Chapter Five
E-Commerce Payment Systems

E-payment systems are becoming central to e-commerce as companies look for ways to serve customers faster and at lower cost. Emerging innovations in the payment for goods and services in electronic commerce promise to offer a wide range of new business opportunities. The current state of online electronic payments is in many ways reminiscent of the medieval ages. The merchants of Asia and Europe faced a similar problem while trying to unlock the commercial potential of the expanding marketplace. Those ancient traders faced a number of obstacles such as conflicting local laws and customs regarding commercial practices and incompatible and nonconvertible currencies that restricted trade. To circumvent some of these problems, traders invented various forms of payment instruments such as promissory notes, bills of exchange, gold coins, and barter. The merchants also developed commercial law surrounding the use of these instruments that proved to be one of the-turning points in the history of trade and commerce. We are on the verge of a similar sort of development today with regard to e-payment systems.

Everyone agrees *that the* payment *and settlement* process *is* a *potential bottleneck in the* fast-moving electronic commerce environment, if we rely on conventional payment methods such as cash, cheques, bank drafts, or bills of exchange. Electronic replicas of these conventional instruments are not well suited for the speed required in e-commerce purchase processing.

3.1.1. Properties of e-money

Irrespective of the money, there are two distinct sets of properties to consider in money transfer: the ACID test (atomicity consistency, isolation, durability) and the ICES (Interoperability, conservation, economy scalability). The ACID Test .There are four ACID Tests and these are:

1. **Atomicity**: This test says that a transaction must occur completely or not at all. For example, when you transfer Rs. 5000 from savings to checking, the full amount must debit the savings and credit the checking account before the transfer is considered successful.
2. **Consistency:** All parties involved in the transaction process must agree to the exchange. For instance, in a customer-retailer relationship involving a purchase, the customer must agree to purchase the good for a specific price and the merchant must agree to sell it at that price, otherwise, there is no basis for exchange.
3. **Isolation**: Each transaction must be' independent of any other transaction and be treated as a stand-alone episode.
4. Durability: It must always be 'possible to recover the last consistent state or reverse the facts of the exchange. This means reversing charges in the event the customer changes his or her mind.

The ICES Test

The ICES test addresses four important properties of money transfer:

1. ***Interoperability***: Ability to move back and forth between different systems.
2. ***Conservation***: How well money holds its value over time (temporal' ~ consistency) at:\d how easy money is to store ,and access (temporal durability).
3. ***Economy***: The prime condition for processing a transaction should' be inexpensive and affordable. This property has a direct relationship to the size of the transaction. For instance a Rs. 50,000' purchase costing only Rs. 450 to process is quite economical. If the charge IS the same for a Rs. 50 item, it may be considered expansive. In banking, for example, wiring money from one bank to another usually costs a fixed amount of money (say, Rs. 625), regardless of the amount of money transferred.
4. ***Scalability***: This test means to the ability of the system to handle multiple users at the same time.

Cash has all the ICES properties except conservation. Checks and credit cards as electronic methods of payment do not. A check transaction is not isolated, because anyone can write a check and proceed to withdraw the money from the bank well before the check is cleared; the check writer can also put a stop on the check. Checks are money-transfer atomic, although there is usually a 1-to-3 day delay in clearing the check for final payment.

In the case of cash, the ACID properties are fulfilled. The problem with cash is transportability and storage of large amounts. Credit cards may appear atomic to the seller, but they are not. The seller is guaranteed payment, but the credit card issuer may lose out if the card is stolen or used fraudulently. Also, the question of storing and retrieving value is not applicable in a credit-based system.

Cash is probably the most anonymous form of payment with respect to the bank and the merchant. Anyone can walk up, purchase an item, and pay in cash without having to show identification. Checks and credit card transactions are less anonymous than cash, although some forms of digital transactions can hide the identity of the buyer from the seller and vice

3.1.2. Types of E-Commerce Payment Systems

i) E-Commerce Payment Systems on the Bases of Transaction Value

1. Micropayment <5 Euro/Dollar, Transaction costs are nearly zero.
2. Consumer Payment 5-500 Euro/Dollar. Credit card transaction.

3. Business Payments >500 Euro/Dollar. Debit card transactions.

ii) E-Commerce Payment Systems on the Bases of Identified/Anonymity and on line/off line Matrix:

There are four types of e-money:

1. Identified and online (+1 + L).

E-money is unique to credit card, and debit card transactions. The buyer is clearly identified and the card is validated against the issuing bank's computer before payment is made. Making a deposit at the teller window is another example of a transaction that is identified and online. The teller asks for a picture ID to identify the customer and uses the workstation to credit (or debit) the account online.

2. Identified and off-line (+1 -L).

E-money is unique to purchasing by check~ American Express traveler check, or U.S. postal money order. The merchant asks for 10 to make sure the identity of the purchaser is known, but no verification is made against the account. If for some reason the check bounces, the merchant has to call the purchaser, backtrack through the issuing bank, and chase the purchaser for payment-a messy procedure.

3. Anonymous and online (-I +L)

E-money is unique to cash payments
where the identity of the purchaser is anonymous and ~ purchase is made on the spot for cash. It is also applicable to Automated Teller Machine (ATM) transactions such as withdrawals from savings, checking, or special accounts. In the case of deposits, however, the transaction is off-line. The account records the amount of deposit, but the bank does not make the money available until the deposited check clears through the Automated Clearing House (ACH). (This bank-to-bank processing method is explained later in the chapter.)

4. Anonymous and offline~ (-I -L)

E-money is unique to electronic cash.
It includes such transactions as making deposits in one's account via ATM and using a credit card at a merchant who does not have an online connection to the Visa/MasterCard

iii) E-Commerce Payment Systems on the Bases of Parties involved, duration of payment, cost of capital

1. Electronic Cash

What it is:

a. Value storage/exchange system managed by a private entity.
b. No paper documents or coins involved.
c. Used for small payments (under $10) or by people without credit cards.
d. Scrips are e-cash that works like a gift certificate acceptable at multiple stores; can be exchanged for goods or services but not cash.

How it works:

    e. Users open an account with an e-cash issuer (e.g., banks, PayPal).
    f. Users can withdraw e-cash from online account by providing proof of identity (digital signature) and a bank or CC account number.
    g. Issuer transfers e-cash to user's e-wallet or transfers money to third party accounts and debits user account.
    h. Debited amount replenished at the end of month from bank or credit card account.
2. Advantages:
    a. Processing is cheaper than credit cards (no authorization required).
    b. Portable: Freely transferable the Internet.
    c. Preserves user anonymity (cannot be tracked to source).
3. Disadvantages:
    a. Potential money laundering concerns (due to lack of audit trail).
    b. Less secure: Susceptible to counterfeiting.
    c. Double-spending potential: spending the same cash more than once.
    d. Different types of e-cash not interchangeable.
4. Security issues:
    a. Encryption (digital signatures) used to create tamperproof e-cash that can be traced back to its source (loss of anonymity).
    b. Anonymous e-cash requires embedding serial numbers by issuer (potential for double-spending between banks remains).
5. Widely used e-cash system on eBay, Yahoo, and Amazon auctions.
6. Peer-to-peer (P2P) system providing free payment clearing for individuals.
7. How it works:
    a. Users and merchants create PayPal accounts w/ valid e-mail address.
    b. Users fund account by authorizing a transfer from their checking account or via credit card.
    c. Deposited money can be used for online payment; buyer's account is debited and seller's account is credited (instant settlement).
    d. Cash can be withdrawn from PayPal account via ACH withdrawal.
8. How PayPal makes money:
    a. Transaction fee charged to businesses and recipients (free to senders).
    b. Earns interest on float (money deposited in PayPal accounts but not used immediately).

2. Credit Cards

Major credit card types are MasterCard, Visa, American Express ,Discover, Diners For consumers, the difference between a "debit card" and a "credit card" is that the debit card deducts the balance from a deposit account, like a checking account, where the credit card allows the consumer to spend money on credit to the issuing bank. In other words, a debit card uses the

money you have and a credit card uses the money you don't have. "Debit cards" which are linked directly to a checking account are sometimes dual-purpose, so that they can be used as a credit card, and can be charged by merchants using the traditional credit networks. A merchant will ask for "credit or debit?" if the card is a combined credit+debit card. If the payee chooses "credit", the credit balance will be debited the amount of the purchase; if the payee chooses "debit", the bank account balance will be debited the amount of the purchase.

Requirements for Issuing Credit Cards

As the bank or credit issuing agent or credit association will make payment for the merchant from the bank account itself, the access to credit card is quite limited as compared to debit card where anyone who has a balance in the bank can have access to. This shows that credit cards are eligible only to those the bank has more chance of getting the amount it pays on behalf of the merchant. Below are some of the criteria for qualifying customers for getting credit card.

1. Promonency

2. Credit Standing

3. Collateral

How Credit Card works?

- Consumers/businesses apply for a credit line with a bank.
- Issuing banks create a spending account for each user with a spending limit based on user's credit history (prominenecy), credit standing and collateral.
- Payments are processed through Visa/MasterCard networks (for a fee).
- User receives consolidated statement at the end of the month; can pay the entire balance or carry it over as a loan by paying a min amount.
- Issuing banks make money from interest charged on loans.

• Advantages:

- Worldwide acceptance.
- Built-in security for merchants and users (e.g., fraudulent purchases).
- Maintains audit trails (purchase and payment histories).
- Convenient for consumers (don't have to carry cash).
- Payment is simple any where and in any currency, thus matching the global reach of the Internet.
- The credit issuing bank company shares the transaction risk; helping overcome consumers fear and reluctance to buy goods they have not actually seen.
- Transaction costs are hidden from users (i.e. basically met by sellers and passed onto all customers, not just credit card users.)

- Disadvantages:
  - Merchants pay per-transaction fees and monthly fees, which may be expensive (3-5%) for small payments (under $10).This relatively high transaction costs makes them impractical for small value payments.
  - They cannot be directly for individuals to make payments for other individuals (peer to peer transactions)
  - Reluctance from the customers side.
  - Are not very democratic, even though they seem to be ubiquitous. Adults with low income cannot qualify for credit cards.

Credit Card Payment Processing

This document provides an overview of how online credit card processing works. Credit card payment processing for your store takes place in two phases: **authorization** (getting approval for the transaction that is stored with the order) and **settlement** (processing the sale which **transfers the funds from the issuing bank to the merchant's account)**.

The flow charts below represent the key steps in the process starting from what a customer sees when placing an order through completing the sale and finishing with the merchant processing the sale to collect funds.

Authorization process

1. When the buyer clicks the "Checkout" button, they are sent to secure servers to complete the checkout process. The Buyer (cardholder) places an order at the merchant's site by clicking the "Send Order" button on the Review Order page during checkout.
2. Yahoo! sends the authorization request to First Data Merchant Services (FDMS), the payment processor.

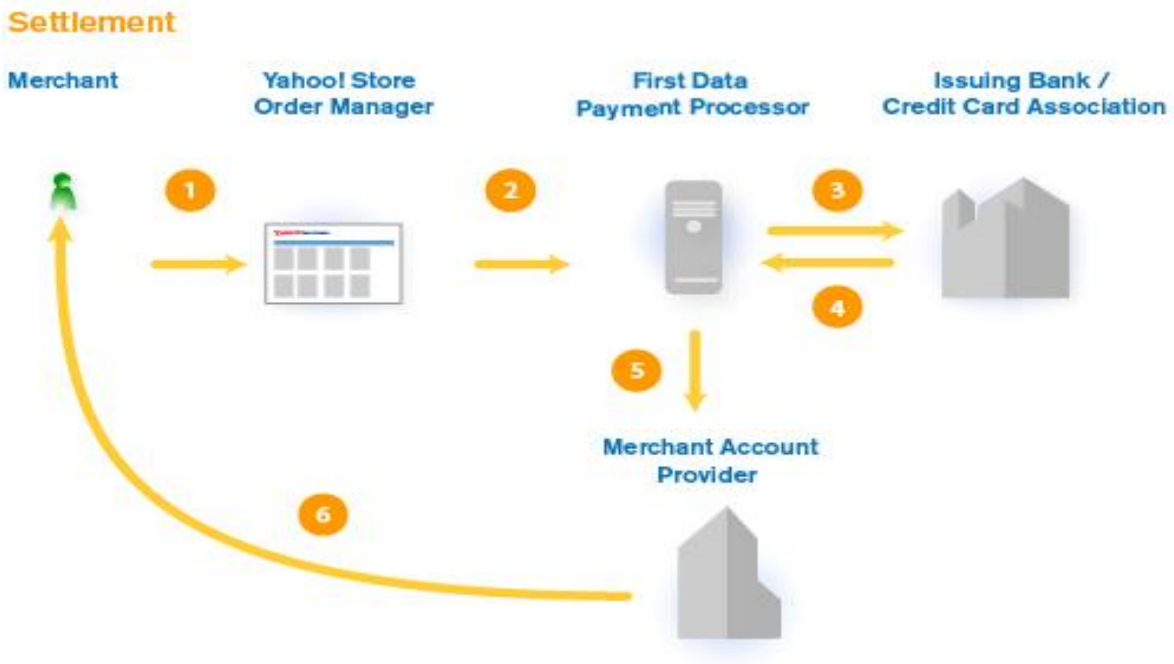
3. FDMS sends the authorization request to the issuing bank (or credit card association). The authorization request includes:
- the credit card number
- expiration date
- the billing address (used for Address Verification System (AVS) validation)
- Card Verification Value (CVV) response codes or CVV number (if entered)
- the amount of the order

The Issuing Bank (or Credit Card Association):

- validates the card number and expiration
- checks the amount of the order against the available credit
- checks the billing address provided against the billing address on file
- validates the CVV number (if provided)

If approved, the amount of the order is reserved from the total of available credit for the cardholder.

4. The Issuing bank (or Credit Card Association) sends the authorization response to FDMS. The authorization response consists of either an approval along with Address Verification System (AVS) and Card Verification Value (CVV) response codes or a decline.
5. FDMS adds response codes to the authorization response and passes the authorization back to Yahoo! Store. If the merchant has enabled Risk Tools, the rules set by the merchant will be run when the response is received from FDMS. The authorization (if approved) is stored on secure servers at Yahoo! for later processing by the merchant.
6. Depending on the state of the authorization, the buyer (cardholder) receives instructions or confirmation of the order:
- If declined, the buyer (cardholder) is informed and asked to try a different payment method.
- If the authorization is approved by the Issuing Bank (Credit Card Associations) then the buyer (cardholder) is taken to the Order Confirmation page.



Settlement process for PayPal (separate authorization and capture)

1. The merchant signs in to their account and goes to the Order Manager. The merchant reviews the order (including AVS and CVV response codes) for signs of fraud. When ready to complete the sale, the merchant clicks the "Capture Funds" button in the transaction panel of the order. Clicking **"Capture Funds"** initiates the settlement process.
2. The amount captured is transferred immediately to your PayPal account.

   Note: It is also possible to set your PayPal Website Payments Pro service to authorize and capture funds immediately without review. Yahoo! does not recommend this process as it does not allow you time to review orders for any issues before settlement.
   Settlement process for First Data™ and other FDMS compatible merchant accounts

1. The merchant signs in to their account and goes to the Order Manager. The merchant reviews the order (including AVS and CVV response codes) for signs of fraud. When ready to complete the sale, the merchant clicks the "Sale" button in the transaction panel of the order. Clicking "Sale" initiates the settlement process. The sale is then stored in a batch for settlement request submitted each night. By default, batches are submitted nightly between 6-11 pm (PST). Merchants can also choose to submit batches manually.
2. The settlement request batch with all completed sales is sent to First Data Merchant Services (FDMS), the payment processor for Yahoo! Store.

3. FDMS submits the settlement request for the buyer's order to the Issuing Bank/Credit Card Association of the buyer on behalf of the merchant.
4. The Issuing Bank/Credit Card Association sends the response to the settlement request back to FDMS. If the request is accepted, the buyer (cardholder)'s account is debited for the amount of the order. It is possible that the settlement request will be declined, e.g., if the buyer has exceeded their credit limit between the time of the authorization and settlement.
5. FDMS sends the approval and details of the payment to the merchant's bank (Merchant Account Provider). The settlement of funds between the issuing bank and the Merchant Account Provider occurs.
6. Following the settlement, the Merchant Account Provider credits the merchant's account. For information about when funds will be deposited, contact your merchant account provider.

3. Stored Value Cards

Are accounts created by depositing funds into an account and from which funds are paid out or withdrawn as needed? They are similar in some respect to checking transfer but which also stores funds but do not involve in writing checking.

Examples include debit cards, prepaid certificates, prepaid cards and smart cards, prepaid phone, copy, subway/bus cards.

3.1. Debit Cards

A **debit card** (also known as a **bank card** or **check card**) is a plastic card which provides an alternative payment method to cash when making purchases. Functionally, it can be called an **electronic check**, as the funds are withdrawn directly from either the bank account (often referred to as a ***check card***), or from the remaining balance on the card. In some cases, the cards are designed exclusively for use on the Internet, and so there is no physical card.

The use of debit cards has become widespread in many countries and has overtaken the cheque, and in some instances cash transactions by volume. Like credit cards, debit cards are used widely for telephone and Internet purchases.

Debit cards can also allow for instant withdrawal of cash, acting as the ATM card for withdrawing cash and as a cheque guarantee card. Merchants can also offer "cashback"/" cashout" facilities to customers, where a customer can withdraw cash along with their purchase.

Types of Debit Cards

There are currently three ways that debit card transactions are processed: **online debit** (also known as **PIN debit**), **offline debit** (also known as **signature debit**) and **Electronic Purse Card**.

Although many debit cards are of the Visa or MasterCard brand, there are many other types of debit card, each accepted only within a particular country or region, for example Switch (now: Maestro) and Solo in the United Kingdom, Interac in Canada, Carte Bleue in France, Laser in Ireland, "EC electronic cash" (formerly Eurocheque) in Germany and EFTPOS cards in Australia and New Zealand. The need for cross-border compatibility and the advent of the euro recently led to many of these card networks (such as Switzerland's "EC direkt", Austria's "Bankomatkasse" and Switch in the United Kingdom) being re-branded with the internationally recognised Maestro logo, which is part of the MasterCard brand. Some debit cards are dual branded with the logo of the (former) national card as well as Maestro (e.g. EC cards in Germany, Laser cards in Ireland, Switch and Solo in the UK, Pinpas cards in the Netherlands, Bancontact cards in Belgium, etc.). The use of a debit card system allows operators to package their product more effectively while monitoring customer spending. An example of one of these systems is ECS by Embed International.

i) Online Debit Card

Online debit cards require electronic authorization of every transaction and the debits are reflected in the user's account immediately. The transaction may be additionally secured with the personal identification number (PIN) authentication system and some online cards require such authentication for every transaction, essentially becoming enhanced automatic teller machine (ATM) cards.

One difficulty in using online debit cards is the necessity of an electronic authorization device at the point of sale (POS) and sometimes also a separate PINpad to enter the PIN, although this is becoming commonplace for all card transactions in many countries.

Overall, the online debit card is generally viewed as superior to the offline debit card because of its **more secure authentication system** and live status, which alleviates **problems with processing lag on transactions that may have been forgotten or not authorized by the owner of the** card. Banks in some countries, such as Canada and Brazil, only issue online debit cards.

Typical examples may include ATM cards and VISA Cards.

ATM Cards

CBE(Commercial Bank of Ethiopia) was trying to offer ATM(Automated Teller Machine) Card to its customers in the capital. Despite its effort, its customers do not seem to be happy with the quality of the service.

For effective ATM Cards service well established infustructure where many banks giving the service have interdependence and network with one another.

Visa Cards

Dashen Bank is the exclusive Visa card agent in our country so far May 2009.Below is requirements to be eligible to be Visa card agent:

- The amount of foreign currency deposit
- Bargaining power
- Well-established business relationship
- Trust

Hence, why Dashen Bank can easily be an exclusive Visa card agent is simply because it has fulfilled the above requirements.

Which part of customers is entitled to get Visa card from Dashen bank and what further provisions are there?

Though Visa card can and is being used for international payment purposes in other nations, in our country context the Visa card Dashen Bank provides to its customers is used only for domestic use.

Here all literate customers of the bank are entitled to get Visa card upon their freewill .That means if the customers are illiterate and cannot put their signiture, they will not be allowed to get Visa card. For better safeguarding the customers, the bank is implanting one customer one card system.

The other element to still protect customers if in case they lose the card is limiting the amount of withdraw using **best of 24 system (5:30 p.-5:300 a.m)** where customers will be allowed to withdraw up to 3000 birr with in 24 hours.

Prominent Problems with the Visa cards paymwnt system are the following:

1. Offline

Every day the system will process the day's transaction and customers will not have chance during those 30 minuses to 1 hour time.

2. Network Problems

The lack of sustainable Internet connection makes big challenge for both the bank and the customers, where customers raise too many complaints on the bank where in fact the bank cannot do anything!!

3. Usage Problems

The Visa card only permits for users to try to insert their PIN code 3 times. If they insert a wrong number in their 3rd trial, they won't have any more chance. Plus a customer should be alert enough to take the card after 30 seconds , otherwise the card and money will be denied to be given thinking that the customer has forgotten the card !!

Some authors indicate that there is preparation from Wegagen Bank to be the 2nd Visa card agent in Ethiopia.

ii) Offline Debit Card

Online Vs. Offline Debit

The term online vs. offline debit denotes the comparison between two distinct methods of making payment through a debit card. The former is a PIN based transaction and the later is a signature based transaction process.

Features of Online Debit Transaction

The online debit transaction is one of the popular transaction methods. This is preferred by most of the clients because the process is very fast as well as very safe in comparison to other methods of transaction. The debit cardholders use their card to pay for different kind of purchases.

For the purpose to such transactions, the magnetic card readers are used. The customer swipes their cards through the reader and the Personal Identification Number or PIN is entered in the machine.

By doing this, the exact price of the purchased commodity is transferred into the shop-owners account from the cardholder's account. This process is safe and convenient for the shop-owners too because the shop-owners are not exposed to any kind of risk. There are a number of requirements for the online debit transaction.

The customer should have access to the following facilities:

- Merchant Account
- Debit Processing Service
- Payment Terminal
- PIN Pad

Features of Offline Debit Transaction

These transactions take nearly three days for clearance. In this type of transaction, the cardholders are not required to provide their Personal Identification Number. There are a number of credit card companies that issue offline debit cards. These cards are accepted in all the shops where transaction through credit cards is allowed. Transaction on Internet is also allowed for these offline credit cards.

For the purpose of transaction, the cardholders give their offline debit card to the shop-owners. The card is then swiped trough the payment terminal and the transaction are almost done. After this the sales draft is signed by the cardholder and the respective shop-owner receives the transaction amount in a maximum period of three days. These transactions are subjected to transaction fees and a number of discounts that are also enjoyed by the debit cardholders.

Both these forms of debit transaction are preferred by the customers but if online vs. offline debit transactions are analyzed, the online transaction is preferred as it is more fast and convenient.

Offline debit cards have the logos of major credit cards (e.g. Visa or MasterCard) or major debit cards (e.g. Maestro in the United Kingdom and other countries, but not the United States) and are **used at the point of sale like a credit card**.

Using this Visa card the bank also provides POS (Point of Sale), where customers can use the card to directly puchase fuels, or get services from hotels like Dire International Hotels, Rift Valley Hotels etc. Here, they can spend up to 5000 birr per day.

This type of debit card may be subject to a daily limit, and/or a maximum limit equal to the current/checking account balance from which it draws funds. Transactions conducted with offline debit cards require **2–3 days to be reflected on users' account balances.**

In some countries and with some banks and merchant service organizations, a "credit" or offline debit transaction is **without cost to the purchaser** beyond the face value of the transaction, while a small fee may be charged for a "debit" or online debit transaction (although it is often absorbed by the retailer). Other differences are that online debit purchasers may opt to withdraw cash in addition to the amount of the debit purchase (if the merchant supports that functionality); also, from the merchant's standpoint, the merchant pays lower fees on online debit transaction as compared to "credit" (offline) debit transactions.

iii) Prepaid Debit Card

Prepaid debit cards, also called reloadable debit cards or reloadable prepaid cards, are often used for recurring payments. The payer loads funds to the cardholder's card account. Particularly for US-based companies with a large number of payment recipients abroad, prepaid debit cards allow the delivery of international payments without the delays and fees associated with international checks and bank transfers. Web-based services such as stock photography websites (istockphoto), outsourced services (oDesk), and affiliate networks (MediaWhiz) have all started offering prepaid debit cards for their contributors/freelancers/vendors abroad.

Iv) Electronic Purse Card/ Smart Card

Smart-card-based electronic purse systems (in which **value is stored on the card chip**, not in an externally recorded account, so that **machines accepting the card need no network connectivity)** were tried throughout Europe from the mid-1990s, most notably in Germany (Geldkarte), Austria (Quick), Belgium (Proton), France (Moneo), the Netherlands (Chipknip and Chipper), Switzerland ("Cash"), Norway ("Mondex"), Sweden ("Cash"), Finland ("Avant"), UK ("Mondex"), Denmark ("Danmønt") and Portugal ("Porta-moedas Multibanco").

The major boom in smart card use came in the 1990s, with the introduction of the smart-card-based SIM used in GSM mobile phone equipment in Europe. With the ubiquity of mobile phones in Europe, smart cards have become very common.

Clarifying further, smart cards are kinds of stored value system based on credit-card-sized plastic cards that have embedded chips that store personal information. Where as credit cards store a single charge account number in a magnetic strip on the back, smart cards can hold 100 times more data, including multiple card numbers an information regarding health insurance, personal identification, bank acconts and loyalty program such as frequent flyer account.

The capacity makes them more attractive alternate to carrying a dozen or so credir and ID cards in physical wallets. Smart cards can also require can also require a password, unlike credit cards, adding another layer of security.

There are 2 types of Smart cards:

1. Contact Smart cards

   In order for contact cards to be read, they must be physically placed into a card reader.

2. Contactless Smart Cards

Have antenna built in that enables transmission of data without direct contact.

Advantages and Disadvantages of Debit Cards

Debit and check cards, as they have become widespread, have revealed numerous advantages and disadvantages to the consumer and retailer alike. Advantages are as follows (most of them applying only to some countries, but the countries to which they apply are unspecified):

- A consumer who is not credit worthy and may find it difficult or impossible to obtain a credit card can more easily obtain a debit card, allowing him/her to make plastic transactions.
- Use of a debit card is limited to the existing funds in the account to which it is linked (except cases of offline payments), thereby preventing the consumer from racking up debt as a result of its use, or being charged interest, late fees, or fees exclusive to credit cards.
- For most transactions, a check card can be used to avoid check writing altogether. Check cards debit funds from the user's account on the spot, thereby finalizing the transaction at the time of purchase, and bypassing the requirement to pay a credit card bill at a later date, or to write an insecure check containing the account holder's personal information.
- Like credit cards, debit cards are accepted by merchants with less identification and scrutiny than personal checks, thereby making transactions quicker and less intrusive. Unlike personal checks, merchants generally do not believe that a payment via a debit card may be later dishonored.
- Unlike a credit card, which charges higher fees and interest rates when a cash advance is obtained, a debit card may be used to obtain cash from an ATM or a PIN-based transaction at no extra charge, other than a foreign ATM fee.

The Debit card has many disadvantages as opposed to cash or credit:

- Some banks are now charging over-limit fees or non-sufficient funds fees based upon pre-authorizations, and even attempted but refused transactions by the merchant (some of which may not even be known by the client).
- Many merchants mistakenly believe that amounts owed can be "taken" from a customer's account after a debit card (or number) has been presented, without agreement as to date, payee name, amount and currency, thus causing penalty fees for overdrafts, over-the-limit, amounts not available causing further rejections or overdrafts, and rejected transactions by some banks.
- In some countries debit cards offer lower levels of security protection than credit cards. Theft of the users PIN using skimming devices can be accomplished much easier with a PIN input than with a signature-based credit transaction. However, theft of users' PIN codes using skimming devices can be equally easily accomplished with a debit transaction PIN input, as with a credit transation PIN input, and theft using a signature-based credit transaction is equally easy as theft using a signature-based debit transaction.

- In many places, laws protect the consumer from fraud a lot less than with a credit card. While the holder of a credit card is legally responsible for only a minimal amount of a fraudulent transaction made with a credit card, which is often waived by the bank, the consumer may be held liable for hundreds of dollars in fraudulent debit transactions. The consumer also has a much shorter time (usually just two days) to report such fraud to the bank in order to be eligible for such a waiver with a debit card[6], whereas with a credit card, this time may be up to 60 days. A thief who obtains or clones a debit card along with its PIN may be able to clean out the consumer's bank account, and the consumer will have no recourse.
- In the UK and Ireland, among other countries, a consumer who purchases goods or services with a credit card can pursue the credit card issuer if the goods or services are not delivered or are unmerchantable. While they must generally exhaust the process provided by the retailer first, this is not necessary if the retailer has gone out of business. This protection is not provided when using a debit card.
- When a transaction is made using a credit card, the bank's money is being spent, and therefore, the bank has a vested interest in claiming its money where there is fraud or a dispute. The bank may fight to void the charges of a consumer who is dissatisfied with a purchase, or who has otherwise been treated unfairly by the merchant. But when a debit purchase is made, the consumer has spent his/her own money, and the bank has little if any motivation to collect the funds.
- In some countries, and for certain types of purchases, such as gasoline, lodging, or car rental, the bank may place a hold on funds much greater than the actual purchase for a fixed period of time[6]. However, this isn't the case in other countries, such as Sweden. Until the hold is released, any other transactions presented to the account, including checks, may be dishonored, or may be paid at the expense of an overdraft fee if the account lacks any additional funds to pay those items.
- While debit cards bearing the logo of a major credit card are accepted for virtually all transactions where an equivalent credit card is taken, a major exception in some countries is at car rental facilities. In some countries car rental agencies require an actual credit card to be used, or at the very least, will verify the creditworthiness of the renter using a debit card. In these unspecified countries, these companies will deny a rental to anyone who does not fit the requirements, and such a credit check may actually hurt one's credit score, as long as there is such a thing as a credit score in the country of purchase and/or the country of residence of the customer.

The smart card is one of the digital icons of the Information Age. Smart card technology is being applied in various ways to facilitate trade, gain access to services and products, verify identity, and establish and influence relationships. In the UK there have been many applications, for example, the electronic purse - Mondex, the Shell loyalty card and the Social Security Benefits Card. Similar examples can be found in different parts of the world. In Spain a smart card has been introduced for benefit payments and access to government databases. A smart patient data

card is being tested in a region of the Czech Republic to replace the paper-based system that had limited capacity, was inaccurate, labour intensive to maintain and open to widespread abuse. Two million smart cards have been issued to the poor in Mexico for distributing food and cash benefits.

A recent study found that 27% of smart card applications were within banking, 18% within health and welfare and 15% within transport. Other applications included; telecommunications, identification, phone cards, retail loyalty schemes, metering, radio security, physical access and gambling. The use of multifunctional smart cards was commonplace.

Smart cards have three broad functions; authentication, storing value and storing personalised information. Authentication is concerned with ensuring only authorised individuals gain access to systems and buildings. A smart card can be used as an electronic purse to store units of value in different currency denominations as well as credit and other units of value such as bonus points or air miles. Values can be replenished on a smart card. The smart card can also be used as a portable storage device independent of some fixed location and with the capability of holding a large amount of data of different forms and for different purposes but usually of a personal nature.

Clearly there are beneficial outcomes from the application of smart cards. Realising these benefits both for individuals and organisations may well profoundly change the relationship between clients or consumers and suppliers or government bodies. A smart card that is your passport, driving licence, credit and debit card, access to your place of work and your car ignition key will undoubtedly alter relationships due to potential uneasiness about what data is held, accessed and modified. Such cards are already being piloted. For example, in South Korea a national citizen card is being introduced which is used as a driving licence, identity card, pension card and medical insurance card.

Some of the potential benefits of smart cards are:

- Using smart cards is safer than carrying cash for an individual
- Smart cards can improve access to services for the disabled and elderly
- It is a secure means of authenticating the identity of reader device
- It is a portable and secure store of information available to all
- Access can be made available in geographical locations where on-line communication is not possible
- The opportunity of fraud is reduced using smart cards
- Social disadvantaged groups can gain access to facilities and resources without feeling stigmatised
- Objective selection criteria can be upheld and the risk of bias or favouritism reduced

Consider just one example. Smart card technology has the capability of addressing access, independence and equality of opportunity issues for the disabled through facilitating adaptive interfaces. Individual requirements could be stored on the smart card so that the interface at the point of use would automatically adapt to the preferred customer verification method (for example hand geometry), input (for example voice activation and speech recognition), operation (for example reduced functionality) and output (for example large colour specific characters). Contactless smart cards could be used to remove the necessity of card insertion into readers, to unlock and open doors, to activate location signals, to increase road crossing times and to adjust access heights of facilities.

There are potential pitfalls for individuals and society in general regarding smart card applications and these include:

- Smart cards lead to a loss of anonymity
- Pseudonimity can be mistaken for anonymity as card schemes indirectly hold cardholder identity
- Smart card schemes could lead to a reduction in the provision of non-smart card facilities and so affect freedom of choice
- Smart cards can reduce access to services and resources for the technology illiterate or technology wary
- There are difficulties in viewing personal data by card holders
- Smart cards can result in significant invasions of privacy
- Profiling and tracking of individuals can occur
- Increases in smart card use could lead to a de facto national and subsequently global identity card that has not been subjected to citizen consultation
- Smart card functionality can be increased without proper consideration of the overall impact

It has been suggested that a number of principles should be adhered to when considering if and how a smart card scheme should be implemented. Of these the key principles are:

- Smart cards must properly respect the legal and ethical rules pertaining to the rights of the card holder
- Individuals should have the right to refuse a cards
- The card holder's prior consent is required for all uses of the card and disclosure of information it contains
- Cards should not be used as tools for overt or covert surveillance

Having decided to implement a smart card scheme certain design features seem appropriate and are summarised as:

- identified transaction trails should only be used where no acceptable alternative exists
- identity should be safeguarded using pseudonimity
- ensure integrity across applications on multi-purpose cards
- the design of smart card schemes must be transparent to the individual
- biometric and encryption key data should be held on the card
- two way device authentication must be used

Smart cards offer great potential benefits to society. Given its pervasive nature careful policy, design and implementation strategies must be in place. With these one can envisage a time when the lack of ownership of a multi-functional smart card will result in a dramatic loss of opportunity and of help in times of need for the "non-citizen". The aim must be to achieve sensitive usage and ensure ordinary people are involved in the technological decision making process which precedes application of smart card technology.

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