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Organisational innovation due to technology advances in the banking sector

Student ID: 1811831

Lecturer: Dr John Lang

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Abstract

The financial institutions have changed dramatically due to large part of technology advances in the last 30 years. The intensive use of communication networking system and information Technology (IT) resulted in drastic changes in operating environment of banks. The technological progresses enabled some of the banks to alter their organisational structure to introduce innovative products and services including online banking, mobile payment, ATM facility and electronic payment. Advancement in technology also resulted in organisational reforms such as development of internet-only banks and market place lenders. From the processing point of view, the development of blockchain and machine learning software's were all due to technological developments in the banking sector. These changes have brought several benefits and disadvantages including globalisation, cost effectiveness and security concerns. In this report we will critically evaluate how the technology resulted financial institutions to transform their structure to stay competitive as well as challenges aroused.

Keywords: Technological innovation, Finance, banking, sub-prime mortgages, mobile banking, marketplace lenders, internet only banks, block chain, machine learning.

Contents

1. Introduction.....	4
2. Role of finance and financial innovation	6
3. Changes in the banking industry over time	8
3.1. Typical Product/Services	10
3.1.1. Sub-prime mortgages	10
3.1.2. Mobile Banking	11
3.2. Industry Structure Reform	13
3.2.1. Marketplace lenders.....	13
3.2.2. Internet-only banks	14
3.3. Product Process	16
3.3.1. Block Chain.....	16
3.3.2. Machine Learning	17
4. Benefits	18
5. Disadvantages	20
6. Conclusion	21
7. References	23

1. Introduction

The banking industry has been around for many years while their main functions are to keep our deposits, provide individuals and businesses with credit and facilitate payments (Sharma and Kansal, 2014). The role of banks and banking industry in society has changed dramatically. They are now become an integral part of our social, economic and political system. In the last few decades, the technology advancement has resulted in significant changes in the commercial banking system. The advances in IT, financial practice and telecommunication due to technological changes have resulted banks to alter their organisational structures and introduce many financial products and services (Berger, 2003).

Technology has given banks a potential allowing for delivery of banking services and products more effectively and conveniently (Frame and White, 2009). This resulted in creating new bases of competition, while giving their customers a high level of services. These changes have brought enormous impacts on banks officers, customers and employees (Koskosas, 2011). Providing customer-friendly services and the ability to act effectively and quickly will distinguish successful banks of the future.

One technological financial innovation example that has significantly reforming the financial industry is continuing shift on depending on automated analysis of customers data than human judgment (Frame, Wall and White, 2018). This has largely replaced the traditional model of banks to evaluate individuals and businesses for credit worthiness. For example, credit scoring tools are used to evaluate retail loan applications designed to use historical databases based on credit registry (McDonough, 2000). This results in reduction in underlying and compliance costs as well as increase risk management and measurement.

Also, in the last 10 years adoption of e-commerce¹ and mobile devices resulted in development of m-commerce² (BNP Paribas report, 2018). Now, the payment methods have shifted more toward mobile devices where people use their devices to pay for the products and services. According to the research done by Criteo (2016) by the end of 2015, mobile payment accounted for 31 percent of e-commerce

¹ E-commerce (Electronic Commerce) is an activity of product purchasing and selling online over the internet.

² M-commerce (Mobile Commerce) is an activity of product purchasing and selling online over the internet.

transactions in the United States and half of the transactions in South Korea and Japan. Furthermore, mobile devices share 40 percent of online transactions and 60 percent of online traffic. Alongside with these changes has come security issues. The development in mobile technology has resulted mobile malware to increase in frequently and sophisticated including the leaking of identity leak, financial data and financial loss. This will further explain later in the report.

Given the increase in importance of technology, the latest trend is development of technology-based firms offering financial services called “fintech” (PWC Global Fintech report, 2017). Fintech companies aim are to compete with traditional financial institutions using technology and innovation. This includes providing products and services such as using smartphones in mobile banking, cryptocurrencies and investing services (Criteo, 2015). They combine more user-friendly interface with automated analysis of consumers in retail to provide services at lower cost and more conveniently. For example, “marketplace lending” platforms that uses leverages credit scoring tools to analyse borrowers and then introduce creditworthy borrowers to potential investors (Frame and White, 2009). This will be explained in more details further in this report. However, now traditional banks see the threats that new entrants have resulted and thus trying to improve their services to meet all their customers’ requirements.

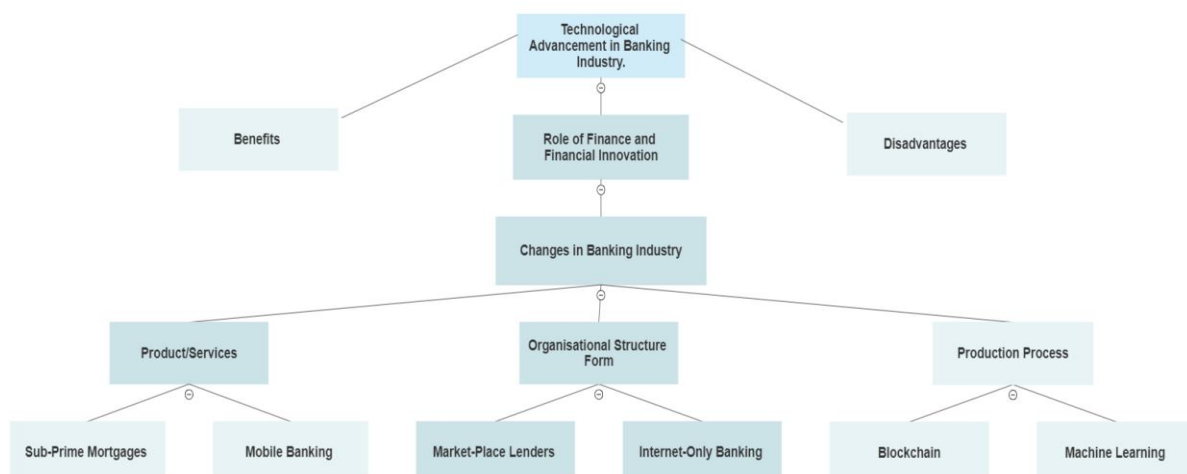


Figure 1 Conceptual Framework of this Report Structure

As shown in Figure 1, this report will critically examine how technological changes have spurred financial innovation and structure changes in the banking industry in the last 30 years. We begin by explaining what is meant the role of finance and financial

innovation in the next section. Then, we will discuss the changes in the banking industry in the last 30 years along the lines of three major categories: new product and services, new organisations structural reforms and new product processes. Finally, we will explain the benefits and disadvantages of technology innovation in the banking industry.

2. Role of finance and financial innovation

According to Merton (1992) the main aim of the financial system is to facilitate the deployment and allocation of economic resources. This function includes the transfer of resources from investors to borrowers, payments system with exchange facility and risk reduction through diversification and insurance (Saqib khan et al. 2015).

Financial markets could facilitate growth through collecting resources from savers and giving investment funds to potential borrowers (Allen and Carletti, 2008). They are acting as financial intermediaries providing interest on depositors and charging interest from borrowers. They continually check and monitor potential borrowers to reduce and avoid credit risk (Allen and Carletti, 2008). Banks do run intensive credit and personal checks before offering loans to potential borrowers to avoid default risk in the future. This was costing banks an enormous amount of money.

There are real resource costs including labour, capital and material involved for the financial institutions to operate in the financial system (Berger, 2003). The main costs associated with the banks are expended in data analysis and data collection in the financial market to deal with the problem of asymmetric information³ (Berger, 2003). Also, there are uncertainties involved with the future of the world that generates risks and thus extra costs for risk-averse individuals (Frame, Wall and White, 2018). Therefore, better financial products and services that could satisfy the individuals and financial institutions demand are generally be welcomed by those participants.

Hence, as defined by Frame and White (2004) innovation in financial institutions is “something new that reduces costs, reduces risks or provide an improved product/service/ instrument that better satisfied financial system participants’ demands”. This has resulted financial institutions to invest heavily to gain the

³ An economic theory studies the decisions in transactions where one party has prior and more information compared to the other party.

advantages that technology brings in the last 30 years. Financial innovations as mentioned above can be grouped as new services (e.g. mobile banking), new products (e.g. mortgages), new structured organisational form (e.g. internet only banking) and new production system (e.g. credit scoring system).

Due to the importance of finance in economy growth, technological financial innovation has become a central consideration for banks (Berger, 2003). Finance is a key facilitator of major production activities as well as consumption activities, therefore, improvements in this sector could result in positive implications for an economy. Furthermore, improvements in the financial sector could result in better investment and saving decisions, making innovation in the financial sector even more valuable (Sharman and Kansal, 2014).

There are number of articles which has discussed the importance of financial innovation in the banking sector: Miller (1986, 1992), Merton (1995), Berger (2003) and Frame and White (2004). The 2007-8 financial crisis casted an idea of instability and insecurity to recent technological innovations in financial institutions. Some viewed technological innovations as a main cause of recent financial crisis focusing on issues such as allowing machines to decide, insecurity, and not being accurate (Krugman 2007).

After financial crisis and despite all criticism of technological financial innovation, we still observe an increase in day to day advances in technology in banking. Recently, PWC published a report “Financial Services Technology 2020 and beyond: Embracing Technology” introduced 10 new technological advancement currently under development. One example was development of “customer intelligence”⁴ which will provide banks with more data accesses in what users do and want. This will be the important predictor of profitability and revenue growth.

Despite the developments in financial innovation and increase in efficiency there are some issues regarding the regulatory framework and supervision of banks. One example is the financial crisis where some believes that financial innovations triggered the development credit risk. It has been discussed that financial innovations must submit for supervision to restrict innovations that could affect the stability of the

⁴ Customer intelligence, the process of gathering customers information and analysing them to have a more effective and deeper customer relationships.

economy and financial institutions. A research conducted by Howells and Bain (2008) found that particular aspects have raised concerns to authorities in relations to the regulation and supervision. These aspects were development of screen-based trading systems, securitisation process⁵, off-balance sheet operations and risks associated with it and new derivative products.

As explained by Pol (2009) the lack of the regulations in 2007-8 financial crisis to evaluate the risks associated with the new financial innovations. The starting point of reforming the regulatory framework regarding financial innovation was the package of measures introduced by Basel committee known as Basel III⁶. This was introduced to strength the Basel II capital framework to point out the issues and treatment of complex securitisation positions and off-balance sheet operations.

Furthermore, Pol (2009) proposed a new institutional arrangement “institutional innovation” to diminish the negative effects of financial innovations. Their aim is to register and examine new financial ideas and select those that do not cause any vulnerability on the economy and financial market. For example, among the financial innovations those who provide credit without taking into account the capacity of the person to repay the loan or innovations that cannot price loans based on borrowers’ characteristics should not be practiced.

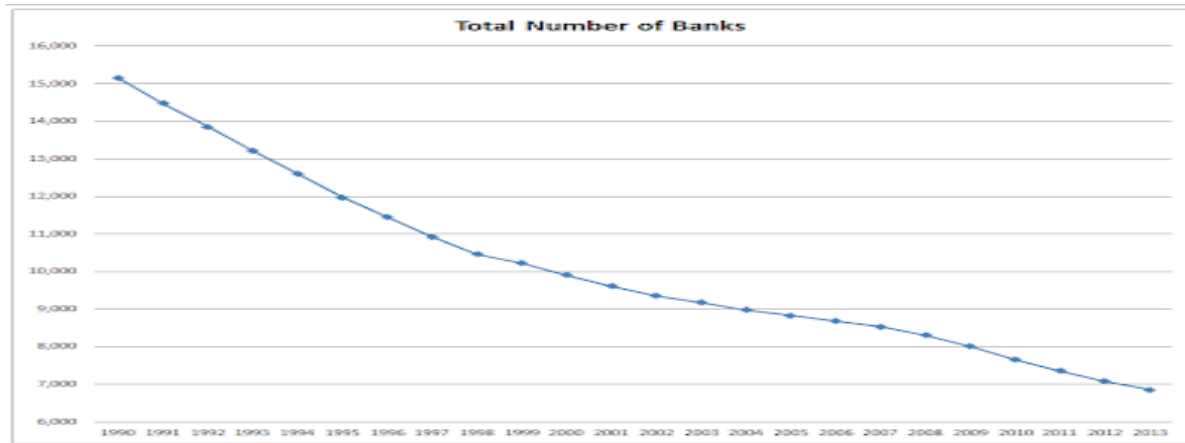
3. Changes in the banking industry over time

This section of report will explain the key financial innovations developed in the banking sector in the last 30 years. Our discussion will be in line of three major categories mentioned in the previous section: new product and services, new industrial structure reforms and new product processes.

The total number of banks have declined substantially from 15,000 banks in 1990 to less than 7,000 in 2013 (Shedlock, 2013). While, after the 2008 financial crisis the number of independent commercial banks declined by 800 institutions- shrank of 14 percent (McCord, Prescott and Sablik, 2015). Table 1 illustrate the changes in the structure of commercial banks from the period 1990 to 2013.

⁵ Securitisation is the process of re-packaging and turning assets into securities that could be sold much quickly for a price lower than the market.

⁶ Set of regulations developed by the bank to promote stability looking at bank capital adequacy, stress testing and illiquidity risk.



The technology advancement created major impacts on operating side of banking industry. During 1980s, financial institutions went for huge computerisation of their branch level. The first phase of digitalisation was concentrated on computerisation of back office at the branch level.

The second phase was in late 1980s with the introduction of Total Branch Automation (TBA). This has resulted in automation of both front office and back office operations at the branch. This has resulted in connecting customer service desk in front office with customer records saved in database in the back office.

The third phase was development of new private banks having automated their structure. Their business model structure was to have a single centralised database instead of having many databases for their entire branches. This was due to availability of good networking infrastructure. Through this development, other banks saw the advantages that centralised database has brought including operating more efficiently and effectively and started to consolidate their databases into a single database.

The fourth wave was started due to evolution of Automated Teller Machine (ATM) delivery channel. This has enabled customers to empower their own transactions. Then, banks started to revamp their delivery channels to attract more customers at a lower cost. This has resulted in development of new products and services including mobile banking and internet banking which will further discuss later. It was also through this that real time gross settlement system were developed so transactions between banks done though electronically and online to ensure for faster collection.

Below, will provide some examples of product/service development in the last few decades due to technological advancement.

3.1. Typical Product/Services

As explained technology has resulted banks to develop their products/services to meet their customer satisfaction and lower their operating costs. The development of sub-prime mortgages and mobile banking were among these developments which further discuss below.

3.1.1. Sub-prime mortgages

Mortgage loans are one of the products that has seen a great deal of change in the last 30 years (Frame, Wall and White, 2018). Mortgage loan is defined as loan in which property or real estate is used as a collateral for the borrower to borrow money from a lender (Frame, Wall and White, 2018). In 1980s, the long-term amortizing fixed-rates in full were the most common type of loans offered mainly by thrift institutions. Furthermore, these loans required good credit history and massive down payments (Schmukler, 2004). However, due to technological advancements these characteristics have evolved.

Sub-prime mortgages in the US has become a mainstream in the last 20-30 years. Sub-prime mortgages are defined as loans given to borrowers with weak credit history and limited down payment available (Frame, Wall and White, 2018). As mentioned above, these borrowers were normally excluded of fixed rate loan markets. However, due to technology and improvements in historical performance databases resulted in developments of statistical models and therefore better risk measurements and facilitate risk-based loans pricing (Frame, Wall and White, 2018). Sub-prime mortgages benefit creditworthy individuals to access to credit who has previously been declined credit.

This market grew substantially between 2000 to 2008- averaging around 20 percent of residential mortgages. At the end of 2007, the sub-prime mortgages saw a decrease of \$260 billion from over \$1.2 trillion outstanding the previous year (Mayer and Pence, 2008). Sub-prime mortgages were aimed to expand the number of potential homeowners and resulted U.S. to hit the record of homeowner's rate of 69.2 percent in 2004 (Mayer and Pence, 2008). On the other hand, borrowers must accept difficult terms including high prepayment penalties and high interest rates. During 2007-8 financial crisis and significant defaults of sub-prime mortgages on credit markets resulted in serious questions on usefulness of statistical models and their basis of risk

measurement as well as development of complex finance products (Frame and White, 2009).

While, prior the crisis there are literatures examines and explains the efficiency of the sub-prime mortgage market. Lax, Manti, Race and Zorn (2004) found that sub-prime borrowers are more likely to have a lower income, poor credit and belongs to minority groups compared to the prime borrowers. In another study, Chinloy and Macdonald (2005) discuss how sub-prime mortgage market could enhance social welfare and complete the credit supply. While, this suggest that sub-prime mortgages enable potential borrowers to get access to funds, however, the pricing will be much higher compared to the prime borrowers due to the risk involved. This means that in the event of another financial crisis this would result in significant defaults of sub-prime mortgages. Thus, technology/innovation could fill in the gap enabling potential borrowers to get access to funds efficiently and effectively.

After the financial crisis, literatures have focused to identify sources of the problem. Some researchers have focused on evolution of sub-prime mortgage standards. Some researchers have focused on possible declining in number of underwriting standards (Mayer, Pence and Sherlund (2008)), while others have focused on forecast errors from empirical statistical models (Demyanyk and Van Hemert 2008). They found that increase in number of defaults in sub-prime mortgages are correlated with the ease in screening potential borrowers by banks. This was mainly due to increase in the number of sub-prime mortgages from the period 2000 to 2006 which resulted to hide much of the weaknesses.

3.1.2. Mobile Banking

Mobile technology is one of the main products resulted in a big revolution in the banking and payment industry. This resulted banks to offer a service with added convenience to its customers across the world. According to the “World Payments Report 2018” (Capgemini and BNP Paribas, 2017), in the period 2015-16 the number of non-cash transactions reached \$482.6, a growth of 10.1% which mainly was due to adoption and inclusion efforts of mobile payment.

In the last few years, banks have started investing heavily in mobile technology through adding new features such as enabling consumers to deposit checks remotely as well as developing new smartphones apps (Gupta,2013). Most of the Mobile

Banking systems offers funds transfer, mobile payments, account balances, delivering online payments and customer service via mobile (Gupta, 2013).

Banks believe using mobile banking would result in reduction in transaction costs as well increase customer satisfaction and engagement (Frame, Wall and White, 2018). This is like online banking business model which believes online banking would increase customer retention and thus reduce the transaction costs. However, study done by Campbell and Frei (2009) shows that an increase in online banking result in increase in total number of offline and online transactions and therefore increase the transaction costs for the banks. While, emergence of new competitors including Google Wallet working with already existing credit card companies such as Visa and Mastercard or others such as PayPal resulted banks to change their ecosystem (He, Tian and Shen, 2015). Banks are now adopting new mobile technology apps including more efficient mobile payment systems and mobile apps to satisfy their customers need.

There are literatures examining significant factors affecting the mobile banking. Sadi and Noordin (2011) studied customer behaviour in relation to mobile banking. They found that there is a negative correlation between customers attitude and costs in mobile banking. Their interest in using mobile banking decrease with increase in costs. However, there are also literatures identifying issues in mobile banking that restrain customers to use it. Sharma and Singh (2009) examined mobile banking issues case of India and found that customers try to avoid mobile banking due to issues relating to security such as frauds and misuse of financial and personal data.

There are different technologies used in mobile payments to perform transaction (Raina, 2014). First is remote payment that normally rely on text messaging (SMS). This type of payment relies on SMS where funds are transferred from mobile wallet or registered account once the transaction authorised by the user (Singh and Sinha, 2016). Also, mobile browser or mobile application. The proximity payments rely on contactless payments or bar codes such as Near Field Communication (NFC) and contactless stickers (Singh and Sinha, 2016). Through this method, it enables two electronic devices to establish communication (exchange data) by bringing them closer to each other.

At the moment, majority of banks use mobile banking including Lloyds TSB, Barclays Bank, HSBC and NatWest. They offer all kind of services to their customers to meet their expectations and be more efficient. Services that they do offer are mobile payment, funds transfer, electronic bill payments and obtaining account balances.

3.2. Industry Structure Reform

the last few decades, new organisational forms have developed around the world. Many developments arose due to regulatory developments, however, two related structures that are directly tied with technological advancements are marketplace lenders and internet-only banks.

3.2.1. Marketplace lenders

The marketplace lenders have grown largely in the last few years where matches small firms and consumers with lenders/investors using online platforms (Perkins, 2018). Normally borrowers apply using the platforms and are subject to automated credit scoring to underwrite their standard criteria as well as risk rating check and additional information (Perkins, 2018). Then, marketplace lenders sell loans to institutional investors in bulk based on credit scoring and risk ratings checks. The online marketplaces are not directly exposed to risk of credit as they do not have the loans or gain interest in them (Frame, Wall and White, 2018). However, they generate revenue from servicing fees and loan origination.

Looking at Marketplace lenders we observe that they are developed using larger banks models (Perkins, 2018). For many years, financial institutions and large banks have used credit scores, credit data registry, and borrower's income as input for their statistical models to price their loans and estimate risk (Deloitte, 2016). However, now marketplace lenders have supplemented their models by adding additional information (Perkins, 2018).

According to the research conducted by Jagtiani and Lemieux, (2018) they found that LendingClub's credit score had an 80% correlation with FICO⁷ scores while this was dropped by 35% for loans originated in 2014-15. They suggested that these changes could be due to alternative data and machine learning as the platforms gained more

⁷ FICO is a type of credit score based on level analysis and provides a numerical expression representing creditworthiness of an individual.

experienced with the consumer lending. In a complementary research by Balyuk and Davydenko (2018) which uses information (prominent factor for marketplace lenders) to verify borrowers and identify the suspicious applications. This has resulted in cancelling 27% of previous accepted applications since 2013.

In another study by Vallee and Zeng (2018) analysing fintech platforms from both investors and borrowers prospective. They found that they use their own statistical models to evaluate borrowers and mark loans, which informed investors would be able to distinguish the quality of borrowers using these rating grades. However, they also found that it will create an adverse selection⁸ for those less sophisticated investors. Consistent with their argument, they found that loans purchased by more informed investors are less likely to default using lending robots from 2014-17. They observed that when marketplace lender (LendingClub) reduce the information availability to potential investors caused those sophisticated investors to reduce their ability to “cherry pick” loans with lower credit and default risks.

This such as automated approach using information technology to underwriting have a large economy of scale⁹ (low marginal costs and large fixed costs). Therefore, this results in an incentive to grow significantly and with the rate of success they are likely to face increase competition from consumer lenders.

One example of market-place lender established in 2012 is Upstart (Bajpal, 2018). In this online platform, they use different criterias to credit score borrowers that is beyond the FICO score such as academic performance, work history, university of graduation and area of study. They offer loans starting from \$1,000 to \$50,000 with annual percentage rate of 8.85% (Bajpal, 2018). As you see, they use additional information to find the creditworthy of individuals. However, they are charging higher rate of interest making harder for individuals to repay the loan.

3.2.2. Internet-only banks

During 1990s and rapid increase in the usage and access for internet banking created the possibility of new industry forms for financial institutions: the internet only or internet-primary banks.

⁸ This is when the market affected by asymmetric information which was further explained previously.

⁹ This is the cost advantage companies benefit due to their scale of operation where cost per unit of the product decrease when the output increases.

According to the report conducted by Delgado, Hernando and Nieto (2007), there were 35 internet-only banks in the Europe and another 20 banks in the U.S. till mid-2002. In the Europe, these banks were connected with the existing financial institutions, while the American internet-only banks were separate entities. This could be the reason why American based internet-only banks were liquidated, closed, acquired or established physical stores to complement their internet-only based banks (Frame, White and Wall, 2018).

A research done by DeYoung (2005) examining internet-only banks found that these banks compared with conventional banks are less profitable due to lower non-interest income and fewer deposits as well as high labour costs. Similarly, Cyree, Delcours and Dickens (2009) find that internet-only banks are larger but have loan losses and lower interest margins.

Despite the failure of internet-only banking in early 2000s, new opportunities opened for new organisational forms in the 2010s due to recovery from 2008-9 financial crisis and continuous developments in technology (Frame, Wall and White, 2018). In 2007, The introduction of Apple iPhone's was one marker of continuous developments in the field of technology (Koskosas, 2011). These developments resulted the technological firms to invest heavily in both commercial and financial activities and providing superior services compared to other financial institutions. However, the 2008-9 financial crisis and the need for the recovery resulted in reduction in banks resources and distracted banks management to invest in new technologies and making new loans (Koskosas, 2011).

One example of internet-only bank founded on 2015 that has gained a great popularity is Monzo bank. Monzo is a digitalised mobile only banking offering services such as current account, overdraft facility, free cash withdrawals, direct debits and standing orders. They are also FSCS protected and FCA approved. The main advantages that internet-only banks have compared to other current accounts are quicker, has 24/7 in-app support and real-time spending notifications. However, they are also some disadvantages such as providing mortgage services, security matters as well as overdraft facilities.

3.3. Product Process

Advancement in technology within the banking industry has also resulted in development in tangible and intangible process. Banks have invested heavily to improve their process in a way to satisfy and attract its customers. Block chain and machine learning are among these technology advancements where the product process have improved substantially.

3.3.1. Block Chain

Block chain and related technologies are one of the new tangible processes that resulted in revolutionising the banking sector (Zheng et al. 2017). The interest for blockchain strengthened by a paper published by Nakamoto (2008) developing peer to peer “electronic cash” where electronic payments were made without financial intermediaries’ intervention. Nakamoto’s interesting idea resulted in many innovative ideas where some of these proposed to replace financial intermediaries such as commercial banks as well as central banks. Others were looked at improving the efficiency of existing financial intermediaries.

Blockchain is like a database shared across nodes in a system (Zheng et al. 2017). In a blockchain system data is added in blocks that are ordered according to the time and connected to each using cryptology¹⁰ (Frame, Wall and White, 2018). An example is Bitcoin and similar cryptocurrencies uses blockchain to give (record) ownerships of coin (currency) that the users sees this as a storage of wealth and form of payment (Zheng et al. 2017). Principally, these could represent as an asset including gold, physical assets or fiat currency (US Dollar) owns by the user. However, all cryptocurrencies are a form of electronic tokens and do not represent any external assets.

Distributor ledger technology is useful when two parties would like to come up with common understanding about the condition, including who owns an asset or terms of a financial contract (Zheng et al. 2017). Blockchains ability to provide temper-resistance records enables them to compete with current financial intermediaries. A study done by Catalini and Gans (2017) stated that blockchains would able to facilitate less costly verifications and thus results in new markets. In other words, blockchains

¹⁰ Is a study of techniques to have secure and safe communication in the presence of third parties.

would be the best substitutes as a “Trusted-third-party” role where large financial intermediaries do at a much less cost. However, Cong and He (2018) stated that blockchains could result in facilitating collusion. There is no regulatory bodies or frameworks to observe and monitor these blockchains and thus it is easy to collude.

As mentioned above, one example of blockchain proposed in 2008 was Bitcoin. Bitcoin is defined as “Peer-to-peer electronic cash system” that allows the online payments to transfer between tow parties without going through a bank (Zheng et al. 2017). Bitcoin is public ledger and decentralised meaning that there is no trusted intermediary controlling the ledger (Zheng et al. 2017). Therefore, this brings the matter od security. Bitcoin gives access to anyone and beyond trusteeed participants which brings false transactions and bad actors.

3.3.2. Machine Learning

Development in capabilities of Artificial Intelligence (AI) and Machine Learning (ML) are among the most important technological advancements within the banking industry in the last few years (Frame, Wall and White, 2018). There are no general definitions of ML and AL, however, in general can be defined as computer system developments in order to perform tasks more efficiently and effectively taught by human intelligence (Shabbir and Anwer, 2015). The interest in Machine Learning has become more popular due to digitalisation of data, efficient and effective computers and better algorithms to analyse data.

AL and ML are technologies that could be applied in varieties of areas in the financial institutions. These include the improvements in already existed products such as better risk and credit management, complying with regulatory requirements easily and efficiently and asset pricing (Shabbir and Anwer, 2015). Also, they are useful at consumer level in personal management of financial products such as analysing consumers expenses and revenues to provide best services and recommendations helping them to achieve their financial goals (Shabbir and Anwer, 2015). Another product which relies on AI and ML is “robo-advisor” providing individuals personal investment advice, portfolio selection, risk tolerance and financial assets all with consumers permission (Frame, Wall and White, 2018).

ML algorithms can be used to get access to vast amounts of high-quality data useful for banks in regard to the questions they are addressing (Shabbir and Anwer, 2015).

Financial institutions able to access to these set of data may have a competitive advantage that could be used to increase their leverage in the market as well as build even large database. Sharing information and data across firms results in reduction in these advantages providing that sharing satisfied privacy concerns (Frame, Wall and White, 2018). Other way of reducing advantage would be that the government take action and take positions of consumers including for example have property rights of their own data and have the right to share data when they choose. This is currently done in EU under PSD2 (Payment System Directive 2)¹¹(Shabbir and Anwer, 2015).

In 2016, Royal Bank of Scotland has launched an AI online “Chatbot” called Luvo that will answer customers questions online and does simple bank services such as money transfers (Williams, 2016). If Luvo cannot understand the customer request, then it will pass it to a staff member. Luvo would allow advisors to free up their time on simple and easy services and help them to focus on more complex questions and issues, improving both services (Williams, 2016).

Also, HSBC to improve its risk of money laundering it is using google cloud machine learning capabilities in 2017 (Williams, 2016). They started analysing their huge dataset to identify suspicious activities within their customer base using machine learning resources (Williams, 2016). They use AI techniques to analyse publicly available, internally, and transactions within their customer network. The bank has spent \$3.3 million (£2.3) in this technology working with big data start-up Quantexa helping bank to identify money laundry activities.

Next, we will be examining the benefits and problems that IT has brought into the banking sector.

4. Benefits

There are several advantages of technology advancement in the banking industry including globalisation, operational excellence and cost effectiveness, and business intelligence.

The Information Technology resulted the information to be shared efficiently and effectively while bringing the world closer. According to the research conducted by Schmukler (2004) globalisation can improve the financial infrastructure. In more

¹¹ This enables bank customers to allow third party providers to manage their finances.

details, lenders and borrowers would be able to operate in a transparent, more efficient and competitive financial system. However, this results in asymmetric information problem to be minimised and increase in credit borrowing.

However, there are some arguments examining risks and net effects of globalisation. A research conducted by Dornbusch, Park and Claessens (2000) surveyed the literature on contagion. They found that globalisation in the financial market could lead to financial crisis through contagion. In the last few decades the globalisation has resulted the financial market to be systematically interconnected. This means a shock in the market could easily be transmitted across countries. This was observed in 2007-8 financial crisis¹².

Second main advantage that IT has brought into the banking industry is the operational excellence¹³ and cost effectiveness (Sharma and Kansal, 2014). Automation of the processes in the banking industry resulted individual and business lives to be transforming to be much easier and economically effective. A report by Deloitte (2009) identifying which areas of the banks have been evolved due to IT and their operational performance increased significantly. Front office and back office services and performance and profitability management were among the areas of operational efficiency.

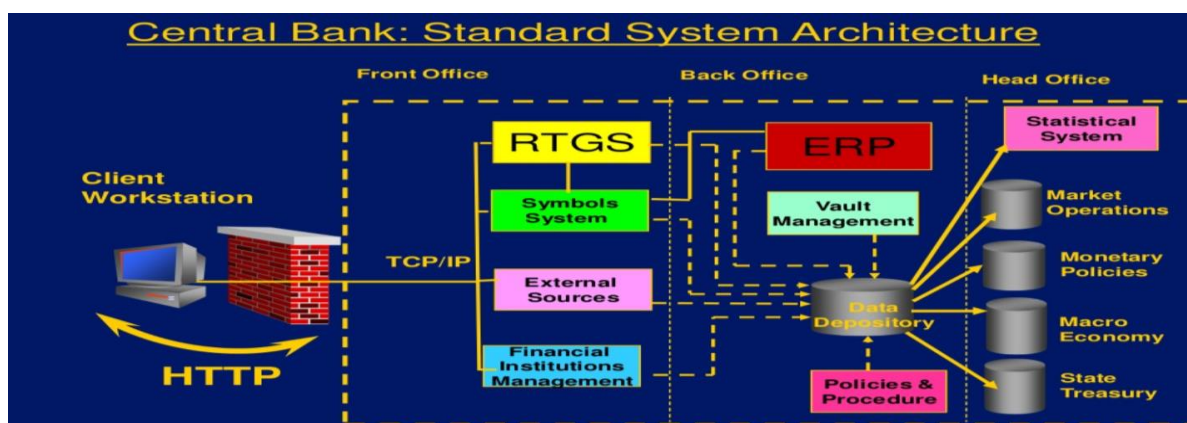


Figure 2, Banking Standard System Architecture

As shown in Figure 2, the introduction of Real Time Gross Settlement (RTGS) were one of the developments in the front office resulted in more operational efficiency. RTGS is a specialist fund transfer system enables the transaction to be transfer from

¹² Collapse of bank Lehman Brothers resulted in crisis spreading all around the world.

¹³ Operational excellence is the optimal use of processes, people and facilities to successfully implement the banking strategy to achieve operational efficiency.

one bank to another in “real time” and in a gross basis (Kahn and Roberds, 1999). Alternatively, the back office of traditional banks was lacked client centricity and had a very low Straight-Through Processing (STP) rate. However, technology advancement and introduction of automated back office processes and Enterprise Resource Planning (ERP) has resulted in a significant reduction in the processing times and error rates.

Thirdly, business intelligence is another main advantage (Frame, Wall and White, 2018). In the banking industry IT gives a competitive edge compared to other rivals. The use of business intelligence to collect necessary information is crucial in making strategic business decisions.

5. Disadvantages

There are several potential problems associated with technological advancement in the banking industry. It is extremely important for the consumers to understand the main problems that technology has brought into the banking sector. Some of the disadvantages are as follow.

One of the main concerns associated with bank technology is security (He, Tian and Shen, 2015). All banks subject to the same regulations and laws protected by FDIC (Federal Deposit Insurance Corporation). There is sophisticated software designed to protect your information, however, no system is perfect (Koskosas, 2011). Customers accounts could subject to hacker attacks, phishing and other unauthorised activities (Koskosas, 2011). For example, on May 2018 Canadian fourth and fifth largest banks were hacked stealing 90,000 customer’s data. Bank of Montreal and Canadian Imperial Bank of Commerce’s Simplii Financial have confirmed that both personal and financial information were stolen where they were known for their leading cyber-security practices (Pittis, 2018).

Other disadvantages include less opportunity for personal relationships (Koskosas, 2011). The developments in technology in the banking sector would result customers to involve on more online banking and miss the opportunity to directly build a personal relationship with the banks (Koskosas, 2011). Traditional banks provide the opportunity to build a personal relationship with the banks and employees. This would enable customers to get to know the staff in their local branches and if needed to receive additional financial services or any changes needed in your banking

arrangements. Bank managers have the authority and discretion to change the terms of accounts and or helping in reversing fees or charges (Frame, Wall and White, 2018).

6. Conclusion

In this report, we examined technological innovations within the banking sector. In the last few decades, we have observed enormous technological development such as mobile banking, fintech companies and blockchain in banking industry. First, we explained the importance of finance and financial technology. Finance is an important factor in economy that facilitates growth and deployment resources. Financial institutions are playing key role through acting as intermediaries to provide resources to potential borrowers and save the depositors money. Due to the importance of finance and financial institutions in economy growth, technological financial innovation has become central consideration for banks. They try to consistently upgrade their structure, products and services to meet an increase customer requirement and reduce their costs.

Technological innovation has resulted banks to continuously reshaped themselves in terms of product/services, structural forms as well as production process. In the last few decades banks have developed new product/ services to meet their customer satisfaction and reduce the risks. Development of sub-prime mortgages and mobile banking are examples of such advancements. Sub-prime mortgages are those loans given to less creditworthy individuals that otherwise are not eligible. Banks use different background, credit and additional information checks to provide mortgages to individuals that would otherwise decline. Mobile banking is also another product/ service development which has attracted many customers. Mobile banking enables customers to use their mobile devices to do contactless payments, online payments and use banking apps to access to their accounts and personal details.

Technological innovations have resulted the banking industry structure to change. The developments of market-place lenders and internet-only banks are results of these changes. Market-place lenders are established to match borrowers and lenders using online platform. Borrowers are subject to credit, personal and some additional checks using algorithms enabling investors to see creditworthiness of individuals or companies. Internet-only banks are banks operating online and there is no physical

branch available. These banks use technology to operate daily and provide services to its customers using online platform and apps. This is very cost effective for internet-only banks; however, people restrain in using these banks due to security and trusting issues.

The tangible and intangible production process of banks also developed in the last few decades due to technological innovation. The development of blockchain and machine learning software's are examples of evolvement in production process. Blockchain is a list of records connecting to each other using cryptography. Cryptocurrency such as Bitcoin is an example of blockchain which was created in 2009. One of the main advantages that has resulted blockchains to increase in popularity is because it is cost effective and has small transaction cost. However, security issues and not the currency backed by government are the arguments among individuals in society. Development of machine learning (ML) and artificial intelligence (AI) are among technological developments in the banking sector. ML and AI are used to facilitate different bank sectors. Providing better risk management services, pricing loans using algorithms and an in-depth credit checks of borrowers are among the advantages of ML and AI.

In general, there are several benefits and disadvantages that technology has brought into the banking industry. Technology has resulted banks to operate more efficiently and effectively. Also, operational excellence and cost effectiveness are other advantages resulted banks to update their structure in away to make individual and business lives much easier and economically effective. The security issues and personal relationship are among the main disadvantages that technology has brought in to the banking industry. Now, customer accounts are targeted more by hacker attacks and malware activities due to banks dependence to IT. Also, development in technology has made individuals miss the opportunity to develop personal relationships with their banks. Personal relationships would benefit individuals to use the opportunity to receive additional services and use the advantages that you might have not known otherwise. However, now banks closing most of their branches to reduce their operating costs which could deteriorate this advantage.

7. References

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