

10 New Digital Economy

10.1 Introduction

The widespread adoption of consumer infocomm technologies such as social media and mobile telephony, coupled with the increased acceptance of online activities like online shopping, e-banking and content sharing have led to the emergence of the New Digital Economy. These driving forces are powered by the Internet and driven by consumer trends that will transform businesses and government processes and responses, in turn leading to new wealth creation around the world.

There is no authoritative definition for the Digital Economy although the term has been in use since the 1990s. Most definitions of the Digital Economy will expand beyond just the Internet Economy (economic value derived from the Internet) to include economic and social activities resulting from other information and communications technologies (ICT). For example, the Australian government defined the Digital Economy as “the global network of economic and social activities that are enabled by platforms such as the Internet, mobile and sensor networks”¹.

Mobile is fast becoming the primary window to the Internet for most consumers. The adoption of smart mobile devices has empowered a new era of infocomm-enabled business models that can either potentially disrupt traditional businesses or be leveraged for a new phase of growth and opportunities. Apps on handheld devices have one of the highest consumer “face time” (Figure 1) and social networking sites are becoming consumers' first site of visit on the Web, replacing “Search”. Even in emerging markets, because of the millions of new mobile customers, new business models are emerging that can be applied back to developed markets.

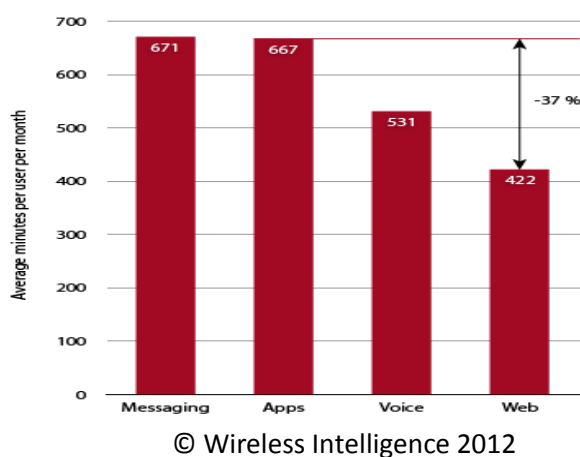


Figure 1: Smartphone usage activity per category²

¹ Department of Broadband, Communications and the Digital Economy, Australian Government. What is the digital economy? [Online] Available from: http://www.dbcde.gov.au/digital_economy/what_is_the_digital_economy [Accessed 9th July 2012].

² Wireless Intelligence. Smartphone users spending more ‘face time’ on apps than voice calls or web browsing. [Online] Available from: <http://www.wirelessintelligence.com/analysis/2011/03/smartphone-users-spending-more-face-time-on-apps-than-voice-calls-or-web-browsing/> [Accessed 9th July 2012].

10.1.1 Mobility, Internet and Economic Growth

Adoption of digital technologies like the mobile phone and Internet has direct correlation to economic growth. According to the World Bank, every 10 additional mobile phones per 100 people in a typical developing nation results in a Gross Domestic Product (GDP) growth of approximately 0.8%³.

Furthermore, a 2010 study conducted by Ericsson and Arthur D. Little found that GDP increases by 1% for every 10% increase in broadband penetration. The study also revealed that approximately 80 new jobs are created for every 1,000 new broadband connections provided. In 2011, a follow-up study on the socio-economic impact of faster broadband speeds found that doubling a country's broadband speed increases GDP by 0.3%. The equivalent monetary value of a 0.3% GDP growth in the OECD region is US\$126 billion. This in turn corresponds to more than one seventh of the average OECD growth rate in the past decade.

10.1.2 Digital Economy and the Internet

According to David Reed, an adjunct professor at the MIT Media Labs credited for his involvement in the early development of core Internet protocols, the Internet consists of three conceptual "clouds": the connectivity cloud - for the transfer of information, the resource cloud - for the storage of data, and the social cloud - for networking and collaboration. These clouds, which can be public, private or semi-private, provide the infrastructure for the growth of the New Digital Economy. They enable the creation of new markets and provide the conduit for the movement of resources and demand. As a result, firms and individuals worldwide can participate in innovation, wealth creation and social interaction in ways never before possible.

Access to the Internet is the driving force behind the digital economy. It increases the speed with which information is produced (instantaneously), transmitted (immediately), shared (collaboratively) and acted upon (spontaneously). According to Internet World Stats, an estimated 2.2 billion (nearly 33%) of the world population used the Internet as of end 2011. This number is expected to continue growing in the next few years. Not surprisingly, the biggest spike will be in Asia which will account for more than half of the world's Internet users by 2015⁴.

The shift of economic power to emerging markets in Asia defines the new digital marketplace and creates the new global dynamics which has been described as "the new normal market"⁵. Populated by countries that are not plagued by the debt and banking problems of the advanced economies and

³ Oxford Economics. The New Digital Economy: how it will transform business. [Online] Available from: <http://www.pwc.com/gx/en/technology/publications/assets/the-new-digital-economy.pdf> [Accessed 9th July 2012].

⁴ Morgan Stanley. Tablet demand and penetration. [Online] Available from: http://www.morganstanley.com/views/perspectives/tablets_demand.pdf [Accessed 9th July 2012].

⁵ Oxford Economics. Digital Megatrends 2015: The Role of Technology in the New Normal Market. [Online] Available from: http://fm.sap.com/data/UPLOAD/files/Final%20Digital%20Megatrend%20Research%20Report%20%282%29_2011.10.7-13.57.10.pdf [Accessed 9th July 2012].

cash-rich from trade surpluses, foreign exchange reserves and sovereign wealth funds, countries such as the BRIC (Brazil, Russia, India and China) will take a bigger slice (17%) of global GDP by 2015.

The BRICs now number 75 among the Fortune 500 companies, compared with just 29 in 2005. In 2010, China overtook the USA as the world's biggest economy when measured by purchasing power parity⁶. In end-December 2011, China's Internet users numbered 513 million⁷. The Internet penetration rate rose to 38.3%, increasing by 55.8 million Internet users, up 4% from the same period in 2010. At the same time, the number of mobile phone Internet users also increased, reaching 356 million by end 2011, up 17.5% from the previous year. Correspondingly, the number of websites in China also increased by 20% to 2.3 million in 2011.

10.1.3 The Size of the New Digital Economy

According to IDC, the size of total worldwide e-commerce, combining business-to-business (B2B) and business-to-consumer (B2C) transactions, is US\$16 trillion in 2013⁸. IDate, the French technology research firm, estimates the global market for digital products and services at US\$4.4 trillion in 2013. Adding these figures together gives us an estimate of the total size of the digital economy at US\$20.4 trillion, equivalent to approximately 13.8% of all sales flowing through the world economy.

The digital value chain is broadly defined as the creation, dissemination, delivery and consumption of digital content. Profits for players in the digital value chain have grown at an average pace of 5% a year, from US\$498 billion on US\$3.7 trillion in revenue in 2002 to US\$726 billion on US\$4.3 trillion in revenue in 2010⁹. The benefits, however, have not been distributed evenly. Companies in the segments furthest from consumers, such as the pure content and service providers operating in traditional media publishing which has very limited direct consumer engagement, are losing profit share to those closest, such as the device and platform companies, the game and app developers, and the Internet software and services providers.

⁶ Bloomberg. China Overtakes U.S. As Biggest Economy When Measured by Purchasing Power. [Online] Available from: <http://www.bloomberg.com/news/2011-01-14/china-tops-u-s-as-biggest-economy-by-purchasing-power-update1-.html> [Accessed 9th July 2012].

⁷ Gao Qihui. China's Internet population hits 513 million. [Online] Available from:

http://www.chinadaily.com.cn/china/2012-01/16/content_14453469.htm [Accessed 9th July 2012].

⁸ Oxford Economics. The New Digital Economy: how it will transform business. [Online] Available from: <http://www.pwc.com/gx/en/technology/publications/assets/the-new-digital-economy.pdf> [Accessed 9th July 2012].

⁹ Booz & Co. Profit Migration in the Digital Economy. [Online] Available from:

<http://www.booz.com/media/uploads/BoozCo-Profit-Migration-Digital-Economy.pdf> [Accessed 9th July 2012].

10.2 Market Trends: Consumer Trends behind the New Digital Economy

The recent rise in **Mobility** resulted directly from the phenomenal mobile penetration globally. Along with this huge reach, the primary environment for Internet access is moving away from the desktop to mobile devices. In the next few years, successful businesses would have transformed themselves to position mobile as one of their primary channels with consumers.

The **Applications (Apps) Economy** really began with the creation of the Apple App Store in July 2008. The Apps Economy is only four years old but has already seen more than 50 billion apps downloaded globally across all platforms. A key driving force of this success has been the creation of vibrant apps ecosystems around mobile platforms. Software developers can now reach mass consumer markets directly in this new consumption category.

Today, we have the “hyper-connected” and “hyper-informed” consumer who is more value-driven and has access to more opportunities and information because of the Internet, globalisation and the explosive growth of data. Crowdsourcing and collaborative consumption characterise the **Social Economy** which is based on sustained user engagement and interaction.

Beyond the cashless nature of economic transactions, we are moving toward **Money 2.0** which includes next-generation payment solutions and alternative currencies that may challenge the traditional role of banks.

These consumer trends in the new digital economy should not be viewed in isolation. They are closely related and their combination will introduce a **Convergent Experience** for consumers (Figure 2). For example, a new retail experience lies in the intersection of all these consumer trends. It will offer consumers a new personalised and socially enabled experience completed by a seamless, cashless payment solution. Similarly, new e-learning and e-commerce landscapes will evolve around the converged mobile and social experience, powered by context-enriched services, apps, next-generation payment solutions and the consumer personal cloud.

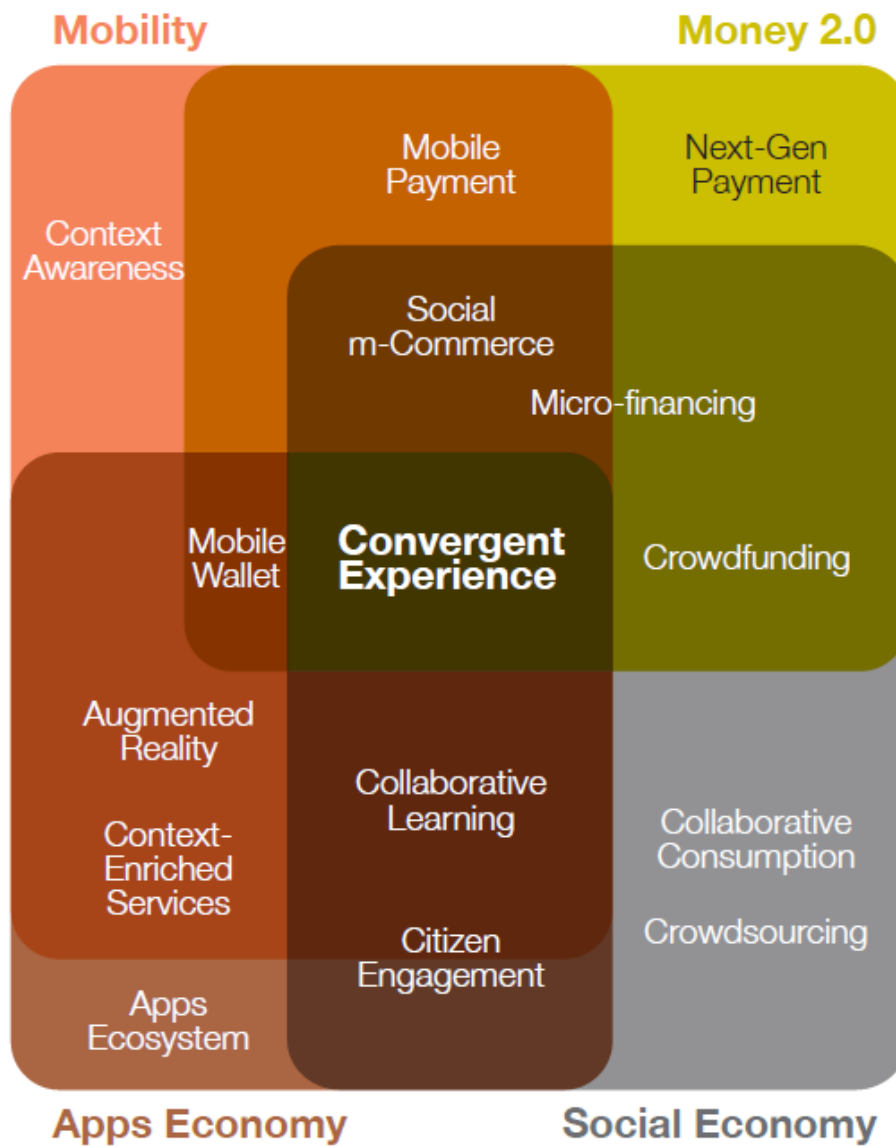


Figure 2: Convergence of consumer trends brings new services

10.2.1 Mobility

The number of mobile subscriptions in Asia Pacific is predicted to grow to 1.3 billion by 2016, representing 55% of global net additions. Mobile download traffic is forecast to increase from 38.2 billion in 2011 to 182.7 billion in 2015, representing a compound annual growth rate (CAGR) of 47.9%¹⁰.

Smartphone users have a pattern of frequent, short Internet access that is spread throughout the whole day. Almost 40% of global smartphone owners habitually use their phones even before getting out of bed. Ericsson reports that the only point during the day when smartphone usage dips significantly on a global scale is dinner time¹¹.

Mobile Web use is increasing quickly, especially in developing regions where mobile phones vastly outnumber desktop computers. In Asia, mobile Web traffic increased from 6.1% in 2010 to 17.84% in 2012 while Africa experienced an increase of 156% from 5.81% in 2010 to 14.85% in 2012. In Nigeria and Zimbabwe, for example, mobile traffic accounts for 50% of all Web traffic. In India, Web traffic from mobile phones has already surpassed that from the desktop since April 2012¹².

The rapid growth in smartphone ownership is crucial for the emergence of mobile services like mobile banking, location and context-aware applications. Mobile applications are increasingly incorporating social sharing features, leading to the coining of the term “SoLoMo” (Social, Location and Mobile) by the industry. The key technology that will make a difference for mobile services in three to five years will be context-enriched services that will accurately deliver services just in time, based on user needs.

Global expenditure on mobile advertising and marketing is expected to grow. Gartner predicts that mobile advertising revenue will reach US\$20.6 billion in 2015, jumping from US\$3.3 billion in 2011¹³. According to Gartner, search and location ads (paid-for positioning on maps and augmented reality apps) will deliver the highest revenues while video/audio ads will see the fastest growth through 2015. Brand spending on mobile advertising will grow from 0.5% of the total advertising budget in 2010 to over 4% in 2015.

10.2.2 Apps Economy

Mobile app software is written for mobile devices to perform a specific task, such as a game, calendar or music player. GIA defines a native app as one that is specifically designed to run on a

¹⁰ Ericsson. Traffic And Market Report. [Online] Available from: http://www.ericsson.com/res/docs/2012/traffic_and_market_report_june_2012.pdf [Accessed 9th July 2012].

¹¹ Ericsson. Traffic And Market Report. [Online] Available from: http://www.ericsson.com/res/docs/2012/traffic_and_market_report_june_2012.pdf [Accessed 9th July 2012].

¹² Mary Meeker. Internet Trends. [Online] Available from: <http://www.kpcb.com/file/kpcb-internet-trends-2012> [Accessed 9th July 2012].

¹³ Gartner. Press Releases. [Online] Available from: <http://www.gartner.com/it/page.jsp?id=1726614> [Accessed 9th July 2012].

device’s operating system and machine firmware, and typically needs to be adapted for different devices. A Web app or browser application is one in which all or some parts of the software are downloaded from the Web each time it is run. It can usually be accessed from all Web-capable mobile devices.

In the USA, the apps economy is responsible for approximately 466,000 jobs, up from zero in 2007 before the first iPhone was introduced¹⁴. This includes jobs at apps firms, apps-related jobs at companies developing in-house apps and apps “infrastructure” jobs at firms such as Google, Apple, and Facebook. In addition, the apps economy also includes employment spillovers to the rest of the economy. Removing the employment spillovers will reveal that more than 300,000 direct jobs are contributed directly by the apps economy, roughly 50% the size of custom computer programming jobs (Figure 3).

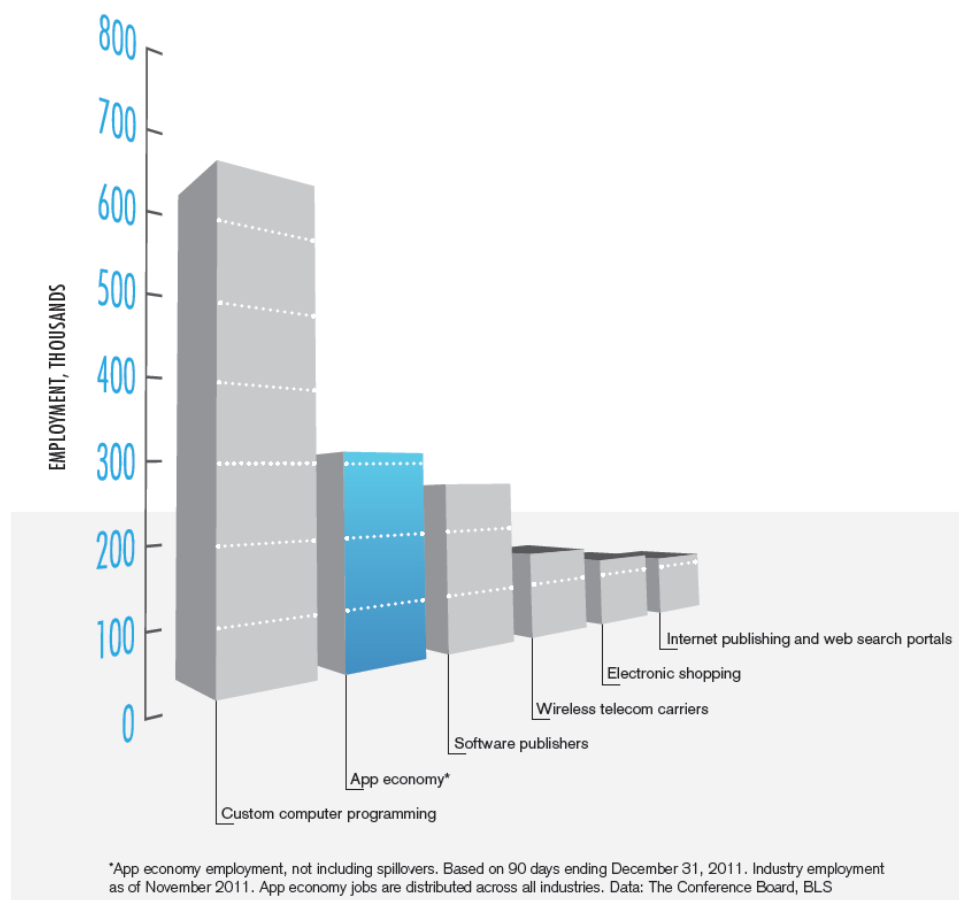


Figure 3: Sizing the App Economy (jobs by the thousands)¹⁶

The apps economy, however, is much more than a delivery channel for software. It is essentially a collection of interconnected ecosystems that comprise a core company which creates and maintains a platform and an apps marketplace comprising small and large companies that produce apps, mobile device manufacturers for that platform and content providers.

¹⁴ Michael Mandel. Where the Jobs Are: The App Economy. [Online] Available from: <http://www.technet.org/wp-content/uploads/2012/02/TechNet-App-Economy-Jobs-Study.pdf> [Accessed 9th July 2012].

The key mobile platforms in the apps economy today are Google's Android, Apple's iOS, Blackberry, and Microsoft Windows Mobile. New app platforms include social media, television, cars and desktop PCs (e.g. Mac OSX).

The apps economy includes native mobile apps, Web apps, mobile Web apps, platform apps and social network apps. Developers' new focus on sustainable business models will underscore a shift toward in-app purchasing as a central element of app monetisation strategies¹⁵. This is because consumers are doing more than just basic Web browsing on their computers and mobile phones. The success of Apple's and Google's app ecosystems has demonstrated the importance of having an active third-party app development community to create a vibrant platform for consumers.

¹⁵ Scott Ellison. Worldwide and U.S. Mobile Applications, Storefronts, Developer, and In-App Advertising 2011–2015 Forecast: Emergence of Postdownload Business Models. [Online] Available from: <http://www.idc.com/getdoc.jsp?containerId=228221> [Accessed 9th July 2012].

10.2.3 Social Economy

The social economy is enabled through a greater level of trust among online communities (contrasting with the anonymous nature of the Internet), as well as the large population size and reach offered by social networking platforms. This trust and reach facilitate the growth of new ideas and innovative solutions such as collaborative consumption, crowdsourcing, crowdfunding, peer-to-peer (P2P) loans, citizen journalism, online media monetisation and social commerce. P2P loans in particular have seen continued acceptance and growth (Figure 4).

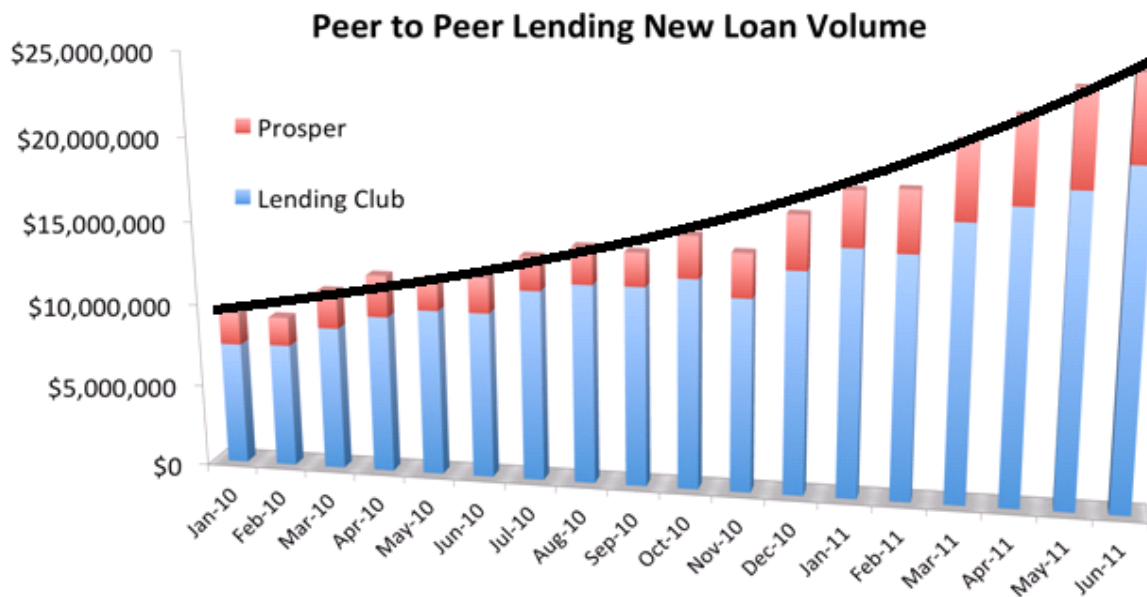


Figure 4: P2P Lending is growing¹⁶

Collaborative consumption, a term coined by Rachel Botsman¹⁷ who is a global thought leader on this subject, is a business model in which shared goods or services are distributed via a marketplace (swapping, bartering, renting) to a community of users¹⁸. It is essentially a more effective form of resource allocation, enabled by technology and P2P sharing. It turns the power of the crowd into a bargaining tool and creates an economy of more sustainable consumerism, as opposed to the ownership model of consumption. Collaborative consumption describes old-world behaviour such as lending, exchange, swapping and bartering that are now able to operate on a much bigger scale, across geographic boundaries, enabled by technology¹⁹.

¹⁶ Jim Bruene. U.S. Peer-to-Peer Lending Hits Record High for Seventh Month in a Row. [Online] Available from: http://www.netbanker.com/2011/07/us_peer-to-peer_lending_hits_record_high_for_seventh_month_in_a_row.html [Accessed 9th July 2012].

¹⁷ Rachel Botsman, Roo Rogers. What's Mine is Yours: the Rise of Collaborative Consumption. [Online] Available from: <http://spectrumculture.com/2011/04/whats-mine-is-yours-the-rise-of-collaborative-consumption-by-rachel-botsman-and-roo-rogers.html/> [Accessed 9th July 2012].

¹⁸ Tomasz Tunguz. The New Market Places – Peer to Peer Collaborative Consumption. [Online] Available from: <http://miter.mit.edu/article/new-market-places-peer-peer-collaborative-consumption> [Accessed 9th July 2012].

¹⁹ Nesta. Trust between strangers. [Online] Available from: http://www.nesta.org.uk/areas_of_work/public_services_lab/collaborative_consumption [Accessed 9th July 2012].

To date, the most successful efforts in collaborative consumption have involved goods that can be mailed (clothes, DVDs), time and cost sharing of expensive goods (cars, apartments and books) and services (graphic design and commodity labour). Time banking is another new concept in which time contributed or labour hours in one location can be “re-paid” in another location or even country. This barter exchange can be classified into three categories – product service systems, redistribution markets and collaborative living services²⁰. Some collaborative consumer networks have managed to raise substantial funding. Airbnb, an apartment-sharing start-up, received US\$112 million in Series B financing in July 2011 while ZipCar, a car sharing scheme, raised US\$174 million through its IPO in April 2011.

Crowdsourcing refers to a distributed problem-solving and production model. It can be used to develop a new technology, carry out a task, discover a solution to a problem or gather information. The “wisdom of the crowd” can help businesses define/refine their brands and their customer relationship management programmes.

Crowdfunding, a form of crowdsourcing, involves financial contributions from social networks in fund-raising exercises online. One of the most successful crowdfunding platforms is Kickstarter which raised US\$200 million from 2 million backers for 22,000 projects in the past three years since its launch²¹. The motivation for crowdfunding may be enjoyment-driven (e.g. skill variety and pastime) or community-driven (e.g. community identification and fulfilment of the social contract) or cause-driven (e.g. raising funds for poor regions around the world). Crowdfunding serves a variety of purposes such as disaster relief, citizen journalism, political campaigns and startup funding.

Since February 2012, Kickstarter has had seven fundraising projects which exceeded US\$1 million each. Pebble, an e-paper watch for the iPhone and Android, raised US\$1 million within 28 hours of its launch on Kickstarter. Pebble eventually raised over US\$10 million by the end of their five-week fundraising campaign on Kickstarter²².

The other forms of crowdsourcing are summarised in the diagram below (Figure 5).

²⁰ Rachel Botsman, Roo Rogers. *What's Mine is Yours: the Rise of Collaborative Consumption*. [Online] Available from: <http://spectrumculture.com/2011/04/whats-mine-is-yours-the-rise-of-collaborative-consumption-by-rachel-botsman-and-roo-rogers.html/> [Accessed 9th July 2012].

²¹ Lauren Indvik. *Kickstarter Has Raised \$200 Million From More Than 2 Million Backers*. [Online] Available from: <http://mashable.com/2012/05/01/kickstarter-200-million/> [Accessed 9th July 2012].

²² Kickstarter. *Pebble: E-Paper Watch for iPhone and Android*. [Online] Available from: <http://www.kickstarter.com/projects/597507018/pebble-e-paper-watch-for-iphone-and-android> [Accessed 9th July 2012].



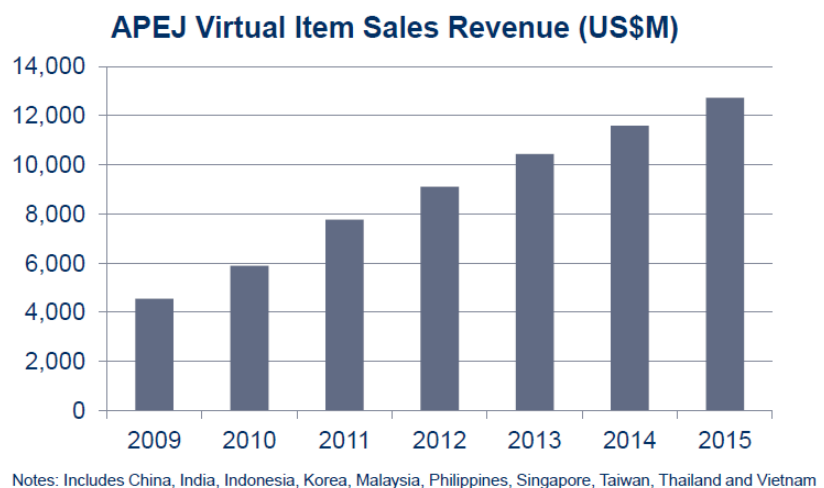
Figure 5: Crowdsourcing Industry Landscape

The social economy is a thriving economy that can potentially reduce environmental degradation, help save money, time and space, build closer relationships and turn passive consumers into active collaborators.

10.2.4 Money 2.0

Money 2.0 includes next-generation payments which comprise mobile payments (m-payments), near field communications (NFC), mobile commerce (m-commerce), mobile ticketing (m-ticketing) and mobile coupons (m-coupons). While it is projected that retail purchases and money transfers will be the two most common forms of m-payment, it is likely that banks may start to offer multiple arrangements for different payment terms, e.g., credit, debit and cash.

Increased consumer acceptance and trust in online financial transactions have generated new alternative monetary transaction concepts including virtual currency such as Virtual Gold and Bitcoin. Leveraging mobile devices, new payment mechanisms such as mobile airtime credits, P2P micro-payments, Google wallet and NFC payment platforms are already being deployed in some countries. Online gaming is another sector that merits some attention because of the convergence of the virtual world (e.g. virtual weapons and equipment) and the physical world (cash transactions in sales and buy-outs for virtual items). There is also the emergence of virtual to virtual as well as virtual to real world currency exchanges in recent years. These exchanges are serving gamers and virtual world participants who have amassed substantial amounts of virtual currencies, typically through virtual item sales over time. IDC projected that virtual item sales revenue will continue to grow steadily in the next few years to more than US\$12 billion by 2015 in the Asia-Pacific region alone, excluding Japan (Figure 6). Although the majority of this revenue will be realised by the games or virtual world platform owners, substantial amounts will still be held by gamers and virtual world participants.



Source: IDC APEJ Online Gaming Market 2011-15 Forecast and Analysis

Mar-12

Figure 6: Virtual goods revenue in online gaming

One area of growth in the Money 2.0 economy is mobile banking in developing countries. In China, 25% of mobile users (or 30% of smartphone owners) are using mobile banking services. In East Africa, one success story of mobile banking is M-Pesa (“Pesa” is Swahili for money; “M” stands for

mobile), a joint venture between Safaricom and Vodafone, launched in March 2007. Conceived in 2005 and initially sponsored by the UK-based Department for International Development (DFID), M-Pesa allows subscribers to make payments and transfers via text messaging over their mobile phones. Within the first nine months, M-Pesa boasted a subscription base of 1 million users; by January 2010, it had registered more than 9 million customers across Kenya, Tanzania and Afghanistan. Today, 15 million M-PESA customers use about 28,000 agent outlets countrywide for cash disposal and withdrawal. Safaricom's innovation started as a small pilot project which now transfers more money than all Kenyan commercial banks combined.

For pastoralists and livestock traders in East Africa, M-Pesa has transformed their lifestyle and business practices. This mobile phone technology has enabled pastoralists to connect to their families and friends. Farmers can quickly find out "where to bring their cattle for grazing instead of roaming in search of water and pasture, and communicate with their business contacts at livestock markets while still at rangelands, saving time for other income generating activities and household chores"²³. Enabling factors are the investment and commitment of Safaricom, entrepreneurial culture and readiness of the business, and supportive government policy.

In February 2012, Barclays Bank launched Europe's first mobile phone-based money transfer system, using an app called Pingit. Barclays Pingit allows customers to send and receive cash through their UK-based mobile phones. The Pingit money transfer system allows mobile users to make quick, small payments between £1 and £300, without having to enter bank account details. All they need to do is key in the recipient's mobile number on the Pingit app and the amount they want to send through a smartphone handset. To receive payments, any handset with at least Short Messaging Service (SMS) capability can be used. The service was subsequently extended to non-Barclays customers and businesses.

Mobile fund transactions are the tip of the iceberg in this digital age. Other emerging financial technologies and services in the mobile, apps and social economies may potentially disrupt the roles of banks and other traditional institutions in the near future. Based on various estimates, between 500 million and 1 billion people will access financial services by mobile by 2015. Given the number of overseas workers who send remittances home, it comes as no surprise to learn that remittance by mobile is growing three times faster than m-banking.

10.2.5 A Convergent Experience

Consumers' acceptance of technology is driving the convergence of the digital and real worlds. Consumers expect their experience to be seamless in both worlds. This convergence is bi-directional. The physical world will see increasing digital influence and integration while the digital world will see more real-world objects digitised and represented within it. In each of these converged worlds, customer experience is central.

²³ Elaine Reinke dan Silvia Sperandini. M-PESA: The power of mobile technology in livestock marketing. Kenya Learning Route, case 3. [Online] Available from: <http://ifad-un.blogspot.com/2012/03/m-pesa-power-of-mobile-technology-in.html> [Accessed 9th July 2012].

The reverse where real-world objects are increasingly being digitised and used to enrich the digital experience is also gaining traction. In June 2012, Apple showcased their 3D mapping solution for their upcoming mobile operating system, iOS6. The realistic 3D maps will enhance end users' digital experience through high-fidelity representations of real-world buildings and places. Given Apple's large developer and customer base within its ecosystem, there will likely be many innovative applications that will leverage the 3D maps for an immersive digital environment for end users in the coming months.



Figure 7: Realistic 3D map supporting the digital experience

10.3 Technology Outlook

Some of the key enabling technologies for the New Digital Economy are highlighted below:

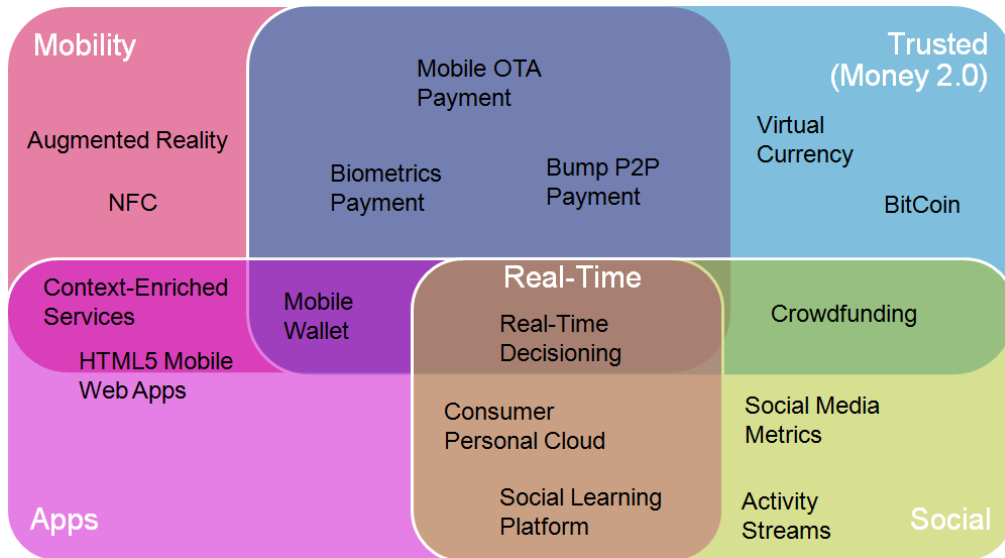


Figure 8: Technologies Enabling the New Digital Economy

Several technologies will be ready for mass adoption within the next three to five years. These technologies will focus on the enrichment of the user experience and the power of social networks. Analytics software such as social media metrics will be getting more attention as organisations in both the public and private sectors realise that the unstructured data that lies within social networks offers important insights into consumer behaviour and expectations. The convergence of technologies will create a more seamless and intuitive user experience while an emerging phenomenon in the new economic landscape will be the dual role played by content consumers who are also content producers. This leads to the development of a virtuous cycle that can be leveraged for the greater benefit of business, government and society.



Figure 9: The New Digital Economy Technology Radar

10.3.1 Less Than Three Years

Near Field Communication (NFC) Technology and Contactless Mobile Payments

NFC is a wireless connectivity technology that allows short-range radio communication between devices. Included in a small chip inside the device, NFC allows for mobile money transactions, data exchange, location tagging and wireless connections between two devices in very close proximity to one other, usually not more than 10 centimetres apart²⁴. Owing to the short-range nature of NFC, transfers are often completed by “tapping” devices either to another NFC-enabled device or a payment terminal.²⁵

The technology has been around for approximately seven years but NFC is only recently gaining traction because of its acceptance and adoption by many global mobile device manufacturers such as Nokia, Samsung and RIM²⁶. Today, many stadiums around the world are using NFC for ticketing.

When London's Summer Olympic Games began on 27 July 2012, there were more than 140,000 contactless terminals around the UK. From the moment visitors landed at Heathrow, they were immersed in a contactless payment (also known as mobile proximity payment²⁷) experience with everything from taxis to retail outlets to the Olympic Park itself. This user experience was made possible by the NFC-equipped phones which were equipped with payment capability²⁸.

In May 2011, Google announced its mobile Wallet initiative, partnering with Citi, MasterCard, Sprint and First Data to embed technology into Android mobile phones that would allow customers to make purchases by tapping their phones over an NFC-enabled point-of-sale system. In September 2011, Google Wallet was rolled out on Sprint Nexus S4G phones in the USA. Then, in May 2012, Google entered the Kenyan payments market, dominated mainly by banks and M-Pesa, with a free-of-charge NFC ticket card service known as “beba” (meaning “to carry” or “to transport” in Kiswahili)²⁹.

²⁴ Infineon. Security on NFC-Enabled Platforms. [Online] Available from: http://www.infineon.com/export/sites/default/media/Applications/ChipCards/NFC_Whitepaper_04.2012.pdf [Accessed 9th July 2012].

²⁵ Wireless Duniya. What is NFC: Near Field Communication. [Online] Available from: <http://www.wirelessduniya.com/2012/03/09/what-is-nfc-near-field-communication/> [Accessed 9th July 2012].

²⁶ Sylvie Barak. Video: NFC technology, proliferation and challenges examined. [Online] Available from: <http://www.eetimes.com/electronics-news/4237739/Video--NFC-technology--proliferation-and-challenges-examined> [Accessed 9th July 2012].

²⁷ Edgar, Dunn & Company. Advanced Payments Report 2011. [Online] Available from: http://www.edgardunn.com/uploads/100012_english/100385.pdf [Accessed 9th July 2012].

²⁸ DifferenceBetween.net. NFC vs Bluetooth. [Online] Available from: <http://www.differencebetween.net/technology/hardware-technology/difference-between-nfc-and-bluetooth/> [Accessed 9th July 2012].

²⁹ Peter Gakure Mwangi, “Google enters Kenya's payment market with NFC card,” 15 May 2012, <http://www.thinkm-pesa.com/2012/05/google-enters-kenyas-payment-market.html>

Mobile network operators (MNOs) and financial services, handset manufacturers, governments, financial service providers, universities and retail companies are collaborating to integrate NFC-enabled mobile phones into their business models. NFC mobile phones can be used not only for payments but also for secure access to buildings and personal computers (PCs), inventory controls with tags and readers, security patrols, patient monitoring and information gathering with educational tags³⁰.

According to Berg Insight, annual global sales of NFC-equipped handsets increased tenfold to 30 million devices in 2011 and is forecast to reach 700 million units by 2016³¹. By 2014, one in six users worldwide will have an NFC-enabled mobile phone while one in eight (13%) of North American and western European mobile users will use their NFC-enabled mobile phones as a metro rail or bus ticket, compared with less than 1% today.

By 2014, NFC-based mobile transactions are expected to reach nearly US\$50 billion worldwide³². By 2015, it is estimated that 500 million people around the world will use their mobile devices as travel tickets on metros, subways and buses. These transactions will reach US\$74 billion by 2015,³³ the year that NFC technology is predicted to reach 30% global penetration³⁴.

Global and open standards are now being established by the NFC Forum, a non-profit association established in 2004. Comprising more than 160 global member companies, the NFC Forum is engaged in developing specifications for a modular NFC device architecture, and protocols for interoperable data exchange and device-independent service delivery, device discovery and device capability.

The NFC take-off depends, to a large extent, on interoperability, standards and the building of trust and acceptance among the public.

As part of the iN2015 Next Generation e-Payment Programme, IDA collaborated with industry partners to deploy a nationwide interoperable NFC infrastructure for mobile payment services. A Call-For-Collaboration (CFC) has been awarded to a consortium comprising seven companies - Gemalto Pte Ltd, Citibank Singapore Ltd, DBS Bank Ltd, EZ-Link Pte Ltd, M1 Limited, SingTel Mobile Singapore Pte Ltd and StarHub Mobile Pte Ltd.

³⁰ Debbie Arnold. Forging the Link Between Global Interoperability and New Business Opportunities. [Online] Available from: http://www.nfc-forum.org/resources/presentations/Debbie_Arnold_WIMA.pdf [Accessed 9th July 2012].

³¹ nfcme.com admin. Near-Field Communication: 30 Million NFC Handsets Sold in 2011. [Online] Available from: <http://nfcme.com/near-field-communication-30-million-nfc-handsets-sold-in-2011/> [Accessed 9th July 2012].

³² Devindra Hardawar. Juniper: Mobile payments to hit \$670B by 2015. [Online] Available from: <http://venturebeat.com/2011/07/05/juniper-mobile-payments-to-hit-670b-by-2015/> [Accessed 9th July 2012].

³³ Juniper Research. Mobile Commerce Market set to scelerate with NFC facilitating \$74bn transactions by 2015. [Online] Available from: <http://www.marketwatch.com/story/mobile-commerce-market-set-to-accelerate-with-nfc-facilitating-74bn-transactions-by-2015-2012-03-08> [Accessed 9th July 2012].

³⁴ Todd Hasselton. NFC chip shipments may surpass 1.2 billion units by 2015. [Online] Available from: <http://www.bgr.com/2011/10/24/nfc-chip-shipments-may-surpass-1-2-billion-units-by-2015/> [Accessed 9th July 2012].

The consortium, led by Gemalto, launched the mobile payment services programme using NFC technology in August 2012³⁵. The implementation of the interoperable NFC infrastructure, hosted in Gemalto's Trusted Services Management data centre in Singapore, marks a significant milestone in CFC. Consumers are empowered with the choice of multiple contactless payment products on their NFC phones, and businesses can deploy new innovative and secured mobile services in a timely and cost-efficient manner. Designed for consumer convenience and confidence, the interoperable NFC infrastructure allows consumers to aggregate multiple payment services from different banks and payment product issuers into a single mobile wallet, giving them easy control of which payment product to use for a specific purchase. As consumers may have multiple banking relationships and want different products to be loaded on their NFC phones, customer care support processes starting from payment product application, activation to product termination have been harmonised across participating banks and telcos to provide a consistent user experience.

Consumers are also assured of security for these new contactless payment services as the NFC infrastructure, SIM cards and handsets have gone through certification processes by international payment schemes such as MasterCard and Visa, as well as by industry standards bodies such as GlobalPlatform and EMVCo where applicable. Consumers can use their NFC-enabled mobile phones to tap and pay at over 30,000 retail points such as convenience stores, fast food outlets, retailers and taxis already equipped with contactless point-of-sales terminals. In the near future, consumers will also be able to aggregate an array of retail or food and beverage (F&B) merchant loyalty cards and discount coupons, all on a single mobile phone platform.

This cross-industry, open access infrastructure facilitates the entry of new businesses to offer secured NFC services to all mobile subscribers in Singapore, in a timely manner and without the need for dedicated infrastructure or deep technical know-how. Examples of such secured services include tickets or access keys to be provisioned dynamically and securely over-the-air. Merchants can also enhance customer engagement through NFC-enabled advertisements, providing product information and promotional discounts, and enabling referrals by customers' friends on social media.

IDA and the consortium members are also working with the Land Transport Authority (LTA) to assess NFC mobile payment readiness for transit in early 2013. As part of the preparation, a public trial will be conducted by EZ-Link, in partnership with public transport operators, in end 2012.

Mobile Wallets

Mobile wallets are smartphones or tablet apps that store a consumer's payment details to finance online and in-store purchases on his device³⁶. Not only do they enable users on the move to access financial accounts or transact online but they also play an integral part in the promotion of e-commerce and e-banking. The mobile wallet is proving especially effective in developing countries

³⁵ Infocomm Development Authority of Singapore. Near Field Communication Services Go Live in Singapore. [Online] Available from: <http://www.ida.gov.sg/News%20and%20Events/20120803093022.aspx> [Accessed 9th July 2012].

where there is limited desktop access to the Internet and equally limited banking opportunities (because they are for a privileged few) but extremely high mobile accessibility.

Mobile wallets from merchants or providers will require funding, either in the form of credit/debit cards or by connecting checking accounts to the merchant-branded offer which will include an incentive for loyalty.

In end June 2012, the National Payment Card Association (NPCA), the US provider of merchant-branded PIN-based debit cards, announced that it had been issued a US patent in the area of decoupled debit technology³⁷. “Decoupled debit” payment methods refer to situations in which a US checking account holder from any bank or credit union is able to accomplish an electronic payment without needing to use a card issued by the bank or credit union they have their checking or debit card with. NPCA’s decoupled debit technology is of particular interest to merchants and point-of-sale vendors seeking to have the lowest method of payment settlement fees in the marketplace which now includes mobile payment. Some examples of a payment token useable by consumers include a smartphone, cellular device and wireless device.

The mobile wallet ecosystem includes mobile or m-banking, m-commerce - the buying and selling of goods using mobile devices, mobile ticketing – the issuing and processing of tickets using a mobile platform and micro-payments – transactions of a specific amount that are processed separately. Mobile wallets come with the advantages of marketing through push notifications and tracking through analytics reporting.

Mobile payments are made via premium message services such as Common Short Codes (CSC) that allow any Global System for Mobile Communications (GSM) device user to make and receive payments, direct mobile billing which transfers money directly from the mobile account with the service provider, using the device itself for verification of the Electronic Funds Transfer (EFT), and mobile Web payments made via the mobile device browser or through device software that is linked to a direct mobile account, credit card or virtual currency account (e.g. PayPal). In addition, there can also be frictionless or contactless NFC which uses wireless connectivity or machine scanners such as RFID chips embedded in wireless devices to transfer data across short distances.

Consumers today are ready to use a variety of services in their mobile wallets, e.g. search and shop, loyalty programmes and real-time incentives. The result is that mobile wallets can pose a significant challenge to traditional banking, primarily because of the willingness of consumers to go outside the traditional banking environment to make payments³⁸. These consumers are already using mobile banking but are open to the idea of using other non-traditional banking services provided by PayPal,

³⁶ Business News Daily. Big Banks Fear Losing Consumers to Mobile Wallets. [Online] Available from: <http://mashable.com/2012/06/05/big-banks-fear-mobile-wallets/> [Accessed 9th July 2012].

³⁷ Business Wire. National Payment Card Association receives patent relating to mobile payment. [Online] Available from: <http://www.virtual-strategy.com/2012/06/29/correcting-and-replacing-decoupled-debit-alive-and-well...in-mobile-wallet> [Accessed 9th July 2012].

³⁸ Business News Daily. Big Banks Fear Losing Consumers to Mobile Wallets. [Online] Available from: <http://mashable.com/2012/06/05/big-banks-fear-mobile-wallets/> [Accessed 9th July 2012].

Apple or Google. Although traditional banks are considering the option of providing mobile wallets, they will have to innovate and move quickly to stay “top of wallet” in the new mobile wallet world.

The challenge posed by mobile payment apps is that the apps will erode the banks' relationship with their customers as the customers come to associate banking with the app rather than their bank. According to Forrester Research, financial institutions risk ending up as “back-end funding sources for mobile wallets and payment products owned by other brands, who operate the front-end, consumer-facing aspects of the interaction and transactions.”³⁹

Consumers most interested in mobile wallet apps are generally younger and more affluent, and comprise two groups: those who think mobile wallets will make shopping easier and those who think they will make shopping more fun. In order to remain competitive, brick-and-mortar financial institutions will need to offer a wide range of financial features, including wish lists, deal management tools and location-based offers. New business models will emerge as banks redefine their mobile wallet strategy and consider partnerships with their non-traditional banking competitors.

More than two-thirds of technology insiders believe that paying with smartphones will overtake cash and credit card payments by 2020, according to a survey released in mid-April 2012 by the Pew Internet and American Life Project and Elon University's School of Communications⁴⁰. The survey results also indicated the increasingly prominent role of NFC in m-commerce (Google Wallet uses NFC technology). Although the convenience is an attraction, security and privacy issues prevail as the main inhibitors to the adoption of mobile wallet payments by consumers. Other constraints that might slow down the mobile payment industry include consumers' desire for anonymous payments, demographic inertia, a lack of infrastructure to support widespread adoption and resistance from those with a financial stake in the existing payment structure⁴¹.

Mobile Over-the-Air (OTA) Payment

Over-the-air (OTA) mobile payment transactions are initiated by a mobile handset and authorised via a wireless network operated by a mobile operator (or a mobile virtual network operator)⁴². It is essentially a technology used to communicate with, download applications to, and manage a Subscriber Identification Module (SIM) card without being connected physically to the card.

OTA provisioning enables a network operator to introduce new SIM services or to modify the contents of SIM cards in a rapid and cost-effective way. The technology is able to update and

³⁹ Cameron Scott. Mobile wallet systems could hurt brick-and-mortar banks, survey suggests. [Online] Available from: http://www.computerworld.com/s/article/9227826/Mobile_wallet_systems_could_hurt_brick_and_mortar_banks_survey_suggests [Accessed 9th July 2012].

⁴⁰ Cameron Scott. Paying with smartphones to outpace credit cards by 2020, experts say. [Online] Available from: <http://news.idg.no/cw/art.cfm?id=867E1CAE-F636-8341-110455AB457C6016> [Accessed 9th July 2012].

⁴¹ Aaron Smith. The Future of Money in a Mobile Age. [Online] Available from: <http://www.pewinternet.org/Reports/2012/Future-of-Money.aspx?src=prc-headline> [Accessed 9th July 2012].

⁴² Christophe Uzureau, Alistair Newton. Hype Cycle for Financial Services Payment Systems, 2011. [Online] Available from: <http://www.gartner.com/id=1753114> [Accessed 9th July 2012].

change data in the SIM card without having to re-issue it. OTA is based on a client/server architecture where there is an operator back-end system (e.g. customer care, billing system or application server) at one end and a SIM card at the other end.

In order to implement OTA technology, the following components are needed:

- ⤴ a back-end system to send requests;
- ⤴ an OTA gateway to process the requests in an understandable format to the SIM card;
- ⤴ an SMS Centre to send requests through the wireless network;
- ⤴ a bearer, e.g. SMS, to transport the request;
- ⤴ mobile equipment to receive the request and transmit it to the SIM card;
- ⤴ a SIM card to receive and execute the request.

OTA-based mobile payments require a user to initiate a payment to a third party by means of a text message or mobile application. Debits can be made to bank cards or accounts, mobile phone billing systems or pre-paid accounts. Funds are generally transferred using existing bank payment infrastructures - internally or through electronic transfer via automated clearinghouses.

The ecosystem that is developing around the use of mobile devices to facilitate OTA payments is becoming more complex and diverse (e.g. Google Wallet includes an OTA mobile payment system). To succeed with OTA payments, mobile phone operators and financial institutions should develop collaborative local partnerships to leverage mutual benefits. The security feature in mobile banking should be enhanced to build customer trust and a positive perception. Customer usage, needs and expectations should be continually monitored to ensure that the OTA mobile payment ecosystem remains relevant and responsive.

To succeed with OTA technology, it is important to adopt an enterprise mobile financial services strategy that is supported by an enterprise mobile financial services platform so as to optimise Return on Investment (ROI). Contrary to developed markets, the mobile phone has a more important role in the payment value chains of emerging and unbanked markets in Asia. For example, financial regulators in India are driving plans for financial inclusion and these involve the development of mobile payment systems. Gartner believes that mobile payment systems in emerging markets will only be successful if the ecosystem approach takes into account local partnerships, the pricing model provides incentives to the local partners and the mobile payment system is fully integrated with existing payment habits and channels.

HTML5 Mobile Web Apps

A new standard for displaying content and running applications from the Web, HyperText Markup Language 5 (HTML5), has emerged to challenge the power of closed app platforms such as Apple iOS and Google Android on smartphones. Since the specification process started in 2004, seven years after HTML 4.01 became the standard in 1999, HTML5 has become a hot topic among various technology communities. Major players like Microsoft, Apple and Adobe have already incorporated

HTML5 into their products. Google has already adopted HTML5 in its Gmail, Google Reader and Google Docs products.

Some telcos believe that HTML5 gives operators a chance to reclaim some control over the growth and direction of the smartphone industry by allowing developers to create platform-agnostic apps (as opposed to today's "native" apps developed on specific proprietary platforms). HTML5 also promises the benefits of multi-screen applications and services, with browser-based apps working seamlessly across TVs, PCs and other devices.

The inclusion of multimedia in the specification of HTML5 negates browsers' need for third party plug-ins like Flash and Silverlight to view multimedia content. This enables interoperability across platforms as content access is now possible with any HTML5-enabled Web browser. It also helps eliminate external dependencies. HTML5 can also bring about innovation in terms of applications and user experience. In 2011, NVIDIA and Mozilla announced a collaboration to bring 3D videos to the Web through the use of HTML5 and WebM⁴³.

According to an Ovum case study, the increasingly fragmented smartphone market and tighter restrictions on the Apple App Store forced the Financial Times to review its mobile application strategy. The outcome was the adoption of a primarily HTML5 mobile Web app strategy which gave the Financial Times greater autonomy and control over the distribution of its content.

Moving onto HTML5 is a natural progression from the current HTML version but adoption is likely to be slow because of some challenges. One is the lack of standardisation of the video codec to go along with the HTML5 specification. Another is security as the lack of digital rights management (DRM) support for the embedded multimedia gives rise to some reticence. HTML5 is likely to co-exist with Flash or Silverlight in the near term as developers harness the benefits of HTML5 while continuing to exploit the features of these third party plug-ins.

The video codec license, H.265, is owned by MPEG-LA. Initially, MPEG-LA announced that the codec would remain royalty-free till 2016. The possibility of the codec standard being chargeable after 2016 drove companies such as Google towards the open source alternative (VP8 codec). However in August 2010, MPEG-LA changed its stand by declaring H.264 to be royalty-free permanently⁴⁴. It will be interesting to see how this scenario will play out.

HTML5 does not provide support for any recognisable digital rights management (DRM) capabilities. Content providers that wish to monetise their media products over the Internet will hesitate to adopt HTML5 since there is a possibility that their content can be re-used without re-payment. For

⁴³ Lucian Parfeni. Watch HTML5 3D Videos from YouTube in Firefox 4 with Nvidia Hardware. [Online] Available from: <http://news.softpedia.com/news/Watch-HTML5-3D-Videos-from-YouTube-in-Firefox-4-with-Nvidia-Hardware-202605.shtml> [Accessed 9th July 2012].

⁴⁴ Eric Silivka. MPEG LA Declares H.264 Standard Permanently Royalty-Free. [Online] Available from: <http://www.macrumors.com/2010/08/26/mpeg-la-declares-h-264-standard-permanently-royalty-free/> [Accessed 9th July 2012].

example, NBC and Time-Warner have issued public statements indicating their support of Flash over HTML5⁴⁵ because of this issue.

According to IDC, there will be over 1 billion HTML5 mobile browsers in the market in 2013⁴⁶. The underlying principle behind HTML5 is a belief that the Internet is the future platform for all services and applications, breaking the link with underlying hardware, device type or operating system. HTML5, however, is still evolving and is not expected to be ready till 2014⁴⁷.

In 2011, there were about 700 million smartphone subscriptions worldwide. In 2017, Ericsson expects this number to increase to 3 billion⁴⁸. Correspondingly, the total number of subscriptions of data-heavy devices (e.g. smartphones, mobile PCs and tablets with cellular connectivity) will grow from around 850 million by end 2011 to around 3.8 billion in 2017.

This growth in smart mobile devices signals an increasing consumer hunger for mobile apps and services. IDC expects annual mobile app downloads to increase from 38.2 billion in 2011 to nearly 182.7 billion in 2015 as developers create apps for virtually every aspect of a mobile user's personal and business life⁴⁹. App developers are also moving toward more sustainable mobile app business models that are increasingly focusing on in-app purchasing and in-app advertising for additional revenue streams beyond initial app purchases.

The emergence of HTML5 as a response to operating system (OS) and hardware fragmentation in mobile devices, and the dependence on OS-affiliated app stores can affect the development of new apps. IDC believes that HTML5-based apps will represent 15% of new apps deployed in 2012 and 40% by 2015⁵⁰.

HTML5 mobile Web apps enable the development of apps across multi-platforms, overcoming the fragmentation in mobile operating systems and app store marketplaces when delivering content and services over mobile devices. Developing and delivering Web apps mean no low-level coding languages, no payments to app store platforms and no approval processes⁵¹.

To build native apps, developers need to know a variety of native application programming languages such as Objective-C, C++, Java or Visual Basic. One advantage of HTML5 mobile Web apps

⁴⁵ Trends Updates. NBC and Time Warner support Flash. [Online] Available from: <http://trendsupdates.com/nbc-and-time-warner-support-flash/> [Accessed 9th July 2012].

⁴⁶ Scott Ellison. Key Milestones Reached in Mobile HTML5. [Online] Available from: <http://www.idc.com/downloads/lcUS23480012.pdf> [Accessed 9th July 2012].

⁴⁷ Telco 2.0 Research. HTML5: market impact and telco strategies. [Online] Available from: http://www.telco2research.com/articles/EB_HTML5-what-does-it-mean-for-telcos_Summary [Accessed 9th July 2012].

⁴⁸ Ericsson. Traffic And Market Report on the Pulse of the Networked Society. [Online] Available from: http://www.ericsson.com/res/docs/2012/traffic_and_market_report_june_2012.pdf [Accessed 9th July 2012].

⁴⁹ Scott Ellison. Worldwide and U.S. Mobile Applications, Storefronts, Developer, and In-App Advertising 2011–2015 Forecast: Emergence of Postdownload Business Models. [Online] Available from: <http://www.idc.com/getdoc.jsp?containerId=228221> [Accessed 9th July 2012].

⁵⁰ IDC. Worldwide and U.S. Consumer 2012 Top 10 Predictions. [Online] Available from: <http://www.idc.com/getdoc.jsp?containerId=232880> [Accessed 9th July 2012].

⁵¹ Mark Power. Mobile Web Apps: A Briefing Paper. [Online] Available from: <http://blogs.cetis.ac.uk/mark/2011/03/02/mobile-web-apps-a-briefing-paper/> [Accessed 9th July 2012].

is that developers may find it easier to build them using just HTML and related Web technologies. This ease of development also means that developers can very quickly identify bugs and fix them immediately with very little impact on users.

A practical consideration is the hosting of HTML5 mobile Web apps which makes them easier to administer and manage. There is no need to go through the various stages of approval and re-submission for every updated version, as required by certain app stores. The other advantage of HTML5 mobile Web apps is that app development skills do not need to go beyond HTML, Cascading Style Sheets (CSS) and JavaScript to access the key capabilities of mobile devices, e.g. geolocation, camera, SMS and e-mail. Web solutions all share a similar runtime environment: the browser, which is pre-installed on all smartphones, tablets, e-book readers, some game consoles and music players. HTML5 mobile Web apps can tap into the ubiquity of the Web to have greater reach and that can be a distinct advantage for app developers.

The disadvantages of HTML5 mobile Web apps include the exclusion of access from certain hardware features of mobile devices and the inability to match the sophistication of native apps' user interface and experience. If an app is graphics-intensive or requires high performance in the user interface, it will benefit from being built in native code. The screen size, availability of specific feature support and other differences between mobile browsers will have an impact on how apps are developed.

Consumer Personal Cloud

Today's consumers are highly mobile and networked, accessing data on the go through their mobile devices such as smartphones, tablets and laptops. The personal cloud refers to the storing, accessing and sharing of content over the Internet across multiple devices. According to Gartner, the personal cloud is "poised to eclipse the PC as the hub of consumers' digital lives by 2014 as rapid growth in the use of apps and services introduces a new paradigm for how people store, synchronize, share and stream content."^{52,53} Consumers apparently spend over US\$2 trillion a year on content, devices and services. The emergence of personal clouds reflects consumers' desire to access content on any device, at anytime, anywhere, without complications or restrictions⁵⁴. Gartner forecasts that personal clouds will be ubiquitous on 90% of consumer devices by 2015⁵⁵.

As consumers become more comfortable and versatile with new services on new devices, they will come to expect more of service providers and cloud computing. This will lead to a transformation in the way businesses define markets and organisations respond to the consumerisation of IT. The migration of content and services, as well as applications, to the cloud will increase the demand for

⁵² Gartner. Gartner Says The Personal Cloud Is Poised To Eclipse The PC As The Hub Of Consumers' Digital Lives By 2014. [Online] Available from: <http://www.gartner.com/it/page.jsp?id=2008517> [Accessed 9th July 2012].

⁵³ Michael Gartenberg, Shalini Verma. Competitive Landscape: Consumer Personal Cloud. [Online] Available from: <http://www.gartner.com/id=1967316> [Accessed 9th July 2012].

⁵⁴ Gartner. Gartner Consumer Research: Personal Cloud. [Online] Available from: <http://www.gartner.com/technology/research/personal-cloud/> [Accessed 9th July 2012].

⁵⁵ Brandon Butler. Personal cloud will be on 90% of devices by '15. [Online] Available from: <http://www.networkworld.com/news/2012/030612-personal-cloud-256984.html> [Accessed 9th July 2012].

cross-platform cloud services, a transition that will re-define production and distribution channels as well as business models. Networking will experience price reductions and greater flexibility as broadband service operators grapple with the competition and right pricing formula.

Consumers will gradually define their own sets of personal cloud services with regard to communication, collaboration and media consumption, in effect creating a co-ownership relationship with service providers within the cloud computing ecosystem. Smaller vendors will capture parts of the consumer experience with more vertically oriented and dedicated offerings, such as digital storage and streaming services accessible across particular platforms and devices.

Gartner expects competition in the personal cloud market to grow according to the degree of mobility, and location-aware/contextualised devices that consumers possess to remotely access information over the Internet. Personal cloud integration will not only be confined to the storage of content but will extend to include content creation and content consumption using platform-agnostic services. The synchronisation of content in its different forms, e.g. music, video, documents and photographs, will demand a more seamless delivery, and result in a more interactive and immersive user experience.

The personal cloud can comprise devices connected to a (fully managed and hosted) cloud storage service or a home network with a distributed or unified storage architecture where a network-attached storage device or media storage server acts as the central content repository⁵⁶. The type of personal cloud chosen by a consumer is dependent on the type of devices used and the degree to which the consumer wants to be involved in managing the cloud.

Some personal clouds may not deliver an optimum user experience and their infrastructure may not be geared for large-scale synchronisation and backup. Personal cloud providers will have to prove the reliability, security and privacy of their service. Currently, consumers store less than 5% of their digital content in the cloud⁵⁷. The quality of broadband access and cost of service in specific markets may inhibit or expand the usage of personal clouds for streaming content.

Virtual Currency

Virtual currency is a form of alternative currency located within the virtual economy, an artificial economy originally developed within traditional online games that has since expanded to social networks and other online communities. Virtual currency can be used to purchase virtual, digital or physical goods and may be exchanged for real currency. According to a June 2011 report presented by Javelin Strategy & Research, the virtual goods market has experienced significant growth in

⁵⁶ Shalini Verma, Neha Gupta. Hype Cycle for Consumer Services and Mobile Applications: Personal Cloud. [Online] Available from: <http://www.gartner.com/id=2098515> [Accessed 9th July 2012].

⁵⁷ Jeffrey Mann. Hype Cycle for Social Software, 2011. [Online] Available from: <http://www.gartner.com/id=1783415> [Accessed 9th July 2012].

recent years, with growth projected to increase from US\$0.6 billion in 2009 to US\$2.4 billion in 2012 in the USA alone⁵⁸.

Javelin found that two-thirds of consumers who used an alternative payment method in the past 12 months (mid-2010 to mid-2011) were current Facebook users, compared to 58% who used credit cards. According to Javelin, the increased use of virtual currencies and socially networked payments could present new challenges to traditional payments services providers, regulatory bodies and even cross-border economies. "Currently, credit and debit cards have the greatest share of the overall e-commerce payment market, comprising 40 percent and 29 percent of all e-commerce transactions, respectively. However, non traditional payment options like alternative online payments and prepaid and gift cards will gain traction in the coming years and take market share and transaction fees away from financial institutions."⁵⁹

Facebook had its Facebook credits since July 2011 but in June 2012, the company announced that it would stop using Facebook credits by end 2012, requiring developers to use their own in-app virtual currencies priced according to local currencies. Another change was that app developers on Facebook could charge subscription fees, starting July 2012. The social network said it would convert existing Facebook Credits balances to their equivalent values within the individual games and apps. Facebook, however, will continue to store consumers' payment information and continue to take a 30% cut of all transactions conducted on its site. Some analysts say that the move shows that the social network has failed to make Facebook Credits the *de facto* virtual currency for in-app transactions.

⁵⁸ Javelin Strategy & Research. Virtual Currency and Social Network Payments – The New Gold Rush: How Emerging Virtual Transactions Will Alter the Payments Landscape Forever. [Online] Available from: <https://www.javelinstrategy.com/brochure/212> [Accessed 9th July 2012].

⁵⁹ CardNotPresent.com. Report: Virtual Currencies Could Shift Power in Payments. [Online] Available from: http://cardnotpresent.com/news/cnp-news-june11/Report_Virtual_Currencies_Could_Shift_Power_in_Payments_-_June_23,_2011/ [Accessed 9th July 2012].

Social Media Metrics

A Nielsen landmark study to understand how viewers watch the London Olympics across multiple screens and how advertisers can maximise the effectiveness of their association with the broadcast was launched in July 2012, bringing together broadcast TV ratings, online and mobile video views, and engagement with content in apps and social media.⁶⁰ The findings, including an incremental reach analysis of cross-platform advertising, the official rating currencies of TV and online, app usage, social media buzz and brand health metrics from a daily online survey, was delivered in real time via a customisable online dashboard so that telecast partners and sponsors could adapt their campaigns on the run. The viewer data also encompassed broader consumer attitudes, buying rituals, and media and product consumption behaviour, enabling advertising and marketing companies to use a flexible reporting tool to deliver and apply cross-platform metrics and research in real time.

There are basically eight kinds of social media. They include:

- ⤴ **social networks** where members build personal Web pages and connect with friends to share content and communication;
- ⤴ **blogs** that are essentially online journals;
- ⤴ **wikis** that are communal in nature, allowing people to add information or edit content;
- ⤴ **podcasts** that are actually audio and video files available free or through subscription;
- ⤴ **forums** which are online discussions around specific issues;
- ⤴ **content communities** such as Flickr (photos), videos (YouTube) and Digg (bookmarked links);
- ⤴ **microblogging** which comprises social networking combined with bite-sized blogging where small amounts of content (updates) are distributed online and through the mobile phone network (e.g. on Twitter);
- ⤴ **location-based social networking sites** (e.g. FourSquare) that enable users to find friends in the neighbourhood or locate useful places of interest.

These social media sites are a platform for unstructured data that, if measured, will yield useful nuggets of information for advertisers, retailers and consumers. Sentiments can be amplified and perceptions confirmed or shifted onto these channels of communication, providing a tool for branding and product innovation. The social platforms enable marketers to track audience reach by interest, geography, gender and engagement so that they can more effectively identify content that resonates with consumers and prepare more relevant outreach strategies.

⁶⁰ Marketing Magazine. Nine to roll broadcast, online and social into single Olympics metric. [Online] Available from: <http://www.marketingmag.com.au/news/nine-to-roll-broadcast-online-and-social-into-single-olympics-metric-16391/> [Accessed 9th July 2012].

Social media metrics may be part of a larger metrics framework such as Web analytics or performance management and should be incorporated into a social media strategy. It comprises certain unique features that can be described as sentiment, buzz, rating, influence, exposure and virality.⁶¹ The technology is still in the developmental stage but is expected to mature within the next three to five years.

Today, companies are already tracking volume, not so much in terms of numbers but more so in terms of change and modulation over time. For instance, Facebook Insights has a metric called “people talking about this” that measures how many unique people have posted something to their walls about a brand page⁶². Another social media metric is reach which measures the “spread” of an online conversation and potential audience size. Engagement metrics tracks the degree to which online users interact with a topic or brand to effectively build its reputation through retweets and “likes” - the conversion rate (from passive interaction to active buying) will interest businesses.

Influencers are important people who are able to move their “followers” along a certain path, driving conversations about a particular brand and inspiring others to consider purchase of products. Influence scores prepared by social metrics companies are able to measure online social capital and the capability to influence others. There is also a metric called “share of voice” which refers to the comparison of conversations around a brand with those of competitors in the industry, essentially measuring the online equivalent of marketshare.

The lack of metrics standardisation across different social media platforms means that users within customer support, product marketing and research must learn to calibrate available metrics to their environment and match trends, remaining agile and responsive. Retail, consumer product goods, finance and government are sectors that will use social media metrics to better understand consumer needs, measure impact, spot trends and identify new markets by tracking patterns and connections to yield some form of predictive modelling and business intelligence.

Activity Streams

According to Gartner, an activity stream is a publish-and-subscribe notification mechanism that provides frequent updates to subscribers about the activities or events they subscribe to (or “follow”)⁶³. It can be a feature of social networking environments that enables users to keep track of the activities of others or a separate service that aggregates activities across multiple sites or applications.

The metaphor of a stream is used to suggest the idea of a continuous, uninterrupted flow of information that is defined mainly by its sustained momentum. Just as streams flow into one another and sometimes converge as a bigger water flow into the ocean, an activity stream could also

⁶¹ Bill Gassman, “Social media metrics,” in “Gartner's Hype Cycle for Social Software, 2011,” 6 September 2011

⁶² Jenn Deering Davis. 5 Essential & Easy Social Media Metrics You Should Be Measuring Right Now. [Online] Available from: <http://blog.kissmetrics.com/essential-social-media-metrics/> [Accessed 9th July 2012].

⁶³ Nikos Drakos, “Activity Streams,” in “Gartner's Hype Cycle for Social Software, 2011”

include activities in other environments into which the activity stream has access, e.g. Twitter or blog posts, picture uploads in Flickr or a transaction in a business application.

Users can usually control how much of their activity stream is available to other users and can choose when to be notified about the ideas, comments or activities of others. Activity streams have the potential to become a general purpose mechanism for personalised information dissemination, uniting people, data and applications in real time in a central, accessible, virtual interface⁶⁴. Instead of disparate pockets of knowledge captured in departmental silos, corporate information can be captured in a central social network where collaboration is real-time, relevant and placed within an ecosystem that enables users to see and use details that make sense within this big picture.

Activity streams can be useful in managing teams across departments or coordinating different members engaged in a project. Regular updates and progress statements can be transmitted in activity streams that keep members informed and help orientate newcomers to processes and structures. This technology helps aggregate and distribute information across an organisation to facilitate knowledge-sharing and engagement.

⁶⁴ Socialcast. What's an activity stream? [Online] Available from: <http://www.socialcast.com/activity-streams> [Accessed 9th July 2012].

10.3.2 Three to Five Years

Context-Enriched Services

Context-enriched services are those that use context (e.g. location, presence, social attributes and other environmental information) to form compelling, situation-aware and intuitive functions that anticipate and react to end users' immediate needs⁶⁵. According to Gartner, context-aware technologies will affect US\$96 billion of annual consumer spending worldwide by 2015. By that time, more than 15% of all payment card transactions will be validated using context information. Gartner estimates that simultaneously, 40% of the world's smartphone users or 720 million people (about 10% of the global population) will opt in to context service providers that track their activities.

Context-aware computing has been identified as a disruptive technology that will lead to the use of "model-driven security in fraud detection and prevention, convergence in television, games, Web and mobile advertising, and new styles of application programming."⁶⁶ Naturally, security and privacy issues will merit regulatory attention while social networks continue to build the social graphs of its users, blending information from mobile, social, digital and physical world sources.

Organisations will have to re-think the positioning of their services and how to leverage context-aware computing to create greater customer intimacy. Businesses will have to understand how context-enriched services will influence their physical stores, e-commerce and mobile user experiences, and plan their IT resource allocation and coordination strategies carefully. The other sectors affected will include transportation, utilities, energy and healthcare. The growth of context-enriched services also leads to a host of new partnerships and collaborative ventures as companies merge, consolidate and compete to improve the quality of communication and efficiency of interaction to try to meet expectations for instant info-gratification, and a converged and more personalised user experience.

Ultimately, the effectiveness of the concept lies in the fact that context-enriched services use empirical data to predict and meet customer needs. Service providers will be better able to create an enhanced demographic profile of market segments with additional user data while context-aware computing captures behavioural data from customer habits, usage patterns and preferences online⁶⁷. Advances in networks, mobile hardware capabilities, social computing, cloud computing, and unified communication will make it easier to build and use context-enriched services⁶⁸, presenting significant business opportunities for service providers, mobile device manufacturers and suppliers of communication infrastructure.

⁶⁵ Gartner. IT Glossary: Context-Enriched Services. [Online] Available from: <http://www.gartner.com/it-glossary/context-enriched-services/> [Accessed 9th July 2012].

⁶⁶ Gartner. Gartner Says Context-Aware Technologies Will Affect \$96 Billion of Annual Consumer Spending Worldwide by 2015. [Online] Available from: <http://www.gartner.com/it/page.jsp?id=1827614> [Accessed 9th July 2012].

⁶⁷ Emotum. Statistics & Reporting Service (ESRS). [Online] Available from: http://www.emotum.com/downloads/Emotum_ESRS.pdf [Accessed 9th July 2012].

⁶⁸ Anne Lapkin. Next generation IT: understanding user context. [Online] Available from: <http://www.computerweekly.com/opinion/Next-generation-IT-understanding-user-context> [Accessed 9th July 2012].

Augmented Reality

Augmented reality (AR) is a technology that superimposes graphics, audio and other virtual enhancements on a live view of the world, using this “real-world” element to differentiate AR from virtual reality. AR, originally used in aerospace maintenance and repair in the 1990s, has been primarily used in entertainment (e.g. gaming) and marketing. Recently though IBM Research has identified AR shopping as a powerful trend in the retail industry and has created a prototype mobile application that acts as a user's personal assistant while at a store⁶⁹.

The app, developed by IBM's Research Lab in Haifa, Israel, will make it possible for consumers to pan store shelves and receive personalised product information, recommendations and coupons while they browse shopping aisles. Upon entering a store, consumers download the app on their smartphone or tablet, register, and create a profile of features that matter to them - dietary needs, pricing, and environmental (e.g. biodegradable packaging) or religious preferences (e.g. kosher food). When they point their device's video camera at merchandise, the app will instantly recognise products and, using AR technology, overlay digital details (e.g. ingredients, prices and reviews) over the images. If consumers opt in, information from their social networks can be integrated into the information stream. Through partnerships with retailers, IBM hopes to integrate promotions and loyalty schemes into the app which will close the gap between online and in-store shopping experiences, helping stores to better understand the buying habits of individual consumers and gain invaluable insights that can help optimise floor plans and product arrangements⁷⁰.

In Finland, VTT Technical Research Centre has developed an AR app that can be used to plan “construction planets”⁷¹ and add value to architectural and construction planning. The application can make digital changes to a physical landscape, allowing users to see how construction efforts will change the area and showing projects at various stages of development. Some researchers believe that AR technology can serve as a practical tool for nearly any industry and can help with problem solving, logistics, or as a way to communicate new ideas.

The integration of the visual power of AR with other immersive technologies can be used to help children with autism spectrum disorders by providing them with a visually appealing, easy-to-use and responsive interface⁷². By augmenting the space within which the user is currently in and

⁶⁹ Julie Campbell. Augmented reality shopping cited as a future trend by IBM Research. [Online] Available from: <http://www.qrcodepress.com/augmented-reality-shopping-cited-as-a-future-trend-by-ibm-research/8510358/> [Accessed 9th July 2012].

⁷⁰ Zachary Lutz. IBM Labs pitches the future of augmented reality shopping with mobile app prototype. [Online] Available from: <http://www.engadget.com/2012/07/02/ibm-augmented-reality-shopping-app/> [Accessed 9th July 2012].

⁷¹ Mobile Commerce Press. VTT Technical Research Center develops practical augmented reality application for construction. [Online] Available from: <http://www.qrcodepress.com/vtt-technical-research-center-develops-practical-augmented-reality-application-for-construction/858118/> [Accessed 9th July 2012].

⁷² Rene van Meeuwen. Into the Matrix: the future of augmented reality (and you). [Online] Available from: <http://theconversation.edu.au/into-the-matrix-the-future-of-augmented-reality-and-you-6675> [Accessed 9th July 2012].

animating, illustrating and enhancing the reality⁷³, AR technology is creating a more seamless and personalised user experience, and providing instant information to satisfy consumer expectations.

In June 2012, Google introduced an early prototype of Google Glass⁷⁴, demonstrating the potential of an AR eyeglass that is head-mounted and flashes information on a small light-emitting diode (LED) display that sits in front of and above the wearer's right eye. The main selling point of Google Glass is that it is supposed to help the wearer maintain eye contact with the real world, as opposed to smartphone where users have to look up, down and at their phones in their hands, thus losing eye contact focus with a person or space, perhaps during critical moments. In 2006, Apple had filed a patent for a similar device, with displays for both eyes⁷⁵. The AR landscape, with Google planning to launch a consumer version of its Google Glass in 2014, seems to be headed for some exciting developments in the next few years.

One indirect outcome of using AR is that there may be “too much information” provided by an over-reliance on AR, leading to consumers missing out on the action that is right in front of them, in the real world⁷⁶. Another issue pertains to privacy – image recognition software, coupled with AR, will allow us to point our phones at people, even strangers, and instantly see information from their social network profiles. This exposure may not be desirable to active online users with dynamic social graphs.

Social Learning Platform

A social learning platform exhibits distinctive characteristics that distinguish it from the traditional learning systems of which it is an extension. It is democratic – individuals decide how, when and with whom they want to learn. It is autonomous in that there is no manager controlling the interaction. The learning is socially embedded in the context of work, i.e. there is a seamless flow of interest that “spills over” from work and passion into the online learning community such that the participants benefit from just-in-time learning because it is immediate and real-time.

The learning content management incorporates social software features to support structured social, informal and formal learning abilities, allowing emergent structures to develop organically. Linking, tagging, following and friending all give rise to patterns and structures (“emergent structures”) that arise from unplanned, undirected, low-level social interaction online. Individuals

⁷³ Abigail Phillips. The future of augmented reality technology. [Online] Available from: <http://www.businessrevieweurope.eu/marketing/mobile-marketing/the-future-of-augmented-reality-technology> [Accessed 9th July 2012].

⁷⁴ Andy Ihnatko. Google demonstrates augmented reality of glass. [Online] Available from: <http://www.suntimes.com/technology/ihnatko/13466864-452/google-demonstrates-augmented-reality-of-glass.html> [Accessed 9th July 2012].

⁷⁵ Jason Gilbert. Google Glass by Apple? Patent shows an Apple-made Glasses Rival Could Be In The Works. [Online] Available from: http://www.huffingtonpost.com/2012/07/05/google-glass-apple-patent_n_1651176.html [Accessed 9th July 2012].

⁷⁶ Kevin Bonsor. How Augmented Reality Works. [Online] Available from: <http://computer.howstuffworks.com/augmented-reality4.htm> [Accessed 9th July 2012].

are able to create a personal learning space within the context of social networks. Today, more than 60 companies worldwide provide learning management systems⁷⁷.

According to Gartner, a social learning platform provides learners with the ability to:⁷⁸

- ⤴ Establish a presence or social profile that reflects their expertise and interests;
- ⤴ Organise and learn from a variety of sources, such as search or peer ratings;
- ⤴ Interact with peers in their social networks and reach beyond their networks to find other trusted sources of insight;
- ⤴ Engage in experience-based learning exercises;
- ⤴ Receive real-time, online coaching and support.

Social learning platforms reflect organisational learning capability as organisations and educational institutions tap into the collective knowledge of employees, customers, partners or students to provide a more continuous learning experience, creating a more engaged and collaborative workforce that is part of a knowledge sharing community.

Crowdfunding

Crowdfunding is the process of gaining capital for businesses or ideas through multiple avenues that mainly involve networking. It involves the support of an individual or organisation through enlisting the attention, trust, cooperation and monetary support of a large crowd of people online. Funds can be raised to support a humanitarian or political cause, entrepreneurial startup, disaster relief or personal causes (e.g. a wedding, college fees).

The first Crowdfunding Industry Report from research firm Massolution reveals that as of April 2012, based on Crowdfunding.org's Directory of Sites, the most comprehensive database of crowdfunding sites, there were 452 crowdfunding platforms active worldwide, mainly in North America and Western Europe⁷⁹. Crowdfunding platforms (CFPs) raised US\$1.47 billion in 2011, up 72% from US\$854 million in 2010, and almost tripling the US\$530 million raised in 2009⁸⁰. Equity-based and lending-based crowdfunding (i.e. for financial returns) is most effective for digital goods (e.g. software, film and music), raising the largest sum of money per campaign. Meanwhile donation-based and reward-based crowdfunding for cause-based campaigns (e.g. environment) that appeal to founders' personal beliefs and passions perform best.

The study predicts worldwide funding volume to almost double to US\$2.8 billion in 2012, driven by a 300% growth in equity-based (for financial returns) and reward-based (for non-financial rewards

⁷⁷ Sonia Kolesnikov-Jessop. Schools Go Into the 'Cloud' to Embrace the Popularity of Social Media. [Online] Available from: <http://www.nytimes.com/2012/05/21/world/asia/schools-go-into-the-cloud-to-embrace-the-popularity-of-social-media.html> [Accessed 9th July 2012].

⁷⁸ Jeff Freyermuth, "Social-learning Platform," in "Gartner's Hype Cycle for Social Software, 2011"

⁷⁹ Crowdsourcing.org. Crowdfunding Industry Report: Market trends, composition and crowdfunding platforms. [Online] Available from: <http://www.scribd.com/doc/92834651/Massolution-abridged-Crowd-Funding-Industry-Report> [Accessed 9th July 2012].

⁸⁰ MarketingCharts. Crowdfunding Platforms Raised Almost \$1.5B in '11, Up 72% Y-O-Y. [Online] Available from: <http://www.marketingcharts.com/direct/crowdfunding-platforms-rai...49/massolution-crowdfunding-volume-growth-2009-2012-may2012jpg/> [Accessed 9th July 2012].

such as tokens) crowdfunding, with lending-based (75%) and donation-based (50%) funding also to experience solid growth. The report defines lending-based funding as a crowdfunding model in which funders receive fixed periodic incomes and expect repayment of the original principal investments. The reward-based category is the largest in terms of the number of CFPs while the lending-based category is the smallest. Basing the analysis on a sample of 143 CFPs, the report determines that the donation-based (50%) and lending-based (41%) categories are growing at a relatively similar pace, though both markedly slower than the reward-based category which boasts a 79% CAGR - 63% of the funds raised by these platforms were paid out to projects that drew less than US\$5,000 in funding. The equity-based category produces the largest amount of funds on a per-project basis, growing at 114%.

The total number of crowdfunding campaigns in 2011 reached close to 1.2 million, with almost all occurring in North America (532,000) and Europe (654,000). It takes 2.84 weeks on average across all categories (from a sample of 83) to raise the first quarter of the funding goal and 3.18 weeks on average to raise the last quarter. Lending-based campaigns take about half as much time to complete (4.8 weeks) as equity-based (10 weeks) or donation-based campaigns (10.2 weeks). Using a sample of 60 CFPs, the report found that 42% charge a transaction fee based on a percentage commission of funds paid out.

On 4 April 2012, President Obama signed the Jumpstart our Business Startups (JOBS) Act into law, making funding more accessible for startups by allowing non-accredited investors to participate in the funding rounds⁸¹. Under the new law, friends, family, and strangers can more easily use a crowdfunding platform to invest in a startup in return for shares of the company, and companies can have a higher total number of investors before triggering public disclosure regulations that will ordinarily compel companies to list their shares on a public market⁸². If a company raises more than US\$500,000 it will have to prepare audited financials, an expense that will discourage most companies from resorting to crowdfunding for significant amounts of capital.

Although some industry analysts expect securities-based crowdfunding to bring new sources of funding to many startups and early stage businesses, only 89% of investors reported participating in only one or two campaigns, which could affect the ongoing success of crowdfunding. Investors tend to return to the same crowdfunding platform they used previously, instead of branching out.

10.3.3 Five to Ten Years

Biometric Payment Solutions

Biometric payments refer to a point-of-sale technology that employs biometric authentication using the eye, fingerprint, face or voice to identify the user and authorise the deduction of funds from a bank account. The purpose is to reduce fraud and identity theft. In finger scanning, the payment

⁸¹ Deborah L. Jacobs. JOBS Act Gives Full Employment To Journalists. [Online] Available from: <http://www.forbes.com/sites/deborahljacobs/2012/04/04/jobs-act-gives-full-employment-to-journalists/> [Accessed 9th July 2012].

⁸² Sarah Mitroff. Crowdfunding raised \$1.5B last year – and is on track to double in 2012. [Online] Available from: <http://venturebeat.com/2012/05/08/crowdfunding-1-5b/> [Accessed 9th July 2012].

solution usually comprises a two-factor authentication in which the finger scan takes the place of the card swipe, followed by the typing in of a personal identification (ID) number. In November 2006, Citibank inaugurated a biometric payment system for its Platinum credit cardholders in Singapore⁸³.

In 2009, Hitachi tested its Finger Vein Authentication System internally, using it as a method of payment at vending machines⁸⁴. The plan was to develop high-precision ID systems combining finger vein and finger print authentication systems for military use.

Hitachi's now patented finger vein printing uses near-infrared light, transmitted through the finger and irradiating the back of the hand. As haemoglobin in the blood absorbs the infrared light, the patterns of veins in the palm side of the finger are captured as shadows. The solution using finger veins is contactless and therefore more hygienic, and is not affected by dryness or roughness which is the problem with fingerprint scanning today. In Japan, finger vein recognition is widely used in the financial sector⁸⁵.

In April 2010, France launched a six-month trial of a biometric payment system in supermarkets, using the record of the unique pattern of veins underneath a person's index finger (and not the fingerprint itself) for customer identification⁸⁶. Earlier, in 2007, Germany had implemented a similar system in a supermarket chain. The aim was to reduce fraud and speed up supermarket queues.

In January 2012, a school in the UK started using fingerprint recognition technology for school meal payments⁸⁷, replacing the traditional cards used to top up students' credit balances. The school had to write to parents to ask for permission to record "certain points of a finger image", typically between 10 and 60 points, "as a short string of encrypted numbers". The school administration assured parents that this number would not provide enough detail for the reconstruction of the full image of the finger but would be sufficient to provide a template for finger scanning.

The storage of identification information in a central database is in conflict with data privacy protection laws. Hence, some researchers believe that a better solution is a verification in which the biometric data can be encrypted on a smart card. This solution will support privacy protection and increase security and trust, particularly in the banking and finance sectors. Japanese auto-teller machines (ATMs) using biometrics are already in place but there are challenges such as the

⁸³ Sumner Lemon. Citibank Singapore Rolls Out Biometric Payment System. [Online] Available from: http://www.cio.com/article/28183/Citibank_Singapore_Rolls_Out_Biometric_Payment_System [Accessed 9th July 2012].

⁸⁴ Joseph L. Flatley. Hitachi develops biometric payment system, uses it to sell junk food. [Online] Available from: <http://www.engadget.com/2009/07/22/hitachi-develops-biometric-payment-system-uses-it-to-sell-junk/> [Accessed 9th July 2012].

⁸⁵ Gerik Alexander von Graevenitz. Biometric authentication in relation to payment systems and ATMs. [Online] Available from: http://www.appliedbiometrics.com/fileadmin/download/Biometric_authentication_in_relation_to_payment_systems.pdf [Accessed 9th July 2012].

⁸⁶ The Connexion. Use your finger to pay for shopping. [Online] Available from: <http://www.connexionfrance.com/france-fingerprint-payment-biometric-scanners-accord-bank-auchan-11614-view-article.html> [Accessed 9th July 2012].

⁸⁷ Littleover Community School. Biometric Payment System for School Meals. [Online] Available from: http://www.littleover.derby.sch.uk/content/letters/files/2012-01-27_bio_app_letters.pdf [Accessed 9th July 2012].

substantial investment in IT infrastructure at ATMs and point-of-sale terminals, and the lack of interoperability of biometric technologies.

For governments in developing countries, the biometric payment solution validates payments to legitimate recipients and reduces fraud. For instance, some African governments are implementing this solution to thwart the payment of salaries to “ghost workers, dead workers and greedy workers”, with one government reporting savings of up to NGN88 million (US\$50,000) from the pension scheme alone⁸⁸.

Bump P2P Payment

Bump technology is a data transfer technology that facilitates the routing of data from a transmitting phone to a receiving phone using the Bump software application installed on the mobile phones (currently limited to the iPhone and Google Android devices). Within the Bump environment, the action of “bumping” is captured as a multi-dimensional image by the accelerators in both phones and matched with the mobile devices that have identical physical impact patterns.

Currently, the Bump technology is used primarily for social communication, e.g. sharing information, photographs and contact details. An emerging functionality is in the field of finance, namely payments between individuals and between individuals and businesses. What happens then is that once a transaction is initiated, the transfer value is first communicated to the Bump cloud service which then links to the bank or payment company offering the service. The actual transfer of value takes place within the confines of the latter - what Bump does is primarily to act as authentication of presence of devices.

Currently, Bump adoption is limited to the USA where a handful of operators such as ING Direct and PayPal provide niche markets. The main competitor to Bump is NFC technology which facilitates contactless transactions. The Bump P2P payment system also faces security issues with regard to customer authentication but may be attractive to markets that are considering the replacement of paper-based cheques with e-payment within a niche environment.

Bitcoin

An open source project launched in 2009, Bitcoin is an electronic cash system that relies on P2P networking, digital signatures and public key cryptographics to enable irreversible payments between parties, represented by transferring a symbolic token stamped with complex numbers that confers ownership to someone else. As of March 2012, this virtual currency has a value ranging between US\$4 and US\$5.

⁸⁸ Umuahia Ugochukwu Eke. Orji to councils: Embrace biometric payment or [Online] Available from: <http://www.thenationonlineng.net/2011/index.php/news/50544-orji-to-councils%3A-embrace-biometric-payment-or-....html> [Accessed 9th July 2012].

Unlike other currencies, Bitcoin does not have a central issuing authority run by a government, bank or organisation nor is the value backed by any real-world currency or solid commodity. The Bitcoin Network is somewhat similar to the BitTorrent Network invented by Bram Cohen. Participants begin by downloading the Bitcoin client which provides a mechanism to find other peers on the Internet, a mining tool to generate new Bitcoins in the network, a wallet to store these Bitcoins, a mechanism to send/receive the Bitcoins to/from other participants and a large distributed public ledger that keeps track of all transactions in the network.

To make Bitcoin an alternative currency, the first Bitcoin Market was established in February 2010, allowing the Bitcoin community to trade Bitcoins with real world currencies. Bitcoin started trading at 0.3 US cents and stayed below 8 US cents for the next six to seven months. Several online merchants as well as a few brick-and-mortar shops started accepting Bitcoins as payment. In May 2010, a Bitcoin member bought a US\$25 pizza with 10,000 BitCoins. By mid-2010, Bitcoin news surfaced in a number of social media sites such as Slashdot, Reddit and Digg, gaining new Bitcoin members and causing the value of BitCoin to rise to US\$1 by February 2011. Mainstream media such as Forbes, Time, The Economist and Wall Street Journal also published stories about Bitcoin, leading to the peaking of Bitcoin at US\$29.57 on 9 June 2011. Four days later, the bubble burst and Bitcoin devalued to US\$2 by November 2011, causing some financial analysts to dismiss it as a Ponzi scam.

There are two ways users can obtain Bitcoin: buy them off the open market or mine them, using the Bitcoin software. In the case of the latter, the Bitcoin client is used to search for solutions to some difficult cryptography challenges. Each time a solution is found, the miner will be rewarded with 50 Bitcoins. The difficulty is automatically adjusted regularly so that the number of solutions found globally, by everyone, is constant: an average of 300 Bitcoins per hour. Approximately every four years, the number of Bitcoins that can be “mined” will be reduced by 50%. Any coins that are created by a malicious user that do not follow this rule (or any other rules) will be rejected by everyone else. The result is that no more than 21 million Bitcoins will ever exist. As of 2012, over 8 million of the total 21 million Bitcoins have been mined.

Bitcoins are secured with public-key cryptography. Each address consists of a public key, which is published, and a private key, which the user will keep secret. Anyone can send Bitcoins to any public key, but only the person with the private key can spend them. While addresses are public, nobody knows who the addresses belong to as Bitcoin addresses are pseudonymous. Bitcoins use a 256 bit public/private key encryption algorithm that has never been cracked in practice and is considered secure by US National Security Agency.⁸⁹

However, in May 2012, a leaked Federal Bureau of Investigation (FBI) report on Bitcoin revealed the FBI's concern that Bitcoin may become a payment method for cyber criminals in the near future and can be used to fund “illicit” groups⁹⁰. The report, published on 24 April 2012 and entitled “Bitcoin

⁸⁹ Synaptic Laboratories Ltd. Bibliography: Secure Hash Algorithm (SHA). [Online] Available from: <http://synaptic-labs.com/resources/security-bibliography/62-hash-functions/182-bib-secure-hash-algorithm-sha.html> [Accessed 9th July 2012].

⁹⁰ Adrienne Jeffries. FBI: That Bitcoin Report Was Authentic, But It Wasn't Leaked by Us. [Online] Available from: <http://betabeat.com/2012/05/fbi-that-bitcoin-report-was-authentic-but-it-wasnt-leaked-by-us/> [Accessed 9th July 2012].

Virtual Currency: Intelligence. Unique Features Present Distinct Challenges for Deterring Illicit Activity”, noted that Bitcoin's decentralised nature presents some challenges for law enforcement.

One of the biggest problems for the FBI was the risk of people stealing Bitcoins from each other and the unauthorised use of computer equipment to mine Bitcoins. The other concern was that “If Bitcoin stabilizes and grows in popularity, it will become an increasingly useful tool for various illegal activities beyond the cyber realm” in areas such as child pornography, human trafficking, gambling and terrorism. The FBI estimates the Bitcoin economy is worth between US\$35 and US\$40 million.

Real-Time Decisioning

Enterprise real-time systems refer to software and hardware systems that process information at a speed natural to the flow of real world processes. A real-time enterprise is a “zero latency” organisation because it needs to process information quickly, using its real-time systems, so that decision makers can use the information to make operational and strategic decisions. The main difference between real-time decisioning and traditional data warehousing systems is the speed at which information is processed and the ability of the organisation to detect events, evaluate and then respond to them.

Real-time information drives parallel and not sequential planning, real-time and not pre-arranged,= decision-making⁹¹. This has made it necessary for decision makers to adapt and adjust information processing procedures which have operational and strategic implications.

By blending operational and strategic systems (data warehousing and analytics), a much richer environment for decision support is created. The goal of real-time decision support is to facilitate access to information that cuts across multiple applications, systems and data sources⁹². Real-time decision support focuses on both the process events important to operations and the business events that support strategic management. The combination of systems that support business operations with systems that examine historic and analytic results provides a superior framework for decision making.

Real-time decisioning technologies can be useful to military organisations, corporate boards, marketing departments and organisations that want to be more relevant to their stakeholders. A better understanding of the events and processes that take place in real-time can be used to generate more appropriate and strategic responses to manage stakeholder expectations and corporate objectives. For example, traffic control and logistics departments can use the information provided by real-time vehicle routing and mobile technologies to manage traffic on the roads more effectively and minimise congestion and accident risk.

⁹¹ William G. Adamson. The Effects of Real-time News Coverage on Military Decision-making. [Online] Available from: <http://www.au.af.mil/au/awc/awcgate/acsc/adamson.pdf> [Accessed 9th July 2012].

⁹² Greg Barnes Nelson. Real Time Decision Support: Creating a Flexible Architecture for Real Time Analytics. [Online] Available from: <http://www2.sas.com/proceedings/sugi29/109-29.pdf> [Accessed 9th July 2012].

10.4 Market Applications

10.4.1 Retail

In-store retail experience can be greatly enhanced by these New Digital Economy technologies. The new retail experience can potentially be complemented by AR, consumer's digital social interactions, context-enriched services and next-generation payment solution. Retailers will be eager to integrate some of these technologies to offer consumers a personalised and interactive experience whenever they walk into their stores.

The success of AR trials by IBM will encourage retailers to explore, using AR to reduce merchandise search and retrieval time while increasing the number of merchandise exposed to consumers in each visit. The increased exposure of merchandise per consumer visit is expected to raise sales.

Other aspects of the in-store shopping experience that can be enhanced by digital information are already being piloted around the world. The in-store experience can be further enhanced through integration with social networks. A retailer in Brazil is already testing out displaying its items' real time Facebook "like" counts with the physical item on display in its store.



Figure 10: Brazilian retailer C&A's networked, real time updated hangers⁹³

Convergence of a shopper's personal social network with context awareness will further enhance in-store experience. The shopper in such a convergent environment will have additional information, comments and references from friends in real time while in the store. Retailers will be able to proactively promote their products through a variety of digital channels, like in-store display screens, and can potentially customise real-time offers shaped by the shopper's history with them.

⁹³ Meghan Kelly. Brazil retailer using Facebook likes on its clothing hangers. [Online] Available from: <http://venturebeat.com/2012/05/06/brazil-facebook-likes/> [Accessed 9th July 2012].

Next-generation payment solutions can provide shoppers with instant access to their overall budget and change their purchasing behaviour. Loyalty programmes from retailers can be integrated with payment for seamless benefits delivery. Shoppers' budgets and lifestyles can be used for proactive recommendations and shopping plans by a personal digital concierge solution.

Indoor positioning is another potential technology for developing innovative and enterprising services that will bring about many benefits to both consumers and retailers. In order to realise the benefits of indoor positioning, IDA has issued a Call for Collaboration (CFC) under its Digital Concierge programme to develop and deploy Mobile Positioning and Analytics Services (MPAS)⁹⁴ for the tourism, hospitality, retail, and the food and beverages sectors. The aim of the CFC is to establish an accurate, scalable and interoperable MPAS ecosystem to drive the adoption of MPAS by demonstrating their business value and lowering the barriers to adoption.

MPAS will allow shoppers to locate amenities, shops, eateries, where their car is parked, and even their friends, using their mobile devices. Merchants will be able to select certain pre-approved areas to be geo-fenced so that whenever shoppers enter these areas, the merchants' promotions and offers can be pushed to the shopper's mobile devices using a mobile application. Alternatively, a heat map view could be produced to show crowd density throughout a venue, allowing businesses to better understand crowd behaviour in order to optimise resources and rental yield.

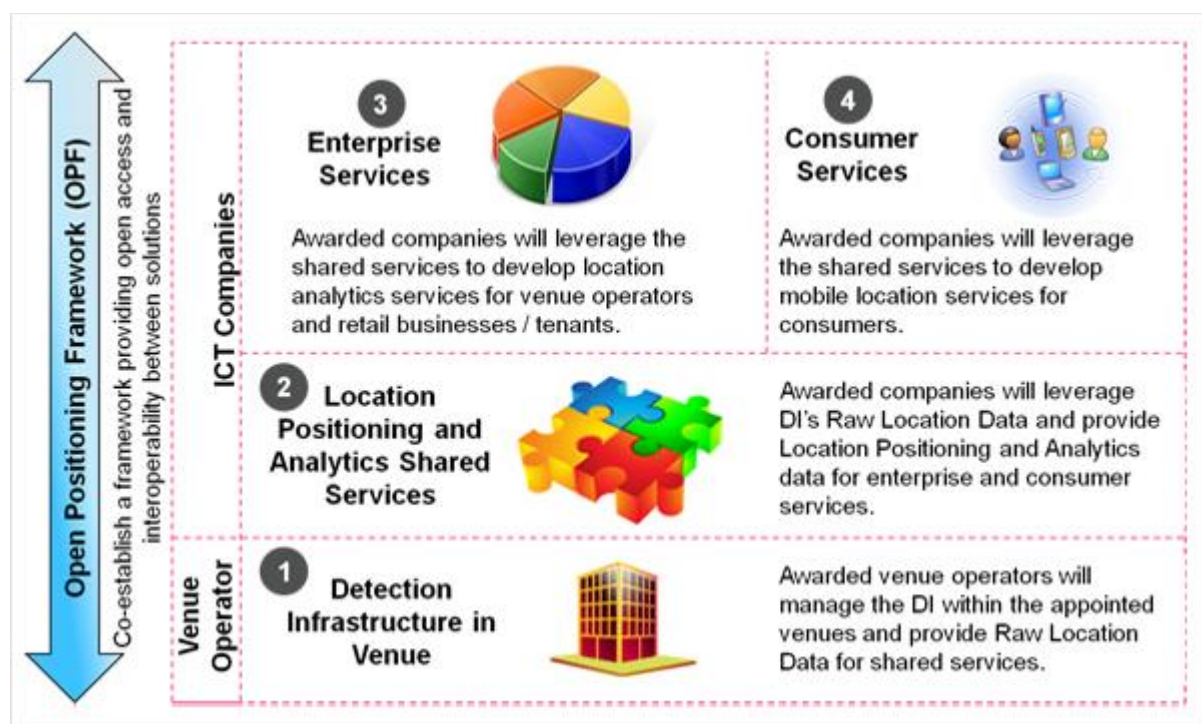


Figure 11: The indoor positioning and analytics partner ecosystem

The MPAS platform will be created to offer accurate, easily accessible and competitively priced location positioning and analytics services to enterprises and consumers across multiple sectors. The platform will consist of the detection infrastructure, the location positioning and analytics shared services, enterprise services, as well as consumer services and an open positioning framework.

⁹⁴ Infocomm Development Authority of Singapore. Mobile Positioning & Analytics Services (MPAS). [Online] Available from: <http://www.ida.gov.sg/Collaboration%20Opportunities/20120504171814.aspx> [Accessed 9th July 2012].

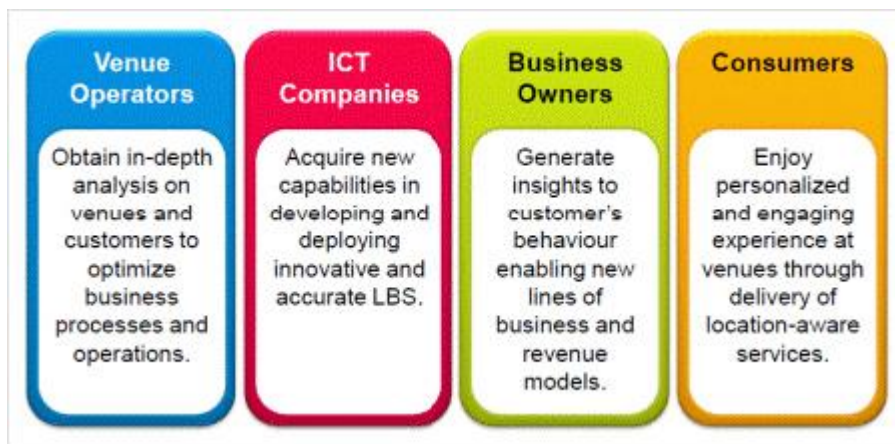


Figure 12: Key benefits of MPAS

Under MPAS, infocomm companies providing services targeted at consumers will be able to make use of the available shared services to provision mobile services such as navigation, finder and tracker services. For consumers, MPAS will allow them to enjoy more personalised and engaging experiences at various venues through the delivery of context-aware information and services such as targeted advertising based on the consumer's location and preferences, a "Shop Finder" service, a "Find Friends Near Me" service, or a "Where is My Car" service.

Business analytics is also becoming a key competitive differentiator for retailers. It enables retailers to analyse the vast amounts of data that they have accumulated over time, in order to discover greater insights about their customers and operations. This allows them to make data-driven, informed decisions to improve service levels, minimise inventory holdings and increase overall operational efficiency.

To facilitate the adoption of analytics applications in the retail and wholesale sectors, IDA and its industry partners will be developing a suite of shared services to enhance capabilities in Customer and Marketing Analytics, Inventory Optimisation and Operations Analytics. The aim is to help businesses lower the cost of adopting business analytics, shorten the implementation time and make analytics services available on demand.

Retailers and wholesalers that adopt business analytics are expected to derive benefits for their front-end store operations and back-end processes. For front-end store operations, Customer & Marketing Analytics will enable retailers to identify their key customer segments, understand purchase behaviour and trends, and optimise their marketing and promotion campaigns to better meet the needs of customers. These insights will help retailers to enhance the customer experience by delivering more relevant products and services, and improve the effectiveness of their campaigns and promotions.

From Front End Store Operations to Back End Processes



Figure 13: Application of Business Analytics in Retail

For back-end processes, Inventory Optimisation will enable retailers and suppliers to forecast demand more accurately, determine optimal stock and replenishment levels, and optimise assortments of goods. Retailers will also be able to collaborate more closely with their suppliers to optimise and manage inventory levels in order to improve efficiency and reduce inventory-related costs.

Operations Analytics will enable retail suppliers to optimise their resources such as goods and manpower in order to increase operational efficiency and boost productivity.

10.4.2 Education

Tablet usage in education has already begun for a number of years. Closely associated to tablet use in education have been interactive textbooks and other multimedia educational content. This tablet-centric digitisation of education, together with the New Digital Economy trends highlighted above, will introduce transformation for both the learners and learning providers.

With students each equipped with a powerful mobile computing device which they will have access to all the time, a digitally enhanced learning experience can be delivered outside the classroom and beyond school hours. This can enable outdoor, location-aware interactive lessons to be conducted. AR can be used to superimpose learning content onto real-world objects.

Tablets with Internet connectivity will enable collaborative learning anywhere in both synchronous and asynchronous modes. Learning content will not be limited to resources from the learning providers but can also incorporate knowledge bases from the Internet. This high usage of technology for collaboration and self-directed information research in education is vital in preparing learners for a job marketplace where similar technologies are used ubiquitously.

10.4.3 Government

The twin driving forces of mobile penetration and social connectivity in the New Digital Economy has empowered citizens to make their voices heard to large communities in the population. Mass media no longer belongs exclusively to the broadcasters and publishers. With the population consuming more media from non-traditional media sources, governments will need to look at effective communication with its citizenry using these new media.

A digitally connected citizenry enables governments to conduct large-scale engagement and consultation efficiently, something which was not possible before. This may potentially shape the way government policies are being crafted in the future.

Beyond new media communication, governments could tap on the energy and creativity from a community exposed to the digital social behaviour of crowdsourcing and collaborative consumption. Social issues which government find difficult to deal with might be better addressed by communities of interest, socially engaged citizens or social enterprises. Encouraging social entrepreneurs to leverage social technologies like crowdsourcing to gather and coordinate information, resources, fundraising efforts and even volunteer time will multiply the impact of social outcomes and accelerate progression of these social needs-driven initiatives.

10.5 Implications

With the Internet Economy migrating to mobile-centric platforms, businesses need to be ready to serve their customers effectively through the mobile channel. This will pose several challenges compared to the desktop Internet. The screens on mobile devices are smaller, limiting the amount of information that can be presented. Current websites designed for the desktop environment will not be sufficient for users accessing through the mobile Internet. User interactions on mobile are either step-scrolled or touch-driven which is different from a point-and-click mouse environment. Some existing Web technology may also not work on mobile devices while alternative Web technologies like HTML5 have not yet reached full maturity. With the business imperative of customer engagement, organisations need to streamline their digital engagement strategies in order to remain effective on the small screens of mobile devices.

Although there are challenges, the move by consumers to mobile connectivity and networks will also offer opportunities for enterprising businesses. The mobile devices offer additional information like location and orientation which can be leveraged for new business and services models. Location and other information from onboard sensors of the mobile Internet users can be combined with other backend information to provide context-aware services. Accenture predicts that context awareness will be the key strategic differentiator for organisations from their competitors, starting from 2012⁹⁵. The key is to ensure that context will enable services that make sense right at the point where a consumer action takes place.

The apps economy, resulting from the creation of a new consumer consumption category in software, presents opportunities for the infocomm industry, especially for startups and the infocomm SME community. Innovative business models, design and user experience will be key success and differentiating factors as global competition will be keen. The infocomm industry needs to create an innovation-driven business environment, encourage the emphasis on design in product development and build expertise in User Experience (UX).

The social economy is enabled through a greater level of trust compared to the *de facto* anonymous nature of the Internet. The large population size and reach offered by social networking platforms are also important factors supporting this economy. This trust and reach allow innovative community-driven solutions and business models known collectively as collaborative consumption and crowdsourcing to flourish. Today's "hyper-connected" and "hyper-informed" consumer is value-driven and not afraid to experiment with new business models. Collaborative consumption and crowdsourcing characterise this trend which is based on trust, sustained user engagement and interaction.

This digital social trend also enables social innovation which can potentially solve social issues and bring multi-faceted benefits to Singapore through community participation and engagement. Community support and openness to initiatives from the ground will encourage these efforts.

⁹⁵ Accenture. Accenture Technology Vision 2012. [Online] Available from: http://www.accenture.com/us-en/blogs/accenture-blog-on-insurance/Media/ACN_Technology_Vision_2012.pdf [Accessed 9th July 2012].

A key enabler for a seamless converged experience is the next-generation electronic payment solutions. Consumer acceptance of online cashless transactions through e-commerce readies them for digital payment solutions in the real world. Money 2.0 may introduce non-financial institutions into the landscape and challenge established business models in the industry. Close monitoring of developments in next-generation payments and financial solutions will be needed to ride this new digital wave.

10.6 Challenges

Along with economic opportunities come challenges that must be addressed. These pertain to trust and the need to educate the public to encourage the practice of discretion when it comes to managing online trust. Where there is money to be made, there will be opportunities for fraud and crime. Security cuts across all driving trends and has implications at every level of the New Digital Economy but is particularly relevant to m-commerce. In a global consumer study conducted by Accenture in 2011, consumers had expressed apprehension towards using their mobile phones to make purchases (Figure 14).

To what extent do you agree with the following statements about the use of mobile phones (both cell phones and smartphones) to make purchases?



Source: Accenture Tech Forward 2011 – Global Consumer Study Results

Figure 14: Consumer Acceptance Level of Mobile Commerce⁹⁶

Trust is associated with respect for privacy and sometimes, anonymity. Facebook, which has persuaded its users that privacy can co-exist with sharing, now has to grapple with government regulators in the European Union who are revising its 1995 data protection rules incorporating the

⁹⁶ Accenture. Upward Mobility. [Online] Available from: <http://www.accenture.com/us-en/outlook/pages/outlook-journal-2012-upward-mobility.aspx> [Accessed 9th July 2012].

“right to be forgotten and to erasure”⁹⁷ (Article 17). Compliance means that companies will have to respond to requests to delete customer data which will probably incur additional costs. Non-compliance means severe fines – up to one million Euros or 2% of global annual revenue. In the USA, Facebook faces 20 years of privacy audits and a host of legislators ready to hold hearings or open investigations when controversies arise.

For apps that require location information, privacy is of particular concern, especially with the older users. According to Nielsen, more than 60% of app users aged 45 and older in the USA have concerns when using location-based services or check-in apps on their mobile devices (Figure 15).

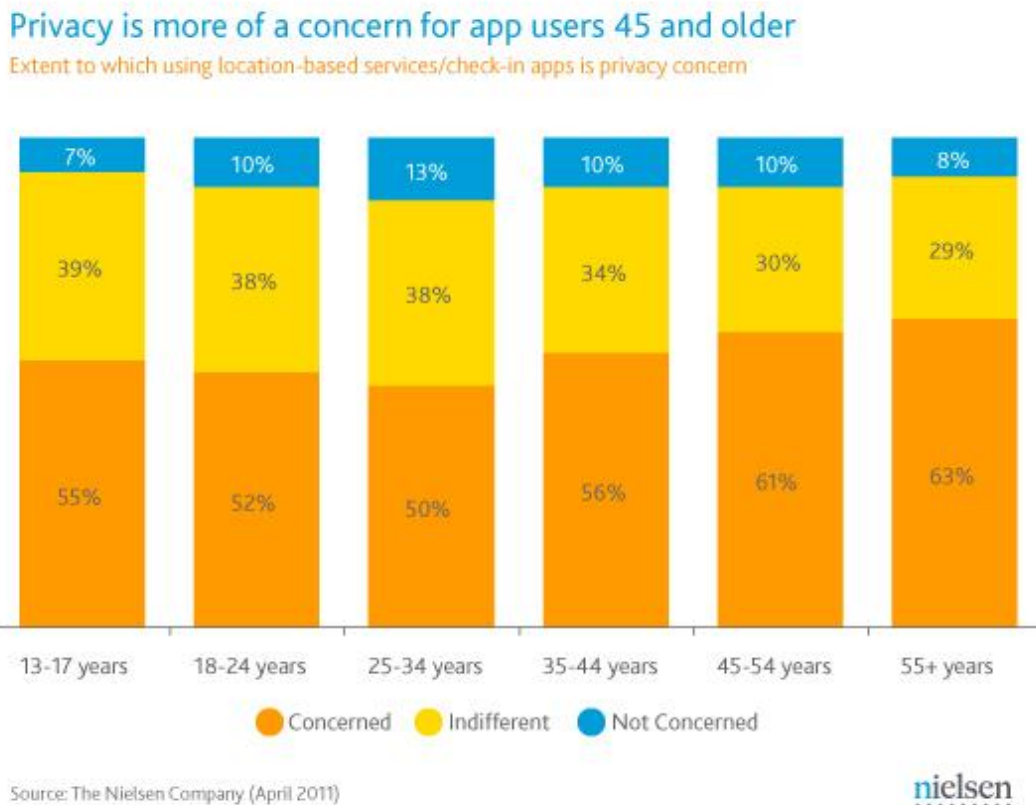


Figure 15: Privacy matters more to US app users aged 45 years and older⁹⁸

Various factors play a role in shaping the direction, scope and growth of the New Digital Economy. Balancing growth with risk management will require adaptability and innovative thinking. Understanding how best to align consumer infocomm technologies to create greater economic, competitive and strategic advantage will be key to leveraging the power of online social interactions to acquire, retain and engage digitally -informed consumers.

⁹⁷ Thomas Claburn. EU Data Rules Worse Than SOPA? [Online] Available from: <http://www.informationweek.com/news/security/privacy/232500742> [Accessed 9th July 2012].

⁹⁸ Nielsen Wire. Privacy Please! U.S. Smartphone App Users Concerned with Privacy When It Comes to Location. [Online] Available from: http://blog.nielsen.com/nielsenwire/online_mobile/privacy-please-u-s-smartphone-app-users-concerned-with-privacy-when-it-comes-to-location [Accessed 9th July 2012].

10.6 Summary

The digital economy is expected to be a key driver of future growth in the global economy. In the European Union's 10-year growth strategy, "Europe 2020", the Digital Agenda is a key flagship initiative. There are 100 action items under the Digital Agenda to support key pillars such as creating a digital single market for goods and services across Europe, enhancing e-skills of its workforce and using ICT to address social challenges.

The USA similarly believes that a key driver of economic competitiveness will be leadership in advanced networking and information technology, enablers of the digital economy. This is highlighted in the report, "Designing a Digital Future", drafted by the President's Council of Advisors on Science and Technology. The report also pointed out that advances in digital technologies would be crucial in achieving other major national priorities like education and healthcare, as well as national and homeland security.

With the Internet economy migrating to the mobile platform, businesses need to be ready to serve their customers effectively through this channel. The mobile channel will pose several challenges, compared to the desktop Internet. The screens on mobile devices are smaller, limiting the amount of information that can be presented. User interactions on mobile are either step-scrolled or touch-driven, different from a point-and-click mouse environment. Some existing Web technologies may also not work on mobile devices while alternative Web technologies like HTML5 have not yet reached full maturity.

Although there are challenges, the mobile Internet economy offers opportunities for enterprising businesses. Location and orientation capabilities on mobile devices can be leveraged for new services and business models. Location and other information from onboard sensors of mobile users can be combined with other back-end information to provide context-aware services. Accenture predicts that context awareness will be the key strategic differentiator for organisations from 2012 onwards. The key is to ensure that context will enable services that make sense right at the point where a consumer action takes place.

One significant change brought about by the apps economy is that software developers and small software development companies now have direct access to the mass consumer market. Infocomm SMEs can definitely take advantage of low barriers of entry into the global mass consumer market. Members of the infocomm industry can come together to discuss how to leverage Singapore's current strength in the global infocomm ecosystem as a springboard onto the global digital economy stage to fuel the next phase of growth.

The social economy is enabled through the greater level of trust compared to the default anonymous nature of the Internet. The large population size and reach offered by social networking platforms are also important factors supporting this economy. This trust and reach allow innovative community-driven solutions and business models, known collectively as collaborative consumption and crowdsourcing, to flourish. Today's "hyper-connected" and "hyper-informed" consumer is value-driven and not afraid to experiment with new business models. Collaborative consumption and crowdsourcing characterise this trend which is based on trust, sustained user engagement and interaction.

A key enabler for a seamless converged experience is next-generation electronic payment solutions. Consumers' acceptance of online cashless transactions through e-commerce readies them for digital payment solutions in the real world.

Popular acceptance of technology is driving the convergence of the digital and real worlds. Consumers expect their experience to be seamless in both worlds. This convergence works both ways. The physical world will see increasing digital influence and integration while the digital world will see more real world objects digitised and represented within it. In each of these converged worlds, customer experience is central.

In the case of Singapore, we are well positioned to participate actively in the New Digital Economy. The Next Gen National Broadband Network (Next Gen NBN) gives citizens the bandwidth necessary for 24/7 connectivity and active engagement on the Internet. The convergence of the apps economy, social network interactivity, mobile payments and e-commerce provides netizens with a range of opportunities that encourage participation and collaboration. How we make use of ICT to create a quality of life that accords with our socio-economic aspirations will define our directions and ability to maximise the potential of the Internet to fulfil the promise of the New Digital Economy.