

Market Intelligence Report Retail Commerce & Finance

*An initial study of the market for Retail Commerce & Finance, defined as:
"The conducting of retail transactions and the provision of financial
services using electronic means, involving digital computers, electronic
communications and the application of information technology. It includes
the buying and selling of goods and services, the transfer of funds and
related internal company functions."*

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EXECUTIVE SUMMARY

This document provides market intelligence into the sector defined as Retail Commerce and Finance (RC&F) by the Intermediary Technology Institute (ITI) in Techmedia. RC&F covers a large segment of the overall economy and, for the purposes of this document, the definition of RC&F is:

The conducting of retail transactions and the provision of financial services using electronic means, involving digital computers, electronic communications and the application of information technology. It includes the buying and selling of goods and services, the transfer of funds and related internal company functions

The report describes the future market opportunities, challenges, key drivers and potential functional needs of the RC&F sector.

Using this acquired knowledge as the base input, the ITI will select those functional needs that have strongest potential market 'fit', and the greatest potential to be a success when utilised within the identified target markets. The functional needs will be used to define potential technology platforms which will then be used as input to ITI Techmedia's programme selection process.

During this process, ITI Techmedia will continue to report to its Membership on progress and results. Members are encouraged to provide comment and input, and to become actively involved in programmes.

ITI Techmedia intends to further develop its knowledge base in this sector. In order that the Membership gain visibility of ongoing developments identified by ITI Techmedia, this Report will be subject to periodic review and re-issue.

The RC&F sector comprises both retail and financial services markets

The global RC&F sector comprises a very significant proportion of world GDP. By 2008, the combined value of the sector is expected to grow to some USD14 trillion.

The Retail Commerce market comprises the purchase of a wide range of goods and services with the major product areas being food, clothing and household goods. In developed markets, the Retail Commerce market tends to be strongly concentrated, with a small number of players with strong brands accounting for a large proportion of market value.

The Financial Services sector is involved in the delivery of a wide range of services via a range of organisations such as banks, mutual societies and insurers. There is a substantial overlap in the services provided by these different organisations, although the market is dominated by a relatively small number of large organisations.

Analysis of the RC&F sector implies an analysis of current and future methods of undertaking and processing financial transactions. ITI Techmedia believes that future opportunities will be driven by the need to process small to medium sized transactions via a variety of different channels to the consumer. Analysis of this sector excludes segments that exhibit large transaction values where there is a very close relationship

between the service provider and customer. Therefore, segments such as investment banking are not explicitly considered within this report.

The RC&F sector exhibits a number of key trends

The RC&F sector exhibits a number of key trends, in terms of both the consumer and the supplier. For the consumer, the shift in the average age of the population has major implications in terms of the services offered, presented and managed. Also, individuals are increasingly defining the type of personal information that is accessible, and thereby deriving a value for their personal attributes for the purposes of e.g. credit rating.

For retail and financial services providers, there is an ongoing drive to manage costs. However, there is also a trend towards working more closely with a smaller number of trusted suppliers, who are therefore more committed to the success of their customers. In some ways, these trends can be viewed as conflicting, implying a careful balance of widening the supplier base versus the development of close supplier relationships.

These trends will create opportunities for new technology providers. In the Retail Commerce sector, organisations are constantly striving to identify new channels to market while at the same time maintaining tight cost control. In the Financial Services sector, organisations tend to be risk-averse and, although intense users of ICT services, do not tend to deploy unproven solutions.

Despite these issues, opportunities remain for companies to develop key elements of technology which either enable new revenues streams or help to reduce costs. The emergence of online services is one example where new technologies have played a vital role in service innovation within the RC&F sector.

The identified market opportunities exhibit different market size, growth prospects and functional needs

A number of growth areas have been identified through the market foresighting process, and they are considered to have significant market impact in the medium to long term. These market opportunities have been identified and developed based on:

- the views of experts who were asked to consider a ten-year horizon
- market research reports from 'conventional' analysts assessing a five-year horizon.

Where the relevant market data is available, market projections for these opportunity areas have been developed. Figure 1 below summarises the global revenue and projected future growth for a number of these opportunities.

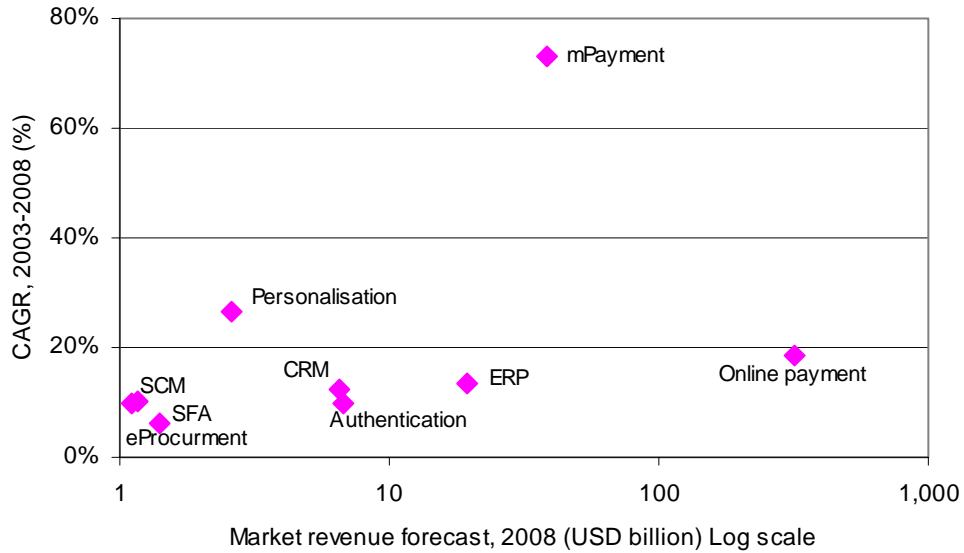


Figure 1: Revenue and market growth projections for different growth areas [Source: ITI Techmedia]

Given the maturity of the RC&F sector, together with the historic high levels of IT intensity within the sector, the opportunity areas in general exhibit forecast annual growth rates below 20%. The exceptions to this are the Personalisation and mPayment opportunities.

Given the revenue and growth potential offered by the different sectors, ITI Techmedia is likely to focus its activities upon those markets which offer strong growth potential.

Through market analysis, the functional needs that underpin the development of these identified market opportunities have been determined.

ITI Techmedia will use this information to identify appropriate Programmes

Using the acquired knowledge in this report as input, ITI Techmedia is undertaking further analysis of the functional needs to select those with the strongest Scottish 'fit' and the greatest potential to be a success when utilised within the identified global markets. The selected functional needs are used as input to define potential technology platforms as part of the ITI Techmedia programme selection process.

1 INTRODUCTION

1.1 Document Purpose

The purpose of this document is to provide a 'snapshot' view of the Retail Commerce & Finance (RC&F) sector in order that the Membership:

- has visibility of the market analysis activities undertaken in this sector by ITI Techmedia
- can gain access to market information relevant to the sector
- is provided with an indication of the functional needs that ITI Techmedia will further explore to identify the technology platforms that will form the basis of ITI Techmedia research and development programmes.

This document should not be considered as providing a comprehensive analysis of the competitive environment within the RC&F sector. Such an analysis is beyond the scope of this document.

1.2 Structure and Content

This document provides market intelligence into the sector defined by the Intermediary Technology Institute (ITI) in Techmedia as Retail Commerce & Finance (see Section 2.1 for the definition of Retail Commerce & Finance). The information captured within the document has been obtained following the principles of market intelligence gathering (otherwise known as foresighting) established by ITI Techmedia. This process is described in an abridged form in Appendix 1.

During the process of developing this market intelligence report, both primary and secondary market data were acquired and collated. Primary data were collected during Market Intelligence Workshops attended by experienced individuals from industry and academia, supplemented by face-to-face interviews with key organisations in the sector. This primary data gathering process was augmented by desk research to obtain secondary data from internationally recognised market analysts. Where possible, the source of any data used in this report has been identified.

Section 1: Introduction. This Section covers the background, aims and scope of the Intermediary Technology Institutes (ITIs). It also provides a high level description of the 'Techmedia' areas of focus. Further background information can be obtained on the website www.ititechmedia.com.

Section 2: Market Overview. This Section provides a working definition of the RC&F sector, highlights the main characteristics of the sector, identifies the main trends, drivers and barriers, and describes generic value chains representing current business practice. This Section provides a framework for the subsequent presentation and analysis of data in Sections 3 and 4.

Section 3: Market Assessment. This Section provides an assessment of the market opportunities identified during the foresighting process. Each opportunity is defined and the main characteristics described in terms of drivers, inhibitors and the functional needs which will need to be met by any fulfilling technologies.

Section 4: Market Data. This Section contains the relevant market size data for each market opportunity identified in Section 2.1. This type of data is traditionally derived from historical figures, and therefore market projections are best viewed as providing a base reference level from which informed extrapolations can be drawn. Where possible and appropriate, the segments identified in this report are matched to existing market data; where a new market opportunity is identified, a potential market size has been projected.

1.3 Background: Intermediary Technology Institutes (ITIs)

1.3.1 Economic Context

A global driver for economic growth is the development and exploitation of technology both for present needs and future requirements. Successful economies are underpinned by a vibrant research base which extends from basic science through to pre-competitive research and development with a clear focus driven by global market opportunities. Scotland has a reputation for world class research in many fields and already undertakes significant research activity in several areas which have the potential to be strong future market opportunities. In addition to the research base, most developed economies have institutes or organisations that promote knowledge generation and increase commercial exploitation capacity. The establishment of such organisations has had significant economic impact over the long term.

1.3.2 ITIs

The creation of the Scottish ITIs is aimed at increasing the effectiveness of Scottish businesses in the key global market sectors of Communications Technologies and Digital Media ('Techmedia'), Life Sciences and Energy, all targeted to address the particular (research) strengths and (company) weaknesses of the local economy. The ITIs will also interact with each other to identify potential overlap or "white space" market opportunities between Techmedia, Life Sciences and Energy. The creation and development of the Scottish ITIs is a long-term initiative, and will be supported for a significant period of time (>10 years).

The ITIs are in essence, a centre or "hub" for:

- identifying, commissioning and diffusing pre-competitive research that is driven by an analysis of emerging markets
- managing intellectual assets to maximise commercial and economic value.

An active Membership is core to the proposed Institutes. The ITIs are open for Membership to all companies and research institutions, and all Members will be encouraged to actively participate in its activities. ITI strategy and operation will be actively guided and supported by its Members. It is essential to attract Members with a broad global perspective on markets and new technology directions, as well as a local focus to ensure that propositions will be transferred effectively into the Scottish economy.

1.4 Definition of the Techmedia Sector

ITI Techmedia is centred on the development and creation of commercial opportunities encompassing the communications technologies and digital media sectors. The activities of the ITI will bring Scotland's economy to the cutting edge of emerging markets by allowing local companies to access and build upon pre-competitive technology platforms developed by the ITI.

The term 'Techmedia' arose out of the need to reflect the market evolution of communications technologies and digital media. The overall trend in the marketplace is one governed by a value chain ranging from content/application generation through delivery to consumption.

The following elements are examples of the areas which fall within the Techmedia remit. These elements are best viewed as illustrations. They represent some of the over-arching philosophies and help to place the output of the ITI in context:

- media content: ultimately the product for which the customer is paying, either directly or indirectly
- service provision: the mechanisms for providing customers with content and applications including navigation and payment
- delivery: technologies and infrastructure required to transport the content to the end-user, as well as providing the feedback channels for interactivity
- enabling software and systems integration: technologies and infrastructure required to condition, control and manage the delivery of content/service to the end customer.

One globally accepted trend is the delivery of content and services over multiple channels e.g. the provision of same (or modified) content to be received over mobile devices, through TVs or via PCs. Multi-channel delivery provides one of the core areas of opportunity and, since content consumption is the key revenue generating stream in many of the markets, it is central to many of the drivers that affect future market evolution in the Techmedia sector.

The Techmedia sector is potentially very broad and hence a phased approach to market foresighting has been adopted. The first phase foresighting has concentrated on five major market areas, defined as:

- **Health:** the delivery of health services including clinical, education and administrative services through the processing, management or communication of information, including video, audio, graphics and signal data

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- **Retail Commerce and Finance:** the conducting of retail transactions and the provision of financial services using electronic means, generally involving digital computers, electronic communications and the application of information technology. It includes the buying and selling of goods and services, the transfer of funds and related internal company functions
 - **Learning and Education:** the provision, delivery and administration of learning through the use of new media and network technologies
 - **Communications Services:** the provision, management and delivery of voice, video, data and IT services over wired and wireless communication networks. These include consumer and business services, vertical sector industrial applications and broadcast content
 - **Entertainment and Leisure:** the delivery of online digital entertainment and leisure services to end consumers. Specifically, this embraces the market for online music, games and movie services over fixed and wireless networks

This report is a first stage analysis of the market for Retail Commerce & Finance.

1.5 Next Steps

This report describes the results of the market analysis activities undertaken by ITI Techmedia in the RC&F sector. As such, the report describes future market opportunities, challenges, key drivers and functional needs.

Using this acquired knowledge as base input, the ITI will select those functional needs with the strongest Scottish 'fit' and the greatest potential to be a success when utilised within the identified target markets. The selected functional needs will be used as input to define potential technology platforms, and these platforms will then be used as input to the ITI Techmedia programme selection process.

During this process, ITI Techmedia will continue to report to its Membership on progress and results. Members are encouraged to provide comment and input, and to become actively involved in programmes.

ITI Techmedia intends to further develop its knowledge base in this sector. In order that the Membership gain visibility to ongoing developments identified by ITI Techmedia, this Report will be subject to periodic review and re-issue.

2 MARKET OVERVIEW

2.1 Market Definition

For the purposes of the document, the definition of the RC&F sector is:

"The conducting of retail transactions and the provision of financial services using electronic means, involving digital computers, electronic communications and the application of information technology. It includes the buying and selling of goods and services, the transfer of funds and related internal company functions."

"Electronic means" includes, but is not limited to, computing (processing, storage); software; wired and wireless communication networks (Internet, World Wide Web); electronic data exchange; credit card processing; micro-payment systems; telephone response; electronic forms; Automated Teller Machines (ATMs); point of sale (POS) systems; smart cards; bar coding; and Radio Frequency Identification (RFID).

"Internal company functions" includes, but is not limited to: enterprise resource planning (ERP), which may include financial accounting; human resource (HR) management; manufacturing management; project management; business intelligence; customer resource management (CRM); sales force automation; supply chain management (SCM); eLogistics; eProcurement; and product life cycle management.

Analysis of the RC&F sector implies an analysis of current and future methods of undertaking and processing financial transactions. ITI Techmedia believes that future opportunities will be driven by the need to process small to medium sized transactions via a variety of different channels to the consumer. Analysis of this sector excludes segments that exhibit large transaction values where there is a very close relationship between the service provider and customer. As such, segments such as investment banking are not explicitly considered within this report.

Technologies that underpin the segment e.g. Digital Rights Management (DRM), are considered within other market sectors analysed by ITI Techmedia (see Market Intelligence Reports on Communications Services, Health and Learning).

2.2 Market Segmentation

For the purposes of analysis and subsequent identification of market opportunities, the RC&F market sector is segmented as shown in Figure 2.

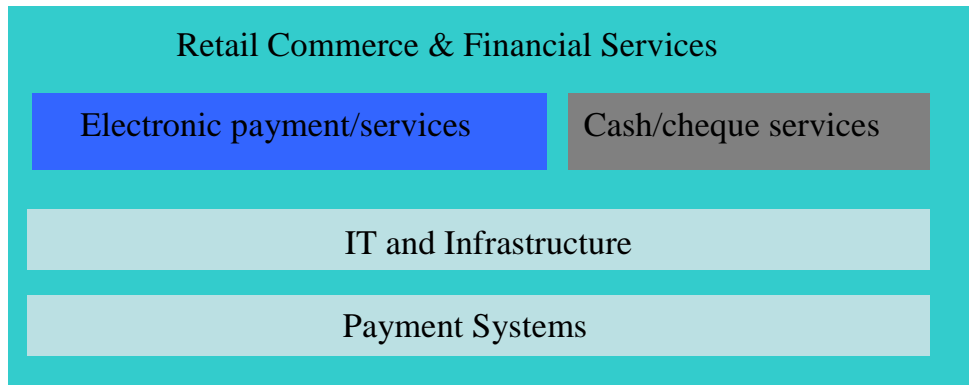


Figure 2: High-level market segments [Source: ITI Techmedia]

Electronic payments and services are, in general, a very mature area. For example, electronic data exchange, credit card processing and barcode systems are widely adopted within the RC&F sector. In order to identify areas of opportunity that are relevant to the ITI, the focus of this report is upon electronic payments and services which are expected to exhibit either significant growth or significant evolution in product requirements. As such, the report focuses upon:

- Internet commerce
- Mobile commerce (mCommerce)
- Electronic banking
- Automated banking (includes ATMs, kiosks and user devices)
- Contact centres, at present principally telephone call centres.

Cash and cheque services continue to be a significant method of transaction, particularly where transaction values are small. However, these services are considered to be outside of the scope of ITI Techmedia and are not considered further in this report.

Whereas electronic payment/services and cash/cheque services can be considered as vertical segments, IT and infrastructure and payment systems may be considered as horizontal segments which underpin the delivery of electronic payment/services and cash/cheque services.

IT and infrastructure comprise a wide variety of functions, ranging from customer-facing systems through to back office systems which support the processing of transactions undertaken by the customer. The report distinguishes between those systems considered to be customer-facing versus those considered to be business-facing.

As with the electronic payments and services, the payments systems area is very mature. However, as take-up of electronic payments services increases, new payment services will continue to emerge, and existing payment systems will evolve to meet emerging requirements. This report focuses upon two payment systems:

- peer-to-peer payment systems
- ePurse.

In Section 2.3 below, an overview of each of these high-level market segments is provided. In Section 3, major functional needs relating to the segments are identified and described. Supporting market revenue data for each segment is provided in Section 4.

2.3 Market Description

The scale of the overall market, including both the Retail Commerce and Financial Services sectors, is substantial; as illustrated in Figure 3, the total value of the sectors is estimated to grow to USD14 trillion by 2008. The market for internet- and mobile-based transactions represents only a small fraction of the total market value. However, these are growth areas that are directly relevant to ITI Techmedia.



Figure 3: Market size projections 2003 to 2008 [Source: Gartner, ITI Techmedia]

It should be noted that the value of the Retail Commerce sector is typically inclusive of the value of the goods and services quoted sold. Analysis of major companies in the Retail Commerce sector indicates that the value of goods sold corresponds to approximately 70% of total market value.

The Financial Services sector is involved in the delivery of a wide range of services (e.g. banking, investments, insurance) provided by a variety of organisations including:

-
- commercial banks
 - mutual societies (called credit unions in the US)
 - investment banks
 - insurers
 - investment brokers.

Following deregulation, there is substantial overlap across many of the services provided throughout the Financial Services sector. The market is dominated by a relatively small number of large banks and the sector exhibits high levels of industry concentration. For example, in the United States commercial banking sector, 5% of institutions (those with assets greater than USD1 billion) account for 86% of total asset value¹.

The Retail Commerce sector is diverse, encompassing the delivery of a wide range of goods including:

- food
- clothing
- household goods including furnishings and electricals.

Although the sector contains a great number of organisations it remains dominated by a relatively small number of major players with strong brands. For example, in the UK, the top 500 retailers account for more than 65% of market share².

Although the dominant retail channel to market remains 'bricks and mortar', the conditions for selling over the Internet, and indeed through interactive television channels, are improving. This has been recognised both by traditional retailers, who utilise in the main 'bricks and mortar' distribution channels, and newer 'pure play' internet based retailers in which the Internet represents the dominant, or even exclusive, channel to market.

A major component of the addressable market is represented by IT services, although it is recognised that much of the IT services market will be the domain of large IT service providers. As illustrated in Figure 4, worldwide spend on IT services by 2008 is forecast to reach:

- USD533 billion in the Financial Services sector
- USD140 billion in the Retail Commerce sector.

¹ Source: FDIC, 31/3/2004

² UK Retail Market Trends, Retail Week, 2002

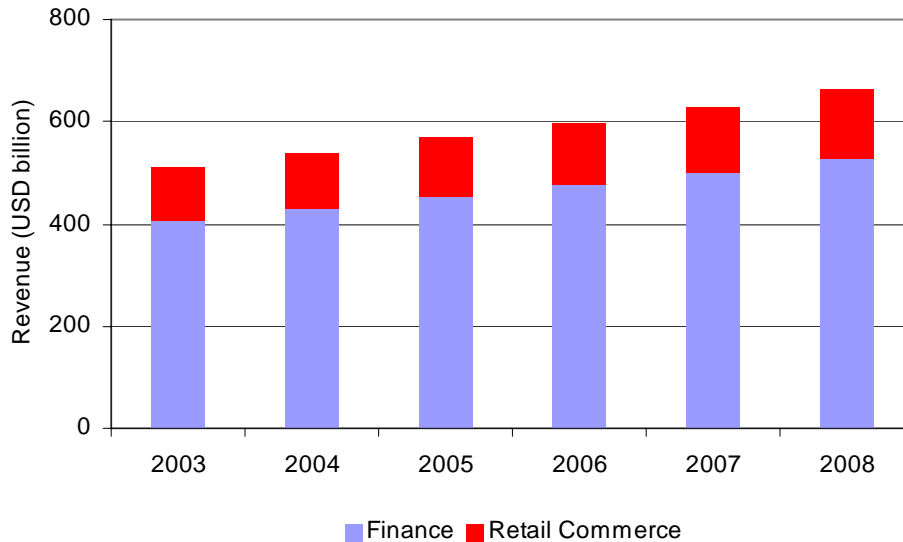


Figure 4: Global Financial Services & Retail IT Spend 2003-2008 [Source: Gartner, ITI Techmedia]

In the following sections the various high-level segments illustrated in Figure 2 are described. The IT and infrastructure segment may be considered as comprising three main components:

- *front office*: the interface with the customer, including the branch/shop, the call centre, ATMs, the Internet
- *middle office*: linking products to channels, this function shares customers' data between the back and the front office to provide information for management and marketing functions
- *back office*: processing all transactions, the back office is where a large institution can achieve economies of scale.

For the purposes of this document, the description of the IT and infrastructure segment is divided into:

- business-facing (middle and back office) functions
- customer-facing (front office) functions.

2.3.1 Retail Commerce and Financial Services Market

Consumer spending using electronic means to purchase goods and services has been increasing steadily in recent years. In the United States, online consumer sales now represent 1.9% of total consumer sales. US online retail sales are expected to reach USD65 billion in 2004, and will continue to grow by a compound annual growth rate of 17% through 2008 to top USD117 billion, according to Jupiter Research³. Although considerably behind the US, European online consumer sales are also increasing due to a growing consumer appetite for purchasing a wide range of goods and services online.

³ Market Forecast: U.S. Retail 2004-2008, Jupiter Research

Datamonitor predicts that consumer electronic payment volumes will continue to increase and could surpass USD300 billion by 2008. Mobile payments are also expected to grow, but will continue to form only a small fraction of the overall sector value (see Figure 3).

In the Financial Services sector, electronic payments have long been the dominant form of transaction, and this is constantly evolving toward the delivery of financial services online. For example, IDC predicts that the take-up of online banking in Western Europe will increase by a compound annual growth rate (CAGR) of 11%, up from nearly 100 million users in 2003 to more than 150 million users by 2007.

To date, the level of internet-based fraud has been relatively low. However, banks are reporting a significant rise in the level of 'user not present' fraudulent transactions. It is anticipated that the growth of internet-based transactions will be followed by a coincident rise in online card fraud. While clearly a concern, this will present an opportunity for new technologies which can address online fraud.

While strong growth is anticipated in online and mobile-based transactions, more traditional payment channels such as electronic banking and automatic banking will continue to dominate.

2.3.2 IT and Infrastructure – Business-Facing Functions

RC&F sector spend on IT is substantial. IT spend is particularly intense within the Financial Services sector since most organisations are heavily dependent on technology to conduct their business. The US Financial Services sector spent approximately USD62 billion on IT in 1999, estimated to rise to over USD76 billion by 2005⁴. Of this, US retail banks spent USD19 billion in 1999, rising to USD23 billion in 2005.

Spend in Europe was also substantial at approximately USD74 billion in 2001, projected to rise to USD82 billion by 2004⁵; European retail banks spent USD19 billion in 2001, rising to USD32 billion in 2004. In contrast, the European insurance industry spent USD19 billion in 2001, falling to USD16 billion in 2004.

As a result of the foresighting process, a number of areas have been identified as being potential areas of focus for ITI Techmedia. These are:

- **Enterprise Resource Planning:** A substantial IT infrastructure is maintained to support internal business and management requirements. Defined under the general term of Enterprise Resource Planning (ERP), these systems typically support human resources, project management; business intelligence; supply chain management and procurement.
- **Supply Chain Management:** SCM systems are employed to improve a company's processes for product and service design, purchasing, invoicing, inventory management, distribution, customer satisfaction and other elements of the supply

⁴ Source: Datamonitor "Technology Review from US Retail banking to 2005" Report No. DMTC0664 Published 01 Jan 2000

⁵ Source: Datamonitor "CRM: evaluating what it is doing for Financial Service Institutions" Report No. DMFS1467 Published 13 May 2002

chain. SCM usually refers to an effort to redesign supply chain processes in order to achieve streamlining.

- **eProcurement:** eProcurement is the business-to-business (B2B) purchase and sale of supplies and services over the Internet. eProcurement software makes it possible to automate some buying and selling. Companies implementing eProcurement systems expect to be able to control inventory more effectively and reduce purchasing agent overhead.
- **Channel Integration:** Businesses interact with customers through multiple delivery channels, such as retail outlets, the Internet, call centres and ATMs. Currently, these channels offer limited collaboration, user interface, application and data integration. This disconnect can result in inconsistent customer service, information provision, transaction capabilities and a varying total customer experience (TCE). Channel integration tools are required to create an enabling infrastructure to address the requirements of a comprehensive, multi-channel integration.
- **Regulatory Reporting:** In order to demonstrate regulatory compliance, onerous reporting requirements are imposed on financial services institutions. Although the level of compliance is a function of geography, there is a global trend near-real-time reporting and disclosure of all material information, which will be mandated in many regions. Regulation is viewed as increasing the transparency of organisations' operations, benefiting customers; while a stringent regulatory regime imposes an overhead, it promotes trust. The solution to address these increasing reporting obligations involves extensions to the IT system, with major vendors offering new modules to meet such requirements.
- **Data Interchange:** Exchanging data between companies and/or institutions is an essential feature of everyday commercial activity. This is accomplished via the exchange of standardised document forms, allowing information to be passed between computer systems.
- **Security and Authentication of Businesses:** A major challenge facing businesses providing services over platforms such as the Internet is assuring the integrity of electronic transactions. A range of hardware and software products and tools are available to provide secure solutions to these transactions. Furthermore, businesses need to be able to demonstrate that they are capable of managing security and authentication processes.
- **Identification and Authentication of Individuals:** Identification and authentication are the keystones of most access control systems. Identification is the act of a user establishing his identity to a system, often in the form of a log-on ID or presentation of a bank/credit card. Authentication is verification that the user's claimed identity is valid and may be implemented through a user password or PIN number. As mentioned earlier, security will become an increasingly important issue as more transactions are performed electronically. This presents an opportunity for new technologies which may include moving to two or three level authentication procedures.

2.3.3 IT and Infrastructure – Customer-Facing

In parallel with the IT infrastructure supporting the business-facing functions, there is a significant market for tools which support customer-facing functions. As a result of the foresighting process, a number of areas have been identified as being potential areas of focus for ITI Techmedia:

- **Customer Relationship Management:** Customer relationship management (CRM) systems are employed to enable a company to better serve its customers through the introduction of reliable service automated processes, personal information gathering and processing, and self-service. It attempts to integrate and automate the various customer serving processes within a company. It typically involves three general areas of business:
 - customer service system
 - marketing information system
 - sales force management system.
- **Sales Force Automation:** Sales Force Automation (SFA) tools aim to improve the effectiveness of the sales process by capturing sales leads and managing them as they move through the qualification process. Generally they assist with contact management, calendar keeping, preparation of marketing collateral and presentations, maintenance of sales territories and assignment of commissions.
- **Personalisation Tools:** Within the context of CRM, personalisation tools assist business to customise their product towards specific communities. Often considered in the context of web presence, personalisation tools enable the supplier to customise the content of a website by country, publication date, subject or even user. Personalisation tools can use web registration information, email address or IP address to make intelligent choices when serving content to a web page to make the browsing experience more valuable.

2.3.4 Payment Systems

The development of new, innovative channels for commerce, with most money transactions occurring between computers, raises the need for new forms of charging. The majority of high value payments (although relatively few in number) were made electronically as far back as 1996, although cash has remained the dominant mechanism for small payments. Since 1996, even though electronic payment has proliferated, banks have continued to endure the relatively expensive process of handling cheques, and cash remains a vital mechanism for small face-to-face transactions.

In parallel, charging methods have evolved from cash to debit to credit cards, the latter currently being the only ubiquitous means of electronic payment. However, credit cards are unsuited for small transactions; they are not anonymous and, under the laws of some countries, cannot be used for certain types of activity e.g. gambling. Therefore the need has emerged for new means of making payments for online transactions.

Proposed solutions include charges to phone bills; pre-pay accounts; peer-to-peer payments, usually through a third party intermediary such as PayPal; “eWallets”, micro-payments based on pre-pay, and credit and billing of charges to a mobile phone account allowing customers making purchases from a website to send money and bills to anyone with email. There are also systems which create pseudo credit card numbers that are limited in value to that required for a single transaction, after which they are discarded.

Credit card fraud is relatively infrequent since the payer is usually present e.g. less than 0.1% of the money spent on Visa cards in the EU region is fraudulent⁶. Visa nevertheless estimate that total losses in 2003 amounted to some EUR500 million, representing about EUR3 for each card issued⁷, and have observed a growing trend in “card not present” fraud associated with online transactions. New forms of payment must earn the trust of customers and institutions alike before they are widely adopted. Although the implementation of anti-fraud measures will be central to this, a substantial part of this activity against fraud is internal and will be largely invisible to the consumer.

2.4 Market Trends and Drivers

A number of drivers and trends will affect the development of the RC&F market.

*A **trend** is a discernible pattern of change, which can be linear, accelerating or decelerating. An example of a trend is: the average age of the UK population is increasing.*

*A **driver** is a factor that directly influences or causes the change. Drivers can be direct or indirect. An example of a driver that influences the above trend is: better healthcare allowing greater life expectancy.*

2.4.1 Current Trends

New communications technologies - the Internet being the most significant to date - have enabled the evolution of a variety of new business models in the RC&F sector. In its basic mode, the communications infrastructure provides a cost-effective means of interacting with the customer, enabling a substantial reduction in the cost of transaction processing, as illustrated in Figure 5 below.

Channel	Bank Branch Transaction	Telephone Banking Transaction	Call Centre with interactive voice response	Internet Transaction
Cost USD	1	0.54	0.20	0.01

Figure 5: Relative Cost of Transaction Processing Across Channels [Source: ITI Techmedia]

⁶ Source: Datamonitor “Online consumer payments: Determining the key components of a winning online payment solution” Brief No. BFFS0266 Published 22 Dec 2003

⁷ Source: Datamonitor “Card Scheme Security Initiatives” Brief No. BFFS0202 Published April 2003

The current drivers and trends pushing the market include:

- *Cost*: the need to minimise operating costs in order to improve competitiveness (driver)
- *Provision of a range of services*: the need to deliver a comprehensive portfolio of services to customers in a competitive marketplace (driver)
- *Regulation*: the need to meet increasingly stringent regulatory requirements (driver)
- The availability of cheap and increasingly powerful computing capacity (trend)⁸.

2.4.2 Key Trends – Identified by an Expert Foresight Group

The above trends are complemented by input collated during a Market Intelligence Workshop attended by experienced individuals from industry and academia as well as face-to-face interviews with key organisations in the sector. The expert group identified the following issues which will impact the overall sector:

- *Identity management (driver)*: including the authentication process core to any trusted transaction across the sector
- *Global open standards (driver)*: developments in trust systems and infrastructure verification will evolve to provide universally accepted global open standards or de-facto proprietary standards
- *Trust as a currency (trend)*: individuals are defining the type of personal information that is accessible, and thereby deriving a value on their personal attributes e.g. credit rating
- *Ageing population (trend)*: the shift in the average age of the population has major implications in terms of the services offered, presented and managed
- *Dis-intermediation versus re-intermediation (trend)*: there is an ongoing drive to manage costs. However, there is also a trend towards working more closely a smaller number of trusted suppliers, who are therefore more committed to the success of their customers. In some ways these trends can be viewed as conflicting, implying a careful balance of widening the supplier base versus the development of close supplier relationships.

2.4.3 Barriers to Market Entry

Financial services institutions are inherently very conservative organisations, making market entry difficult for small and new companies. Key to this difficulty is that banks cannot afford to jeopardise their status as a trusted third party. As a result, banks must be careful to ensure the integrity of suppliers and their solutions.

Most banks have rationalised the supplier base, establishing partnerships with a few key (large) suppliers. Smaller companies are only used for very specific tasks where the risks are limited and manageable. However, substantial market entry opportunities remain for innovative technology providers that:

⁸ Source: Generics; PWC Technology Forecast 2002-2004

- enable new revenue opportunities that, for example, facilitate exploitation of emerging arbitrage opportunities
- facilitate reductions in both the cost of service provision and business overheads.

Within the Retail Commerce sector, businesses continue to seek new ways of expanding channels to market and improve channel effectiveness. Establishing a web-based market presence is readily achievable at little cost, but this does not of itself ensure effective market access. The development of new business processes, for example a well organised distribution channel, is required if an effective online channel is to be established. Such requirements will continue to offer opportunities to organisations that can offer innovative technological solutions.

2.5 Value Chain Analysis

2.5.1 Commerce and Financial Services Value Chain Analysis

A simplified generic value chain is shown in Figure 6 below.

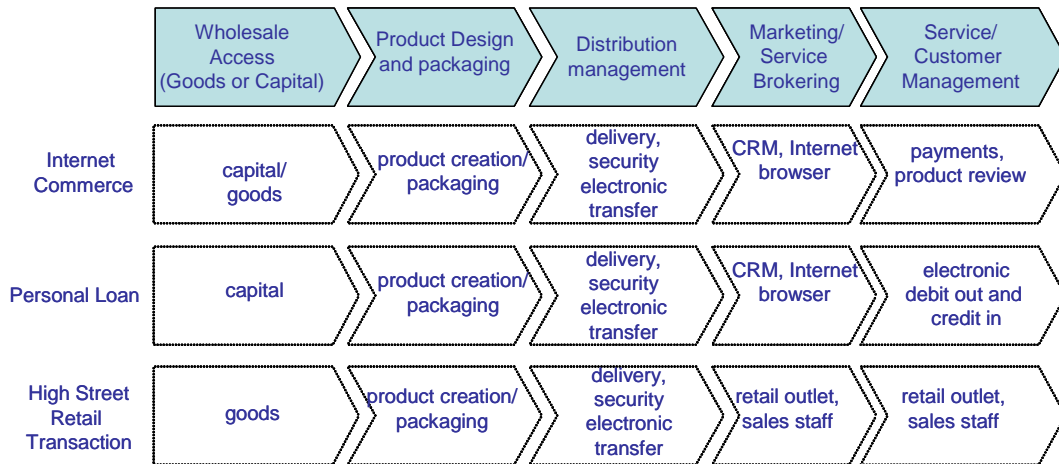


Figure 6: Generic Retail Commerce and Financial Services value chain [Source: ITI Techmedia]

The elements in the value chain are briefly described in Figure 7 below.

Wholesale Access (goods or capital)	Access to goods from wholesale supplier or capital from wholesale money markets
Product Design and Packaging	Design of product including all activities that add value
Distribution Management	Tools required to ensure that the funds/services/products are allocated/conducted/distributed appropriately and that regulatory and reporting functions are fulfilled
Marketing, Service Brokering	All marketing activities and management of appropriate delivery channel
Service/Customer Management	Delivery and ongoing monitoring and execution of payment flows to and from end-client. Customer follow up, returns etc

Figure 7: Elements in the e-Commerce Financial Services value chain [Source: ITI Techmedia]

3 MARKET ASSESSMENT

This section summarises the market opportunities in RC&F over the next 10 years, based upon the views of experts addressing the next 3 to 10 years and on market research reports from conventional market forecasting analysts assessing the next 5 years.

For convenience, these market opportunities are described under the same market segments defined in Sections 2.3 and 2.4. For each of the identified areas, a brief description of the following is given:

- the area of growth
- the drivers and inhibitors that support the market growth
- the functional needs that support market growth, together with an illustration of the value chain impacted by the functional need
- a roadmap highlighting the indicative timing (i.e. when a particular need is required by the mass market) of some of the identified functional needs.

A brief description of each of these functional needs is provided in Appendix 3.

3.1 Retail Commerce and Financial Services Market

Within the RC&F sector there is a variety of marketing channels which consumers can use to purchase goods or services. For example, purchases may be made from a website or through other electronic channels. Alternatively, consumers may prefer to carry out the transaction within retail stores or through branch offices. As a result of the foresighting activity, four areas are considered to offer potential:

- Internet commerce
- Mobile commerce (mCommerce)
- Electronic banking
- Automated banking (includes ATMs, kiosks, user devices)

3.1.1 Internet Commerce

This is defined as selling online through a website, or by means of email. The drivers and inhibitors that will shape the adoption of internet-based commercial transactions are summarised in Figure 8 below.

<i>Drivers</i>	<i>Inhibitors</i>
Reduction in operational/sales costs	The challenges in producing virtual products and environments
Personalisation of service	Consumer concerns about security
Transparency of transaction (cost of sale)	Retailer concerns about security
Minimal infrastructure requirement	
Greater geographical reach	

Figure 8: *Internet Commerce, drivers and inhibitors [Source: ITI Techmedia]*

3.1.2 mCommerce

mCommerce is any transaction with a monetary value that is conducted via a mobile telecommunications platform. mCommerce follows on from eCommerce - a fusion of internet technology and wireless applications. Applications based on mobile telecommunication infrastructure provide a new channel for marketing and sales, which in the supply side involves new actors and new technologies.

One of the substantial initiators of e-commerce was the introduction of well functioning and reliable electronic payment systems. The introduction of effective mobile payment systems will increase the interest and general distribution of m-commerce.

The number of mobile phone subscribers is expected to reach 2 billion in the next 5 years. Mobile phone utilisation will continue to be driven by voice services, although the share of revenues from non-voice services is expected to grow significantly in the short to medium term⁹.

The drivers and inhibitors that will shape the adoption of internet-based commercial transactions are summarised in Figure 9 below.

⁹ Refer to the ITI Techmedia Communications Services report for an analysis of the revenue prospects for non-voice mobile services.

<i>Drivers</i>	<i>Inhibitors</i>
Desire to exploit the high number of mobile phones in use as a new channel to the consumer	Perceived security issues may act to discourage service take-up
Mobile phone operators are keen to provide value added services to increase ARPU	Insular approach of operators
Mobile phones can receive, contain and give access to chargeable mobile commerce goods and services	Lack of payments infrastructure
	Lack of standards
	Poor usability of mobile devices
	Retailer processing centre integration problems
	Tension between key players

Figure 9: mCommerce, drivers and inhibitors [Source: ITI Techmedia]

Since mCommerce data is like any other data, no new network standard is needed to carry out mCommerce transactions. As a subset of eCommerce, mCommerce will therefore require broadly similar technologies.

3.1.3 Electronic Banking

Electronic banking is an umbrella term for the process by which a customer may perform banking transactions electronically without visiting a bricks-and-mortar institution. The following terms all refer to one form or another of electronic banking: personal computer (PC) banking, Internet banking, virtual banking, online banking, home banking, ATMs and remote electronic banking. It should be noted, however, that the terms used to describe the various types of electronic banking are often used interchangeably.

A subset of electronic banking is mobile banking (mBanking). mBanking relates to the conducting of banking transactions using mobile electronic devices, such as mobile phones, connected PDAs etc. At present, many banks have put mBanking initiatives on hold. They consider that there are few compelling arguments for the use of mobile channels at present. This situation may change when new high bandwidth technologies become commonplace.

Major drivers and inhibitors that will affect the take-up of electronic banking are described in Figure 10 below.

<i>Drivers</i>	<i>Inhibitors</i>
Customer: Availability of inquiry and transaction services around the clock that can be undertaken quickly without the need to visit a financial institution	Resistance of customers to use the Internet for banking, in some cases due to security concerns
Customer: Worldwide connectivity	Lack of a sufficiently widespread standard
Customer: Easy access to transaction data, both recent and historical	Current lack of functionality available e.g. full range of branch banking services may not be available via electronic banking
Customer: Direct customer control of international movement of funds without intermediation of financial institutions in customer's jurisdiction	Lack of services that can be provided using a mobile device that cannot be provided using a conventional voice call (although there might be a cost saving, this is not perceived as sufficient to justify the investment)
Bank: Reduced cost of transaction processing	Mobile banking service deployment, and the associated underlying technologies, remain unproven both to banks and consumers
Bank: Service enhancement	Perception that "Mobile phones are just a chunkier credit card"
	Failure of WAP to produce a return on banks' investment

Figure 10: *Electronic Banking, drivers and inhibitors [Source: ITI Techmedia]*

3.1.4 Automated Banking

Automated Teller Machines (ATMs) have evolved to form a worldwide network of cash dispensing and banking service machines. Together with kiosks, they also have the capability to dispense a wide range of information and provide interactive services, including most of the services that can be provided via the Web, as well as dispensing and receiving money and documents.

Major drivers and inhibitors that will affect the take-up of automated banking are described in Figure 11 below.

<i>Drivers</i>	<i>Inhibitors</i>
The need to reduce costs of interactions	There is a diminishing return as the number of ATMs increases, and the improvement in convenience becomes incrementally less
The need to improve service by reducing queues	Providing additional services on ATMs “only makes the queues longer”
The ability to provide banking services in new locations, such as within supermarkets, shopping malls, restaurants, roadside service stations	Reluctance of customers to enter private information, and instead use them only for browsing information
	Use of Internet channels by customers as a preferred alternative

Figure 11: Automated Banking, drivers and inhibitors [Source: ITI Techmedia]

3.1.5 Functional Needs

The functional needs that support the development of multi-channel RC&F transactions are illustrated in Figure 12 below.

<i>Functional Need</i>	<i>Wholesale Access</i>	<i>Product Design</i>	<i>Distribution</i>	<i>Marketing/ Brokering</i>	<i>Service</i>
Accessibility design (access for people with disabilities)		✓			✓
Advanced Graphics Rendering (Turbo Graphics)				✓	
Authentication				✓	✓
Content aggregation (Smart Enterprise Suites)		✓	✓	✓	
Distributed Point-of-Sale Networking				✓	✓
Encryption technologies (Advanced Encryption Standard)	✓		✓	✓	✓
Language processing e.g. Interfaces with call centres				✓	✓
Money counting and handling mechanisms					✓
Natural Interfaces				✓	✓

Payment methods			✓		✓
Presence				✓	
Robust and scaleable middleware platforms		✓	✓	✓	
Secure browser technologies			✓	✓	✓
Secure communications technologies (including encryption)	✓	✓	✓	✓	✓
Smart card technologies				✓	✓
Tamper detection	✓	✓	✓	✓	✓
Technologies for repurposing content for a variety of device platforms		✓	✓	✓	✓

Figure 12: Identified functional need, Automated Banking [Source: ITI Techmedia]

3.1.6 Technology Roadmap

Figure 13 below provides a roadmap illustrating the adoption of some of the key technology functional needs listed above. The technology adoption is shown in the context of the relevant market sizes from 2001 to 2008 and beyond. Indicative timing is based on when the technology starts to reach the mass market, not when it first appears.

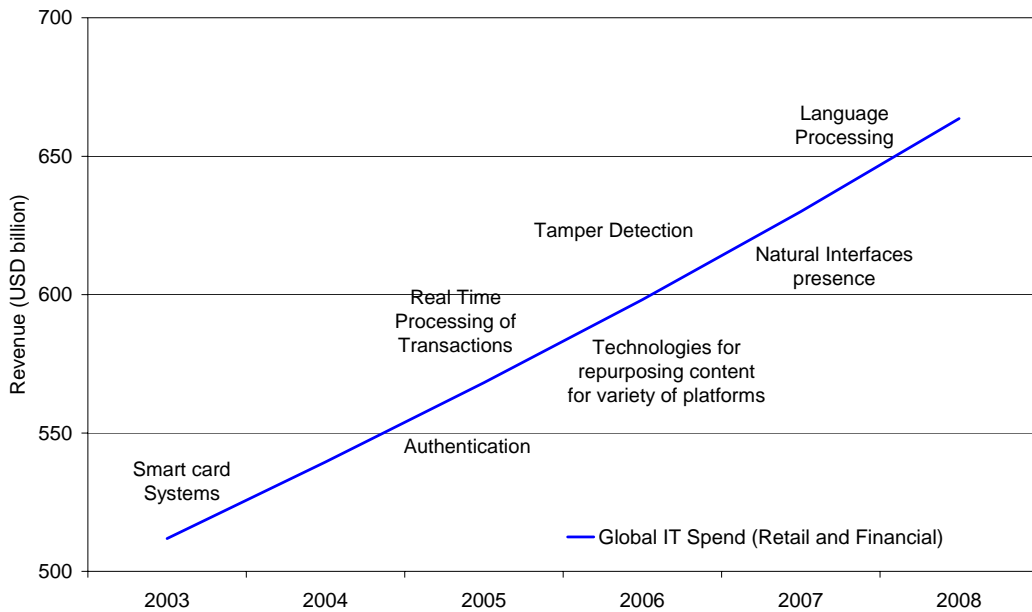


Figure 13: Channels to Market functional needs [Source: ITI Techmedia]

3.2 IT and Infrastructure – Business-Facing

Worldwide IT spend is forecast to reach USD500 billion by 2008. This figure covers all elements which come under the general heading of IT and includes both business and customer-facing IT. As a result of the foresighting activity, five areas are considered to offer potential:

- Enterprise resource planning
- Supply chain management and eProcurement
- Channel integration
- Regulatory reporting
- Security authentication

3.2.1 Enterprise Resource Planning

Enterprise resource planning is a term for suites of enterprise software that typically comprises:

- CRM and business intelligence; sales force automation. (CRM can be considered as both a customer-facing tool and a business management tool. For the purposes of this document, it is included within support for customer-facing activities)
- Supply chain management; eLogistics; eProcurement

- Regulatory reporting
- Channel integration: businesses invest significant effort to provide their services easily through a wide a range of channels.

Typical suppliers include Baan, Oracle, PeopleSoft, SAP and Microsoft.

Major drivers and inhibitors that will affect the take-up of ERP are described in Figure 14 below.

<i>Drivers</i>	<i>Inhibitors</i>
Reduction in lead times	Incompatible systems
Reduction in administrative costs	Lack of standards
Allow greater visibility of inventory enabling reduction in overall inventory costs	
Closer partnerships with suppliers – better integration of production	
Improve product offering through better business intelligence	

Figure 14: Supply Chain Management, drivers and inhibitors [Source: ITI Techmedia]

3.2.2 Supply Chain Management and eProcurement

Most businesses procure material and services from suppliers. In the past this was managed using paper based systems – orders, schedules, delivery notes invoices, etc. Most well organised businesses now make use of electronic communication up and down the supply chain. Looking forward, widespread use of such systems can be anticipated.

eProcurement offers benefits by reducing the cost of managing the process of acquisition of goods and services. A particular case is that Government is a major buyer of goods and services. It is typically subject to rules governing the way it conducts transactions, to control costs and provide transparency.

Major drivers and inhibitors that will affect the take-up of supply chain management are described in Figure 15 below.

<i>Drivers</i>	<i>Inhibitors</i>
Reduction in lead times	Incompatible systems
Reduction in administrative costs	Lack of standards
Allow greater visibility of inventory enabling reduction in overall inventory costs	
Closer partnerships with suppliers – better integration of production	

Figure 15: Supply Chain Management and eProcurement, drivers and inhibitors [Source: ITI Techmedia]

3.2.3 Channel Integration

Financial services institutions tend to view the channels as interchangeable methods of providing a common core of products and services. This is made a reality with a channel integration approach.

Major drivers and inhibitors that will affect the take-up of channel integration are described in Figure 16 below.

<i>Drivers</i>	<i>Inhibitors</i>
Need to support and develop multiple distribution channels	Lack of a clear route ahead between J2EE and .NET (many banks appear to be favouring J2EE)
Need to interchange channels as required	
Need to maximise the return of investments e.g. in internet channels	
The need to reduce the costs of setting up and running channels	

Figure 16: Channel Integration, drivers and inhibitors [Source: ITI Techmedia]

3.2.4 Regulatory Reporting

The Financial Services Authority (FSA) in the UK, the Securities and Equities Commission (SEC) in the US and other regulators are imposing increasingly stringent reporting requirements on financial services businesses. In the US, the Sarbanes-Oxley Act passed into law into 2002, while various (relatively less stringent) regimes have emerged, notably Basel II. It can be anticipated that near real-time reporting and disclosure of all material information will be mandated.

Measures to combat crime and terrorism have also imposed stringent requirements on many businesses to monitor and report particular activities related to money laundering.

The support of regulatory reporting requirements needs the recording and reporting of accounting data within the organisation, including functions such as general ledger, accounts payable, accounts receivable, budgeting and asset management.

In a financial services institution, the accounting functions are the major activity of the business, and the core processing of transactions, settlement and treasury functions is seen as a major asset of the business.

Major drivers and inhibitors that will affect the development of regulatory reporting services are described in Figure 17 below.

<i>Drivers</i>	<i>Inhibitors</i>
<p>The need to provide more comprehensive information more easily to address issues including:</p> <ul style="list-style-type: none"> - prevention of business fraud, insider trading etc. - prevention of crime and terrorism - desire for transparency of businesses 	<p>The need to minimise cost and maximise Return on Investment.</p>
<p>The need to provide statutory reporting, against a changing requirement</p>	<p>Privacy concerns of the individual</p>
<p>The need to rapidly implement new requirements</p>	<p>Difficulty in identifying suspicious activity in legitimate activity</p> <p>Difficulty of supporting new processes and products</p> <p>Need for verification and validation of information</p> <p>Need for security and confidentiality</p> <p>Significant costs and commitment are invested in legacy ERP systems</p> <p>Tendency towards conservatism in introducing new technologies</p>

Figure 17: Regulatory Reporting, drivers and inhibitors [Source: ITI Techmedia]

3.2.5 Security Authentication

Business management tools and systems are required to support all areas of business. One of the key areas which has emerged is Identity Management, a part of which is authentication. Authentication is the procedure of verifying the identity of a person or process. In a communication system, authentication verifies that messages really come from their stated source.

Businesses need to be able to demonstrate that they are capable of managing security and authentication processes. A UK initiative is tScheme - an independent, non-profit making, industry-led body set up to approve new commercial security services, generally called "trust services", and to provide confidence.

For individuals, authentication ("I am who I say I am") and authorisation ("I have the authority to spend money on behalf of the person I say I am") are key enablers for electronic Commerce. As online spending levels increase, these will become increasingly important.

Major drivers and inhibitors that will affect the take-up of security authentication systems are described in Figure 18 below.

<i>Drivers</i>	<i>Inhibitors</i>
The need to have and demonstrate capability	Lack of universal standards
The need to ascertain the identity of individuals and their authorisation to spend money	Systems are needed which can operate reliably for remote transactions

Figure 18: Security Authentication, drivers and inhibitors [Source: ITI Techmedia]

3.2.6 Functional Needs

The identified functional needs supporting business-facing IT functions are shown in Figure 19 below.

<i>Functional Need</i>	<i>Capital Access</i>	<i>Product Design</i>	<i>Distribution</i>	<i>Marketing Brokering</i>	<i>Service</i>
Bid management tools	✓			✓	
Collaborative Planning tools		✓	✓	✓	
Channel Dependent Content Adaptation		✓	✓	✓	
Enterprise Resource Planning suites	✓	✓	✓	✓	
Electronic Wallet				✓	✓
Encryption	✓		✓	✓	
Federated identity management			✓	✓	✓
Identity and access management			✓	✓	✓
Managed authentication services				✓	✓
Public Key Infrastructure			✓	✓	
Risk Management Tools (Advanced Fraud Detection)	✓		✓	✓	
Trust schemes e.g. tScheme	✓	✓	✓	✓	✓

Figure 19: Identified functional needs, Business-facing IT [Source: ITI Techmedia]

3.2.7 Technology Roadmaps

Figure 20 below provides a roadmap illustrating the adoption of some of the key technology functional needs listed above. The technology adoption is shown in the

context of the relevant market sizes from 2001 to 2008 and beyond. Indicative timing is based on when the technology starts to reach the mass market, not when it first appears.

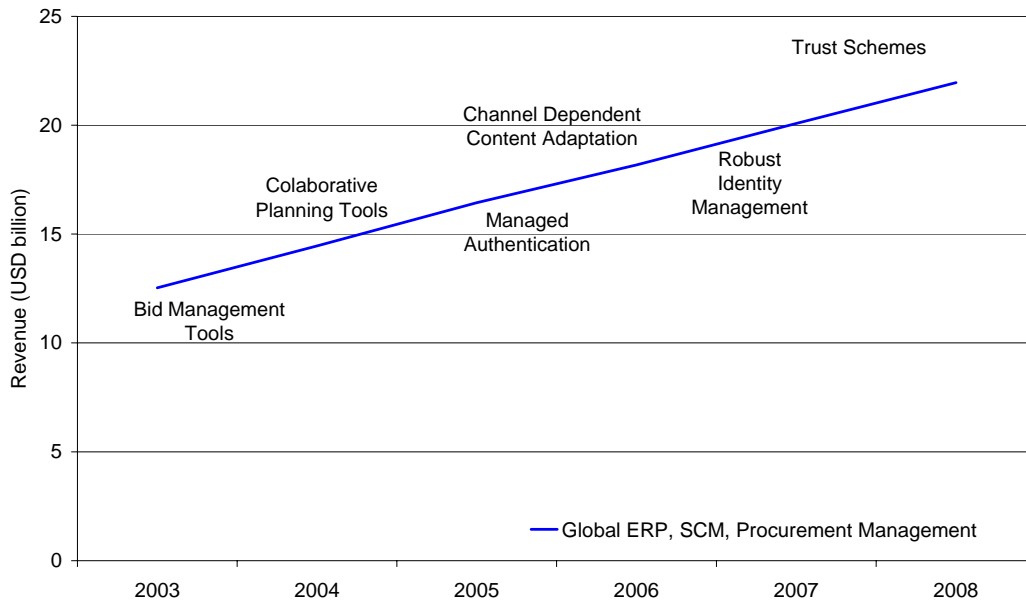


Figure 20: Business-facing IT functional needs [Source: ITI Techmedia]

3.3 IT and Infrastructure – Customer-Facing

In parallel with the business-facing IT requirements there are distinct opportunities for IT within customer-facing roles. As a result of the foresighting activity, three specific areas are considered to offer potential:

- Customer resource management
- Personalisation tools
- Sales force automation tools

3.3.1 Customer Resource Management (CRM)

CRM has become a strategic tool to attract new customers and retaining and developing existing ones. It underpins many aspects of the marketing and personalisation processes.

Major drivers and inhibitors that will affect the take-up of CRM systems are described in Figure 21 below.

<i>Drivers</i>	<i>Inhibitors</i>
Increasing sales through customer acquisition, retention and cross-selling	Difficulty in understanding customer behaviour
Reducing costs of customer management	Data Protection and Privacy issues
	Complexity and lack of inter-operability of IT systems
	Significant costs and commitment invested in legacy systems

Figure 21: *Customer Resource Management, drivers and inhibitors [Source: ITI Techmedia]*

3.3.2 Personalisation Tools

Personalisation is the selective delivery of content and services to customers and prospective customers, e.g. on the basis of their current and past interests, contacts and behaviour. It is a component of CRM.

Major drivers and inhibitors that will affect the take-up of personalisation tools are described in Figure 22 below.

<i>Drivers</i>	<i>Inhibitors</i>
People wish to focus less on the mundane, and be made to feel special	Privacy concerns
Provide tailored products and promote to specific customer groups for targeted sales	

Figure 22: *Personalisation Tools, drivers and inhibitors [Source: ITI Techmedia]*

3.3.3 Sales Force Automation Tools

Sales Force Automation helps to improve the effectiveness of the sales process by capturing sales leads and managing them as they move through the qualification process. It typically assists with contact management, calendar keeping, preparation of marketing collateral and presentations, maintenance of sales territories and assignment of commissions. Sales force automation is usually considered a subset of CRM.

Major drivers and inhibitors that will affect the take-up of sales force automation tools are described in Figure 23 below.

<i>Drivers</i>	<i>Inhibitors</i>
The need to manage sales resources effectively	
Increase sales opportunities and improve conversion to confirmed sales	

Figure 23: *Sales Force Automation Tools, drivers and inhibitors [Source: ITI Techmedia]*

3.3.4 Functional Needs

The identified functional needs to support Customer-facing Requirements is shown below in Figure 24.

<i>Functional Need</i>	<i>Capital Access</i>	<i>Product Design</i>	<i>Distribution</i>	<i>Marketing Brokering</i>	<i>Service</i>
Artificial Intelligence				✓	✓
Customer Experience Management			✓	✓	✓
Intelligent personalisation engines		✓	✓	✓	✓
Natural Language Search			✓	✓	
Personalisation tools				✓	✓
Profiling and user analysis			✓	✓	
Real time analytics				✓	✓
Speech recognition				✓	✓
Tailored Services		✓		✓	✓

Figure 24: Identified functional needs, Customer-facing requirements [Source ITI Techmedia]

3.3.5 Technology Roadmaps

Figure 25 below provides a roadmap illustrating the adoption of some of the key technology functional needs listed above. The technology adoption is shown in the context of the relevant market sizes from 2001 to 2008 and beyond. Indicative timing is based on when the technology starts to reach the mass market, not when it first appears.

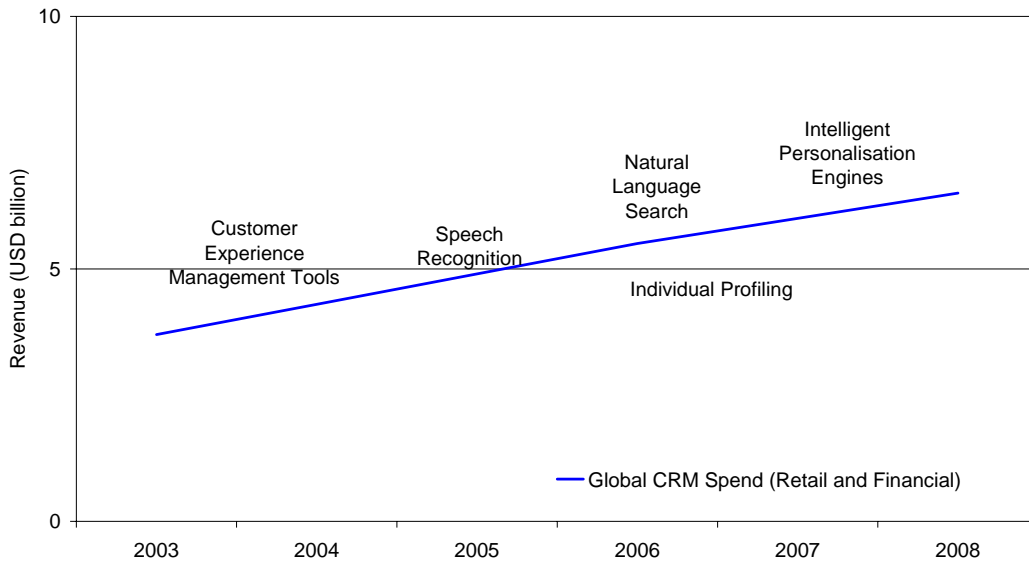


Figure 25: Customer-facing requirements functional needs [Source: ITI Techmedia]

3.4 Payment Systems

A continuing trend in the payments market has been the declining share of all payments made by cash. Cash payment volumes in the UK were some GBP27 billion in 2002, accounting for three-quarters of all payments. This remains an important payment method in value terms, accounting for about 42% of all personal spending in the retail sector. Volumes are expected to continue to decline and migration to online debit cards and ePurse will be important influences; however, it is projected that the use of cash will still account for 62% of all payments in 2009¹⁰.

Around 3% of all card payments were made over the Internet last year. This is expected to grow to one in ten by 2012. Given that total card spending was GBP211 billion in the UK last year and that spending is forecast to double to GBP415 billion in 2012, online payment methods will represent a significant growth opportunity.

Activity on ePurse in the UK has been limited. Looking forward, pre-paid applications could emerge on the back of non-bank chip cards being introduced for transport and other purposes such as Transport for London's Oyster scheme. The introduction of chip and PIN on credit and debit cards may improve the economics for an ePurse scheme in the UK and cause banks to revisit the business case. However, a number of other electronic alternatives to the ePurse are also emerging in the marketplace, such as the use of mobile phones to make payments at car parks.

¹⁰ APACS

3.4.1 Peer-to-Peer Payment Systems

Cash has been used as a means of settling payments between individuals for thousands of years. Provided the currency is supported by an institution in which both parties have confidence, promissory notes are acceptable. Otherwise the currency itself must be intrinsically valuable to both parties, e.g. gold coins.

Cash is not effective when the two parties are remote, and other methods for arranging an exchange of value have to be introduced. In almost all cases these involve a trusted third party; these can all be considered to a greater or lesser extent as extensions of the banking system.

Systems which are purely peer-to-peer (in that they don't involve a trusted third party) are relatively rare, but a few prototypes have been established. These depend on a high level of trust within the communities. In effect, individuals exchange "IOUs" within a controlled environment, typically managed by the community. Currency units may be monetary, or intangible e.g. based on hours of labour. From time to time, settlement of net amounts may be made between individuals using conventional means.

It is questionable whether such systems can become mainstream methods of payment handling, given that they rely on the presence of trust throughout the community. Few of the systems have so far developed beyond an experimental status, and none are currently "mainstream" payment methods.

Major drivers and inhibitors that will affect the take-up of peer-to-peer payment systems are described in Figure 26 below.

<i>Drivers</i>	<i>Inhibitors</i>
Desire of individuals to trade one to one	Regulation of the systems by tax authorities who assign value to each transaction and tax them accordingly
Avoidance of third party intermediaries	Lack of communities that possess the necessary level of mutual trust and common interest
	Incentive to defraud once the amounts handled become significant

Figure 26: Peer-to-Peer Payment Systems, drivers and inhibitors [Source: ITI Techmedia]

3.4.2 ePurse

A chip application designed to mimic the use of cash, ePurse cards are sometimes referred to as eCash or Stored Value Cards (SVC), and can be either re-loadable or disposable. They are popular for use with mass transit and road tolling systems.

Major drivers and inhibitors that will affect the take-up of ePurse tools are described in Figure 27 below.

<i>Drivers</i>	<i>Inhibitors</i>
Less cash means a higher degree of safety (merchant)	Cost of new systems, machines, and cards estimated at USD20 billion
Convenience (consumer)	Fees consumers/merchants would have to pay
	Privacy concerns
	Need is unproven: once people get past the novelty, will they really use the new options?
	Cards need to be periodically reloaded

Figure 27: ePurse, drivers and inhibitors [Source: ITI Techmedia]

3.4.3 Functional Needs

The identified functional needs which support charging schemes are shown in Figure 28 below.

<i>Functional Need</i>	<i>Wholesale Access</i>	<i>Product Design</i>	<i>Distribution</i>	<i>Marketing Brokering</i>	<i>Service</i>
Authentication			✓	✓	✓
Collaborative tools			✓	✓	✓
Electronic wallet			✓	✓	✓
Grid computing tools			✓	✓	✓
RFID			✓	✓	
Smart cards				✓	✓
Secure communications technologies			✓	✓	✓

Figure 28: Identified functional needs, Payment Systems [Source: ITI Techmedia]

3.4.4 Technology Roadmaps

Figure 29 below provides a roadmap illustrating the adoption of some of the key technology functional needs listed above. The technology adoption is shown in the context of the relevant market sizes from 2001 to 2008 and beyond. Indicative timing is based upon when the technology starts to reach the mass market, not when it first appears.

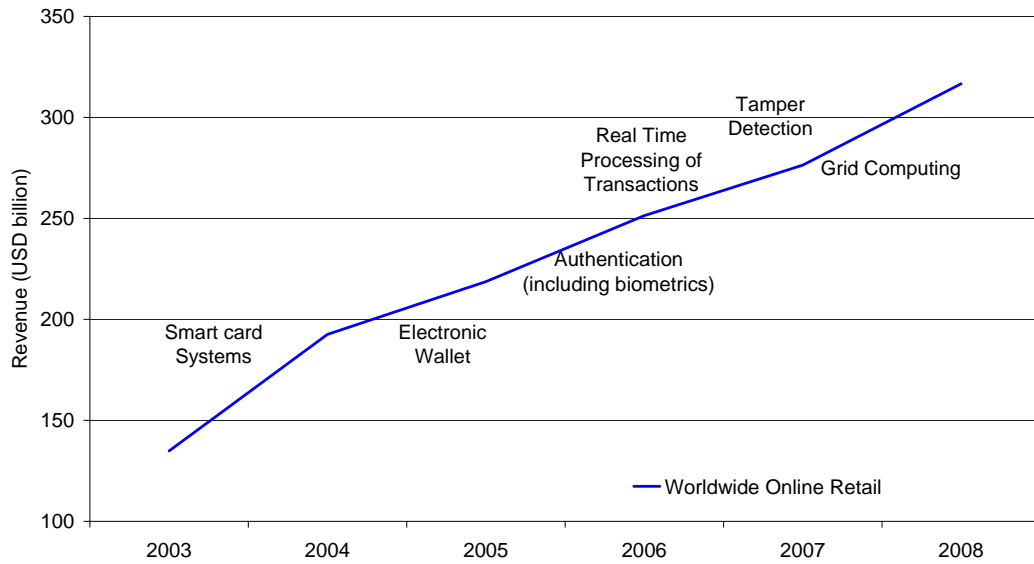


Figure 29: Payment Systems functional needs [Source: ITI Techmedia]

4 MARKET DATA

In this Section, market data is provided for the market areas identified in Section 3.

4.1 Retail Commerce and Financial Services Market

4.1.1 Worldwide Online Payment Revenues

Revenues from online retail commerce are forecast to reach USD317 billion by 2008, as illustrated in Figure 30 below.

USD billion	2003	2004	2005	2006	2007	2008	CAGR
	134.9	192.6	218.7	251.3	276.4	316.6	18.6%

Figure 30: Global online payment revenues, 2003-2008 [Source: Datamonitor]

4.1.2 Worldwide mPayment Revenues

Revenues from mobile commerce are forecast to reach USD39 billion by 2008, as illustrated in Figure 31 below.

USD billion	2003	2004	2005	2006	2007	2008	CAGR
	2.5	6.1	13.2	21.2	38.4	38.8	73%

Figure 31: Global mPayment revenue, 2003-2008 [Source: Strategy Analytics]

4.2 IT and Infrastructure Business Management

4.2.1 Enterprise Resource Planning Software

Spend on Enterprise Resource Planning Software worldwide is forecast to reach USD56 billion by 2008; the element of that accruing to the financial and retail sector is detailed in Figure 32 below.

USD billion	2003	2004	2005	2006	2007	2008	CAGR
Financial	7.4	8.5	9.7	10.7	11.8	12.9	13.6%
Retail Commerce	3.8	4.4	5.0	5.6	6.2	6.7	

Figure 32: Global ERP revenue, 2003-2008 [Source: PWC, ITI Techmedia]

According to Gartner, SAP, Oracle, Peoplesoft and JD Edwards lead the ERP market. Gartner believe that there will be further consolidation in the market with the large providers increasing their position. Key vendors include Baan, JD Edwards, Hyperion, Microsoft Business Solutions, Oracle, PeopleSoft, SAP and Sage.

4.2.2 Supply Chain Management Software

According to Gartner Dataquest, economic conditions have depressed the supply chain management (SCM) software industry, and the market is believed to have declined by around 20% worldwide in 2002.

Gartner estimate that worldwide SCM Software Application Licence Revenue will be in the region of USD1.8 billion to USD3 billion by 2007, and the proportion accruing to the RC&F sector is illustrated in Figure 33 below.

USD million	2003	2004	2005	2006	2007	2008	CAGR
Finance	472.7	496.3	546.0	611.3	697.1	768.2	10.2%
Retail Commerce	246.6	259.0	284.9	319.0	363.7	400.8	

Figure 33: Global SCM software, application and licence revenue, 2003-2008 [Source: Gartner, ITI Techmedia]

The supply chain management software market is dominated by five large players who between them account for over 30% of the market. Key vendors include SAP, I2 Technologies, Oracle, Ariba and Manugistics.

4.2.3 Procurement Management Software

Electronic procurement software (eProcurement) replaces paper catalogues and multipart paper forms with searchable electronic catalogues, electronic requisitions and automated workflow through email.

Spend on procurement management ("buy-side") software worldwide is forecast to reach USD1.4 billion by 2008, and the proportion accruing to the RC&F sector is illustrated in Figure 34 below.

USD million	2003	2004	2005	2006	2007	2008	CAGR
Finance	172.5	207.0	253.0	264.5	292.1	317.4	11.3%
Retail Commerce	90.0	108.0	132.0	138.0	152.4	165.6	

Figure 34: Global buy-side procurement management software revenue, 2003-2008 [Source: PWC, ITI Techmedia]

Spend on procurement management (“sell-side”) software worldwide is forecast to reach USD1.8 billion by 2008, and the proportion accruing to the RC&F sector is illustrated in Figure 35 below.

USD million	2003	2004	2005	2006	2007	2008	CAGR
Finance	230.0	287.5	345.0	354.2	386.4	418.6	9.7%
Retail Commerce	120.0	150.0	180.0	184.8	201.6	218.4	

Figure 35: Global sell-side procurement management software revenue, 2003-2008 [Source: PWC, ITI Techmedia]

There is currently a move by the traditional procurement management software providers into supply chain management and vice versa. Ariba, CommerceOne and I2 Technologies account for over 50% of the market.

Key vendors in this area include Ariba, Commerce One, I2 Technologies, Manugistics, Oracle, PeopleSoft, PurchasePro, PurchasingNet, SAP, SupplyWorks and Verticalnet.

4.2.4 European Spend on Channel Integration

Spend on channel integration in the Financial Services sector is estimated to rise to about USD1.7 billion by 2008, as illustrated in Figure 36 below.

USD billion	2003	2004	2005	2006	2007	2008	CAGR
	1.49	1.49	1.57	1.63	1.69	1.71	1.3%

Figure 36: European channel integration revenue, 2003-2008 [Source: Datamonitor]

4.2.5 Regulatory Reporting

Regulatory compliance and reporting is a major area of spend for most institutions. AMR Research estimates that US companies will spend up to USD2.5 billion for Sarbanes-Oxley Act Compliance in 2003; many large financial institutions spend in excess of 25% of their IT budget in ensuring compliance with regulatory changes.

4.3 IT and Infrastructure Customer Management Systems

4.3.1 Customer Relationship Management Software

CRM enables the user to have a better picture of their customer with regard to the products they have bought in the past and the channels they have used to do so. This information can then be used to determine which products are likely to interest them in the future.

According to Datamonitor, expenditure on CRM software worldwide is forecast to reach USD18.7 billion by 2008; the proportion accruing to the RC&F sector is illustrated in Figure 37 below.

<i>USD billion</i>	<i>2003</i>	<i>2004</i>	<i>2005</i>	<i>2006</i>	<i>2007</i>	<i>2008</i>	<i>CAGR</i>
Finance	2.4	2.8	3.2	3.6	3.9	4.3	12.3%
Retail							
Commerce	1.3	1.5	1.7	1.9	2.1	2.2	

Figure 37: Global CRM software revenue, 2003-2008 [Source: PWC, ITI Techmedia]

Key vendors in the space include Accenture, CGEY, Deloitte Consulting, EDS, IBM, KPMG, PWC, AIT, Brio, Business Objects, Chordiant, Cognos, eGain, ePiphany, KANA, NCR, Oracle, Pegasystems, Peoplesoft, Protagona, SAP, SAS and Siebel.

4.3.2 Sales Force Automation

According to Strategy Analytics, sales force automation (SFA) is widely perceived as a way of increasing the productivity of sales professionals, whether through enhanced contact management, granting management greater visibility over sales activities, or ultimately streamlining multiple business processes (when integrated with larger CRM solutions, ERP packages or discrete functional subsystems such as Production, Inventory and Accounting/Finance)¹¹.

Greater availability of mobile technology within the sales force is acting as a stimulus to SFA, and Strategy Analytics believe that mobile SFA could be worth USD2.5 billion worldwide by 2008. These projections are generally in line with those of Datamonitor, as illustrated in Figure 38 and Figure 39 below.

¹¹ Wireless SFA: Streamlining the Enterprise or Glorified Contact Management? Strategy Analytics, February 2004.

USD million	2003	2004	2005	2006	2007	2008	CAGR
SFA Financial Services	250	270	300	300	300	330	5.1%
Service Automation	220	250	270	290	290	310	6.4%
Marketing Automation Software	170	190	210	230	230	240	7.9%
Total CRM	640	710	780	820	820	870	6.3%

Figure 38: Global Financial Services SFA revenue, 2003-2008 [Source: Datamonitor, ITI Techmedia]

USD million	2003	2004	2005	2006	2007	2008	CAGR
SFA Retail	150	160	170	180	180	190	5.1%
Service Automation	130	150	160	170	170	180	6.4%
Marketing Automation Software	100	110	120	130	130	140	7.9%
Total CRM	380	420	460	480	480	510	6.3%

Figure 39: Global Retail Commerce services SFA revenue, 2003-2008 [Source: Datamonitor, ITI Techmedia]

4.3.3 Personalisation Software

PriceWaterhouseCoopers define personalisation as:

"The selective delivery of content and services (such as specific product and service offerings, advertising, coupons, and other promotions) to customers and prospective customers¹²".

Spend on personalisation software worldwide is forecast to reach USD2.6 billion by 2008, as illustrated in Figure 40 below.

USD billion	2003	2004	2005	2006	2007	2008	CAGR
	0.90	1.25	1.60	2.10	2.28	2.60	26.5%

Figure 40: Global personalisation software revenue, 2003-2008 [Source: PWC]

Key vendors in this area include ATG, Black Pearl, Haley Enterprises, HNC Software, ILOG and Macromedia.

¹² Technology Forecast: 2002-2004, PriceWaterhouseCoopers

4.3.4 Website Analysis Application Software

Global spend on website analysis application software is forecast to reach USD817 million by 2008, as illustrated in Figure 41 below.

USD million	2003	2004	2005	2006	2007	2008	CAGR
	220	320	470	573	695	817	80.7%

Figure 41: Global website application software revenue, 2003-2008 [Source: PWC]

4.4 Payment Systems

4.4.1 Micro-payment

Datamonitor¹³ defines micro-payments as 'any payment up to GBP10 in value', sub-divided further into online and offline, where offline is primarily cash and ePurse.

Many of the early micro-payment solutions failed; however, the penetration of mobile phones and the ease with which mobile phones can be used to make micro- and macro-payments is creating new opportunities in this area. Loosely grouped under the heading 'm-payments', there are numerous payment offerings. Some use the handset as a convenient access mechanism to traditional payment means. Others are integrating characteristics of the mobile phone itself into payments procedures, such as piggy-backing on existing billing of phone calls or spending the mobile phone's pre-paid airtime. Further, there are attempts to bring arrangements together under the umbrella of single-branded services.

The key vendors in this area are PayPal, Firstgate click&buy, Vodafone m-pay and Splash Plastic.

4.4.2 Card Payment

Datamonitor state that credit and debit cards are ill-suited for payments under GBP10 and especially for payments greater than GBP1, since:

- retailers are not prepared to accept cards for micro-payments, largely due to high merchant service charges
- consumers are not prepared to use cards to make micro-payments, largely due to concern over security.

Several standards have been developed and initiatives launched in recent years to allow safer transmission and storage of credit card information. These include, inter alia, SSL (Secure Sockets Layer), SET (Secure Electronic Transaction), Visa 3D Secure and

¹³ Micro-payments, Datamonitor, January 2003

MasterCard SPA. The complexity of, and lack of interoperability between, the different initiatives has, however, hampered customer adoption of technologies other than SSL.

Around 3% of all UK card payments were made over the internet in 2002¹⁴. This is expected to grow to 10% by 2012.

Research from the Nilson Report has found that micro-payments and low value mobile payments could account for as much as 5% of worldwide credit and debit card usage by 2007, pushing the figure from USD 5.7 trillion to USD6 trillion.

Given the size of the card payment market, payment mechanisms are an important area.

4.4.3 Authentication

The Yankee Group forecasts that the identity management market will expand at an average rate of 7.1% over the next 5 years, reaching USD3.3 billion market by 2008. Datamonitor project a market value of nearly twice this value as illustrated in Figure 42 below.

USD billion	2003	2004	2005	2006	2007	2008	CAGR
Financial	1.0	1.1	1.2	1.3	1.5	1.6	9.9%
Retail Commerce	0.3	0.3	0.3	0.3	0.4	0.4	9.7%
All Sectors	4.3	4.5	4.9	5.5	6.2	6.8	9.9%

Figure 42: Global identity management revenue, 2003-2008 [Source: Datamonitor, ITI Techmedia]

Authentication falls into software, token and biometric based solutions. Currently, businesses typically use software-based solutions such as digital certificates to provide authentication, but are moving to token- and biometric-based solutions. The International Biometric Group predicts a much steeper rise in the biometric market, suggesting that it will reach a figure of USD1.9 billion by 2005. They believe that the biometric market (excluding AFIS) is divided into:

- finger scan
- facial scan
- hand scan
- middleware
- iris scan
- voice scan
- signature scan
- keyboard scan.

¹⁴ APACS

Within the RC&F sector, smart cards and biometrics are anticipated to experience substantial growth, as illustrated in Figure 43 below.

USD million	2003	2004	2005	2006	2007	2008	CAGR
Smart Cards	67	89	113	141	180	230	28%
Public Key Infrastructure	222	230	246	263	281	298	6%
Biometrics	80	83	95	110	149	174	17%
Tokens	212	219	234	260	276	295	7%
USB token	17	21	35	59	92	142	53%

Figure 43: Global RC&F authentication product revenue, 2003-2008 [Source: Datamonitor, ITI Techmedia]

A strong driver for the uptake of biometric authentication is the increase in identity fraud. Gartner predict that the rate of identity fraud in 2004 will be 30 times the rate of credit card fraud for in-store transactions. However, more than two-thirds of fraud losses will be mis-assigned as credit losses, because banks and lenders lack tools, systems and incentives to track and catch identity fraud¹⁵. Gartner further believe that banks and lenders should invest in cross-industry recognition applications that score identities and their validity, and that they should not rely on some databases to verify account applications.

Key vendors in this space include BMC, Computer Associates, IBM, Netegrity, RSA Security, Business Layers, Communicator and Waveset.

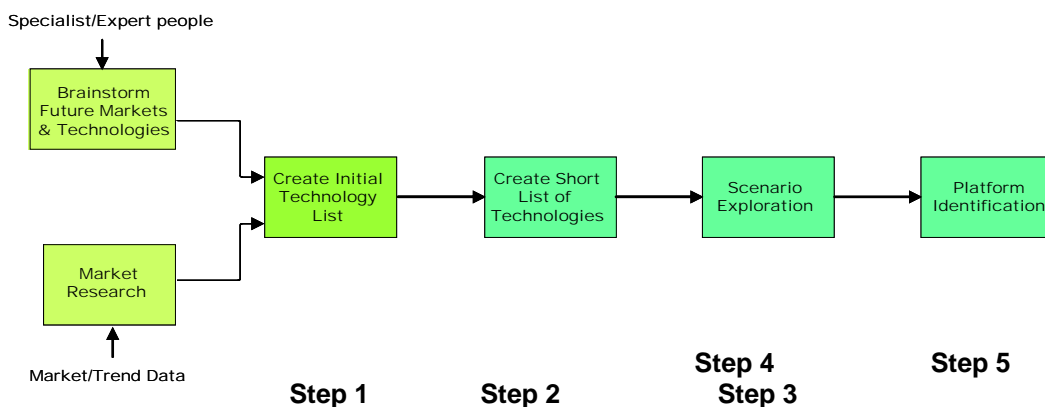
¹⁵ Predicts 2004: Financial Services, Gartner Group

APPENDIX 1: THE MARKET FORESIGHTING PROCESS

The foresight process for market identification, which is at the heart of the ITI activity, has been established to meet three main objectives:

- to identify and define the potential for new and emerging global markets, over a three to ten year horizon
- to provide an objective basis for assessment and comparison of any defined markets
- to identify and define key functional needs and platforms that will support market development

A market foresight process has been created and adopted by ITI Techmedia. Using the experience and expert advice of organisations recognised as having best practice capabilities in this field, it is designed not only to meet the objectives detailed under 'market identification' above, but also to take into account other relevant factors including sector specifics, timescales and resource needs. The main elements of the process are shown in simplified format below.



Step 1 identifies a vision for the market opportunity, the challenges, key drivers and market and technology barriers. This is achieved using specialist market knowledge, input from expert individuals in organisations across the sector, product and service companies, research organisations through to regulatory and other government offices. This is then enhanced by existing market knowledge to estimate the possible market size, timing, geographies, and demographics to create views of the value chain, the main stakeholders and resultant business models.

Step 2 creates a long technology list relevant to the individual sectors, which is in turn reduced in Step 3 to a shortlist, using input from technology experts. The process so far identifies the functional needs that best fit the market characteristics and hence highlight the most likely technology winners.

The functional needs and markets are validated in Step 4 via a process of scenario planning, a common tool used in foresighting environments. This uses example events to test if market and functional needs meet overall objectives and targets.

Step 5, the final step, identifies a resultant technology platform. A technology platform is defined as a cluster of connected technological capabilities comprising discrete technologies which together define a system with multiple potential applications.

The market foresight process and the usefulness of functions within it are subject to ongoing evaluation and refinement throughout, based on experience gained in the first phase.

APPENDIX 2: GLOSSARY OF TERMS

AI	Artificial Intelligence
API	Application Programming Interface
ARPU	Average Revenue per User
ATM	Automated Teller Machine - a cash dispenser
B2B	Business to Business - Electronic commerce between businesses, as opposed to between a consumer and a business (B2C)
B2C	Business to Consumer - Electronic commerce between a consumer and a business
Biometrics	Authentication techniques that rely on measurable physical characteristics that can be electronically verified
Bluetooth	A specification for short-range radio links between mobile computers, mobile phones, digital cameras, and other portable devices
CAGR	Compound Annual Growth Rate
FSI	Financial Services Industry
CRM	Customer Resource Management
DRM	Digital Rights Management
Electronic Wallet	System that stores a customer's data for easy retrieval for online purchases
ERP	Enterprise Resource Planning
J2EE	Java 2 Platform, Enterprise Edition
GSM	Global System for Mobile
HR	Human Resources
OBPP	Online Bill Presentation and Payment
P2P	Peer to Peer
PDA	Personal Digital Assistant
POP3	Post Office Protocol 3 – POP3 allows a client computer to retrieve electronic mail from a POP3 server
RFID	Radio Frequency Identification
SCM	Supply Chain Management
SFM	Sales Force Management
Smart Card	Any plastic card (like a credit card) with an embedded integrated circuit for storing information
XML	Extensible Mark-up Language

APPENDIX 3: FUNCTIONAL NEEDS DESCRIPTION

Accessibility Design (access for people with disabilities)	Design of computing devices and services (e.g. screens) to enable their use by people with disabilities
Advanced Graphics Rendering (Turbo Graphics)	Video/graphics processing technology enabling lower cost, high resolution displays
Advanced Web Services	Advanced service definition and invocation standards for web-based services (e.g. Business Process Execution Language for Web Services) providing support for advanced service oriented architectures and quality of service
Analytical Tools	Tools for real time monitoring and analysis of business activities, allowing immediate correction and response
Artificial Intelligence	Provision of computer-based expert systems and intelligent agents to support staff and services
Authentication	Systems to test and prove the identity of users or user agents over a communications network
Automatic Translation Tools; Text-to-Speech Translation.	Computer-based systems to enable translation between human languages, via natural speech or text; the generation of human speech from a textual or phonetic description
Bio-metrics (voice, fingerprint, iris, face, etc., recognition)	Authentication techniques based on measurable physical characteristics that can be electronically verified
Channel Dependent Content Adaptation	Customised/common user interface/experience for applications delivered through services channels
Channel Integration	Infrastructure/tool to support seamless interaction with customers through multiple channels (e.g. ATM, Internet, call centre, teller)
Collaborative Planning Tools	Applications for collaboration via email, instant messaging, application sharing and video-conferencing
Collaborative Tools	Interaction between meeting or presentation participants in real time, for example using application or whiteboard sharing
Common Services Layer Middle Tier	A layer of 'Common Services' that includes inter alia authentication, authorisation, rules management, logging, globally unique identifier (GUID) management, user messaging, database management, file management, and related common objects
Communication Links and Protocols	Communications links based on internationally agreed standards to allow interoperability
Contact-Less Communication Technologies	Short range wireless communications technologies, (e.g. Radio Frequency ID, Bluetooth) typically used for identification of devices
Content Aggregation	Drawing customer information together from across the enterprise, e.g. via smart enterprise suites

Customer Experience Management	Working with the customer or with customer data to find the optimum contact method or delivery channel
Data Access Policy Control	Rules-based system functions controlling access to user data across electronic channels
Data Format Conversion and Content Semantics	Unambiguous categorisation of information to enable intelligent indexing and processing of that content by a variety of machines/systems.
Distributed Point-of-Sale Networking	Higher capacity financial networks, e.g. removing bottlenecks in Point of Sale device networks
Electronic Wallet	Secure storage of electronic 'cash' in a user's device e.g. a mobile phone or PDA
Encryption Technologies (Advanced Encryption Standard)	An encryption method to protect electronic information selected by the National Institute of Standards and Technology to replace the US government-endorsed Data Encryption Standard (DES)
Enterprise Resource Planning Suites	Software products supporting Enterprise Resource Planning (ERP) services, including automating and supporting business functions for manufacturing, human resources and finance.
Expert Systems	Advanced intelligent agent-based computer systems to support customer services staff
Fault Tolerant Computing	Computer systems designed to allow business continuity in case of (for example) host system failure
Federated Identity Management	A system that allows individuals to use the same user name, password or other personal identification to sign on to the networks of more than one enterprise in order to conduct transactions
Grid computing tools	Co-ordinated and secured use of computing resources drawn from dynamic collections of distributed, shared computing resources
Identity and Access Management	Systems for proving the identity of end users, for example via a shared secret, and allowing or disallowing access to resources on that basis
Information Retrieval/Search (Data Mining)	Advanced search and information finding mechanisms, e.g. based on natural language
Intelligent Personalisation Engines	Ability to configure end user devices and services to the specific needs of the end user
Language Interpretation Tools	Tools to allow computer systems to recognise meaning from natural language
Language Processing	Capabilities allowing computers to understand the structure and meaning of natural language
Language processing e.g. Interfaces with call centres	Use of technologies such as speech recognition to facilitate the use of call centres by end users
Lead Management Tools	Web-based CRM tools aimed at creating new business
Local Area Networking	High speed fixed computer networks covering buildings and campuses

Managed Authentication Services	Outsourced (third party) systems to test and prove the identity of users or user agents over a communications network
Mobile Services Tools	Support for applications that manage financial accounts and relationships using wireless devices, for example funds transfer, account information retrieval and updating, trading, and customer service
Money Counting and Handling Mechanisms	Methods for handling/dispensing money with improved accuracy
Natural Interfaces	Capabilities allowing computer systems to understand humans using mechanisms such as speech recognition, gaze tracking or gesture recognition
Natural Language Search	Capabilities allowing computers to understand the structure and meaning of natural language, allowing users to interact with computers using natural sentences in customer service or contact centres
Payment Methods	Electronic payment methods such as eWallet or ePurse
PC Software and Operating Systems	More capable PCs, e.g. with faster processors enabling an improved user experience
Personalisation Tools	Ability to configure systems, devices and services (e.g. a web site, a call centre or the entire enterprise) to the specific needs and preferences of the user
Presence	Method to provide a computer-generated 3-D environment that surrounds users and responds to their actions in a natural way
Profiling and user analysis	Ability to analyse the use of financial systems and services by specific groups of end users
Public Key Infrastructure	A system for identification/authentication, encryption and digital signing based on the use of digital certificates that identify the holder of assigned public and private cryptographic key pairs
Real Time Analytics	Systems for rapid analysis, interpretation and pattern matching on data from enterprise systems, allowing response before the business process completes
Real Time Processing of Transactions	Transaction processing dynamically optimised to achieve efficiency improvements or fraud reduction
RFID	Provision of radio tags for individual items used as an enabler for applications such as retail outlet 'smart shelves'
Risk Management Tools (Advanced Fraud Detection)	Advanced fraud detection and response systems, e.g. for credit card processing
Robust and Scalable Middleware Platforms	Software that acts as an interface between different computer system components, allowing them to communicate and enabling new applications

Secure Browser Technologies	Web browser implementations which resist hacking or damage through malicious attack
Secure Communications Technologies	Communications systems that resist hacking or damage through malicious attack, e.g. through integrated secure hardware/software firewalls
Secure Server Technologies	Convergence of several network security components (e.g. firewalls, intrusion detection, gateway antivirus technology) to create trusted computing platforms
Smart Packaging; Low Cost sensors/processors/displays	Low cost technologies embedded in or associated with packaging to enable tracking or logistics applications
Smartcard Technologies	Chip-based cards capable of storing and processing information
Speech Recognition	The conversion of human speech into a textual or machine-command form
Tailored Services	Data configured to the specific needs and preferences of the user delivered through services channels
Tamper Detection	Methods for intrusion detection and prevention in computer networks
Technologies for Repurposing Content for a Variety of Device Platforms	Methods for translating content to different device platforms
Trust Schemes	Support for secure services and verification of user identity enabled by authentication, digital rights management and information protection mechanisms
Wireless CRM	CRM systems accessible over wireless radio links
