smartphone. It can be used to do direct marketing and proximity marketing for all active persons passing by an equipped store. It can also provide geo-fencing marketing services. These constitute targeting couponing just-in-time and based on analytics and customer behavior. Inside a shopping center it can serve as an anti-showrooming service by providing information—even videos—of the product. Another application can be internal stores mapping and instant checkout accelerator.

1.4.3 ELECTRONIC IDENTIFICATION CARDS AND PAYMENTS

In 2013, Nigeria chose MasterCard to launch a pioneering common payment smartcard and citizen identity card. A first pilot phase with Access Bank will enroll 13 million people out 162.5 million Nigerians. Other banks will follow to cover Nigerians above the age of 16. [61]

The card is called National Identity Smart Card; it features a unique National Identification Number (NIN). The enrollment registers an individual's data and biometric data: fingerprints, facial photo and digital signature. This initiative came from the cashless economy in Nigeria and is pushed for by the Central Bank of Nigeria. Electronic card terminals in Nigeria went from 8,000 to 160,000 in 2 years. [61]

MasterCard had also launched a comparable scheme in South Africa with 10 million cards for recipients of social grants, or welfare benefits.

In Mongolia (population 2.8 million in 2011) and South Africa (57.8 million) governments are already rolling out an electronic citizen ID card using Gemalto's biometric technologies. Since May 2012, 3 million cards have been distributed in Mongolia. [2] [59]

The electronic ID card can feature secure embedded software to protect the holder's biometric data, and can be contactless-capable. The scheme can support public key infrastructure (PKI); it can be used to provide secure online services such as authentication, as well as the ability to legally sign documents and applications. It can also be used for elections voting and e-government services. It's also a powerful tool for anti-corruption enforcement since it's theoretically impossible to counterfeit.

In France there are initiatives around electronic ID already in use for immigrant cards and police agents.

Visa attacked the African market with a different strategy. It initiated a pilot scheme in Rwanda, enrolling 100,000 users in a mobile telephone banking system. Visa with Google also launched BeboPay in Kenya—a re-loadable, prepaid debit card system that bus operators can process with their NFC-compatible smartphones.

1.4.4 BIOMETRIC PAYMENTS

Biometric authentication can be based on many personal unique features such as: fingerprints, iris-based systems, retina-based systems, facial recognition, voice-based systems, sub-skin biometric characteristics, and mind-activity-based systems (an example is to think of a password).

Why Biometric Payments?

Today all security measures fail to ensure that scheme participants are truly who we think they are. Even in the most secure payment scheme (based on fraud statistics), EMV contact smartcard, we only **identify** and **authenticate** the card but not the cardholder.

The major fraud reason in payments is identity theft over remote transactions, which accounts for 70 % of the fraud. [43] [63] In France, the country where the smartcard was invented, losses due to identity fraud are growing exponentially from €6 million in 2006 to about €320 million in 2012. [65] In online transactions, all today's payment schemes fail to authenticate the cardholder too. They only identify the cardholder via a login-password or via some *not-that-secret* information (such as the card-related data, all printed on the plastic). This case is called *card-not-present* (CNP) at the terminal for card authentication.

More sophisticated and problematic techniques attempt to secure card-not-present cases by "authenticating" the mobile of the cardholder. This is called (without deserving this name) 2-factor authentication (see 3D Secure below).

The problem biometric authentication solves is knowing the true identity of the payer and the payee. A login-password identification scheme is as old as the Roman Empire and is today totally insufficient to secure a payment transaction.

Adoption

Biometric enrollment and data usage are very sensitive due to the nature of the information and the consequences of any misuse. Biometrics are found today in defense and national security schemes and are becoming mature for deployment worldwide.

The independent French administrative authority *Commission Nationale de l'Informatique et des Libertés* (CNIL) ensures that data privacy law is applied to the collection, storage, and use of personal data. The CNIL, founded in 1978, is looking fearfully at the deployment of any biometric authentication systems in France. In 2011, it pushed the state to cancel a law disposition for the French biometric passport. The new disposition reduced from 8 to 2 the number of collected fingerprints during the enrollment. It's actively supervising the deletion of the 6 excluded fingerprints. [48]

Furthermore, when a leak revealed that the Parisian subway group RATP was launching a facial recognition scheme for check-in into metro stations, the project didn't survive 24 hours of criticism.

The RATP, accused of becoming “Big Brother,” canceled the project and the Request For Information, stating it’s not in accordance with its ethical code. [49]

Compared to payments data (bank number, card number, their passwords, dates, etc.), biometric data are more sensitive. They are subject to strict regulations compared to PCI DSS for payments. For instance, the European Council issued the *Regulation (EC) No 2252/2004* and *Regulation (Ec) No 444/2009* on standards for security features and biometrics in passports and travel documents. In France, no biometric solution in the workplace can be deployed before prior justification and authorization from the CNIL administration. [54]

Security

Biometrics is the best known way of authenticating users. [50]The user may be authenticated via his smartphone based on his voice, photo or a fingerprint.

Liveliness of the biometric information is critical to the success of the authentication; this is ensured via multiple measures to ensure no replay can be possible.

A trusted biometric sensor and operating system are essential also. This is the whole point of the Payment Card Industry – Payment Application Data Security Standard (PCI PA-DSS): the safety of execution of application over an operating system environment. To date, no smartphone operating system can pretend for a PA-DSS certification.

That said, enough security can be ensured by protecting the banking application on the smartphone and by securing the channel to a server where the authentication is truly and securely done. This achieves in theory much higher security than any traditional card-not-present scheme for online transactions.

“Biometric authentication is a good additional authentication method. Even cheap and simple biometric solutions can increase the overall system security if used on top of existing traditional authentication methods.” [50]

1.4.5 VIRTUAL CURRENCIES

Relative to *paper bank notes* and *metallic coins*, virtual currency is any unregulated form of electronic money issued and controlled by an information system scheme and accepted as a means of exchange by all scheme participants. It’s also called “digital currency.”

Electronic money should not be confused with “virtual money,” which is only one kind of (*a type 1, see below*) electronic money.

Virtual-currency schemes should not be confused with *electronic money.*

According to the Electronic Money Directive (2009/110/EC), “electronic money” is monetary value as represented by a claim on the issuer which is: stored electronically; issued on receipt of funds of an amount not less in value than the monetary value issued; and accepted as a means of payment by undertakings other than the issuer. [55]

In electronic money schemes, after an exchange between the real (or traditional) money and the electronic format, values use the same unit such as EUR or USD. In virtual currency schemes, the unit of account is changed into a virtual one (e.g., Linden Dollars, Bitcoins).

The Encyclopedia Britannica defined in 2011 the currency as “a portion of the national money supply, consisting of bank notes and government-issued paper money and coins, that does not require endorsement in serving as a medium of exchange.” [56] In Encyclopedia Encarta (2006) it is “any circulating media of exchange of a country.” [57]

We clearly see that e-money is changing the definition of currency. It's not anymore bound to a country, nor issued by a national regulating authority. This definition might evolve quickly in the near future since virtual currencies are still in their genesis-era and haven't reached yet their golden age.

The European Central Bank [55] considered that today "virtual currencies do not pose a risk to price stability, provided that money creation continues to stay at a low level." The ECB also classified virtual currencies into 3 types relatively to their interaction with the "real" money and the real world economy:

1. **Closed virtual currency:** This is basically used within electronic games only. They do not have any interaction whatsoever with *real* currencies; such as in-game-only World of Warcraft (WoW) Gold currency.
2. **Unidirectional flow currency**: You can only buy it using "real" money and use it in a virtual world (e.g., inside a game), or exceptionally to buy real goods and services. You cannot exchange it back to "real" currencies.
3. **Bidirectional flow currency:** It's fully convertible with traditional physical currencies (two exchange rates: buy and sell). It's used to buy virtual or real goods and services (e.g., Bitcoin).

The advantage of virtual currency is that it can create a lock-in effect or a sort of loyalty to the community on scheme participants, especially Types 1 and 2. Type 3 is in competition with real world currencies.

Airlines' frequent-flyer programs can be classified as Type 2 virtual currency schemes. Facebook, Google, Tweeter, MySpace, other network Games present in-game or private currency although it can be Type 2 or Type 3. Since 2009, Facebook has allowed users to buy virtual goods using the **Facebook Credits (FB)** currency, which can be bought via payment cards online. Another Type 2 example is the in-game currency of **Nintendo Points,** which can be redeemed in Nintendo's shops.

Linden dollars (L$), issued by Second Life, is bidirectional flow currency used only in a virtual game world where users create "avatars." Users can sell Linden dollars back in return for US dollars. **e-gold,** founded in 1996 and operated by Gold & Silver Reserve Inc., is backed 100% by physical gold (or silver, platinum and palladium).

Size of the Virtual Goods Market

Visa recently acquired PlaySpan Inc. for USD $190 million. In September 2011 American Express acquired Sometrics for USD $30 million.

The IMF World Economic Outlook database and Smith and Hudson (2010) estimates the size of the U.S. virtual goods market at **$1.6 billion in 2010** and **$2.1 billion in 2011**. Another source, M. Shiels (2009) BBC News, estimated it to reach **$5 billion in the US in 2014**; "in Asia this figure has already been reached." [55]

Using straight line projection and extrapolation to the worldwide market, the virtual goods market can be estimated between USD $10 and USD $15 billion in 2012.

Reputation and Adoption

Authorities have proved that these schemes are violating anti-money laundering regulations (egold and Bitcoin).

In China, "Q-coin" (by Tencent) had an impact on the money supply of the country and became illegal. After several billion yuan traded in 2009, Chinese authorities banned all **bidirectional flow currencies**. [55]

1.4.6 NEW INTER-BANKING SCHEMES

In the midst of these payment innovations and the competition with worldwide payment service providers (PSP) and Card Schemes, banks are answering these critical challenges with new inter-banking initiatives.

The European Payments Council (EPC) created the Single European Payments Area called SEPA. It integrates banking services in the Eurozone, allowing for Direct Debits (SDD) and credit transfer (SCT) and introducing an internal card framework scheme (SCF) to protect its local market from Visa, MasterCard and other international card schemes.

In Australia, the Big Four Banks—Commonwealth Bank, NAB, ANZ and WestPac—are working to specify an Australian Payments Scheme that would allow for e-billing, push transactions, peer-to-peer payments, instant bank account porting and what may be the most important feature: reachability to all payers and payees regardless of which bank is currently holding their accounts.

Push payments will allow the payment systems to *walk on its feet*. Today almost each common payment scheme *walks on its head,* being based on pull payments. The merchant's bank (the acquirer) *puts its hand* in the cardholders' bank (the issuer) and *pulls* the money to complete a payment. In Push payments the cardholder *puts his hand* in his own bank account and *pushes* the money to the merchant's bank. It's simply common sense and it's proven that it reduces card fraud drastically when a proper authentication system of the payer is in place. By definition it eliminates all abusive or fraudulent debits. Push payments are also called "*giro*" or "*giro* transfer."

Guaranteed reachability is based on a universal payment address. Whenever you switch your bank account from old bank A to new bank B you don't have to communicate a new International Bank Account Number (IBAN) to your employer for the salary transfer, or change your bank account information for direct debits of your electricity bills, phone bills, gas, cable, etc. You won't even need to change your credit card credentials on the App Store, PayPal and other e-commerce sites. Guaranteed reachability masks your current bank account address and credit card information and allows you to manage one or multiple accounts.

Account porting is the capability of transferring one or multiple bank accounts from bank A to bank B without losing any recurrent payment, configuration or history information. All your transaction logs will be transferred, and all the direct debit authorizations will be updated and transferred too (based on your universal payment address or by keeping the same IBAN).

Porting delays endanger the customer by unpaid bills, causing his account to be tagged by the central bank. In France, for example, 41% of porting delays take more than a month and 61% of banks do not fully take charge of the porting, especially the recurrent payments. When a bank offers a porting service today, the costs vary largely between institutions and can be up to 82% more expensive among French banks (171.4 €/porting and 311.2 €/porting). Even between the same bank branches cardholders today may pay 30% to 56% higher fees. [58]

An additional power of this capability is instant massive accounts porting. When a bank is failing, governmental authorities can activate the bulk account porting to a new buying bank. Today banks tend to lock in their customers and do not provide assistance in account switching.

Peer-to-peer payments and e-billing allow any payer (person, merchant, institution, or company) to make a transaction with any payee in the scheme. The transaction can be sending a payment request, or answering a payment request with a payment. It can be a one-time payment or scheduled multiple payments. Any bill or fitting document can be attached and transmitted using the scheme.

1.4.7 3D SECURE

The standard 3D Secure is a payment security protocol aiming to protect online card transactions. It's created by Visa (Verified by Visa) and then adopted by MasterCard (SecureCode), JCB International (J/Secure) and American Express (SafeKey).

The span of the protocol covers 3 domains; hence its name: the acquirer Domain (bank of the merchant), the issuer Domain (cardholder bank) and the interoperability Domain (the infrastructure provided by the card scheme—credit, debit, prepaid or other type of finance card—to support the 3D Secure protocol).

Based on XML messages sent over the Secure Socket Layer protocol with client authentication, the 3D Secure protocol ties the transaction authorization to an online authentication, which is often a password that is verified by the issuing bank of the card. This password can take the form of a matrix of secret codes (called tokens) provided to the customers by the issuing bank, but most commonly it's a one-time password generated by the issuer and transmitted via another channel just-in-time for the online payer via an SMS on his mobile; it expires a couple of minutes later.

This protocol answers the weakness of smartcards for online transitions. In a *card not present* (CNP) case, 3D Secure complements the weak card identification process based on the card number (PAN) and the *card security code,* usually the 3 or 4 digits called the card verification value (CCV or CVx2) printed on the plastic.

Adoption

To date 3D Secure adoption is low. The merchants have to subscribe to it as a costly service; in addition, it can create transaction failures and shopping cart drops because the protocol disrupts the customer experience by steering him to a third-party website.

"3D Secure has so far escaped academic scrutiny; yet it might be a textbook example of **how not to design** an authentication protocol. It ignores good design principles and has significant vulnerabilities, some of which are already being exploited." [41]

In France, 84% of cardholders were covered with 3D Secure in 2011, an increase from 67% in 2010. The Observatory for Payment Card Security of the French Central Bank reported that the transaction failure rate is 20% for the 3D Secure transactions. [43] During the massive deployment of 3D Secure by the French major trains transport group SNCF, the banking systems failed and an undisclosed number of transactions were lost due to bugs and failures in the protocol implementation. [42]

In the UK, massive adoption allowed a 52% drop of fraud in 4 years. In France, 50% of e-merchants have adopted the scheme but not the major merchant sites; therefore, only 24% of e-transactions were 3D Secure at the end of 2012. The French administration considered in June 2013 a law making 3D Secure mandatory for all ecommerce sites. [63]

In another report, the ECB reported that fraud dropped by one third between 2007 and 2012 due to 3D Secure and other fraud screening tools. [84]

1.4.8 MOBILE BANKING AND E-WALLET

Innovations in banking services are flourishing around smartphone applications. In 2013 several ATMs allow for cardless withdrawals using the cardholder's smartphone. Manufacturers Wincor Nixdorf and NCR unveiled their own systems of cardless ATM withdrawals. Customers can initiate the transaction through their mobile phones using a 2D barcode (QR code) they scan on the machines' screens, for instance.

Banco Sabadell in Spain and the Royal Bank of Scotland (RBS) in the UK are proposing this innovation. Ben Green, head of mobile payments in RBS (2.4 million customers), says: "*We've heard*

countless stories from customers who've left their wallet behind, or parents who need a quick way to send money across to their children immediately." [68]

Smartphone cash withdrawal facilitates and accelerates the transaction over the ATM. It also allows for person-to-person cash payments by sending the QR Code authorization between payers and payees.

A Gold Rush trend appeared around mobile banking services and electronic wallets, which are basically meant to dematerialize the plastic of payment cards. Several European banks launched between 2009 and 2013 a series of e-wallet services over smartphones, without serious success and even followed by a series of failures (Pay2You, Kwixo, S-Money by several major French banks and Buyster by the telecom operators, for instance). The main reason for the failures is that the proposed e-wallet service had no true added value for the user compared to a card payment; worse, it had fewer capabilities in many cases. A user of an e-wallet service can only reach a client within the same bank or group of banks that launched the service. The number of merchants accepting the e-wallet service is relatively negligible compared to the e-commerce sites or actual stores accepting card payments.

The current Visa and MasterCard e-wallet initiatives are not on track regarding their original deployment planning, but they have the advantage of solving certain limitations of bank e-wallets. A V.me or a MasterPass can be more universal, guaranteeing higher reachability to all participating banks.

Google launched Google Wallet in the US and Apple is suspected to be preparing a wallet service in addition to the current Apple Passbook, which is a wallet for coupons and tickets. Without need for deeper analysis of the e-wallet Gold Rush and the PayPal innovation, the competition is fierce between banks and non-bank PSPs. In order to predict the outcome of this battle, we need to continue the analysis and understand the big picture.

1.4.9 MOBILE POINT OF SALE

In the Gold Rush for mobile payments there was a runaway to use standard consumer devices (smartphones and tablets) as card acceptance terminals. It's called: *Bring your own acceptance device* or BYOAD. Although it may be appealing, BYOAD "*keeps the security task force awake at night"* as Visa said. [27]

Seemingly in contradiction to its prior statement, Visa is also battling on the BYOAD front of the payments war. It's investing in "Square," started by the Twitter founder Jack Dorsey. Square is a simple magnetic-stripe card reader accessory for iPhone. It's progressing in the US market and is now valued above $3 billion. [46]

The "PayPal Here" magnetic-stripe card reader, along with merchant application for iPhone, is available to select merchants in the US, Canada, Australia and Hong Kong. Similar to PayPal Here, GoPayment and Square can be used as an accessory to the iPhone. From a security point of view these magnetic-stripe-only devices are not viable in the long run because of the advent of contactless smartcards.

Apple equipped its stores' salesmen around the world (for instance, in France and Australia) with iPhones featuring card-reading enclosures. These enclosures transform the smartphone into a mobile POS terminal. Although it's lacking a ticket printer, an electronic ticket is sent via email to the customer. The payer can be asked for a signature on the iPhone screen if the payment is via a magnetic-stripe card.

Another smartcard reader for iPhone is introduced by iZettle, a Swedish mobile payments startup backed by MasterCard and American Express. [45] It takes advantage of the dock connector of the device. It consists of a smartcard reader with a pin-pad entry on the back of the reader. No card

information is stored on the iPhone. iZettle is approved by EMVCo and is certified to the requirements of the global Payment Card Industry Data Security Standard (PCI DSS). It has a fixed fee of 2.75% per transaction. [44]. iZettle says it is already in use by “75,000 small businesses and individuals across Europe, mainly in Scandinavia, where it launched in 2011.” [45]

Another smartcard reader certified to the requirements of EMVco and Payment Card Industry – PIN Transaction Security (PCI-PTS) has the barbaric name of “SMP-SCTL-PPD2.” It’s a smartcard reader with Chip and PIN for iPhone, iPod Touch and iPad costing about USD $208.

Ingenico, the world leader in payment terminals, also launched iSMP, which turns iPods and iPhones into smartcard payment terminals.

The target market of BYOAD is very large. As an indication, 99.7% of enterprises active within the EU-27’s non-financial business economy in 2010 are small enterprises (employing fewer than 250 persons). The European Commission estimated their number to be 21.7 million small enterprises. [47]

CHAPTER 2 — SMARTER FUTURE OF PAYMENTS

"One common error is to mistake invention for innovation; they are not the same thing. Invention is the creation of something new. Innovation is the creation of something new that makes money; it finds a pathway to the consumer." — Anne Fisher, Fortune senior writer, March 3 2008

2.1 MODELING THE GLOBAL FUTURE OF PAYMENTS

In order to predict the future scenarios of payments we can apply Game Theory mathematical concepts. The future of payments can be modeled as a multiplayer game, with the players being the innovations themselves: contactless cards, near field communications, smartphones, biometric intelligence, virtual currencies, inter-banking schemes and mobile point of sale.

The "game" can be classified as a:

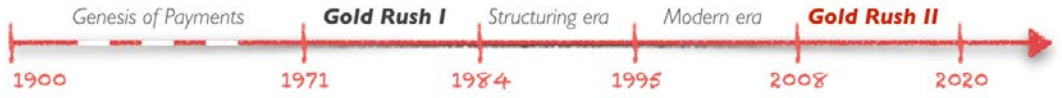
- **Cooperative game**: Players can bind in alliances
- **Symmetric game**: Payoffs of a strategy depend only on the other strategies employed
- **Zero-Sum game**: Since gain by one player corresponds necessarily to a loss by another
- **Simultaneous game:** All players move simultaneously
- **Perfect information game**: All players know the moves previously made by all other players
- **Complete information game**: Every player knows the strategies and payoffs available to the other players but not necessarily their actions

The payoff of any strategy taken by a player or a group of players is the amount that represents the motivations of the player to choose this strategy. In our case, the payoff of players is the share of a payments market in number of transactions and value of transactions.

Several thousand combinations are possible between game parties. To reduce the number of outcomes a probabilistic approach helps to sort the most probable scenarios.

2.2 TAKING AN EDUCATED GUESS

This paper analyzed briefly the landscape, dynamics and changes in the payments industry. Based on the forecast methodologies mentioned above, we can in this exercise take a fairly educated guess without the need to apply each method mathematically to its full extent.



The Advent of smartphones, e-wallets, virtual currencies and biometrics provoked a new Gold Rush era like the one witnessed in the 1970s when electronic payment terminals, magnetic cards and smartcards were invented

Based on the map of global payments and on the state of the art in innovations, we can forecast the following future changes from now till 2020:

Contactless cards may include biometric data and become associated with a national or global identity. They might also become easily accepted over smartphones, not only smarter payment terminals.

Banks, on the other hand, pushed by regulatory directives, might start to integrate their services to compete with international card schemes and PSPs. In certain cases they might even have to outsource completely their payment service processing to keep pace with the changes and to stay profitable.

Smartphones are heading towards a conquest of online transactions, bringing strong biometric authentication to the process. Helped by the use of biometric authentication and by the adoption by banks, smartphones will probably become associated with bank applications and services, thus bringing direct debit and transfer to the palm of the hand between payers and payees. As a consequence, card-based transactions will likely drop strongly in electronic commerce.

In 2020, smartphone payment schemes may be able to gain maturity and standardization to challenge contactless cards in vicinity transactions. They might become linked to electronic identity and thus become a complete substitution for payment cards and other cards, with potential important consequences for terminal constructors and card manufacturers.

Cash will prevail, at least as a virtual currency and most probably in developing countries. Virtual currencies might start putting dangerous pressure on real currencies. This would push regulators worldwide to attempt to control globally such schemes.

The payoff of this new Gold Rush era in payments will eventually benefits cardholders by empowering them with more services and security.

The Gold Rush should lead to a Structuring Era, which will consolidate and normalize the new schemes. The trip towards a stable and steady phase is a bumpy road for all participants. Betting on the right technology and being the first to market it can be an important survival guarantee.

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   China's UnionPay is now the largest payment card scheme in the world, its brand appearing on three in every ten cards worldwide. China UnionPay has supplied in 2010 around 2.4 billion cards, which represents a 29.2% market share.

   The global market is projected to expand from 8.0 billion in 2010 to 10.1 billion by 2015, as a slowdown in card issuance in the mature North American and western European regions is more than offset by rapid growth elsewhere. (link)

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   Table 4, The level and type of card ownership and card use varies considerably by country

   ANY CARD own; own & use; own & use often: EUROPE 83% 74% 39%

   Note: "Any card" usually refers to a combination of payment cards. In France debit card also refers to charge card. Percentage is based on 22,628 European banked adults, aged 16 – 65. Source: Source: "Visa Europe Consumer Payments and Borrowing Lens" Survey.

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   Table 10.1a Number of cards issued in the country, EU total in thousands (2007 – 2011): Total cards: 698,045.32 726,442.18 726,347.66 727,163.93 726,572.10

   Table 11.1a Number of terminals located in the country (2007-2011): EU total in thousands: ATM 407.51 423.77 431.48 433.30 437.40

   Table 11.3a Number of terminals located in the country per million inhabitants. EU total (2007-2011): ATM 820.92 849.77 862.39 863.80 869.74

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    Terminals located in the country (2007 to 2011)

    Australia ATMs 26,067 27,081 27,067 30,092 30,841, POS terminals 628,819 669,600 697,803 707,303 751,097

    United States ATMs 415.3 406.1 425.0 nav nav POS of which: EFTPOS terminals 5,146.5 5,175.5 nav nav nav

    China 333,800 ATM (+23.18% in 2011) and 4,826,500 payment terminals (+44.76% in 2011).

Turkey 32,462 ATM and 1,976,843 payment terminals (2011)

Russia 141,897 ATM and 528,511 payment terminals

Japan 137,750 ATM and 1,859,430 payment terminals (2010)

Mexico 36,448 ATM and 547,708 payment terminals

Korea 110,330 ATM and (not available) payment terminals (2010)

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« Nous demandons également au Gouvernement de présenter au Parlement un rapport sur la mise en œuvre technique et opérationnelle de la portabilité du numéro de compte bancaire, en s'inspirant en particulier des exemples étrangers. […] Les partisans de la concurrence libre et non faussée, que nous avons eu l'occasion d'entendre à plusieurs reprises, seront sans doute partisans de cet amendement. […] Cet amendement permettrait à chaque consommateur de transférer les opérations récurrentes d'une banque à une autre, ce qui l'aiderait à éviter les incidents de paiement. Il faut aussi poser la question de la portabilité : parviendrons-nous à instaurer un numéro unique, permettant de changer facilement de banque, et grâce auquel les Français rattraperaient leur retard en matière de mobilité bancaire ? » M. Laurent Grandguillaume,

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