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Electronic Payments: Building the Case for a National Initiative

A. M. Al-Khouri

ABSTRACT

The explosion of the internet and mobile phones, as well as other rapid technological developments, has significantly influenced momentous changes in the payments market. Perceived as being more efficient and less expensive, electronic payments pave the way for the development of more sophisticated digital services in both the public and the private sector. This article provides an overview of electronic payment systems and their relation to recent developments in the United Arab Emirates (UAE). It summarizes existing card-based stored-value-payment initiatives in the UAE and presents the current identity management infrastructure in the country as a potential enabler to support the development of a more comprehensive national electronic payment system.

Keywords: electronic payment system, digital cash, cashless society, digital economy, identity management, smart card, national ID.

INTRODUCTION

In our ever-changing world, payment systems have been undergoing a transformation from paper to electronic means. Electronic payments refer to any kind of non-cash payment that does not involve a paper element. In general, methods and types of electronic payments include credit cards, debit cards, and automated clearing-house (ACH) systems[1] (Hord, 2005). These electronic payment systems rely profoundly on the use of computer networks, the internet, and digital stored value systems that together represent a process of debits and credits to exchange value in online and offline environments (Radovanović, 2009). In today's digital world, electronic payment systems are largely viewed as a vehicles that provide better value for customers, lower back-office administration costs to the government and businesses, and lower operating costs for financial institutions (CBoI, 2013).

Increasingly, governments and private sector organizations around the world have been showing interest in electronic payment mechanisms for the delivery of goods and services. In fact, there has been a growing usage debit and prepaid cards, online banking, kiosk machines, and mobile payments (BIS, 2012; Capgemini, 2013; Evans et al., 2013; RBA, 2012; Summers, 2012; Wonglimpiyarat, 2007). Irrefutably, the advent of the Internet has created a landscape with over a hundred payment methods that are used solely online (Kannen et. al., 2003). There is literature that is rich in examples that show how the innovations in electronic payment networks have improved the efficiency of business transactions and how they have enabled seamless and secure digital communications (Berlau and Radia, 2009).

Among the different methods, card payments are still one of the most common and preferred payment methods worldwide. Payment cards generally offer consumers more security, convenience, and control than other contemporary payment methods do. They are also perceived to offer more secure mechanisms, with user-controlled authorization processes

[1] Automated clearinghouse (ACH) systems are networks for financial transactions through which depository institutions send each other batches of electronic credit and debit transfers.

when purchasing items. Through their speed and simplicity of use, payment cards have become widespread.

This article serves to provide an overview of electronic payment systems by relating them to recent developments in the United Arab Emirates (UAE). It provides an overview of the existing card-based stored-value payment initiatives in the UAE. It also relates the current identity management infrastructure in the country as an enabler to support the development of a more comprehensive national electronic payment system. This is the first of a series of articles intended to support the UAE government in realizing its vision of transformation through high-impact investments in techno-infrastructure. The intention is to share government experiences with research centers in different governments that are exploring electronic payment initiatives to replace conventional cash at national levels.

It is worth noting that no literature or research that investigates the UAE market has been found in the public domain. As such, this article will contribute to the existing body of knowledge and explain developments in one of the fastest developing economies in the Arab world.

To start, a short overview of digital payment systems literature is provided. We highlight some business drivers, trends, issues and challenges, and opportunities associated with electronic payment systems. In the next section, we shed light on the electronic payment systems being used in the UAE. In the section that follows, the role of the UAE's national identity management infrastructure as a potential enabler for electronic payments is discussed. We also discuss the underpinning technologies of the UAE's identity management infrastructure such as the smart card and public key infrastructure (PKI) to demonstrate how the advanced capabilities could overcome existing shortcomings in the electronic payment industry. The conclusions are given in the final section.

DIGITAL CASH: A FIELD OVERVIEW

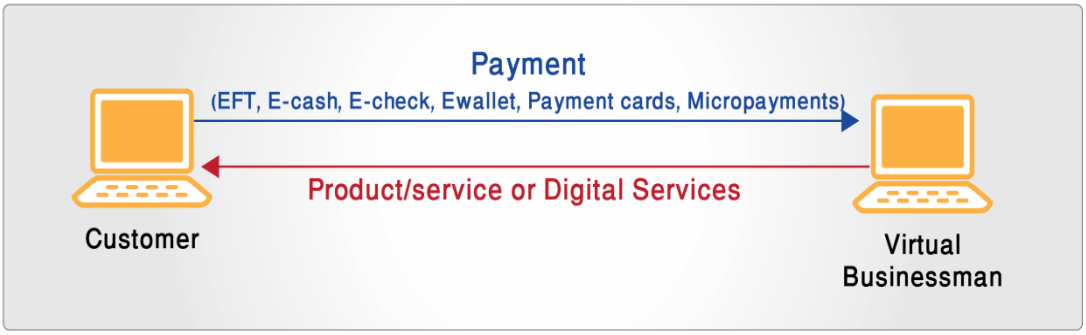

Figure 1: Electronic payment scheme

The advent of computers and electronic communication has led to the conversion of tangible (physical) payment methods into intangible (virtual) forms of money referred to as digital (electronic) cash/money. On the actual groundwork, banks have been acting as the 'movers and shakers' of payment methods and systems around the world (see for example, Sidel and Efrati, 2011). Even with different card types and different payment technologies, the general principles of the electronic payments eco-system remain similar all around the globe (Ingenico, 2012). Figures 2 and 3 depict the payment eco-system and the transaction authorization and processing flow.

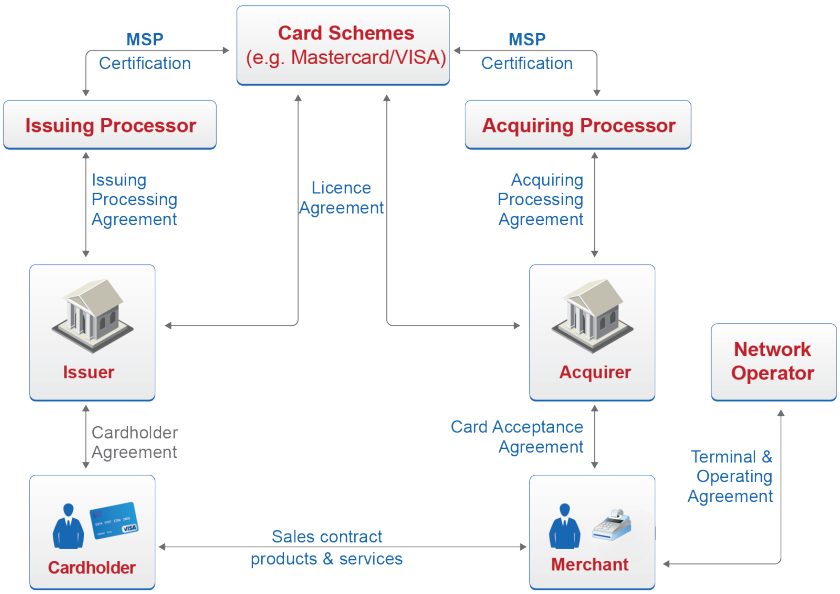

Figure 2: Electronic payments eco-system
Source: (Ingenico, 2012)

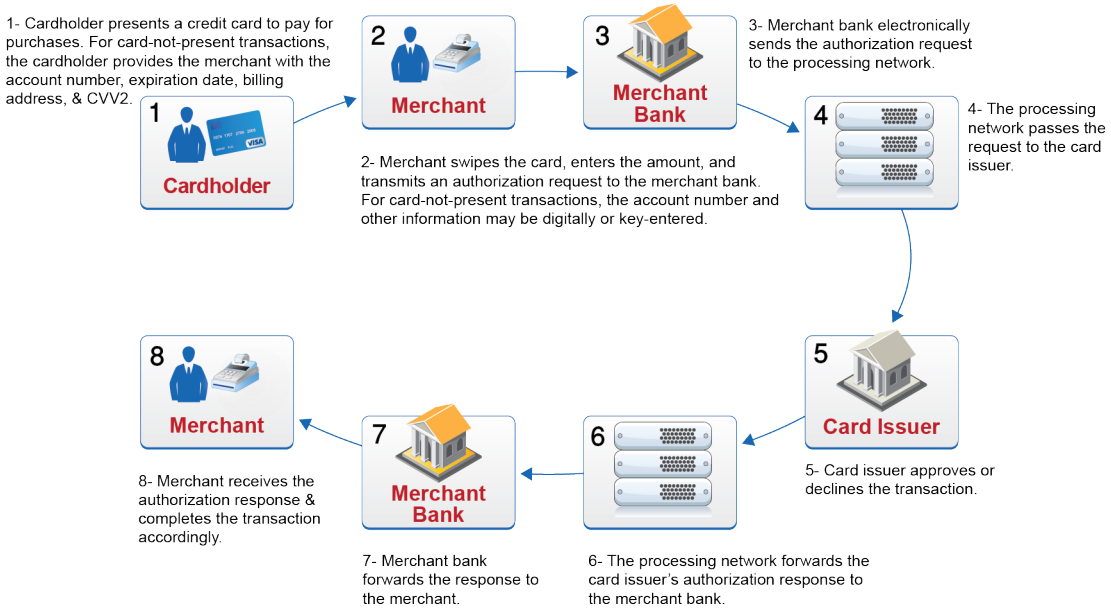

Figure 3: Authorization and transaction process flow for card payments
Source: (Ingenico. 2012)

A large number of electronic payment systems have emerged that support the use of digital cash. Digital cash typically takes several forms like payment cards, e-cash, e-wallet, e-vouchers, and micro-payment coupons. No matter what the physical vehicle used to transmit the information – whether credit card, debit card, PC, PDA, mobile phone, or smart card – the underlying electronic payments system is critical to facilitate transactions in the global, digital economy (Visa, 2003).

The key drivers for the revolutionary speed in developments in the digital payments field are intrinsic in the cost and risks associated with handling physical cash (Zink and Kemna, 2013). According to a recent study prepared by the Asian Banker (2013), cost and security are key concerns for merchants when managing cash. Cost was perceived as an undisputed main

concern for banks in mature markets, but security was perceived as more important in emerging countries. See also Figure 4.

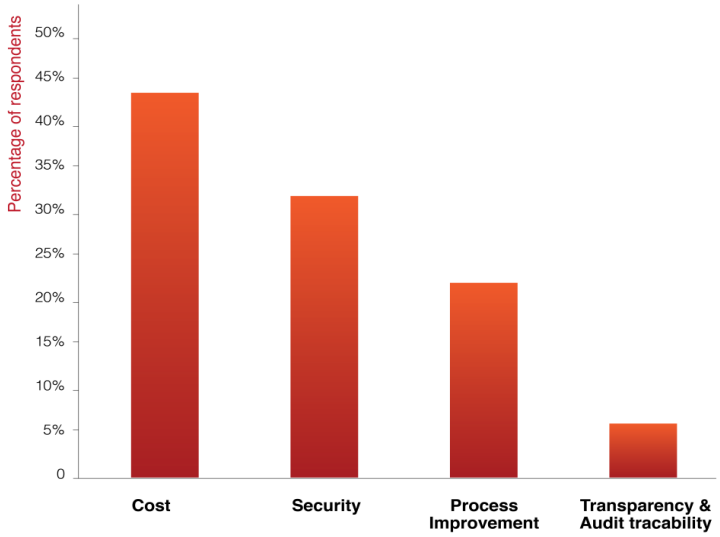

Figure 4: Key concerns for merchants in the cash handling cycle
Source: (Asian Banker, 2013)

For instance, according to Kleine et al. (2013), the cost of handling physical cash in Germany is estimated at €12.5 billion per year. The European Payments Council estimates that the European Union's €360 billion in cash transactions cost at least €50 billion a year (The Economist, 2007). A study done by CBoI (2013) estimated that the average cost of payments in Europe is approximately 1.2% of the GDP. However, there is huge variation in this, with payment costs ranging from 0.6% in the most efficient country in Europe to 1.6% for the least efficient (ibid.). These costs are very substantial and vary widely between countries.

As depicted in Figure 5, the cash cycle is a complicated and highly interactive process, where players with diverse incentives are forced into cooperation. Banks have to carefully balance cost management and cash availability in the tight framework given by the regulator.

Figure 5: Issues in the management of the cash cycle
Source: (Asian Banker, 2013)

As depicted in Figure 6, Asian Banker (2013) identified four development stages for an integrated cash supply chain. These stages are characterized by different levels of cost

efficiency gains and control over the cash cycle. The first stage represents the traditional cash handling approach. In stages 2 to 4, banks develop and fine-tune a number of necessary instruments to counter inefficiencies and to adjust the operating model towards shared responsibilities. These stages represent a transformation roadmap that can shift the cash supply chain from "reactive" to "needs-based".

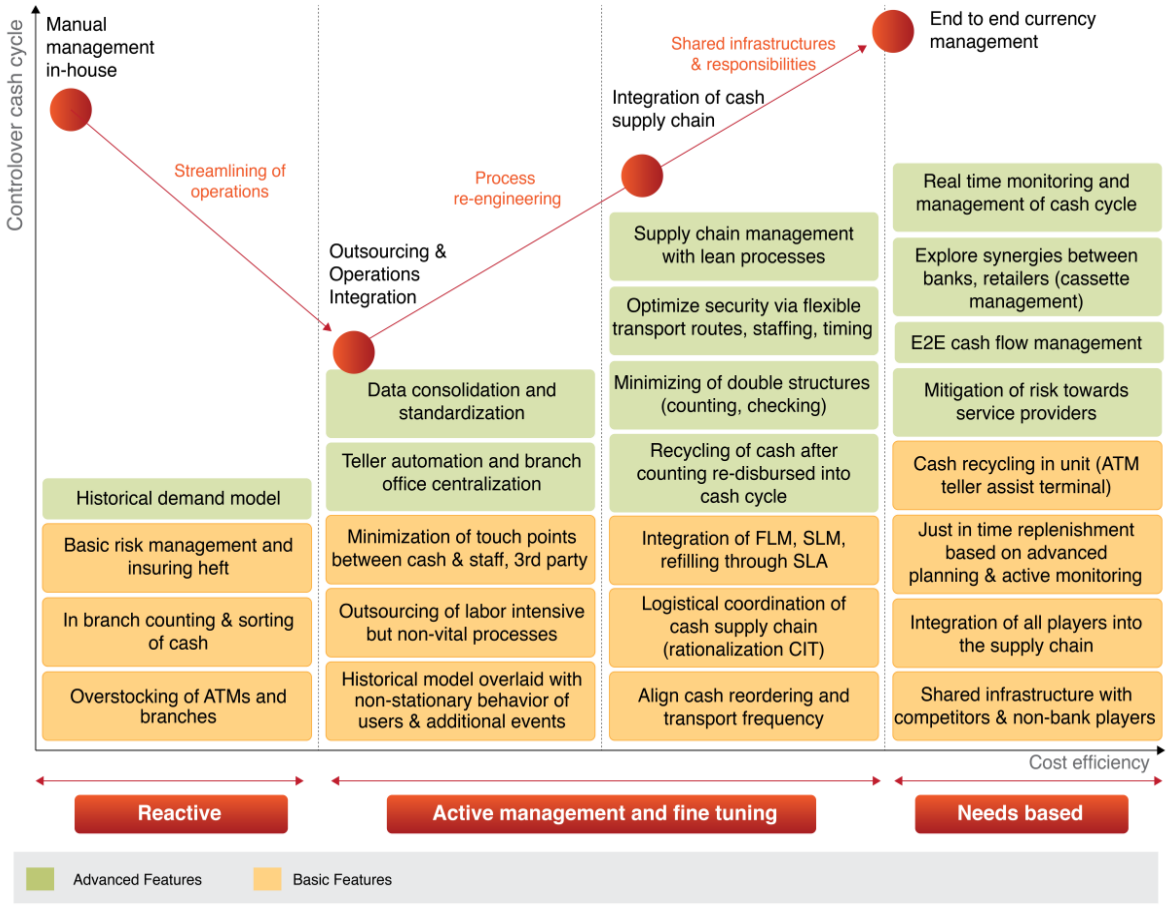

Figure 6: Key building blocks of an integrated cash supply chain
Source: Asian Banker (2013)

In light of the above findings, the financial industry is realizing the implications of the increasing acceptance of electronic payment systems on the development and growth of their economies. The direct consequence is that these implications have the potential to contribute to the enlargement of new business opportunities and the expansion of economic activities. This again has the potential to lead the development of more sophisticated digital services.

Globally, there is a growing preference for conducting financial transactions electronically (Foster et al., 2010; Godin, 1995; Guttmann, 2002; Lynch and Lundquist, 1996; Kupetz, 2007; van Blokland, 2006; Wayner, 1997; Wolman, 2012). Figure 7 depicts a growth rate in global non-cash payment transactions that reached 307 billion transactions in 2011 according to a report published by World Payments (Capgemini, 2013). The report shows that growth rates are higher in the developing markets at 18.7%, versus 6.2% in the mature markets in 2011.

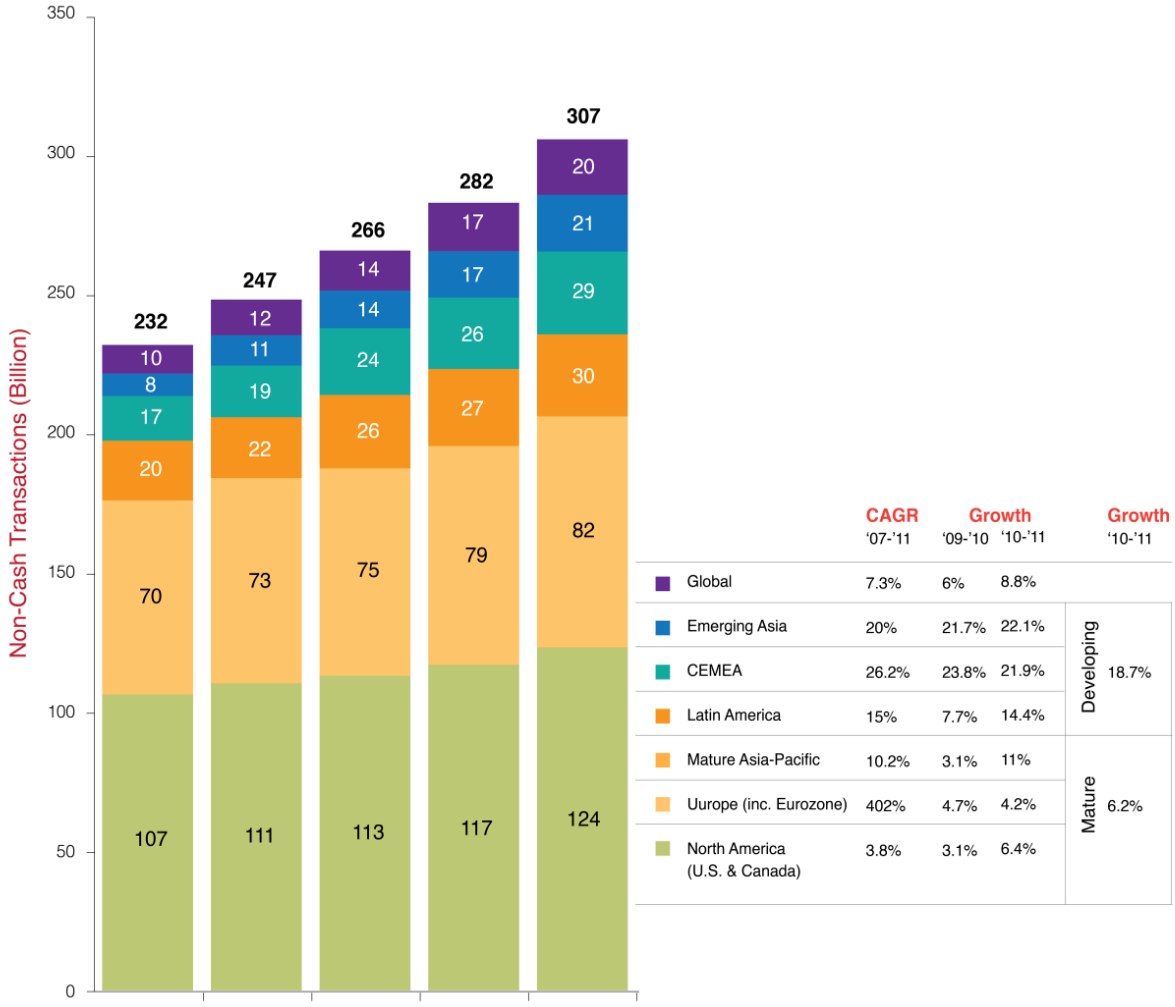

Figure 7: The global non-cash transaction market's continued growth

Source: (Capgemini, 2013)

Another interesting finding from the same report is depicted in Figure 8. It shows the increasing share of the cards compared to other non-cash instrument across all regions. The use of cards accelerated during 2011, with debit card volumes rising 15.8% to a total of 124 billion transactions, and credit cards climbing 12.3% to 57 billion. The growing global popularity of these non-cash payments instrument may have been promoted by liquidity returning to markets and overall improving sentiment, as well as the growing application of e-commerce.

In general, the literature establishes a strong link between electronic payments and their role in supporting countries' participation in the global economy. For instance, the continued expansion of electronic payment options in developed economies is seen as a key factor in reducing friction and creating economic efficiency. In developing or transitional economies, electronic payment systems are envisaged to play a powerful role in modernizing financial systems, creating economic transparency, and contributing to greater predictability, liquidity, and stability.

In general, it is recognized that electronic payments form an ongoing virtuous circle and that they help sustain long-term economic development. Tanaka (1996) argues that digital payment systems will go through three stages of development, as depicted in Figure 9. Although Tanaka (1996) presents more than one scenario for digital cash development, he

states that security will be the most critical element to overcome in the years to come. Many studies have emphasized the need for enhanced security and trust to promote the acceptance of online payment standards (Guadamuz, 2003; Jing, 2009; Maurer, 1998; Singh et al., 2011). Their argument states that both consumers and service providers must be able to trust that their information is kept intact and that it remains secure.

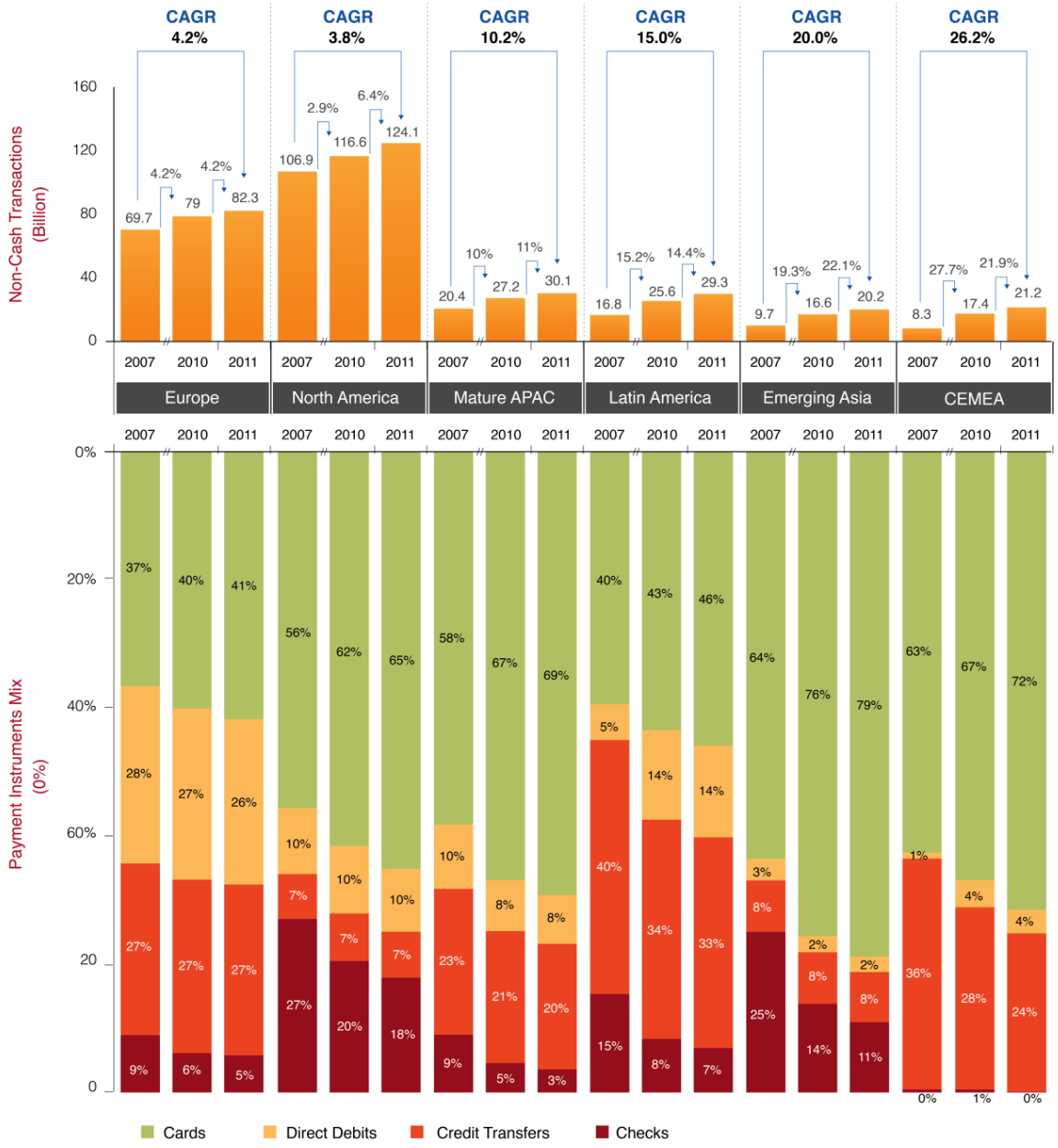

Figure 8: Comparison of Non-Cash Transactions (billion) and Change in Payments' Mix (%), by Region, 2007, 2010–2011
Source: (Capgemini, 2013)

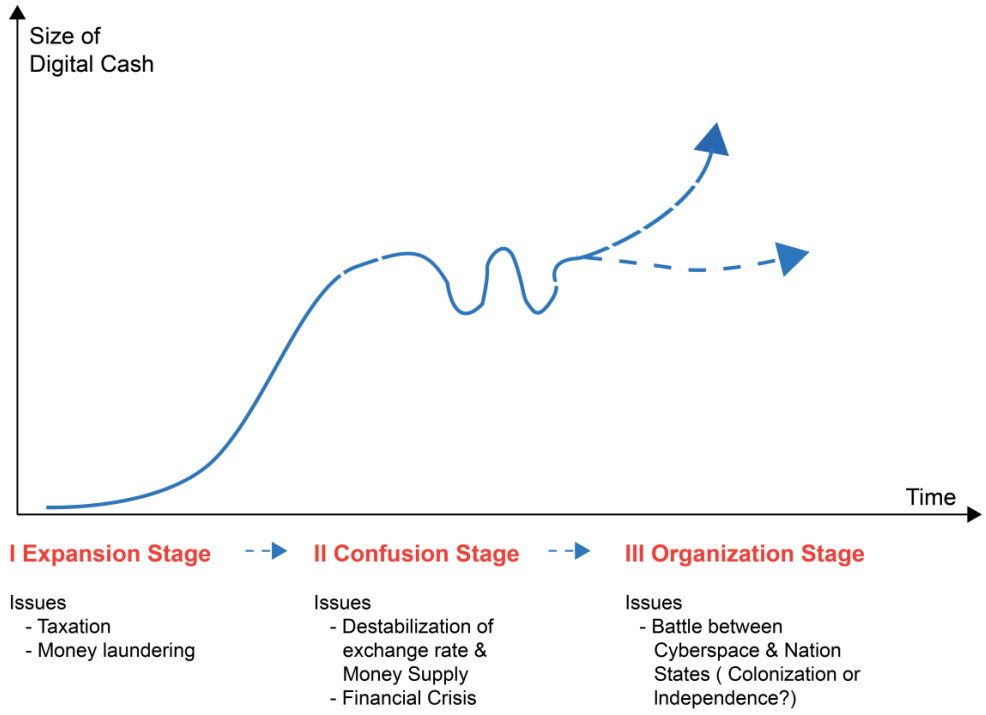

Figure 9: Digital cash development stages
Source: Tanaka (1996)

The literature in general indicates that the evolution of electronic payment systems is dependent on several pre-requisites such as (1) availability of reliable infrastructure, (2) trust and credibility of issuing authority, (3) coverage area, (4) critical mass and (5) the overall ignition strategy [5] (Abrazhevich, 2001; Bellare et al., 2000). See also other factors identified by Kannen et al. (2003) in Table 1.

Table 1: Electronic payment system requirements

Requirement	Description
Security	• Systems security: technical and organizational IT infrastructure security for customers and merchants during the electronic payment process. • Transaction security: the secure and reliable handling of electronic transactions, including data integrity as well as protection against the unauthorized outflow of funds. • Legal security: legal frame for electronic payment and the legally binding closing conditions.
Trust	In order to build trust in the electronic payment system, three areas need to be considered: • Data: protection of personal and business related data in each phase of the electronic payment process in accordance to national laws and regulations of data protection. • Identity: the identity management frame within which the trust is established. • Role behavior: the dynamic aspect of trust is captured, i.e., acceptance of license regulations, correct declaration of data, payment of amounts corresponding to the negotiated conditions.
Fungibility	• An electronic payment is fungible if it can be used comprehensively, i.e., in as many possible payment situations as possible. This presupposes that electronic payment methods need to be available over a wide area and must be broadly accepted and independent of the chosen distribution channels (internet, kiosk, mobile phone, POS)
User friendliness	• Basic principles of user ergonomics such as being clear and self-explanatory, • There are also further requirements such as failure tolerance, integrated IT devices, marginal lags as well as transparency and more control for the user.
Efficiency	• Performance and quantified economic feasibility.

Source: Kannen et al. (2003)

Other studies have focused more on user requirements and systems functionality (Abrazhevich, 2001; Bellare et al., 2000). They refer to multilayered complexity challenges faced by service providers to integrate with the proprietary solutions offered by banks. The primary challenges are depicted in Table 2.

Table 2: Challenges faced by service providers to use electronic payment systems

Challenge Item	Explanation
Requirements	The features of the offered payment systems have to be adjusted to the requirements for the payment process.
Processes	The intended payment systems have to be integrated into business processes. This is no simple task, as every payment system (in particular sophisticated ones) has very specific control logic. Furthermore, it may be that a payment system only supports a part of the entire payment process
Services	The individual services provided by each of the payment systems have to be integrated in an overall concept.

According to literature on the topic, these challenges have created opportunities for new players to enter the market (Brumen and Welzer, 1998; Capgemini, 2013; Gupta and Subramaniam, 2005; Fera et al., 1996; Konvisser, 1997; Morrison et al., 2003). For instance, PayPal and Citadel EFT have emerged as cybermediaries that enable financial transactions over the Internet. They collect fees for facilitating transactions over the Internet without taking ownership of the products or services sold. Cybermediaries allow consumers to establish electronic accounts quickly and to transfer funds into their on-line accounts from traditional bank accounts (typically via the Automated Clearing House's transactions network), and vice versa, after verification of the consumer's identity and authority to access such bank accounts (Malhotra, 2010). In addition, the larger mediaries further allow transactions to and from credit card accounts. The speed and simplicity with which cybermediary accounts can be established and used have contributed to their widespread application (ibid.).

Google has been pressuring applications and mobile game developers to use its costlier in-house payment service, Google Wallet (Barr, 2012). Google Wallet is a mobile payment system developed by Google that allows its users to store debit cards, credit cards, loyalty cards, and gift cards, as well to redeem sales promotions on their mobile phone (Amoth, 2011). Google Wallet uses near field communication (NFC) to make fast and convenient secure payments by simply tapping the phone on any PayPass-enabled terminal at checkout.

A new chip on the block is the Bitcoin, a payment mechanism that is highly based on personal identity credentials. It is the virtual currency touted to be the game changer in the digital world. Completely based on the Public Key Infrastructure and strong cryptography, Bitcoin represents the true digital economy. Publicly traded on currency exchanges, each Bitcoin is currently worth around 455USD. Many e-commerce sites accept payments in Bitcoins. The security and the transparency offered by Bitcoin are making it the payment system of the future.

While these payment methods have established themselves as advanced e-payment systems, they still lack the portability in mainstream shopping (Budde, 2012). Payment systems using mobile phones constitute another fast-growing market, as do calling cards. However, the real breakthrough will only happen when the large financial institutions decide to open up the market to e-payments.

Overall, the main forms of online payments to date are still dependent on the use of credit cards and direct debit cards (ibid). In this line, banks all over the world have been working to improve their payments infrastructures, enabling wider adoption and greater usage of card-based non-cash means and channels.

In comparison, Arab countries still lag behind their international peers. This is to say that Arab countries are still considered to be predominantly cash based societies. Besides, the amount of cash in circulation in Arab countries is on the rise because of several factors including: (1) the growth in population, (2) annual inflation rates, (3) consumer behavior due to media and marketing, and (4) easy access to cash through ATMs. Thus, banks in Arab countries have intensified cash dependency and have been managing the supply of cash to the marketplace.

Though some Arab countries are more advanced than others are, consumers still seem to lack confidence in Internet transactions. Credit card-based payments are showing increasing popularity and usage, but consumers seem to be concerned with the security of their information, which is also argued to deter many other potential users from directly making purchases on the Internet. Governments have come to understand that they can play a critical role in supporting the development of the digital economy. We use here the case of the United Arab Emirates, considered as one of the pioneering countries in the Arab world, in the implementation of innovative technologies to drive growth in the country's overall economy. The next section will highlight the UAE's government strategic intents and will build the thread for discussion on electronic payment practices and future developmental plans in the country.

ELECTRONIC PAYMENT SYSTEMS IN THE UAE

In the past few years, the UAE government has embarked on an extensive review of its processes and structures. As a result, it has announced its 2021 vision that aims to develop a more competitive and sustainable economy (UAE Vision, 2013). Among the many initiatives, it issued a revised e-government plan that prompts government agencies to streamline its processes and deliver all its services electronically (Al-Khouri, 2012). The government is enthused to believe that reliable and trusted electronic payment systems would need to be considered as building blocks to enabling e-government environments. Multiple payments systems currently exist in the UAE, which will be looked at in the following sections.

E-Dirham

The e-dirham is a card-based payment method devised by the Ministry of Finance in order to facilitate collection of government fees and provide a secure payment method [9]. The initiative that was implemented in collaboration with the National Bank of Abu Dhabi started as a stored-value card based payment system to eliminate cash transactions and manage revenue collection in the federal government.

The e-dirham was first launched on February 3, 2001, which made the UAE the first country within the Arab region to introduce such a system. It has evolved over the years into a comprehensive payment platform. The current platform supports various payment channels including: (1) Electronic fund transfer at point of sale (EPOS) terminals, (2) Over the Internet through E-Dirham Payment Gateway), (3) E-Stamp and (4) Debit Cards and Credit cards. See also Figure XX. The government has recently announced a network of ATMs/ CDMs and a network of EFT POS terminals through which customers can top up their e-dirham card.

Wages Protection System

The Wages Protection System (WPS) is an electronic salary transfer system that allows private sector companies to pay their workers' wages via banks and other licensed financial and

authorized institutions that provide the service. The system was developed by the Central Bank of the UAE in 2008 in a step towards ensuring and protecting the rights of workers. It allows the Ministry of Labor to create a database that records wage payments in the private sector to guarantee the timely and full payment of agreed-upon wages.

Once the company's authorized bank receives the employees' salaries, it sends a notification to the Wages Protection System. The system then sends the workers' details as well as the salary transfer instructions electronically to the Central Bank of the UAE, which will in turn forward those details to the Ministry of Labor's database in order to ensure that the details received correspond with those registered with the Ministry. The system will then send the approved information to the appointed agent in order to start paying the wages. To report non-compliance, workers can interact with the government in person through the Ministry's offices or via an online portal. The employee is now able to draw his salary in cash from any participating financial exchange house by providing a proof of identity. Figure 10 illustrates the interactions between the different entities.

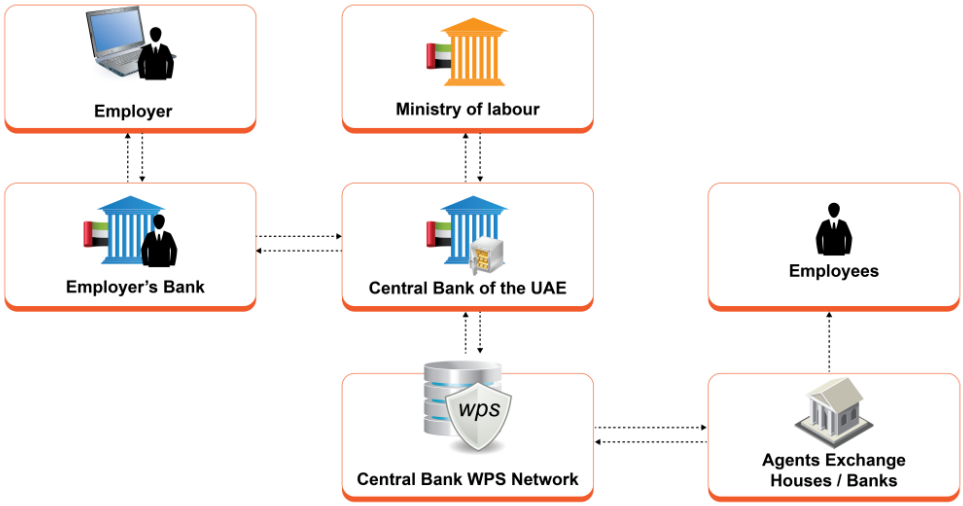

Figure 10: UAE WPS System

Other Stored Value Cards

Several stored-value cards were deployed over the past decade in the UAE, see for example Table 3. All deployments have their own card technology, readers, and back office applications. Most cards are sold as pre-paid debit cards. Some of these provide support for multiple channels for top-up and usage.

Table 3: Stored-value cards in UAE

Fuel Cards	
Rahal card (ADNOC)	The Abu Dhabi National Oil Company (Adnoc Distribution) launched a prepaid smart card named the 'Rahal card' in 2008. The card helps in managing fuel cost and any other services required at ADNOC service stations. The highly customized card comes with a minimum recharge amount of AED 100 (around $27).
Emarat (semi-gov)	This is a smart card based initiative with the objective of easing management and getting more control on spending for fuel and other services at Emarat filling stations. The initiative is designed to cater for different customer segments like, (a) 'safer card' targeted to medium and large vehicle fleets, (b) an 'Aheer card' for individual and small fleets, and the (c) 'Em-cash card', which is a convenient alternative to cash. Online applications and customer care is provided for more effective service delivery as well.

Transport Cards	
OJRA (semi-gov)	The Department of Transport in Abu Dhabi has launched the 'Ojra card' to facilitate travel inside the city. With the 'Ojra Bus Pass', travelers can enjoy unlimited, cost –effective, and flexible travel. The paper card/ pass was designed to suit the need for daily hassle-free travel with its varied options. The pass can be purchased from Ojra Kiosks installed at important bus stops**.**
NOL Card (gov)	The Dubai Roads & Transport Authority (RTA) introduced NOL (Smart card), which enables users to travel in Dubai's metro, buses, waterbuses, and paid parking among others. The project is managed by the Unified Automated fare Collection Department at RTA. The NOL e-services portal helps in managing NOL cards anywhere and at any time. Studies are underway to determine the feasibility of introducing use of Nol cards to pay for cab rides, convenience stores, and other common transactions. Trials are underway to bring this card to the mainstream as a generic stored value card. This card has been very successful in Dubai with millions of users enrolled. NOL has also executed on a successful partnership with a local bank to launch the Go4it Visa credit card that combines credit facilities with loyalty schemes and discounts at various outlets**.**
Sayer cards (gov)	The Sharjah transport authority (Mowasalat) introduced Sayer e-payment smart cards for bus passengers, to prevent complaints such as not having received the exact change from drivers when purchasing tickets. The Sayer card permits passengers to top up their cards at vending machines, which are installed at various stations**.**
Parking Cards	
Abu Dhabi Mawaqif (gov)	Department of Transport (DoT) has launched the Mawaqif program in October 2009 with the aim of establishing an excellent car parking management system in Abu Dhabi. Mawaqif parking cards are available at Mawaqif Customer Service Centers. Mawaqif also accepts payments through mobile phones. Four customer service centers provide information on Mawaqif parking services on a 24/7 basis. At these centers, customers can buy prepaid parking cards and apply for residential permits**.**
Sharjah Parking	The Department of Sharjah Municipality has created a range of parking options, including reservation of parking spaces in advance and prepaid parking cards. Optional parking stickers can be used for two 'regular' areas for Dh1,300 a year, two 'vital' areas for Dh1,700 a year, or one 'regular' and one 'vital' area for Dh1,700**.**
Student Cards	
Jawaz Card	The Dubai International Academic City (DIAC) and Dubai Technology and Media Free Zone Authority (DTMFZA) offer all students enrolled at DIAC and Dubai Knowledge Village (DKV) universities a unique student ID and lifestyle card called the Jawaz card. It is a mandatory and official card for students. Key befits includes discounts on various products across more than six hundred retail outlets, access to events, and mobile updates on promotions and discounts. It also provides a dedicated helpline for access to DIAC's recreation room facilities**.**

Limitations of the current deployments

There are many limitations of current payment deployments in the United Arab Emirates. Following are the major issues:

- **Interoperability:** Lack of interoperability between these systems causes dissatisfaction among all the stakeholders. For example, despite being a critical mode of government revenue collection, limited services are linked to the e-dirham payment system.

- **Multiple Cards:** Customers carry multiple plastic cards with money locked in all those wallets and loyalty points that cannot be aggregated. There is no refund mechanism for these cards and any residual value left in the cards is lost. The cards also have to be recharged separately.

- **Merchants and service providers** face a challenge in integrating multiple schemes with their backend systems.

- **Private Label Players** have to absorb the total cost of the technical infrastructure (issuing and redemptions), integration, upgrades, and supporting business processes

(registration, reconciliation, settlement). Customers end up going through a long registration process for every new card. No single party can maximize the potential of their customer base or get benefits from economies of scale. Generic/small merchants who want to benefit from such technologies cannot afford to launch their own closed loop service.

The UAE government has realized all these issues and their potential impact on the future. It has recognized that in the absence of a coherent strategy to support payments in e-government and e-commerce scenarios, it would just be a matter of time until their disconnected initiatives get further apart. As such, the government is currently in the process of examining leveraging its national smart identity card infrastructure to support secure electronic payment scenarios both for government and for commercial purposes.

SMART IDENTITY CARD AS AN ENABLER FOR SECURE EPS INFRASTRUCTURE

The government of the UAE issues smart identity cards to all of its population (Al-Khouri, 2012). The smart identity card contains digital credentials that are established based on a strong enrolment process that links the cardholder's identity with his/her biometrical and biographical details. The card is mandated today by law as the primary identity document in the country. The government aims to group together existing identity cards (e.g., labor card, health card, etc.) and replace them with the new smart identity card. The advanced features and micro-processing capabilities of the new smart identity card opens up opportunities to support and enhance existing electronic payment systems in the UAE. We argue that the new card can act as a 'killer' application token that ensures the integrity and security of electronic transactions and payment systems. Figure 11 depicts some of the potential benefits.

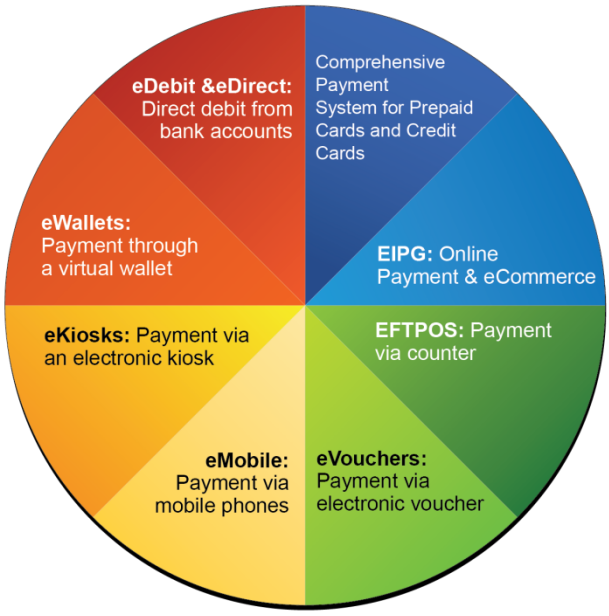

Figure 11: Potential use cases of UAE smart identity card for digital payments

Authentication

The UAE smart identity card offers multiple factor authentication capabilities to verify the identity of the online cardholders. These capabilities range from simple verification methods (i.e. ID numbers and passwords), to more sophisticated ones such as digital certificates and biometrics verification. See also Figure 12.

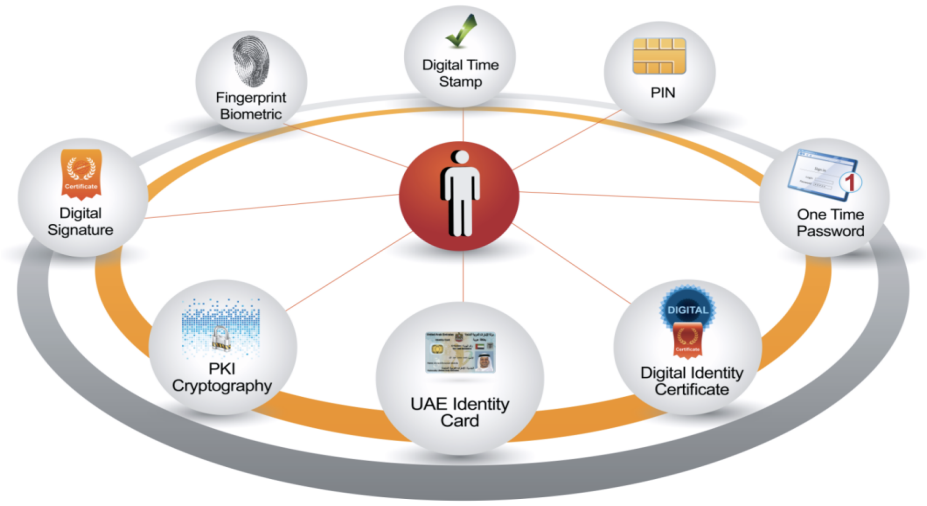

Figure 12: UAE ID card authentication capabilities

Existing payment systems rely on identifying individuals, which is usually based on a username and password for authentication. These variables can often be stolen, accidentally revealed, or forgotten. The smart identity card overcomes this primary weakness by offering a choice of multi-factor authentication options. Electronic payment systems can deploy a more stringent authentication process, prior to the authorization of a transaction.

Besides, the UAE government has set up an online validation gateway that enables public service providers to authenticate identity electronically and instantaneously, similar to a credit card authorization process (Al-Khouri, 2014a; 2014b). Certainly, the integration of such a government backed-gateway with existing electronic payment systems will gain more trust from the populace and hence a stronger case for acceptance and usage.

Public Key Cryptography (PKI)

In addition, the UAE smart identity card uses public key cryptography to provide the highest level of integrity and security to the issuance of its electronic identities and for electronic transactions. The most obvious application of a public key cryptography is confidentiality. PKI ensures that people are who they say they are and proves that documents have not been tampered with, which is critical when conducting online transactions. Figure 13 depicts a simplified process. Two of the important components in the PKI infrastructure, namely, digital signatures and time stamping, will be further discussed.

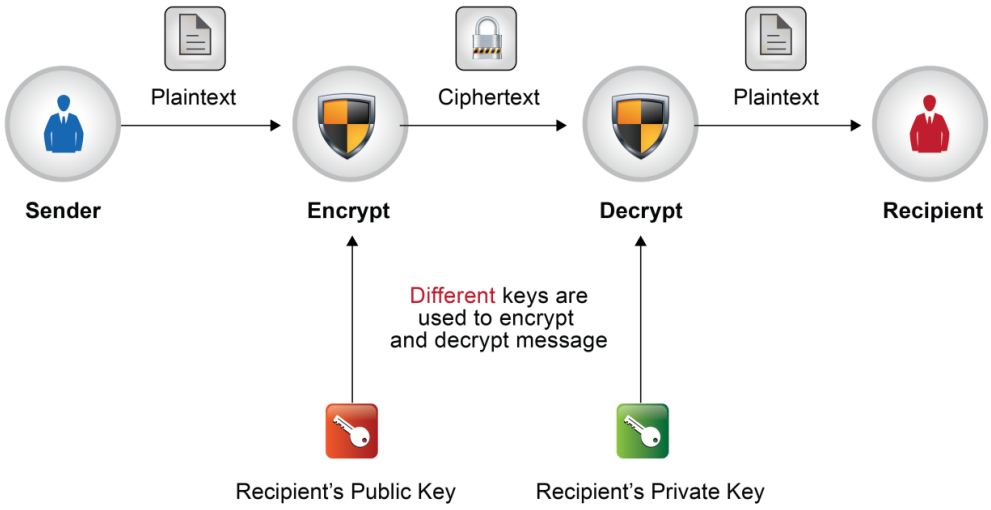

Figure 13: Public key cryptography process

Source: (Miscrosoft. 2005)

Digital Signature

The UAE smart identity card comes with digital certificates embedded in the electronic chip capable of producing digital signatures. A digital signature is an electronic signature that can be used to authenticate the identity of the sender of a message or the signer of a document or transaction, and possibly to ensure that the original content of the message or document that has been sent is unchanged. In simple terms, digital signatures cryptographically bind an electronic identity to an electronic document and the digital signature cannot be copied to another document, producing a legally enforceable electronic record. The digital signature certificates in the UAE identity card are envisaged to support electronic payment systems by enabling automated formal approval processes from within an organization's existing workflow systems. See also Figure 14.

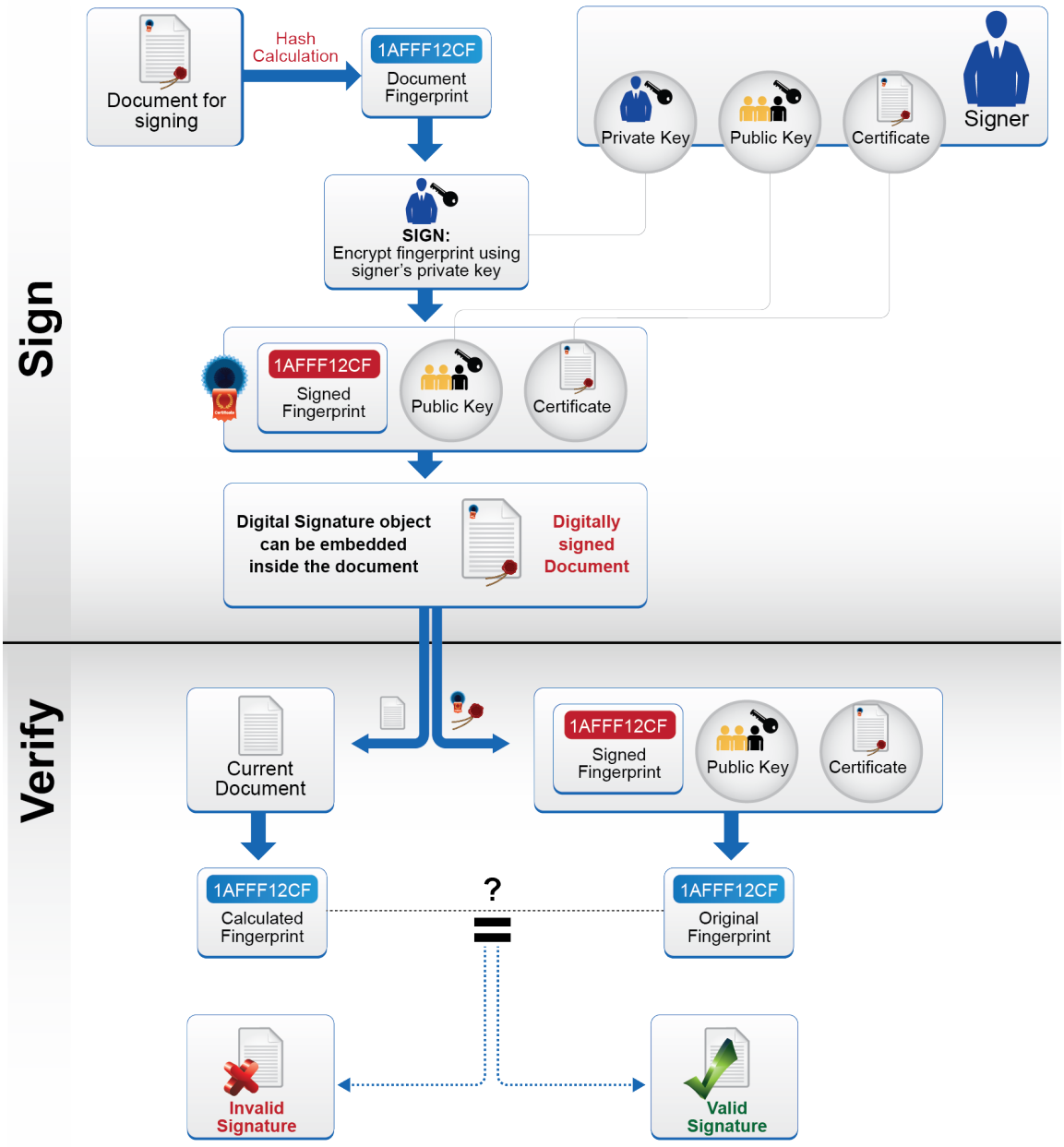

Figure 14: Digital signature process

Source: (Digicert, 2014)

Digital Time-Stamping

The UAE identity management infrastructure provides digital time-stamping services when transactions are validated against the online validation gateway. Time stamping is the process of securely keeping track of the creation and modification time of a transaction. A trusted digital timestamp gives strong legal evidence that the transaction was conducted at a point-in-time and has not been changed since that time. See also Figure 15.

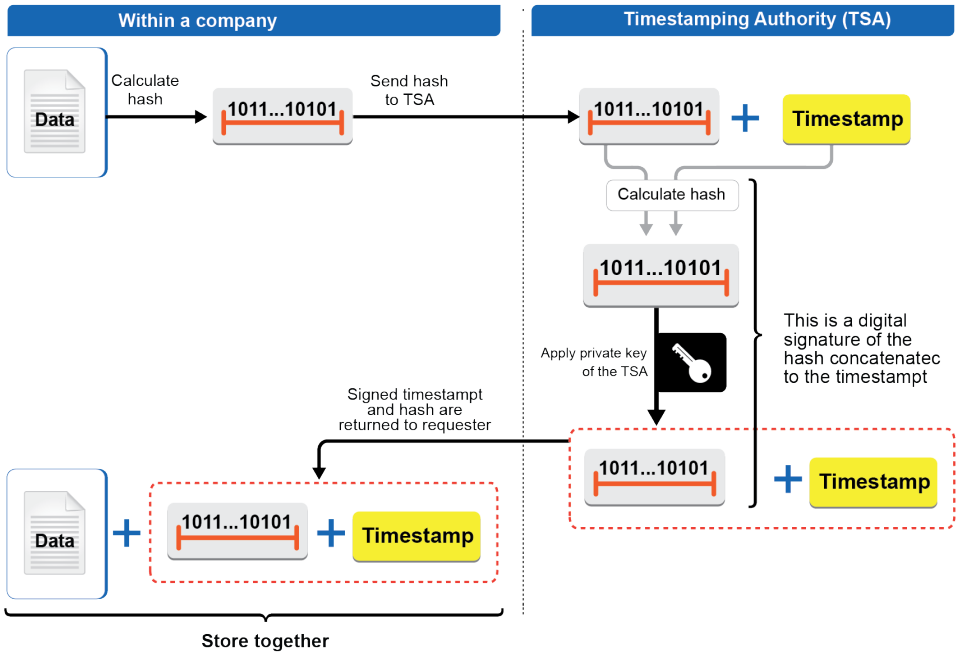

Figure 15: Trusted time-stamping process
Source: (Van den Bosch, 2013)

One-Time Password (OTP)

A one-time password (OTP) is a unique and time-sensitive password used as an additional security layer. It is widely used in online banking, corporate networks, and other systems containing sensitive data. The UAE is working to include this function in its identity card, which is assumed available by the second half of 2014. The distribution mechanism is planned to be both web-based and through text messaging on mobile phones.

The described capabilities have the potential to provide unique Out of Band Authentication capabilities. An ID is presented on a portal for authentication or access to a service. The OATH applet on the ID card is read off the card for OTP generation. This is verified against the provided ID at the backend where OATH Servers to determine the veracity and a signed response is sent to the service provider. This provides an exponential increase in the trust in an online transaction.

Emirates ID Card and Social Inclusion

Using these high security and transaction trust features, the Emirates ID is poised to bring in social inclusion of the non-banked sector of the UAE population into the financial mainstream. A secure ID card that can facilitate financial transactions is now in the hands of every legal resident in the country. The ID card can be used in conjunction with the secure digital identity credentials for online ID authentication. It should also enable the e-dirham to be placed in the ID card. The ID card would work as a pre-paid card in the WPS environment with financial transactions facilitated by the ID verification. The following diagram represents the national ID

schema in the WPS environment.

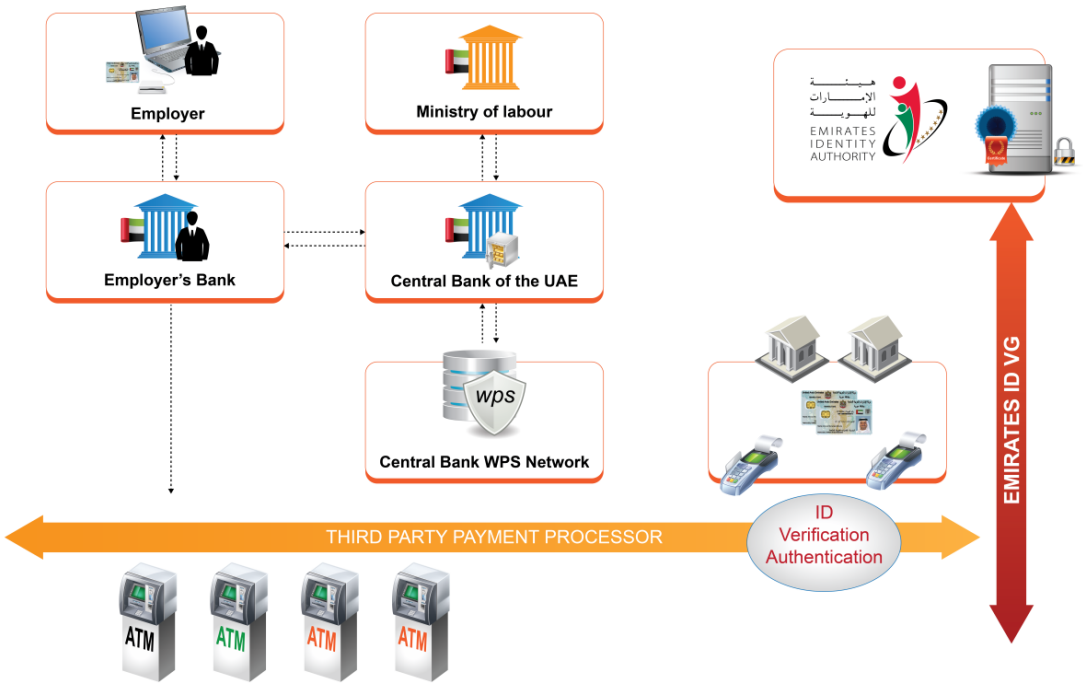

Figure 16: Enhanced (Smart) WPS System

The UAE ID card has the potential of enabling financial transactions across the mainstream financial networks in the country.

CONCLUSION

Today, the technology of money is racing to catch up to social changes that have radically altered how we interact and therefore how, why, and when we use money (Birch, 2012). It is - impossible to say what the unintended consequences of innovations in financial technology will be; we can only note that they will come and we can only make some intelligent guesses (ibid.).

It is evident that alternate payment mechanisms will become dominant in the near future as digital cash overtakes physical cash. The socio-economic benefits and convenience will accelerate the adaptation as ingredients necessary for ignition are already in place. Undoubtedly, the digitally driven world of tomorrow will be forcing the creation and application of more efficient, automated, secure, simple and low cost mechanism to collect money for services and products.

This article attempted to illustrate how the UAE government examines the use of its national identity management infrastructure and smart identity card to enable more secure electronic transactions. The features of the UAE smart identity card represent extensive layers of security and protection to build cardholder confidence to conduct electronic transactions. When used in relation with electronic payment applications, the smart card can provide advanced capabilities ranging from encryption, digital signatures, and strong authentication mechanisms. Current electronic payment systems do not provide the same security commitments for online transactions. Thus, the use of the government identity management

infrastructure is likely to become an integral part of electronic payment systems in the UAE in few years to come.
The integration and application of this government payment method in e-government and e-commerce domains of practice will be a determinant factor for its fruition. Consumers will be more likely to use such methods on the condition that it will provide them with an additional security layer. In this context, the government would then need to consider legal protections as credit and debit cards do.

Further research is needed to identify characteristics of an independent, open, and interoperable platform that can be implemented and supported at national level in the UAE. Further research should also include exploring the possibility of leveraging existing government identity management infrastructures for this purpose.

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